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Modeling of Spaza Shop Operations Using Soft and Hard Operational Research Techniques

by

Jean-Marie Sabwa

Supervisor: Professor T.J.Stewart

Department of Statistical Sciences
University of Cape Town



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Abstract:

Globalization has transformed the world into a big village in which the rich are becoming richer and the poor getting poorer. In the commercial world the trend is for big business to buy out the smaller companies and consequently get bigger. Yet it is arguable that small businesses have assisted in providing much needed services to small communities that occupy informal settlements and exist on or below the poverty datum line. The South African government has amongst its main objectives the alleviation of poverty and the improvement of life in previously disadvantaged communities. The government has allowed the micro-enterprises and small businesses in the informal sector to thrive and in this sector are Spaza shops that supply a wide range of grocery commodities to informal settlements.

This paper is about an application framework of soft and hard operational research (OR) techniques used to address the performance of micro-enterprises with Spaza shops in Western Cape as a specific case study. The techniques include Strategic Options Development and Analysis (SODA) using Causal mapping and Soft System Methodology (SSM). These were chosen because of their suitability to understand performance problems faced by Spaza shops owners and find ways of improving the current situation by modelling the intervention of stakeholders. The improvement of Spaza shop businesses is a matter for all stakeholders. Causal mapping, helped to identify and structure the multiple conflicting aspects of Spaza shops business. Soft System Methodology made it possible to conceptualize the intervention model based on the rich picture and root definitions for relevant world-views and see what changes are culturally feasible and systematically desirable. Computer simulations were used to help design and test performance measurement indicators for the Spaza shops so as to enable decision-makers to choose the optimal strategy. Statistical analysis came into account to enable us to capture the seasonality and bring up clustering patterns.

Keywords: Spaza shops; soft OR; simulation; SODA; SSM,

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Acronyms

OR: Operational Research

SODA: Strategic Options Development and Analysis

SSM: Soft System Methodology

TTO: The Triple Trust Organization

OMT: Oval Mapping Technique

CHAID: Chi-square Automatic Interaction Detection

VAT: Value Added Tax

UNISA: University of South Africa

UCT: University of Cape Town

SME: Small and Medium Enterprise

PSM: Problem Structuring Methods

RD: Root Definitions

DEA: Data Envelopment Analysis

MCDA: Multi Criteria Decision Analysis

VBA: Visual Basic for Applications

Chapter 1

INTRODUCTION

1.1 Aim

This study aims to help investigate the forces and mechanisms driving the Spaza shop market, so as to establish a conceptual model of intervention which will improve this business and set up some strategic indicators that will evaluate the performance of the business. In this study we propose the use of: firstly, soft operational research-OR using problem structuring method with soft system methodology-SSM and Strategic Options Development and Analysis-SODA. Secondly, hard OR as decision making tools in this particular case of the Spaza businesses.

The use of both approaches is aimed at bridging the two branches of operational research towards making a more informed decision. Soft OR helps us to understand the problem and to tackle the conflicting views and interests of stakeholders on the problem. Soft OR also helps us to model by showing where a solution should be implemented to improve the current Spaza shop market. Hard OR, on the other hand reveals different patterns and clusters aiding the decision-making process.

1.2 Background

1.2.1 Triple Trust Organization

Is a South African not-for-profit organization committed to the alleviation of poverty in South Africa through making markets work for the poor. TTO acts as a market development facilitator, and designs and manages projects that will enable poor communities to meaningfully participate in markets (TTO, 2007).

TTO's strategy is to facilitate improvement of markets in poorer communities with specific emphasis on:

- Increased access to business opportunities by individuals and small and micro enterprises (SMEs) in these communities
- Facilitation of business linkages - particularly those that involve a flow of money into poorer communities
- The improvement of existing markets in which poor people participate

TTO's mission is to eliminate poverty through sustainable economic empowerment of both individuals and communities, thereby creating self-sufficiency and restoring the hope, self worth and the power to choose, of the economically disadvantaged of Southern Africa. TTO's Western Region includes the Western Cape and Northern Cape provinces. Its projects in this region are aimed at making markets work for the poor, with projects like:

- Sachet project

The sachet project aims to set up a distribution network of self-employed individuals to market cleaning products to disadvantaged communities, with the products being supplied in small sachets (TTO, 2007). It links local distributors to a number of agents that sell the products door-to-door in the targeted communities.

- Car wash project

TTO has partnered with a supplier of a car wash product that does not require water. Based on this technology and with the intention of facilitating the establishment of a number of unemployed people in 'car wash franchises', TTO has designed a project aimed at creating a number of income generating opportunities for poor people. Although significant progress has been made with regard to the design of the intervention, this project has not got to implementation stage because TTO is still sourcing funding for the project (TTO, 2007).

- Spaza market project

The Spaza shop project is a case study in this thesis. TTO aim for the Spaza project is to identify, unblock or overcome constraints in the Spaza market in Cape Town in the supply and distribution of goods from manufacturers, wholesalers and distributors to Spaza shops (TTO, 2007).

1.2.2 Spaza Shops: As a case study of micro-enterprises

The word Spaza come from the Zulu language meaning hidden; an apartheid-era term used when restrictions were placed on black-owned businesses (Bear et al., 2005). Spaza shops are small, and informal businesses that operate from a section of an occupied residential home or in any other structure on a stand in a formal and informal township which is used for residential purposes and where people live permanently often in a disadvantaged community (Ligthelm, 2002). Spaza market is a value chain that links low-income township consumers of basic grocery items to manufacturers, wholesalers, distributors, and other suppliers of products and services (Ligthelm and Cant, 2002). The Spaza market as an informal retailer market, is an important delivery channel of goods from manufacturers and wholesalers to township consumers. Knowing the dynamics of this informal retail sector may contribute towards an increased awareness of this important but unrecorded sector of the economy (Ligthelm and Masuku, 2003).

To illustrate the importance of this informal retail sector we considered the fact that its sales, in Greater Cape Town, amount to an average weekly turnover of about R1500 per shop. This equates to an annual figure of R1.1 billion, which is about 13 percent of the entire retail industry in Cape Town (Bear et al., 2005). Spaza shops encounter numerous problems ranging from financial and market-related issues to the macroeconomic environment within which businesses have to operate. These problems lead to failures if not properly tackled but improvement and success can be achieved if appropriate decisions are taken.

The study of the Spaza shop market is important as it allows us to determine the factors that can influence transformation to formal business and the barriers to the growth of this business market.

The results of analysis of this informal market may lead to managerial, economic, social, political and financial decisions so as to improve and enhance the transformation of the entire community. Studies have been performed on the size, structure and profile of the informal retail sector in general and Spaza shops as a specific case. Most of these studies aim to understand how Spaza shops, operate facing challenges ranging from financial, environmental, structural and security issues; but not how to intervene to overcome these challenges. This dissertation is an attempt at modelling interventions for an improvement of this key market so as to transform it to a formal market system.

To achieve this objective, we propose the use of:

- SSM, as a cycle of learning that investigates a problematic situation, defines and takes actions to improve it (Checkland and Poulter, 2006). We use SSM to compare the system (Spaza shop market) as it is, and a model of the system as it might be. This comparison should lead to a better understanding of the system as well as suggest some actions to be taken for its improvement.

- SODA, is a general problem identification method that uses causal mapping as a modelling device for eliciting and recording individual views of a problem situation (Mingers and Rosenhead, 2002). Soda with its causal mapping can be used in many different ways with individuals, groups and for the analysis of documents. SODA a problem structuring method aims to enable negotiation through a process of sharing knowledge, collective reflection on that knowledge, synthesizing knowledge to build shared understanding, enhancing collective learning, and continually negotiating understanding and action in the light of this heightened awareness on social process (D.Shaw et al., 2004). Causal mapping when working with a group aims to reach an agreement about how to deal with strategic issues and it can be employed through manual techniques (such as the Oval Mapping Technique OMT), or computer software like Decision Explorer and/or Group Explorer software. In this study, we are going to use mapping as a formal modelling technique to reflect visible thinking and the analysis of the model to support decision making processes.
- Statistical Analysis

We used two sets of data, the first set was data on purchases of Spaza shops over a period of a year, from June 2006 to May 2007. The data represented the total quantity purchased on a given product, the total amount of money, the percentage the sale of that particular product represents and the average price. For this data on purchases, the analysis was exploratory, including spatial and temporal patterns of purchases for different products based on time and areas. The second set was a response to a questionnaire administered by Triple Trust Organization (TTO) to Spaza shops owners over the same above mentioned period. The records (data) for this second category were measured as nominal, ordinal and cardinal; some of these records were captured as binary variables, with yes equal to 1 and no equal to 0. The aims of the analysis were to identify characteristics or predictors of good performances. The analysis was based on the following techniques:

1. Chi-square Automatic Interaction Detection (CHAID) analysis

Is a technique that detects interaction between variables in the data set. It establishes relationships between a dependent variable and other explanatory variables. CHAID does this by identifying discrete groups of respondents and, by taking their responses to explanatory variables, seeks to predict what impact they will have on the dependent variable. It is often used as an exploratory technique and is an alternative to multiple regression, especially when the data set is not well-suited to regression analysis. Like other decision trees, its advantages are that its output is highly visual and easy to interpret (Themasurementgroup, 2005).

2. Correspondence analysis

Correspondence is used to measure the characteristics of correspondence, association, similarity (Friendly, 1995); it is an exploratory and descriptive technique that analyses contingency tables with a large number of variables, considering measures of correspondence between rows and columns (Clausen, 1998). This technique can be considered a special case of factor analysis, but it differs to the extent that it evaluates the relationship between categorical data organized in contingency tables, rather than continuous data. Basically, correspondence analysis converts a non-negative data matrix into a kind of graphic representation that allows studying the relations between the categories of rows and columns in a large contingency table. The technique is appropriate for studying the data structure without hypothesizing an a priori model or assuming a probability distribution, and is thus adequate for studies with population data, as a non-inferential technique (Greenacre, 1981).

The question that arises is whether there are any significant differences between types of Spaza shops (top performing shops compared to non top performing) ? if so, which variables are responsible for the differences ? Statistical analysis was used to detect the variables that influence and determine the rating of business performance, in other words, what makes some Spaza shops top performers and others not ? The technique enable us to identify significant differences in the purchase patterns of different types of Spaza shops.

- Simulation

Simulation is part of mathematical models used to help the decision making process by understanding and predicting the situations. Simulation is a tool which in appropriate circumstances can be of immense value to the system analyst. In general, simulation is used for selection, analysis and design of medium to large systems experiences. However, it can also be very valuable for certain aspects of very small systems. Simulation is the creation of an artificial situation which is meant to represent the real situation and then testing this artificially created one as though it were real. It uses concepts and methods of mathematics as an aid to understanding problems arising in the life and social sciences and in business to gain knowledge in these areas. Clearly, the closer the artificial situation is to the real one the more useful the simulation could be.

The application of SSM and SODA to the Spaza shop market allowed us to determine the factors leading to both transformation and barriers to growth for this business system. The application of statistical methods, on other hand, clarified patterns and associations between products, areas and prices. Simulation was used

to set up strategic options, like optimum ordering quantity, optimum stock, etc to be used by Spaza owners as management expertises.

The project that will be discussed during the course of this dissertation is that of Triple Trust Organization (TTO) based in Cape Town in South Africa. TTO started their project on Spaza shops in 2001. Its aim was to help the owner-managers to improve their businesses in terms of volume sold.

1.3 Problem Statement

Based on the problem and issues raised about the Spaza business market, we have used soft operational methods to construct a model of intervention that will lead stakeholders to enhance this business market. The data set provided by Triple Trust Organization (TTO) includes data on the most frequently sold products from July 2006 to June 2007. This data was used to investigate some purchase patterns of these products based on time and areas.

To reach the needed outcomes, hard operational research methods with correspondence analysis and data mining techniques were used to detect the variables that influence and determine the rating of business performance and the average purchase per cycle level. These techniques enable us to identify significant differences in the purchase patterns of different types of Spaza shops. This was the key issue for the TTO organization. These techniques could not enable us to make comparisons based on individual products sold by Spaza shops as the data provided were for a short period of time only. The question that arises is whether there are any significant differences between type of Spaza shops (top performing shops compared to non top performing)? if so, which variables are responsible for the differences? A similar question is whether average purchase per cycle or the level per cycle of purchases, differs between types of Spaza shops?

This study aims to determine and understand the factors that make some shops top performers and others not. Finally, the Spaza owner-manager may be helped by advice based on information about top performing shops as a reference point for the non-performing shops.

1.4 Objectives of the research study

From the study started by the Triple Trust Organization management, the present work intends to use soft techniques to identify the stakeholders in this business market and make their interventions optimal. Using soft and hard OR techniques, the objectives of the study are:

- To raise the main issue on performance within Spaza shop business, and how it might be addressed as a specific case of micro-enterprises.
- To decide what model of intervention should be implemented to improve the current situation of this specific business sector.
- To recommend useful indicators with which to measure the performance of a Spaza business.
- To determine an outline simple simulation model that can be used to help Spaza shop owners understand the logistic of their business

1.5 The research process

Small and family businesses are faced with challenges that must not be underestimated; especially in a business system where the market parameters are unknown or ill identified. The market system makes those projects highly competitive, more complex and difficult to manage, as the market parameters change the cost might rise. They become problems that are difficult to solve using traditional approaches. A soft OR approach is more appropriate, for example Soft System Methodology (SSM), a system approach that is used for analysing and solving problems in such complex and messy situations. It uses system thinking in a cycle of action research, learning and reflection to help the understanding of various perceptions that exist in the minds of different people involved in the situation. It is particularly suited for wicked, fuzzy and complex management systems, and seeks to evaluate as many different options as possible.

Using SSM helps investigators to capture different views of organizations, and the behaviour and culture of stockholders. SSM uses rich pictures and root definitions to identify responsible actors, key transformations, and the knowledge resources that are appropriate to the needs of a system. Statistical analysis was used also to identify trends and seasonality, and to identify if differences between these areas influences the business. Hard OR using simulation helped to set up different strategies that might possibly be important to the market system.

1.6 Outline of the thesis

Chapter 2 gives a general literature review of the informal sector in a developing country context with Spaza shop as the case on hand. It provides some background on the approaches and methods used to bring about improvement in Spaza shops business.

Chapter 3 presents formal problem structuring methods. It presents soft system methodology (SSM) and SODA, used to structure the model of intervention by the stakeholders involved in this business market. These techniques were used to give a broad overview of this market and enabled us to construct a model of intervention to enhance Spaza shop market businesses.

Chapter 4 discusses the application of statistical analysis. It describes the data sets that are analysed in this study and also provides product-practice comparison analysis. This chapter presents a detailed application of correspondence analysis and CHAID to analyse patterns in the shops and products as well as to examine the differences in the performance of shops. It discusses also the impact of the seasonality on the business.

Chap 5 discusses simulation as support given to the decision and Spaza shops owners in terms of specific products and areas of business. Simulation was used to investigate what could be an optimal quantity to order and to stock for a specific shop.

Chapter 6 gives conclusions for the study and recommendations for possible areas of improvement.

Chapter 2

LITERATURE REVIEW

In the present chapter, we will discuss the definition and performance problems of the informal sector as part of micro-enterprise with Spaza shops as a case in point. We will present the soft and hard approach to the problem and highlight the usefulness of combining the two approaches when addressing business performance in the developing world.

2.1 Definition of Micro-Enterprises

In the developed world, Micro-enterprises are companies that have a small turnover and are therefore not subject to VAT (value added tax). A micro enterprise is reserved for traders and artisans who are usually self-employed. In the developing world, a Micro-Enterprise is very often a family run business and generally operates in the informal sector. Micro-Enterprises which fall in the informal sector of business are defined according to size (number of employees), facilities and premises from which they operate. Harper (1987) defines the micro-enterprises in the informal sector as one or two persons-enterprises that operate from temporary premises and often outside the law. Cited in King and McGrath (1999), Thandika Mkan-dawire emphasizes the relation of small to large firms and the role of the state. "The widespread view of the relationship between the state and the small enterprise sector is that the less the state interferes the better, and both for doctrinal and piratical reasons". He succumbs into a Manichaeian discourse in which 'small is beautiful' and big is ugly to speak about fairly coherent industrial policies that should encourage micro-enterprises because they are not affected by international crisis on the same scale as the big firms. King and McGrath (1999) define small enterprises referring to capitalist small enterprises, "partly because when one talks of small enterprises in Africa one is not usually talking about small decentralized states enterprises or even co-operatives but of small, individually owned firms, and particularly those that rely on wage labour".

(Rasmussen et al., 1992) distinguish large from small firms by “flexible specialization”. They state that, at the micro level, flexible specialization is used to capture a new type of industrial organization able to cope with the increasing innovation and flexibility requirement. Rasmussen et al. (1992) argue that, spurred by success stories about their job creation record, their ability to innovate, and to respond to crises, small firms are increasingly being considered as the more efficient, flexible and dynamic business organizations. Whittaker (1997) distinguishes small to large firms (in Japanese economy) by job security and wages comparison; he emphasizes that large firms offer secure jobs while small enterprises offer unsure jobs with no collective protection. McGrath (2005); Reinecke and White (2004) define the informal sector according to size only and classifies as micro-enterprises and/or informal sector business as any having less than 10 employees. Given that the informal sector encompasses numerous features ranging from type of activities to size, regulatory requirements, legal status, etc, it is acknowledged that no single definition of the informal sector exists (Reinecke and White, 2004), but all definitions try to reflect the issue of providing employment to the unemployed. According to (Charmes, 2000), the informal sector is constituted by groups of individual enterprises owned by households and consisting of informal enterprises of persons working for their own account and having no permanent employees. The informal sector consists of various type of enterprises, ranging from Spaza or tuck shops to hawkers and catering enterprises (Ligthelm, 2002). Spaza shops represent an important component of the trade sector and form the focus of this study. In the developing world where poverty and unemployment is higher, small and micro-enterprises can rescue communities and provide jobs. People create businesses as survival activities without management expertise. The lack of proper skills influences the performance of those businesses.

2.2 Spaza shop

The word Spaza comes from the Zulu language meaning hidden; an apartheid-era term used when restrictions were placed on black-owned businesses (Bear et al., 2005). Spaza shops are small and informal businesses that operate in a section of an occupied residential home or in any other structure which is used for residential purposes and where people live permanently, often in a disadvantaged community (Ligthelm, 2002). Spaza market is a value chain that links low-income township consumers of basic grocery items to manufacturers, wholesalers, distributors, and other suppliers of products and services (Ligthelm and Cant, 2002). The Spaza market as an informal retailer market, is an important delivery channel of goods from manufacturers and wholesalers to township consumers. Knowing the dynamics of this informal retail sector may contribute towards an increased awareness of this important but unresearched sector of the economy (Ligthelm and Masuku, 2003). Spaza shops encounter numerous problems ranging from financial

and market-related issues to the macroeconomic environment within which businesses have to operate. These problems lead to failures if not properly tackled but improvement and success can be achieved if appropriate decisions are taken.

Many of those who start such enterprises do so as a way to make a living when there are few options available to them. Most owners have little direct link to the manufacturing industry; they shop at a mixture of retailers and wholesalers. Obviously this sector provides considerable difficulties for anyone operating in it. Owners spoke of a range of challenges: ranging from infrastructural issues (e.g. storage), environmental (rain and rats), security and insurance, finance (to buy stock/ invest in expanding their business) , theft, insufficient stock and transport (TTO,2004).

2.3 Performance Problem

The performance of micro-enterprises in general and Spaza shops in particular is affected by challenges and problems that Ligthelm and Cant (2002) classify as endogenous and exogenous. In the case of Spaza shops (Ligthelm and Masuku, 2003) show that Spaza shops are facing challenges that might bring failures, once the business is started; some of these challenges are:

- Shortage, limited trading stocks and finance
- High crime rate, robbery, burglary.
- Severe competition/small number of customers
- Unavailable/expensive transport
- Much credit and bad debt
- Lack of adequate operating space and equipment
- Lack of water, electricity/poor infrastructure
- High trading stock prices
- Attractiveness of bigger shops in townships

The UNISA study conducted by Ligthelm and Cant (2002), showed that 52,1% of Spaza owners were unemployed when they started their own business and only 6.2% of business owners chose to start their own firm when they perceived a lucrative business opportunity. The above pattern, especially the fact that the overwhelming majority of businesses were started without the identification of a lucrative business opportunity, suggests high potential for business failure (Ligthelm, 2002).

The failure of Spaza shop business is sometimes due to factors that the business owner-manager cannot control (because they are outside his immediate environment). At the same time the failure can be caused by factors that the owner-manager can control and avoid if the activity is well planned. These factors are major challenges that have to be dealt by the owner-manager of Spaza business. Ligthelm and Masuku (2003), categorizes these outside factors as macro-environmental or exogenous (cannot control), intrinsic to the functioning of the planned economy (Jackson, 1992) and inside factors as internal-micro or endogenous (over which the individual owner-manager has some control).

In general, government action for small and medium enterprise(SMEs) has been motivated by the market failures which inhibit small firm development; and there is public interest in SMEs because of their capacity to create jobs; and that the government can develop and act on a strategic vision for the economy which individual SMEs cannot do (Ligthelm and Masuku, 2003). It is sometimes useful to consider the problems caused by factors outside Spaza shops by combining economy-based as macro environmental or exogenous problems and to distinguish these from problems over which the individual owner has some control, which can be regarded as shop-based problems and classified as internal-micro or endogenous Ligthelm and Cant (2002).

EXOGENOUS FACTORS

1. Macro environmental problems

Management cannot control exogenous problems that manifest themselves in the economic, socio demographic, political, technological and international spheres. Some of the most prominent problems influencing micro-enterprise performance are:

- interest and inflation rate
- economic globalization and international competition
- compliance with legislation e.g. labour market laws and regulations
- resource scarcity resulting from seasonal conditions and natural disasters
- HIV/AIDS
- crime and corruption
- rapidly changing technology

2. Market environment

As with macro environmental issues, management has little or no control over external market factors and success often depends on an adequate, sufficient and prompt response to changing circumstances. The frequent problems are:

- market turbulence
- new competitors offering similar products at lower prices
- entry of substitute products in the market
- loss of major clients
- low demand for product or service
- limited market size
- poor growth prospects
- oversupply of product or service in the market
- decline in the demand for a major product line

ENDOGENOUS FACTORS

Endogenous causes of failure centres largely around the following areas: management skills, management behaviour and financial knowledge. Lack of expertise in the following functional areas is often reported: marketing, human resource management and financial issues.

1. Management issues

- lack of management training
- inexperience in the field of business
- inability to control business growth
- overemphasis on financial rewards
- inability to perform selected managerial tasks
- failure to set strategic goals
- failure to plan forward
- inadequate reaction to environmental changes
- reluctance to seek advice
- conflict of interest: family versus business
- unwillingness to adapt to change

2. Marketing issues

- poor location
- business inaccessible to customers
- insufficient marketing
- inability to identify target markets

- misreading the market
- failure to conduct market research
- poor products or services
- poor customer relations
- no knowledge of customer preferences
- lack of competitor knowledge

3. Human resource issues

- loss of key employees
- inadequate labour capacity-not having additional employees in time
- inadequate training and development of employees
- inability to attract and retain suitable staff

4. Financial issues

Financial management is a crucial field within the endogenous environment of small business that presents numerous potential obstacles to good performance. Management competence is often determined by the availability of management and financial information. Lack of financial sources is often reported as the major obstacle experienced by small businesses. Financial issues contributing to business failure are:

- capital requirement
 - lack of access to financial institutions
 - inadequate financial resources
 - lack of credit
- bad bookkeeping-inability to interpret financial statements
- financial planning: failure to compile budgets and inadequate tax planning.
- financial control and analysis: lack of management information on regular basis and failure to analyse information
- working capital information: poor credit management, excessive provision of credit, difficulties in obtaining supplier credit and lack of inventory control
- income generation: inadequate or incorrect cash flow estimates, large operating expenses, excessive fixed costs, insufficient profits, inadequate credit policy regarding customers and high percentages of bad debt.

There has not been much research done into the Spaza shop business in the Western Cape which is the example of micro-enterprises we are going to use. While Ligthelm and Masuku (2003); Ligthelm and Cant (2002); Jackson (1992) have conducted an exhaustive analysis of characteristics and failure factors of Spaza shops; they have not offered solutions in terms of ways to deal with the poor performance of this business sector. It is the aim of this study to address the performance problem faced by Spaza shops. On one hand, our aim is also to provide the model of intervention of concerned stakeholders to improve the Spaza business. On the other hand, the study attempts to determine the indicators of improvement in those businesses while it will set up some strategic measures on stocking, ordering strategies (policies). At a later stage, patterns on areas and periods of business operations will be identified to raise awareness of owner-managers (and decision-makers) on these issues.

It would appear that the problem is not merely one of efficiency in terms of input-output ratios and the functioning of the support institutions and services but also one of effectiveness in terms of the relevance and appropriateness of the strategies employed (King and McGrath, 1999)

Two approaches namely soft and hard operational research (OR) will be used to address the situation. Soft approach deals with soft problems and hard approach deals with hard problems. The choice of suitable criteria to differentiate between types of problem contexts will play a crucial role in determining the success or otherwise of the study relating those problem contexts to different problem-solving methodologies (Jackson and P.Keys, 1984).

2.4 Operational Research-OR

2.4.1 Introduction

OR rose to prominence during World War II largely because of the British military (Hindle et al., 1995). In the days leading up to World War II, British military management brought together a group of scientists to apply a scientific approach to military operations to determine the most advantageous way of deploying their massive material and manpower (W. Peyton Cunningham and McCloskey, 1984). Soon afterward, the United States military began engaging in OR using specialists from fields such as chemistry, mathematics, and engineering to create management techniques for allocating scarce resources and to achieve both military and industrial goals (McCloskey, 1987). In the 1950s various academic societies were born in both Britain (who today prefer the term Operational Research) and the United States (who prefer the term Management Science) for operation researchers (those who practice OR) to promote, develop and exchange ideas in the field. Those professional societies remain active today and the field of OR has grown even larger

and more diverse. OR uses tools from a wide variety of disciplines including statistics, mathematics, and engineering, and is now applied to problems in military, industrial, transportation and business fields.

2.4.2 Soft Problem and Hard Problem

Soft problems are called messy or wicked problems, the type of problem that problem structuring methods (PSMs) are designed to support are characterized by multiple interpretations, values, beliefs and modes of expressions; that problems have become increasingly complex. They are problems in which there are little data available for analysis and resources limited and for which the most demanding element is problem definition (D.Shaw et al., 2004). (Mingers and Rosenhead, 2002) define hard problems as unstructured problems that are characterized by the existence of:

- multiple actors,
- multiple perspectives,
- incommensurable and/or conflicting interests,
- key uncertainties,

Hard problem is defined by (Mingers and Rosenhead, 2002) as a problem that is well structured for which a formulation can be stated in terms of performance measures, constraints and the relations through which an action produces a well established solution.

2.4.3 Soft Techniques -Soft OR

Traditional or hard OR has taken as its foundation the possibility of a single uncontested representation of the problem situation under consideration. In recent years the limitations of OR have become particularly evident. These limitations are not related to the correctness or validity of the techniques employed, but rather to the applicability of quantitative techniques to certain problems. Critics including Checkland (1981) have argued that OR practice has been considerably more diverse than this. Problems have become increasingly complex and that standard formulations of OR methodology cannot cope with these less structured situations. Soft OR requires methods that enable decision makers to accommodate multiple perspectives; facilitate negotiating joint agendas; function through interaction and iteration; and generate ownership of problem formulation. The methods generate debate, learning, and understanding, and use this understanding to progress

through complex problems. Soft OR has sought to readdress this by understanding that people are an integral part of organizations and that they bring to the organization their own worldviews, interests and motivations. Furthermore, soft OR understands the difficulties involved in the predictability of human behaviour. Soft OR techniques invariably employ a researcher whose role it is to ensure the study group contains key stakeholders and who act, as a facilitator of the process. He orchestrates the discussions and can be seen as open, independent and fair. Soft OR methods seek to help key stakeholders understand the problems they face, the views held by other stakeholders and negotiate the action to take (D.Shaw et al., 2004) and come to a consensus on the course of action that should be taken (Franco, 2006). In very general terms, therefore, soft OR methods are those that structure a problem as opposed to hard OR that seeks to solve it. Soft OR uses predominantly qualitative, rational, interpretative and structured techniques to interpret, define and explore various perspectives of an organization and the problems under scrutiny. They generate debate, learning and understanding and use this understanding to progress through complex problems. It is for this reason that the great majority of such soft OR methods are referred to as problem structuring methods (Rosenhead, 1980). Problem structuring will constitute the technique used in this study to structure and suggest the intervention model. They are suitable techniques for understanding “ complex problems” people face, and therefore should be used as an earlier step in solving problems. (Mingers and Rosenhead, 2002) support this view by showing that PSMs, “although sophisticated in the way they conceptualize and interact with ongoing decision process, are relatively rudimentary in the mathematical or statistical apparatus that they bring to bear”. So depending on the case, PMSs should be completed by hard techniques to complete the solving process. D.Shaw et al. (2004) shows that problem structuring methods are developed and applied for small groups, that Franco (2006) call the management group. While much attention has been paid to group decision-making, much less attention has been paid to the same kind of issues for large groups (D.Shaw et al., 2004). Work should continue to propose the participation of larger groups to decision making processes.

2.4.4 Hard Techniques- Hard OR

The OR described above has in recent times been referred to as hard or traditional OR. The word hard refers to the use of mathematical and quantitative techniques as opposed to softer research that employs predominantly qualitative techniques. The techniques like Linear Programming, Statistical Analysis, Simulation, Queuing Theory, Markov process, Multiple Criteria Decision Making, etc are said to be traditional OR or hard OR because of their quantitative focus. Other writers have defined the hard distinction in terms of its primary and secondary focus. For hard OR the primary focus is on the problem, the people involved with the problem are the secondary focus (Pidd, 2004).

Since the early 1980s, the use of statistical analysis methods in hard OR has been widely recommended Mary et al. (1995). The statistical techniques used has been selected because of their power and capability in supporting the understanding and improvement of this business market. We emphasize that these are supporting techniques and are part of hard Operation Research. The usefulness of these techniques is illustrated in the following case study, where correspondence and CHAID analyses are used as statistical analysis tools with simulation being differently used. We used CHAID analysis to increase understanding of factors determining volume of purchase and performance of businesses indicators (being top or not performing Spaza shop). Correspondence analysis is used to assemble Spaza shops as well as products into clusters that place individuals, as far as is possible, into a homogeneous grouping to reflect association and differences.

2.4.5 Statistical analysis used to enhance the decision

1. CHAID analysis

CHAID (Chi-square Automatic Interaction Detection) is a Classification Tree technique that not only evaluates complex interactions among predictors, but also displays the modelling results in an easy-to-interpret tree diagram (SmartDrill, 2008). The CHAID algorithm starts at a root tree node, dividing into child tree nodes until leaf tree nodes terminate branching. The splits are determined using the chi-squared test. CHAID then creates additional layers of branches of each split grouping using the strongest of the remaining predictors. It continues this branching procedure until the final branches of the tree have been generated. If CHAID is being used to generate a predictive market segmentation model, then these terminal branches are the final market segments (SmartDrill, 2008). CHAID is used for choosing among variables that will lead to significant differences between groups formed on the dependent variable. Typically it will have many possible variables on which the split of the sample will be based, at least in early stages of the analysis. You can usually find one or more ways to split the sample that make sense in terms of your organizational goals and abilities.

Unlike standard multivariate procedures, CHAID analysis group is based on conditional probabilities, which can provide more valuable insights than other procedures. Using cutting edge data mining technology, CHAID can reveal hidden patterns and trends in transactional information, predict future customer behaviour and identify factors that can maximize profitability. Armed with this information, it will enable clients to design a plan to acquire the most profitable new strategies. While CHAID was designed to process non-metric and non-ordinal data that normal multivariate analyses cannot handle Steven (February, 1992) points out some limitations of the method:

- Data must be ordinal, nominal or interval, and not metric. No variable can have more than 15 levels. Any variable having more than 15 levels and all metric variables must get recoded to no more than 15 categories.
- You must specify a “response” or dependent variable. CHAID will partition the sample to maximize inter-group differences (variance) on this variable. If you have no such dependent variable, CHAID will not run. You can, though, run CHAID using dependent variables as segments generated by a clustering procedure, to look at the data in a different way.
- CHAID cannot process zero values or codes that are not in sequence (for instance, you cannot skip from a code “3” to a code “6”). This may add to the time you must spend recoding data.
- Note that CHAID cannot perform an analysis with continuous dependent variables, such as number of packages of the product bought.

Used in this way, data mining (with CHAID analysis) formed part of problem structuring for the study and provided an evidence base that identified variables determining performance of Spaza shops.

2. Correspondence Analysis

Correspondence analysis is a statistical visualization method for picturing the associations between the levels of a two-way contingency table (Bee-Leng, 1994). The name is a translation of the French “Analyses des Correspondances” where the term correspondance denotes a “system of associations” between the elements of two sets. In a two-way contingency table, the observed association of two traits is summarized by the cell frequencies, and a typical inferential aspect is the study of whether certain levels of one characteristic are associated with some levels of another.

Correspondence analysis is a geometric technique for displaying the rows and columns of a two-way contingency table as points in a low-dimensional space, such that the positions of the row and column points are consistent with their associations in the table (Bee-Leng, 1994). The goal is to have a global view of the data that is useful for interpretation. The distance between the row points is a measure of similarity between the row-frequency profiles. Soutar and Still (2000) used the technique to enhance the understanding of start-up motivations of a sample of small business in Western Australia. The technique was used to enable the assessment of the relationships between various start-up motivations and a clustering of respondents into groups with similar motivations. Soutar and Still (2000) show that correspondence analysis was used when the data are categorical (such as the yes/no) as in the case of response to the reasons for starting a small business. These categorical data have to be analysed in a multivariate way.

Reed (2002) demonstrates empirically the use of correspondence analysis to compare social groups or collectivities using measures derived from individual-level multivariate data. The technique was used to develop an aggregate measure applicable at one level that could be a higher or lower level unit; and also to which extent there has to be agreement among individual units in order for means (averages) to measure the construct validly. Applying a construct developed at one level to higher level units risks mis-specification by imputing, for example, individual characteristics to collective entities Reed (2002). The study was used to examine satisfaction and morale as an equivalent pair to individual workers and organizations or workplace. Correspondence analysis provided a useful way of dealing with this type of problem, given categorical data for multiple indicators (Reed, 2002). It was found that the first dimension discriminates between high and low morale indicating workplaces differ more in terms of levels than they do in terms of spread or inter-rater agreement. The method shows that the scale appears as the second dimension. Variation within the group with respect to both level and spread, create a problem for the construction of aggregated scales. The technique is used by (Beldona et al., 2004) to examine purchase motives of pleasure travel components of low and high complexity in a web environment. In fact, there is gradual shift amongst travel technology vendors to move beyond accommodations, flights and car rentals to encompass cruises, destinations and others (NYU and PhoCusWright, 2003). The facets of travel products such as events, attractions, tours and packages have their own unique product characteristics. Therefore the propensity to buy the range of low to high complex travel products will also largely vary due to inherent individual consumer characteristics (Beldona et al., 2004). The question was: "what are the customer motivations that differentiate the purchase of low and high complex travel products ? " The answers were yes or no.

From the data surveyed by the Canadian Tourism Commission (November 2001), the study was motivated by this question and investigated the relationship between consumer purchase motivations across low and high complex travel products. Correspondence analysis using multi-way tables was chosen as the technical technique to analyse the data.

It was found that online shopping motivations of travel products of low and high complexity are distinctively different. Online shopping differs also depending on user skill levels. The technique showed that the purchase of less complex products such as flights and car rentals are driven by motivations with transactional objectives, shopping motivations behind complex systems such as tours, activities and attractions are driven by informational parameters. Low and high-skills Internet users are different. At the outset, one can generalize that high skills users place greater emphasis on information detail when it comes to travel products of high complexity.

Low-skilled users were driven more by the availability than other motivations (Beldona et al., 2004). Although the technique can be used for comparison of clusters (Soutar and Still, 2000) or to aggregate measure for categorical data (Reed, 2002) and to analyse multi-way table of low and high complex products, however, correspondence analysis offers a useful solution for scale construction as well as providing information about the appropriateness of the data for such use. The method extract dimensions that discriminate between level and spread separately, so that effects of group variation will be factored out of the scale, but information retained in other dimensions. In the same way, we will be using this approach, to explore the differences and association patterns according to shops categories (top performer, middle performer and low performer), products, period and area. The technique offers useful visualization and display of Spaza shops categorical data into clusters (of association or differences) of products, periods and areas.

2.4.6 Simulation

Computer simulation is the discipline of designing a model of an actual or theoretical physical system, executing the model on a digital computer and analysing the execution output. It is the manipulation of a model in such a way that it operates on time or space to compress it, thus enabling one to perceive the interactions that would not otherwise be apparent because of their separation in time or space (Bellinger, 2004). Modelling and Simulation is a discipline for developing a level of understanding of the interaction of the parts of a system and of the system as a whole. The level of understanding which may be developed via this discipline is seldom achievable via any other discipline Bellinger (2004). A system is understood to be an entity which maintains its existence through the interaction of its parts. A model is a simplified representation of the actual system designed to promote understanding. Whether a model is a good model or not depends on the extent to which it promotes understanding. Since all models are simplifications of reality there is always a trade-off as to what level of detail is included in the model. If too little detail is included in the model one runs the risk of missing relevant interactions and the resultant model does not promote understanding. If too much detail is included in the model, the model may become overly complicated and actually preclude the development of understanding.

Simulation models have a considerable potential for use in assisting decision-makers in investigating alternative management policies. However, as yet this potential has not been fully realized largely due to the nature of the models built and more specially in micro-enterprises with Spaza as a case study. The simulation model in this study will discuss the use of a stock management as an investigatory mode and will illustrate its use in relation to possible management strategies for an individual Spaza shop guide.

The options discussed in this study show clearly the importance of business expertise at the Spaza shop level. Our focus is to show how the intervention on endogenous factors, in terms of policy, could be directed at the Spaza level, as a way of improving the business.

2.5 Multimethodology

The essence of multimethodology is to utilize more than one methodology, or part thereof, possibly from different paradigms, within a single intervention (Mingers and Brocklesby, 1997). Some observers have expressed concern over the state of the OR profession, especially as to its failure to tackle complex and messy problems. One response has been to develop various soft methods also called also problem structuring methods, that focus on the human and political aspects of OR/MS interventions (Mingers, 2000). The combination of complexity, ambiguity, dynamism and limited opportunities for data gathering creates less of an opportunity for one traditional approach of OR to tackle issues (Georgiou, 2007) in a real-world situation. Recent work, both theoretical and practical, involves the combination of several methods in a particular project. Often combination includes both hard (quantitative) and soft (qualitative) approaches (Mingers, 2000). Different paradigms, each focusing on different aspects of the situation, and multimethodology are necessary to deal with the full richness of the real world (Mingers and Brocklesby, 1997). The purpose is to generate a richer and more effective way of handling the problem situation. Real world problems are complex, no matter how technical and well defined they may appear. The social and personal factors can make the problem more complex. This is the reason for combining methods to tackle all aspects of a problem situation.

Jackson and P.Keys (1984) support the idea of combining methods with emphasis on the problem context. Different problem-solving methodologies are presented as being appropriate for dealing each with one type of problem context (Jackson and P.Keys, 1984). Classic (hard OR) and soft OR should tackle each a specific aspect of a problem. Mingers and Brocklesby (1997) show that combined methodologies might be desirable for more effective practice when one deals with the richness of the real world. The philosophical, cultural and cognitive feasibility issues are raised and can be tackled only by using multimethodology. The reason is that, according to Mingers and Brocklesby (1997), the multi-dimensional world (highly complex), the intervention as process (not single or discrete event), the practice ahead of theory and the post modern world (beliefs and values) support pluralism in methodology. Pidd et al. (2005) argue that soft and hard OR can be combined in a powerful synergy, with emphasis on how the combination should be done. They support the idea of Mingers, which stipulates that the soft approach should precede the hard approach.

Mingers (2000) and Mingers and Rosenhead (2002) argue that soft methods and techniques should be used in combination, both themselves and with more traditional quantitative modelling to yield a richer form of multimethod.

It is initially known and arguable that hard problems should be tackled using hard OR approaches and soft problems should be solved using soft OR approaches. This dissertation is an attempt to use both approaches to handle a given case of Spaza business problem. Spaza shop businesses as an informal sector of business is characterized by various and complex factors that influences its operations. The study is to show that both soft and hard methods or techniques should be used together to capture all the aspects of this kind of business, specially when dealing with the performance aspect which is the focus of this study. In the following chapters we will discuss cognitive mapping and SSM representing soft approaches in one hand and data mining (correspondence and CHAID analysis). Simulation, on the other hand, will represent hard approaches as a way of understanding the performance issue and set up strategies that could be adopted for the improvement of the informal sector of business as characterized by Spaza shops.

Chapter 3

PROBLEM STRUCTURING

3.1 Introduction

The improvement (performance) of Spaza shop as a case study of micro-enterprises and small businesses in the informal sector has two aspects. First, we consider it as a soft problem. It is not well structured: what should be improved to handle the performance of the Spaza business? It is unclear and complex. The shop appearance should be improved, the shop owner should improve his business skills, the partners should improve their participation and collaboration within Spaza businesses, etc. How should the performance of Spaza shops be improved? The issue involves multiple actors (Spaza owners and customers, the local distributors, the government, the NGOs) with multiple perspectives from each actor. Spaza owners would like to receive subsidies for example. The government would like to select candidate with abilities to manage the business. So there is conflict of interests. There seem to be lot of uncertainties because of the issues mentioned above, the lack of proper data and clear definition of what needs to be resolved. It is not clear what should be done. Should shop activities be improved? Or should the shop owners abilities be upgraded? Should the community issues be tackled? Every stakeholder has his/ her own view of how things should be improved, therefore, it is a soft problem that need soft techniques to be addressed.

Secondly, we consider the hard part of the problem as being the small quantity of data that need to be analysed. Hard techniques will be used to tackle this matter.

In this chapter we present the use of problem structuring methods and the choice made on some of the methods to structure the case study. The approach we present in this chapter is the problem structuring method we have employed to derive planning guidelines as part of a comprehensive strategic planning process of Spaza shops for structuring decisions, but it will not provide any direct solution. Problem Structuring Methods are a family of methods that provide structure and guidance

for analysing systematically messy or wicked problems faced by the managers of organizations (Franco, 2006). They are used to improve the understanding of situations characterized by uncertainty, conflict and complexity.

In using problem structuring we have to take into account the designing process as well as the emotional commitment because, as (Pidd, 2004) emphasized, “without emotional commitment to delivering agreement, the rationality of the reasoning becomes irrelevant and so politically infeasible”. In fact, the organization may encounter a great danger of deliberate sabotage for highly rational decisions that have ignored the social needs and emotional commitment of the group at the lower level. Decisions that focus only on rationality may fail to be correctly implemented because, a lower level team member will sabotage them, Eisenhardt (1989) in order to retain social equilibrium and comfort.

Bringing the involvement of all stake-holders gives the decision-maker the power to embark in a procedurally coherent process which gathers cognitive commitment from most participants within the organization to decisions. It is likely that the resolutions and decisions from negotiations increases the chances of political achievability in the implementation of agreements. Today it is accepted that problems cannot be solved by a single decision-maker act, but it requires cooperation and involvement between many different actors and stakeholders so that they work out solutions, the implementation and the monitoring process as well for the success of the organization (Rukato and all, 2001). This shows the complexity of issues and conflicts within each organization when dealing with problems to be solved. A complex problem can be divided into problem components to be solved but their respective solutions cannot be added because the solutions will interact. Problems, may be solved but messes are to be managed.

According to Ackoff (1979), Managers are not confronted with problems that are independent of each other, but with dynamic situations that consist of complex systems of changing problems that interact with each other (Rosenhead and Mingers, 2001). For a good analysis that leads to optimal solutions, problem structuring is a crucial step and the basis on which the whole analysis starts. It provides structure and guidance for systematic judgement in complex situations where the decision-maker should understand the situations thoroughly, establish the impact and degree of involvement of each member, then take decisions at the last stage of the whole process. Problem structuring helps to understand the problem better and also optimizes the decision so that it improves the chance of enhanced outcomes.

For the Spaza case we have used SODA (Strategic Options Development and Analysis) and SSM (Soft System Methodology) to structure and enhance the understanding of the dynamics around this specific business. SODA with causal mapping helped us to capture the ideas of the system in which Spaza shops are working, put it in a map using decision explorer software, and get the different

conflicting views of the problem. Soft System Methodology was used as an overarching methodology guide to gain an understanding of what could be the probable transformations and outcomes that could be expected from this project and establish the framework for actions, and also raise what might be the contribution of each individual actor to the implementation of the outcomes (output). Soft System Methodology formed the basis of the problem structuring with the aim of raising some desirable and feasible changes. Our primary contacts were with Triple Trust Organization management team that we were dealing with, but we did not have direct contact with all stakeholders in the communities. Generally, direct contact should be made with all stakeholders.

3.2 Some Methods used in Soft Operational Research-OR

3.2.1 Strategic Options Development and Analysis-SODA

Strategic Options Development and Analysis (SODA) is the method used to work on problems that are complex and messy. It is the approach designed to provide consultants with a set of skills, a framework for designing problem solving intervention and a set of techniques and tools to help the client. The consultant using this approach to structure and solve problems needs two kinds of skills:

- He needs to have the skills of a facilitator to guide the teams to work together efficiently and effectively.
- He needs the skills to analyse the content of ideas addressed by team members and also be able to build the appropriate model.

Thus the traditional model building and analysis skills of the operational researcher are used to handle the complexity which faces a team working on a messy issue (Rosenhead, 1989). According to the above author, the user of the SODA approach has to:

- be personally interested in the practical aspects of social psychology and cognitive psychology which is explicit and reflective about managing a social process.
- be prepared to work face to face and relate personally to a small number of clients, for example three to ten people.
- tend towards a contingent and cyclic approach to working on problems. The approach will be to proceed flexibly and experimentally from broad concepts to specific commitments.

- be more interested in designing and managing problem solving workshops rather than researching and analysing the problem characteristics.

Subjectivity is the foundation of the SODA approach. Every member of the client group is held to have his own personal view about the real problem. It is important that wisdom and experience of members contribute towards developing decisions with which participants feel confident. This view of the behaviour, the judgement and the decision making in organizations sees experience gathering as an act of scientific endeavour (Rosenhead, 1989). Using SODA some difficulties might be encountered, for example:

- The user or the facilitator needs to have the ability to model a given situation encountered by the organization
- The approach takes time to learn and create a map that every one will agree is not a simple task. It is difficult to listen and design a map of conflicting views at the same time.
- Attempting to keep the map on one sheet of paper allows errors
- The approach captures the inputs and structures them, but does not reflect directly the outputs as transformations of the modelling.
- First attempts are often time consuming, messy and discouraging

As we were focusing on raising the transformations that might occur, this approach was not appropriate for the current case study, but it helped us capture the conflicting views of the Spaza business into a map.

3.2.2 Strategic Choice

The strategic choice method is an approach which deals with the interconnection of decision problems in a complex world (Rosenhead,1989). The distinctive feature of this approach, when compared to others, is the way it helps users in making incremental progress towards decisions with focus on ways to manage uncertainty. Because it combines a concern for complexity with emphasis on real time decision making, the strategic choice approach has been described as an approach to planning under pressure (Rosenhead, 1989). The strategic choice is a decision process governed by perceptions of the relative importance attached to three broad types of uncertainty, each calling for a different type of response (Rosenhead,1989). The three categories of uncertainty are:

- Uncertainties pertaining to the work Environment-UE
This can be dealt with by responses of a technical nature.

- Uncertainties pertaining to guiding Values-UV
Here this kind of uncertainty calls for more political responses.
- Uncertainties pertaining to related decision fields-UR
Here this uncertainty calls for more response in the form of exploring the structural relationship between the decision currently in view and others with which it appears to be interconnected.

Decision-makers face continually practical choices about how to invest in different kinds of response to uncertainty. This calls for dynamics of strategic choice.

This approach requires:

- Extensive Participant Interaction
- A skilled Facilitator
- Flexibility and Awareness
- Time and Commitment

Strategic Choice is an approach that brings involvement and interaction between participants when focusing on uncertainty and implementation of the decisions. It is designed to be flexible and it incorporates cyclic nature of decisions which are more robust. The method is more complex, requiring a highly skilled facilitator and depends on computer power. When using this approach, it is difficult to transfer the technical knowledge and the risk of getting lost is high. As the case of Spaza shops has to be structured firstly to get the dynamic surrounding it, may be future work could be done with focus on uncertainty. The work might help with strategic planning as a way of improving Spaza shops businesses.

3.2.3 Soft system Methodology-SSM

Any discipline which is concerned with rational intervention in human affairs, such O.R and systems engineering or system analysis, must both establish theory and be practical. Theory and practice will exhibit a groundless relationship, each generating the other, with neither being prime (Checkland and Scholes, 1990). The mutual development of theory and practice calls for action research in a real situation, research in which the researcher has to allow the situation to take him where it will and whose focus is the change process rather than some expected hypothesis under test. To do better, it is essential to declare in advance the methodology framework which the research will follow. One suitable methodological framework for action research is provided by soft systems methodology (Checkland, 1981), a learning or enquiring system which uses systems models to understand and intervene in the

conflictual real world situation (Checkland, 1985). The learning is about the complex problematical human situation and leads to finding accommodations when taking purposeful action in the situation aimed improvement (Rosenhead, 2001). SSM is a problem solving approach developed from System Engineering when it failed to be applied to messy, changing and ill-defined problem situations. It is built around the concept of human activity and allows that whenever we describe purposeful human activity, we include an intervention, a taken-as-given point of view or *Weltanschauung* (Checkland, 1981). The assumption in this approach is that there is no “wrong” or “right” description of human activity system, only several possible descriptions based on different taken-as-given images of the world. SSM selects the relevant human activity systems and builds a number of models based on different *Weltanschauung* made explicit in the different “root definitions” of the chosen system (Checkland, 1981). The models are used to provide structure to debate about what to do; those debates are organized by comparing the models with real-world perceptions and happenings. The aim of debate is to get some kind of accommodation between conflicting views, and to arrive at some changes that are systematically desirable and culturally feasible (Mingers and Rosenhead, 2002). When the changes are established SSM could be used also to implement those changes.

The figure 3.1 illustrates the stages of soft system methodology. By the end of the modelling process, the consultant has to make sure that the five Es, as defined by (Paul and Emma, May 1997), are clearly recognized so that the monitoring process will follow successfully. The implementation and monitoring are complete after answering the following questions, each related to a specific E:

- efficacy: will the system work?
- efficiency: are the resources available?
- effectiveness: are the transformations meeting the longer term goal?
- ethicality: are the transformations a moral thing to do?
- elegance: are the transformations performed aesthetically?

These are the guidelines for the modeller to always look at and check when implementing a model together with the decision-maker. At this stage, it is the system and decision-maker who have the right to choose which E is more important than the other (Things that are highly valued in one society might be useless in another society).

Rich Picture

The rich picture is defined as the attempt to capture the problem situation that characterizes problem structuring; they are devices for thinking about the problem.

The idea is to include information that could be regarded as soft (such as attitudes, roles and assumptions) as well as hard or technical data (Checkland, 1995). Rich picture shows that there is not yet a definite sequence in which the issues will be handled, and also shows the relationships between issues, people and systems.

Formulation of Root Definitions

At the beginning of the application of the method in the research, “root definitions” (RDs), as the names of relevant systems are called, were written rather casually, covering essentially only the purpose which the system in question pursued. Later, “when RDs from many studies were examined against a general model covering any purposeful activity a rule was derived for ensuring that RDs are well formulated” (Rosenhead and all, 2001). The root definitions, when structuring a system and building the model, should be constructed by considering the elements of the mnemonic CATWOE. The central part of an RD is the transformation process T that implies change of inputs into some defined outputs. CATWOE stands for:

- C: Customer; the customers are people that are victims of the purposeful activity or people that will benefit from it.
- A: Actors; these are the people that do the activities
- T: Transformation process; here we see what could change the input to some expected outputs. The transformations are considered as a black box in which the inputs are changed into some outputs.
- W: Weltanschauung; which is the view the world got of the activity and also the world that makes the definition meaningful.
- O: Owner; here we see who are the people that have the power to initiate or stop the activity.
- E: Environmental constraints; here we see what are the constraints from the immediate environment; the taken as given.

3.3 Application of SSM to Spaza Shops

3.3.1 Context of the project

Spaza shops are informal small businesses in disadvantaged communities owned mostly by people with lack of management skills. It was found that the owners

of Spaza shops and their potential customers are mostly poor within the same locations. The main issue is to find, at the end of the study, the fundamental problem and investigate the possibilities of addressing that problem. The question that should be kept in mind is how to help Spaza shops to do well (getting more returns) while selling goods at affordable prices to their respective customers and managing the stock well? In the present dissertation, we have used an approach in the context of supply chain management of Spaza shops in the disadvantaged communities in Western Cape, where quantitative data were particularly scarce. We relied upon the informed judgement of the technical management-planning team of triple trust organization which managed to provide data. We discussed ways of ensuring that the approach which could address the problem remains flexible. Our duty as analysts was to help TTO team management to understand the real problem faced by Spaza shops owners and see how this issue could be appropriately addressed so as to optimize the outcomes. The following sections will illustrate the framework that guided and structured actions on the use of SSM based on the “rich picture” and “root definitions” for relevant world views and possible changes. It is built with the aid of the causal map illustrated in Figure 3.2. The causal map was developed based on different meetings with TTO and documents handed over to us. We raised the relationships of different aspects of the business and their influence on each other.

3.4 Root Definitions for Spaza Shops Operations

In this section we are going to define the stakeholders that are involved in this project as well as the transformations or outcomes that are expected to occur when tackling this problem.

3.4.1 Customers

Township consumers

From this project the customers are all the disadvantaged communities in the townships. This includes both Spaza owners themselves and their potential customers for the reason that all of them are poor. The owners of Spaza shops are poor compared to manufacturers, wholesalers and they live with their customers in the poor areas where the number of super markets is limited. The customers also are poor people willing to spend much of their income at the nearest Spaza shop to avoid theft by robbers when carrying goods from distant supermarkets.

3.4.2 Actors

Local distributors

Local distributors have a role to play especially when it comes to the prices and supply of merchandises to the shops. The distribution chain (in which distributors are included), if well managed, helps the owners to avoid leaving the shops often, because the articles will be supplied to the shops in the distribution chain.

Product manufacturers

Manufacturers have a role to play when it comes to the supply chain network, in which the owner can offer good prices when the linkages are well established. The products manufacturers might become a major partner in dealing directly with Spaza shops rather than using distributors. This could cut on the costs faced in the distribution process.

Service Providers

There are several services needed by Spaza owners while doing their activities. Spaza owners need help to kill pests and other insects that damage their stocks. They need to order by phone to avoid closing the business for long hours when travelling to buy goods. They need wholesalers and products manufacturers to do the marketing for the Spaza by painting and putting attractive pictures of their products on the wall of the shops as well as the advertisements. Most of Spaza shop owners use public transport to buy their merchandise, private taxis which are safe and expensive while trains are unsafe. The transport is a daily needed service and it needs to be better organized so that it is cheaper.

Municipal Government/Councils

In order to encourage the development of Spaza shops, the government should subsidize Spaza shops in order to encourage their development. The idea is to help the owner with great management abilities so that he can put up small and medium businesses that are successful. With subsidies, the government fulfils the primary role of the state in creating a favourable environment for entrepreneurship, including fiscal and monetary control. At this stage, the government may be able to play a leading pro-active role in shaping a national framework of policies, practices and institutions to foster Spaza shops development. To a great extent, this depends on the resources available. There are strong general arguments for subsidies on the basis of giving disadvantaged groups access to particular services and innovative

ways in which the government support which will strengthen Spaza shops owners responsiveness to demand can be provided.

3.4.3 Transformations

The most important aspect of the project is the transformation process of Spaza shops owners into successful business owners using management knowledge, skills and expertise to get more returns and profits that lead to sustainable economic growth. The expected transformations are:

Transform the Spaza shop owner into a successful business owner

Successful rapid growth economies are all driven by private mechanisms of learning, exchanging knowledge and mutual support to transform inefficient businesses into efficient ones. It is widely assumed that education and training systems have a role to play in developing entrepreneurial values, attitudes and behaviours. TTO and the government can help Spaza shop owners to have vision and abilities to manage well with courses, seminars, workshops and training for those willing to further their studies in management. The lack of required skills is a major obstacle to sustainable management capacities and therefore to success. These skills are important for the Spaza shop owner to understand the market mechanisms and parameters. The main instrument is the training program where Spaza owners could be made aware of the relationship between working conditions and productivity, and learn how to identify concrete improvements in the workplace. This could be initiated by organizations like TTO, SA government and training programmes implemented in collaboration with those organizations. Even universities could help to build formal businesses. The design of Spaza which are both profitable and of value to formal business will require innovative and creative approaches like analytical ability, risk taking, innovation, planning and skills in human relations.

Create good network linkages between Spaza shops and their partners

Customers of Spaza shops are dissatisfied with limited stock choices. Their units preferences are not always available and prices are perceived to be relatively high in comparison to supermarkets. To make stocks available, good linkages and networking of Spazas and their trading partners should be created. The connection of Spaza shops with their potential suppliers will help the owners to get merchandises at factory prices and also they will be provided with services that are needed to run their businesses. Credit cards and delivery at home may be used to reduce the knock-off activity hours. Membership networking organization will have the

potential to play an important role in advocating Spaza shops interests. The networking system will help Spaza shops to get goods at good prices, therefore the customers of Spaza shops will benefit from good prices.

The Spaza business networking will help the owners to have one voice as Spaza shops in interacting with business partners. They may have a committee that negotiates with all other partners for the interest of their businesses.

3.4.4 Weltanschauung

Poverty alleviation

The success of businesses driven by management skills will lead to a society in which poverty will be alleviated. Firstly, good prices will leave customers of shops with more money which gives them more purchasing power. Secondly successful businesses will create jobs in the communities. If every Spaza shop could employ only one person, 14400 jobs could be created in the Western Cape, therefore unemployment would decrease leading to a decrease in crime which is often driven by poverty. Thirdly, the status of business changes from informal to formal business leading to profitability of rich and safe communities driven by work.

Structured network market

Spaza shop businesses are mostly situated in the locations. Some of the locations are undeveloped in term of facilities like for example roads, electricity, easy access to public transport, decent houses. But once these facilities are in place, big supermarket and wholesalers are attempted to relocate their businesses in these newly transformed areas, therefore the competition become high and some Spaza shops may found out of the business. Also it become a big problem for those who are attempted to start an economic activity to do so. The market business Spaza shops should follow must be effective and efficient. It needs to be a free market without barriers to entry from big manufacturing, wholesalers and supermarkets, but a market in which loyal concurrence is a rule. A connection of Spaza shops with other partners is very much needed as it will help to improve this business as we can see in **Figure 3.2** . The networking and interconnection of the Spaza shops as a force will help in advocating for their needs in the related market.

3.4.5 Owners

Triple Trust Organization (Usaid, SEEP)

This project is initiated by the Triple Trust Organization (TTO). The project could be terminated at any time by TTO when the goal is achieved or when the operators realize that the project might be infeasible. This means TTO have influence and control on the existence of this project.

Local Municipalities or/and Councils

The government becomes one of owners in the sense that it also has the power to stop the project if it is unlawful for example, or if from the government's point of view, it is neither profitable nor feasible.

3.4.6 Environmental Constraints

Economical

1. Scarce funds:

According to the report published in business development services by TTO, the owner-managers of Spaza shops need funds to organize and empower their businesses, but more rigorous application of the business-like principle affect donors' (including government) general concern over distributional questions and commitment to disadvantaged groups (Bear et al., 2005). The donors' interventions require their being clear about whom they are seeking to assist, and mostly with conditions like:

- Using a more demand-led approach which inevitably means that those with more demand benefit most from the funders;
- The self-selection implied by this approach means that those with most ability, drive and resources select themselves, while those without these qualities are left behind;
- The self-employment into which many Spaza owners have gone is an involuntary state. Given the chance, many would gladly go into employment; their businesses are useful in a welfare sense, but are unlikely to contribute significantly to economic growth in the current state;
- If the poor do benefit from donors, it is primarily as indirect beneficiaries working as employees with larger enterprises, but not directly as entrepreneurs. So a system should be created where the poor should be given a chance to express their abilities as potential business operators.

2. Market system models unknown:

The elements of these markets are dynamic as they are driven by human beings. The market environment in which there is demand for Spaza shop products is influenced by numerous factors related to locations, customer tastes, purchasing power and this information is unavailable specifically to Spaza shops. For flourishing economic activities, the owner must have a keen understanding of their customers needs so that they can provide an appropriate response before starting a business activity. There is no information of which model these markets might follow for improvement, these are still subjects for research. But for this study a model of intervention from stakeholders will be provided to allow decision-makers to focus their interventions in such a way that improvement could be reached.

Political

1. Ideological:

The black empowerment entrepreneurialship is a good idea but it is limited because it looks only to a category of people, but in this case the fund should be available for any South African with ideas and capacities to build a successful business. Most Spaza operators are not able to request funding as they can not provide, for instance, a detailed business plan which is needed by most funders. This discourages most owners from applying to financial institutions for business funding support and this undermines their abilities and capacities. Some of these Spaza owners do not apply, only because they believe that they are not going to succeed with their applications. This belief could be a barrier to the growth of their capabilities.

2. Geopolitical links:

The project focuses on the disadvantaged areas, whereas in other locations some poor people could have great ideas. This limits the success of the project as a whole. On the other hand the owner of a Spaza as an entrepreneur cannot stick to one region of operation. The business may shift to anywhere where the opportunity of making profit is better.

Demographic

The migration of populations from rural to urban areas transforms the small townships into big townships; therefore the big super and hypermarket see an opportunity for business. The entry of supermarkets into the townships makes it difficult for Spaza shops to compete and survive, they are forced to quit the market or to move from locations where business opportunities are lacking. These changes of locations are sometimes accompanied by troubles that bring failures.

Cultural

The culture has an impact on businesses run by coloured and black people according to their beliefs in certain values derived from culture and religion. But in business, opportunity should be identified by market situation, not driven especially by culture and religion. The culture and beliefs are big issues that lead to insecurity in the township where people kill, rape, rob easily because of their beliefs.

Unsafe and inadequate storage facilities

The stock product in most of Spaza shops is limited, customers are willing to spend more in the shops, but articles needed are scarce. This run-out of stock sometimes is caused by the pests and other insects that destroy the merchandise in the shop. Some Spaza shops are not well built so the rain sometimes also destroys the merchandise. The issue of robbery and poor security is an other obstacle to the stocking of a lot of merchandise in the storage facilities.

3.5 Model of intervention

There is need of funds and services for Spaza shops, these should be directed to where they are most needed. The intervention of stakeholders in Spaza shop businesses should follow certain phases (stages). This intervention in phases shows the way of transforming the inputs (money and services) into the desired output (successful business man). **Figure 3.3** illustrate phases of intervention in the model, which is detailed in **Figure 3.4**. The model is considered as a black box in which the inputs are transformed into useful outputs. In the case of Spaza shops, we have the inputs considered to be “needed services” and “financial-aids” that should be transformed into “poverty alleviation” in disadvantaged communities and “successful business man” as illustrated in **Figure 3.2**. The inputs come from the Spaza shops partners as essential services like: transport, pest services, workshops and short courses for the improvement of management skills, etc. To improve these needed skills and services, the input should be monitored through actors and TTO so that the transformation occur as the intended output. The money is also needed to boost the business as subsidies from the government.

The whole modelling could be meaningless if the criteria for efficacy, efficiency, effectiveness, ethicality and elegance are not defined to ensure that monitoring of the process is successful. The five Es’ have still to be defined together with the TTO management team to ensure the success of the project. The whole process of modelling shows that lack of finances and stock management skills are the key issues that need change to ensure successful improvement of Spaza shops.

The Spaza owners might be trained (seminars, workshops, short courses) to get those important skills. But for the stock management a proper analysis should be done by the experts (those who understand and have the abilities to analyse businesses) to derive scientific conclusions that could be applied by the Spaza owners. Several techniques might be used, but for the present case, we opted to apply computer simulations, with its sensitivity analysis and see how the stocks change, therefore the conclusions will follow on which are the optimum stocks and what is the optimum management stock model. This is the focus of the following chapter. Spaza shop market is a problematic situation in which many parameters are unknown. The main issue presently is to help Spaza shops improve increasing volume of sales assuming that the profitability increases as well with the sales. With the shop making profit, business will change from being informal to formal. To reach this goal there are challenges that need to be addressed:

3.5.1 Lack of management skills

The lack of proper management expertise, by the owners of Spaza shops:

- Owners starting business for the wrong reason:

Most of Spaza shop owner start their own business aiming to make lot of money, or they start it thinking they will have more time to spend with their families. The main reason should be passion and love of business ensuring that the products and services delivered will fulfil a real need in the market place without neglecting the monetary gain.

- Poor management of the business:

Many reports on business failures cite poor management as the number one reason for failure. This situation is expected when the business owner lacks relevant business and management expertise in areas like finance, purchasing and selling strategies. It is said that also the negligence of the business can be its downfall. Care must be taken to regularly study, organize, plan and control all business activities which are: stock control, customer relations, proper bookkeeping, planning.

Like in any other market, Spaza shops market are related. The owner-manager has to know the needs of the customers. He has to be part of the concerned community to identify the needs. For this reason relations with customers are crucial as it determines survival of the business. The stock of the Spaza might be at the maximum capacity although some products (even more needed) does not need the storage maximum capacity; this will be discussed later in **Chapter 5**.

Most of Spaza shops does not classify their products into fast and slow moving products as well as high, medium and low margin profit contribution.

This classification can be made and record of each category kept separately to investigate the contribution to the growth of the business. Therefore management skills is more than needed, because it is a key to the transformation as illustrated in **Figure 3.2**.

3.5.2 Lack of formal network

Through a formal network or association Spaza shop owners could derive business benefits such as volume discounts through group buying, access to better stock, preferential treatment from stock suppliers.

The Spaza shop market is pluralist, comprised of many diverse perspectives. A number of questions need to be addressed if we acknowledge the inherent complexity and plurality of this market system. For example, how can soft system methodology (SSM) be used to address and communicate in such a pluralistic situation as to allow collaboration, communication and network between components of this market system? How might such collaboration of stakeholders be utilized both for learning and transforming the entire system?

Robert and Norma (1996), show that in a pluralistic view context, the complementarist strategy is one of several possibilities to address this issue. So we are going to use these concepts to seek complementarity of actions by actors when addressing the problem. We can see that the complementarist perspective is used to integrate the various strands. This notion of openness and conciliation can be used in network of the Spaza shop market that will allow debate and exchange of views when addressing an issue. This notion of openness and conciliation can be seen as being central to complementarism as the way to intervene in this situation market (Robert and Norma, 1996). This complementarist strategy would seem to offer the best possible support when applying soft system methodology. It may initially seem strange that an ideal model for conceptualizing (organizational dynamics) is put in place alongside a theory that pushes for local decision-making and local relevance. The question remains how can we enrich our understanding of the whole organization in these systemic terms. The dimensions of the market system guide our modelling. We need to have some understanding of organizational processes, the flows and controls from suppliers right through to consumers, including stakeholders with an interest in the process. We need to consider organizational design within which the process flows. This means considering the degrees and forms of structure in terms of which patterns of coordination and control are created.

We must also appreciate individual and cultural differences and similarities that exist between people that take part in the decision-making process. People are different, people need different things, respond to things in different ways, and understand things differently (Jackson and P.Keys, 1984). Despite this differentiation, or even because of it in some circumstances, cohesion may be attained.

This sharing is often associated with world culture. Culture means that people who share a common history similarly, have a common sense of belonging, and are therefore readily able to engage with people who share these feelings. It encapsulates processes by which people mediate their relationship to social rules and practices which provide some framework for continued communication or mutual engagement. On the contrary, in a dynamic cultural setting, differences of opinion, of ways of interpreting exchanges, of ways of interpreting one another's conduct, and of ways of seeing issues of relevance in the course of interaction, inevitably arise. It is important to consider how power is distributed and how this power may be used for certain interests. It leads us to explore who is in a position to bring resources or biases to bear to get their own way. The problem solving model is thus a term used broadly to mean a response to issues considered to be problematic. I have argued that problematic issues for Spaza shops are related to questions (how, what, and why) directing attention to power to in organizational life. The process that leads to the activation of a type of action option (of how ?-type, what ?-type, or why-type) is called the problem solving mode.

Given the concept of a whole which we chose to regard as a system, we have two possible approaches to the task of describing it. It may be described in terms of its state by describing the elements which comprise it, their current condition and their relationships with external elements (Checkland, 1981). We may describe a system as an entity which receives some inputs and produces some outputs; the system itself transforms the inputs into outputs (Checkland, 1981). In the case of human activity systems like the business market, it seemed the only feasible descriptive mode, by describing the activities according to the scheme INPUT-TRANSFORMATION-OUTPUT. Now, any root definition may be looked at as a description of a set of purposeful human activities conceived as a transformation process. The model of the activity system needs to achieve the transformation described in the definition. We will now build the model which will accomplish what is defined in the root definition. The conceptual model is an account of the activities which the system must do in order to be the system named in the definition. Because the conceptual model is a model of an activity system, its elements will be verbs. The technique of modelling is to assemble the minimum list of verbs covering the activities which are necessary in a system defined in the root definition and to structure the verbs in sequence according to logic. From Figure 3.4, the study was conceived as classic application of SSM. The methodological cycle forms the basis of the project plan. At this stage the impression was of a study taking place in a situation which called for much more formality than expected in the industry, noticeably in the form of a very precise and required outcome and a process involving formal meeting of TTO management team. Some of this might be foreign to the spirit of SSM, given the questing approach of the methodology, but it is natural in a human organization. The TTO management team therefore provided early indication that they saw themselves, as a group, receiving periodic reports and commenting upon them (rather than on the study

itself). They would be monitors rather participants, and this persisted throughout the course of the study. The stages 1 to 4 of the model from Figure 3.4 have to be more carefully organized. The classification of practices, perceptions, problems, ideas and comments is a version of finding out about structures, processes and the relation between the two. The root definition and the model definitions were developed based on meetings with TTO management team and documents will be handed over after completion for approval of the model. Eventually a root definitions and CATWOE analysis was derived. The definition was based on the following idea: “An intervention system towards an effective and efficient market of goods supply and distribution chain while empowering members of the Spaza shop community to become successful business owners in a safe environment”. Comparing and recommending changes from stage 6 to 9 of the model from Figure 3.4. The conceptual model produced in this dissertation will be used to define questions which can be asked of the real situation:

- Does this activity or relationship exist in some form?
- How is it done and by whom?
- Is it a source of concern or is it regarded as well done?

These questions are tackled in Table 3.1 that shows how the activities would be done and by whom. The formal structure of the project and expectations of TTO management team meant ideas for change would have to be developed and tested in a fairly extensive round of further work. TTO management team will be assigned the role of inspector, consultant, communicator, representative and promoter of the project. It is unrealistic to expect this role to be filled as it is at present by relatively inexperienced, middle-graded, temporarily seconded people working on a wide-ranging, rapidly developing, highly technical changes, as from stages 6 and 12 in the model. Compared with most of the examples of the problem structuring method using SSM, this one was more formal in its arrangements and requirements. This was the case because primarily the TTO management team requested for purely statistical analysis (hard O.R) while the UCT team wanted to look at both aspects (soft and hard) of the Spaza shop market. The study was carried out within an organizational arrangement (not with TTO) which focused on the product of the study (final report) rather than its process. The decision of the outcomes of the study is an account of what happened following the submission of the report rather than a conventional account of stage 7 in Figure 3.1.

Activities	How the activity is done	Measure of performance	Information needed	Support given by
1a. Develop management skills	course, workshops	Ability to manage using business norms	Which skills are needed	Owner, TTO
1b. Identify business service needed	interview with owners	TTO	services available	TTO, actors
1c. Identify efficient and effective supply system	contact with actors	TTO	which actors are partner in supply chain, what they can supply	different actors
1d. Empower membership	money(loans)and skills	profitable, status of the Spaza shop	loans available, partners available	TTO
2. Describe and design measure management and entrepreneurial skills	identify most needed skills		list of skills that will empower business	government, and service providers
3a. Appreciate need for Spaza network	meeting Spaza owners		benefice of linkages and network	all actors
3b. Identify institutions for skills transfer	going to potential institutions		name those institutions their location and skills provided	government
4a. Identify, know, consult and prepare Spaza owners	contact at shops	list with accurate info	owner details, network of Spaza	TTO, government
4b. Understand customer expectations	interview, meeting or forum	expectations met	list of expectations	Spaza owners
Design indicator to measure performance and efficiency	conception of of the measure		comparison on other successful informal sector	TTO
5a. Provide business service needed	services to determined	improvement of premises	what lack from Spaza	Spaza owner TTO
5b. Acquire subsidies and loan	loan given on subsidies	to be defined	amount needed per shop	owner, service providers, TTO
5c. Create, if possible, safe environment	fight crime and robbery			Government
6. Rationalize 1,2 through appropriate mechanism				
7. Make 5 and 6 operational				
8. Learn from experience of 7	contact with service providers	profit should be measured	evaluate amount to allocate	banks, government
9. Appreciate planning	Using DEA, MCDA or benchmark	to be determined		TTO & UCT for example
10. Take control	regular visits on shops	measure improvement	indicators & bookkeeping	TTO
11. Define criterion for 5E's	in a workshop	to be defined	different criterion	TTO & government
12. Monitor 4 and 7	regular monitoring	to be selected	details of Spaza shop	TTO

Table 3.1: Matrix table of activities in the soft model

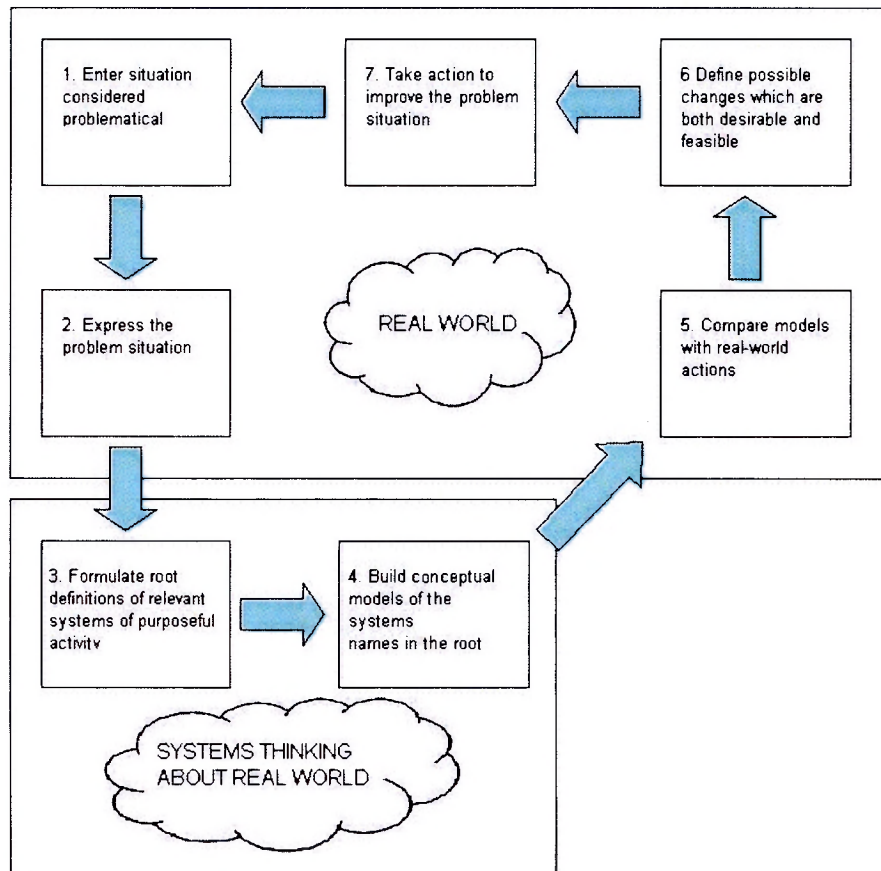
3.6 Conclusion

Decision makers have been trying to help micro enterprises and the informal sector of business to improve and develop, but studies have not been done to raise the real problem within each informal sector context. The same can be said for Spaza shops for which analysis and studies have been done to raise characteristics, size, structures, profile and even factor of failures and success as in Ligthelm (2002); Ligthelm and Masuku (2003), but not much has been done on how to improve the current situation of micro enterprises with Spaza as a case in point. Soft approach of OR with causal mapping and soft system method were used to shape management issues and clarify options also to understand the critical issues within the Spaza businesses. These methods helped us also structure the way for stakeholders to intervene in a way to improve this business; the model of intervention is proposed. The proposed model is subject to change, when and where it might be necessary, as Mingers and Kotiadis (2006) suggest that one of PSM's method characteristics is flexibility and iterativeness. It is revealed that management expertise, network and volume sales are main issues that need improvement in Spaza businesses. But the question is how it can be done?

Hard OR approach with Statistical analysis and simulation were used to answer some aspects of this question. The issues that needed to be addressed are:

- The understanding by TTO and government organs of how the Spaza shops system works. Statistical Analysis will help us use quantitative information (data) to raise patterns on products, shops, seasonality and areas of business.
- Developing understanding by shop owners of how to manage their micro-enterprises. Simulation model will be used to create realistic data and get an idea on the variability on the inventory system that could be used by shop owners.

The combination and complementarity of the two broad approaches have been suggested as a way of improving complex, messy and uncertain problems Pidd et al. (2005); Mingers and Kotiadis (2006); Mingers and Munro (2002). SODA and SSM were used because, on one hand, statistical analysis and simulation lack any problem structuring framework. On the other hand Statistical and Simulation were secondly used because SODA and SSM lack a dynamic modelling capability and could not use quantitative informations. In the two following chapters hard OR with statistical analysis and simulation are going to help use quantitative information (data). The use of these techniques is to highlight patterns of products, shops, areas and seasonality of businesses.



Source: *Originating author(s) Peter Checkland, Seminal articles*
 Checkland, P. *Systems Thinking, Systems Practice*. John Wiley & Sons, London, 1981.

Figure 3.1: The stages of SSM

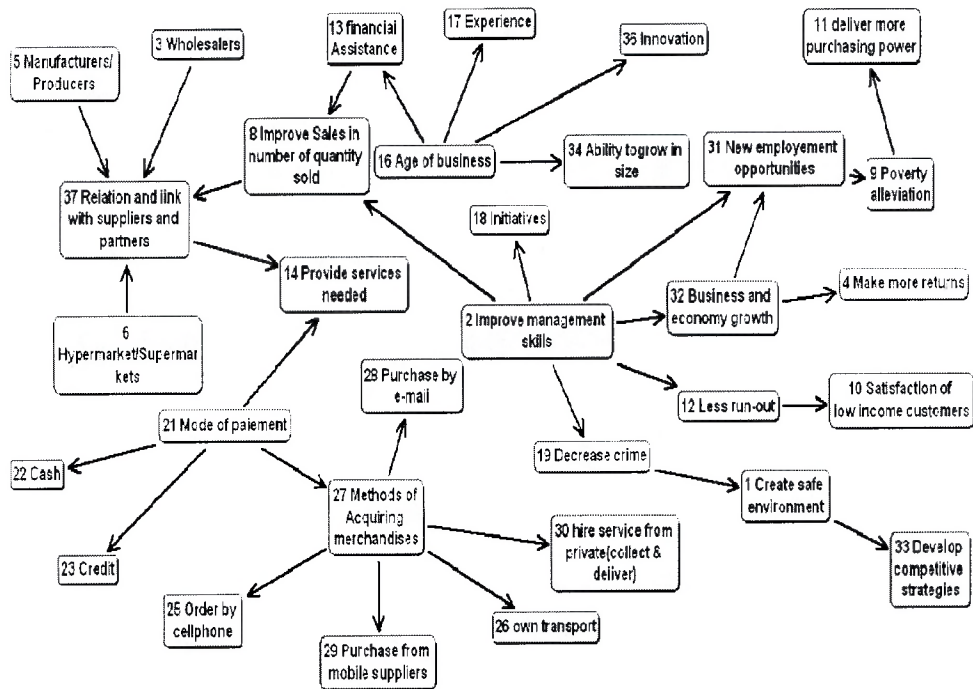


Figure 3.2: Causal mapping of Spaza shop activities

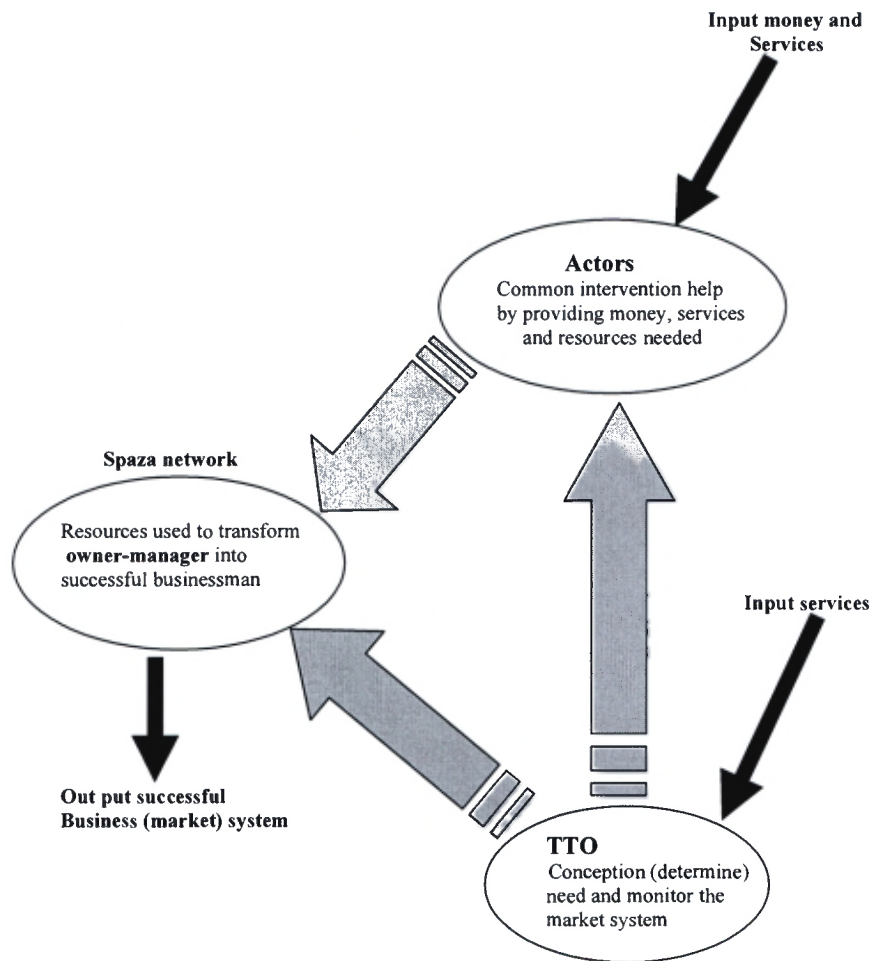


Figure 3.3: Stages of intervention in the model

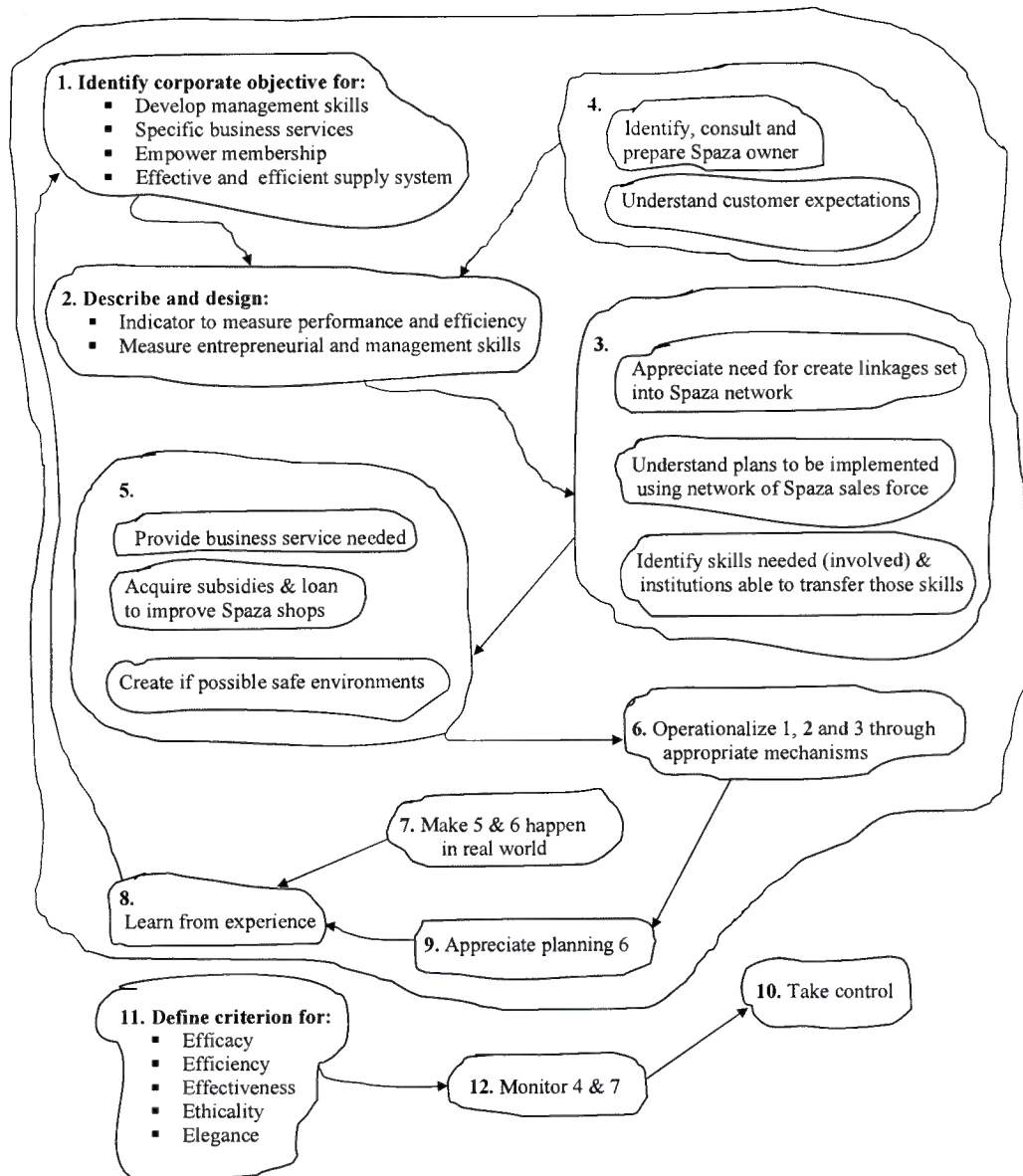


Figure 3.4: Conceptual soft model - Actors intervention in Spaza business

Chapter 4

STATISTICAL ANALYSIS

4.1 Introduction

The detection of best predictors in analysing performance is an important issue in business (formal and informal) market research. In this paper two approaches are applied to deal with this problem, illustrated by a case study from the Spaza shop which is a type of informal business sector. In this case the objective of detecting the best predictor of performance will lead the Triple Trust Organization (TTO) team to best predict and manage the business. We will investigate the rating of business performance (by team member) and the average purchase per cycle level by the application of the suggested approaches. The two approaches that were used for this problem are CHAID and Correspondence analysis. They are appropriate tools that classify dependent variables by their predictors and attribute, and identify patterns that lead to predictions.

The first point of analysis about this business is information about the Spaza shop owner and his activities. This information and data used were provided by Triple Trust Organization (TTO).

They were classified into two data sets namely:

- Record of purchases

The data were recorded over a period of a year from June 2006 to May 2007. The data represented the total quantity purchased on a given product, the total amount spent, the percentage the sale of that particular product and the average price.

For the data on record of purchases, the analysis was exploratory, including spatial and temporal patterns of purchases for different products. Thereafter, differences in these patterns for different levels of performance were identified.

- Response to a questionnaire administrated by Triple Trust Organization (TTO) to Spaza shops owners over the period June 2006 to May 2007.

The data for this second category were measured as nominal, ordinal and cardinal; some of these variables were captured as binary variables, with yes equal to 1 and no equal to 0.

The aims of the analysis were to identify characteristics or predictors of good performances.

4.2 Analysis based on questionnaire survey

4.2.1 Data selection

The following dependent variables were considered as primary measures of performance:

1. Average purchase per cycle

This variable was subdivided into four categories as follows:

- Red, where a cycle purchase ranges from R75 to R200
- Green, for the range R200 to R299
- Yellow, for the range R300 to R399
- Blue, where a cycle purchase ranges from R400 to R1400

2. Rating of business by staff or team members

This variable was categorized as follows:

- Top performer, in which category we found the top 20 shops. This category of Spaza shops were found to have a turnover more than 13949
- Middle performer, these are shops that do not fall in the first category (define as not top 20 by TTO). The turnover this category of Spaza shops vary between 2453 and 13949.
- Low performer, those not classified in any of the above categories. This category comprise Spaza shops that have turnover less than 2453

The following variables were selected as potential predictors of performance.

1. Type of premises:

The type of premises was grouped into three new categories (in place of the original 9):

- Formal business premises, combining the former two first categories (own formal and rented formal business)

- House, either rented, part of a house rented or own house
- Informal premises which include garage, backyard, containers

2. Average mark-up

Initially we used the purchasing and selling prices of five recorded products (white and brown bread, cigarettes, 1.5 and 2 litre coke, milk) to determine the individual mark-up. The average and standard deviation mark-up were deduced from those five products. These products were classified into three categories (fast moving-low margin profit, fast moving-high margin profit and slow moving-high margin profit).

As a later refinement, five average mark-ups were introduced instead of the previous mark-up. This change followed the new classification of products into five categories (fast moving-low margin profit, fast moving-medium margin profit, fast moving-high margin profit, slow moving-low margin profit and slow moving-medium margin profit) in place of three.

3. Financial record and bookkeeping system used

Once again, the original six categories were combined into three as follows:

- Unorganized, having either no record or with no organized records kept
- Informal bookkeeping, where proper bookkeeping records exist, but without bookkeeping and banking services and support
- Formal, which is considered as having a bank account and or use book-keeping services

4. Business skills learnt

We considered categories defined as follows:

- Formal training, where Spaza owners have learnt business skills either from a training program, at school, at university or from an adviser
- Self learnt, where the business skills were taught by self experience
- Not-trained, if not applicable to the above categories

5. Use of cash-credit from suppliers

6. Level of formalization of business

The variable used was a count of how many of the following attributes applied as legal formalization for the business:

- Have opened personal bank account
- Have completed a business plan
- Have insured the business

A new spreadsheet was created summarizing the data in terms of the above variables 1 to 6 and their categories.

4.2.2 General CHAID Model

The analysis was based on the use of the CHAID (Chi-squared Automatic Interaction Detector) techniques (Kass, 1980). This approach seeks the best split of the shops according to predictor variable categories, in order to obtain groups of similar levels of performance and to find out where significant relationships are hidden. These relationships are used to control the structure of classification. CHAID analyses the interactions of explanatory variables and the criterion variable for significant differences (Eherler, September, 2001). CHAID diagrams may be thought of as a tree trunk with progressive splits into smaller and smaller branches representing groups of similar performance (The measurement group, 2005). The initial tree trunk shows all of the participants in the study. A series of predictor variables is assessed to see if splitting the sample based on these predictors leads to a statistically significant discrimination in the dependent measure. The most significant of these would define the first split of the sample, or the first branching of the tree. Then, for each of the new groups formed, we have to see if the subgroup could be further significantly split by another of the predictor variables. This is repeated until no further significant splits are found. The result at the end of the tree building process is that we have a series of groups that are different from one another based on the dependent variable.

4.2.3 Staff / team member rating

There are three ratings of business, top performer, middle performer and low performer. We want to predict what kind of rating the business will be given these predictors (formal premises, house, informal premises, average mark-up, standard deviation mark-up, unorganized, informal bookkeeping, formal training, self experience, no trained staff, count, total purchase, cash-credit). CHAID and others kind of tree algorithm can classify the data so that if you know these predictors you will be able to determine what type of rating the business (Spaza shop) is likely to be classified. We have taken 14 predictors to predict the rating of the business. After eliminating empty cells, we remained with 87 rows (of rating as top, middle and low performer) against 14 columns of predictors which we use for the analysis. Initially all the variables were included into CHAID model to see how well the model works. **Figure 4.1** shows the tree down to 3 levels. The height of each bar shows the proportion of rating of business given a specific predictor. The nodes are top, middle or low performer. The first predictor of Spaza shop business rating is the total purchases. The first split classifies the shops according to the volume of total purchases, as follows:

- Total volume purchased greater than 13950 being associated largely to “Top performer” group .

- Total volume purchased between 2450 and 13950 being linked to “Middle performer” group.
- Total volume purchased less than 2450 being associated with the “Low performer” group .

The second split shows that Low and Top performer are not using informal business premises. On the other hand, the middle performer group is using (associate) cash-credit services. In the group of Top performing 3 out of 22 shops are in informal premises, and 19 are not. The third split shows that the shops using informal bookkeeping are considered as using informal premises. 17 out of 19 classified as Top performing Spaza shop are not using informal keeping. In other words, no consistent prediction pattern emerges. The important point to notice is that mark-up never appears as determinant of Spaza shop performance, although this had been anticipated by TTO. In order to Investigate further the reason for the lack of association between rating and mark-ups a series of **box-and-whisker** plots were constructed; we started first by plotting the average mark-up and observed no significant differences based on the rating of shops groups, as shown in **Figure 4.2**.

Secondly we plotted the five mark-ups according to the new classification. The products have been classified as:

- Fast moving-low contribution to marginal profit
- Fast moving-medium contribution to marginal profit
- Fast moving-high contribution to marginal profit
- Slow moving-low contribution to marginal profit
- Slow moving-medium contribution to marginal profit

From **Figures 4.3** and **4.4**, we see that there are no significant differences based on the rating of different Spaza groups, and no evident association emerges (except for a slight separation of the low group in **Figure 4.5**).

So further investigation must be done to raise those elements that keep the differences hidden.

4.2.4 Average purchase per cycle level or band

There are four categories of cycle level of purchases, RED with a range of R 75-R 200 average purchase per cycle, GREEN with R 200-R 299 average purchase per cycle, YELLOW with R 300-R 399 average purchase per cycle and BLUE with R 400-R 1300 average per cycle. We want to predict the kind of average purchase per

cycle level of the business given these predictors (formal premises, house, informal premises, average mark-up, standard deviation mark-up, unorganized, informal bookkeeping, formal training, self experience, no trained staff, count, cash-credit). We have 87 rows and 13 columns which gives 1131 observed values.

We want to investigate also, from the analysis, which predictors are best associated with passing from one cycle band to another (for example from red to green).

As illustrated by the tree in **Figure 4.6**, the average mark-ups appear as the first level determinant of cycle purchases. Mark-ups are difference in purchasing and selling prices.

What emerges is:

- Mark-ups less than 0.13 are primarily associated with the GREEN groups.
- The BLUE group (highest volume purchases per cycle) is associated with intermediate mark-up (between 0.13 and 0.17).
- The YELLOW group is associated with intermediate mark-up (between 0.17 and 0.23).
- The RED group (lowest volume purchases per cycle) is mainly associated with the higher mark-ups (greater than 0.23).

Although the splits are statistically significant, there is no clear pattern which can be exploited.

The second split reveals that the YELLOW and Green groups can be separated on the basis of the formalization of the business premises.

The third split is of little interest as it relates to one shop only.

4.3 Analysis of purchase records

4.3.1 Data selection

We have used the data from the detailed 15 client's breakdown of 25 products and classified it into shops-products.

The following dependent variables were considered as primary measures of performance:

1. Shops, the shops were used as number and name given from the spreadsheet.
2. Products, the products were initialized to the first or two first letters.
The products are categorized into five new classifications, namely: fast moving-low margin profit, fast moving-medium margin profit, fast moving-high margin profit, slow moving-low margin profit, slow moving-medium margin profit.

3. Periods of business, we used as periods:
 - month of the year.
 - quarter which is a three month period.
4. Area, the specific places where businesses are run.
5. The total amount purchased or sold during that specific period (month or quarter).

4.3.2 Time trends of purchases

Figure 4.7 displays trends over time of top products and shops. These trends should be useful to facilitate planning of the purchases by shops. On this graph, the month axis starts on June at the origin of the axis. The number 1 represents July, the number 2 represents August etc. But the purchase on all products drops from end December to February (number 8 on the month axis for Figure 4.7). During this period all products drop to lower than 2000 units purchased, except Hulets 15x150g and Omo 10x250g which have the purchase at 3000 units purchased. The reason for the big drop-off over December/January, presumably is that owners close their shops and go home or on holiday. Investigations and studies should be conducted to reveal the real reasons of this drop.

4.3.3 Correspondence Analysis

Correspondence analysis is an exploratory technique related to principal components analysis which finds a multidimensional representation of the association between the row and column categories of a two-way contingency table (Friendly, 1995). It is a technique that generates graphical representations of the interactions between modalities of two categorical variables. It allows the visual discovery and interpretation of these interactions, that is, of the departure from independence of the two variables. In correspondence analysis, response data (in this case purchases) are represented in a two-way table, with rows and columns identified with specified attributes (e.g. shops, products, time periods). Visualizing the coupling between two numerical attributes (variables) is easy in a simple scatter plot that provides a wealth of information about the interaction between the two attributes (variables). Rows and/or columns whose markers lie in a same direction from the centre of the map (the 0,0 position in the figure) are closely associated. The primary reason for using this approach, is to explore the differences and association patterns according to shops categories (top performer, middle performer and low performer), products, period and area.

Plot of Shops-products on total purchases

For these plots, total purchase is the response while shops and products represent the row and columns. In this section we have coded the data for good visualization and display. For the shops we have taken the number and the two first letters, instead of long name (for example 111 - Mrs N Adams is coded as 111 Ad). For the products we have coded it at three letters only (e.g: tomato become tto, grand-pa become gpa, nik naks become nk). The full coding is given in the table 4.1

In **Figure 4.8** we plot the shops and the total purchase on the axes. We can see that the shops below 0.0 in the first dimension belong to coloured areas and the shops above 0.0 on the same dimension are from black areas. As it is seen shop 1765 AyV belongs to Mitchells Plain, shop 39 Zar and 188 KM belong to Manenberg, shops 1485 JK and 1670 Jul belong to Leiden, shops 759 ThM and 742 SalG belong to Delft south; all these areas are coloured. On the other hand, shop 19 MQ belongs to Makasa, shop 991 Notx belongs to Khayelitsha, shop 801 NM belongs to site C, shop 1746 RbM belongs to Philippi, shop 859 RebM belongs to Harare, shop 943 Cent belongs to site B; this late groups contains African areas shops. The important point to raise here is that, shop 1765 AyV is different from others. Further investigations may reveal the reason of this difference.

In **Figure 4.9** we plot the products and the total purchase. We can see, the products Grand-Pa and nik nak are closely associated, but they are different from other categories. The products: Tomato, Albex, Omo, Sunlight, Hulleys, fishoil crown, baked bean are associated while opposed to Ricofy, Iwisa Joko, Bonita, Surf, everfresh, Imbo beans.

The analysis on shops and products (goods purchased from TTO) has revealed some association; it is clear that some products are associated with shops.

For easy display, we now recoded shops and products to one letter, as illustrated in appendix. From this new coding shops are going from S1 to S15 (15 shops) and the products from A to Y (25 products)

In **Figure 4.10**, markers for both shops and products are displayed. We see that the products Grand-Pa and Nik Naks are associated with the shop 1765 Ayesha Varind. The amounts purchased by Ayesha for these two specific products are high. The products Snuff, Iwisa, Ricoffy, Surf are associated with top performing shops; in other hand products 12gr Tomato, Albex, Grandpa, Nik Naks are associated with middle and low performer shops. This approach may be followed in more detail taking into account the combination of all products in shops.

Plot of quarters-products on total purchases

For these plots total purchase will be the response while products and and season in quarters represent row and columns. We rearranged the data into quarters instead of monthly records and did an analysis of association between quarter and products. In other words, the analysis allowed us to know which product is most

sold in each quarter and which products do not depend on time, as illustrated in **Figure 4.11** in which markers for both products and quarters are displayed.

We can see that Imbo beans, Case mia, Ricoffy are not depending on periods, but Flyers, Tomato and Hullets 500g are more associated with quarter 1, therefore we can assume that they are most demanded during that period. Surf, Snuff and Nik Naks are most sold during the third quarter and products like Grandpa, Iwisa, Omo, Crown are sold during quarters two and three.

Plot of average prices

For these plots the prices will be the response while products and products represent row and columns. We have the shops as rows (from S1 to S15) and the columns which are different products with their respective average prices.

From **Figure 4.12** where markers for shops and products are displayed, we can see that the prices of Golden cloud flour (I) is associated with shop Rebecca Mashiya (RebM) and the price of grand-pa is associated with shop Nothukela Xkozela (991NotX). These two products prices are opposed to the other products prices. To explore further, we zoom out the graph to have a good display. **Figure 4.13** where markers for shops and products are displayed, shows that shops 1765 Ayesha, 742 Salie, 188 Kesmeya, 39 Zanap are associated. We deduce that those shops may have the same price structure. The shop 1712 Noludwe, 1801 Nophelo, 19 Nomonde, 943 Centane are associated and are different (opposed to the previous groups). Following this application closely may lead to strategic recommendations on the business sector, specially Spaza shops. It needs time and all the possible details to set up the optimum business strategy.

Shops names	Shops code 1	Shops code 2
111 - Mrs N Adams	111 Ad	S1
1485 - Jacqueline Kruger (Jacqueline T)	1485 JK	S2
1670 - Juleigah and Igshaan Jacobs	1670 Jul	S3
1712 - Noludwe Yayase (Cake Spaza)	1712 Nyy	S4
1746 - Rebecca Mankayi (Xolani Spaza)	1746RbM	S5
1765 - Ayesha Varind	1765 AyV	S6
1801 - Nophelo Magwaxaza	1801NM	S7
188 - Kesmeya Mathews (Waheed Tuck Shop)	188 KM	S8
19 - Mrs Nomonde Qili (Masibambane)	19MQ	S9
39 - Zanap Armidien (Zanap Shop)	39 Zar	S10
742 - Salie Gester (Roadside Tuck Shop)	742SalG	S11
759 - Thobeka Mboxane	759ThM	S12
859 - Rebecca Mashiyi (Maga Cash Store)	859 RebM	S13
943 - Mr Centane (Putumani Spaza Shop)	943Cent	S14
91 - Miss Nothukela Xokozela (Thukela)	991 NotX	S15

Table 4.1: The first and second coding of Spaza shops.

4.3.4 Conclusion

Statistical analysis was used to investigate some patterns of these products based on time and areas of business. It was used also to enable us identify significant differences in the purchase patterns of different types of Spaza shops and detect the variables that influence (determine) the rating of business performance (top performing shops compared to non top performing) and the average purchase per cycle level. This was the key issue for the TTO organization. Now more on CHAID results, we can identify:

- Little clear pattern
- Turnover is the only variable associated strongly with performance.
- Indication that large volume purchase shops (more than R13948.83, see Figure 4.1) associated with moderate mark-ups (not too high or too low between 0.13 and 0.17). The low volume purchased shops (with less than 2453.47) associated with higher mark-up (more than 0.23, see Figure 4.2)

The technique revealed that shops in black (African) areas could be grouped together and had some similarities as well as Shops in coloured areas. The same pattern was evident for products. Period or seasonality has influence on business. This technique could not enable us make comparisons based on individual products sold by Spaza shops as the data provided were for a short period of time only. In the following chapter we will be setting some strategic options on how management expertise could be used to optimize's business activities. Simulation model will be used to deal with the situation. These strategic options from simulation could be used to compare top performing to non performing Spaza shops; this would require resources availability. Finally, the Spaza owner-manager may be helped by providing advice based on information about top performing shops as a reference point for the non-performing shops.

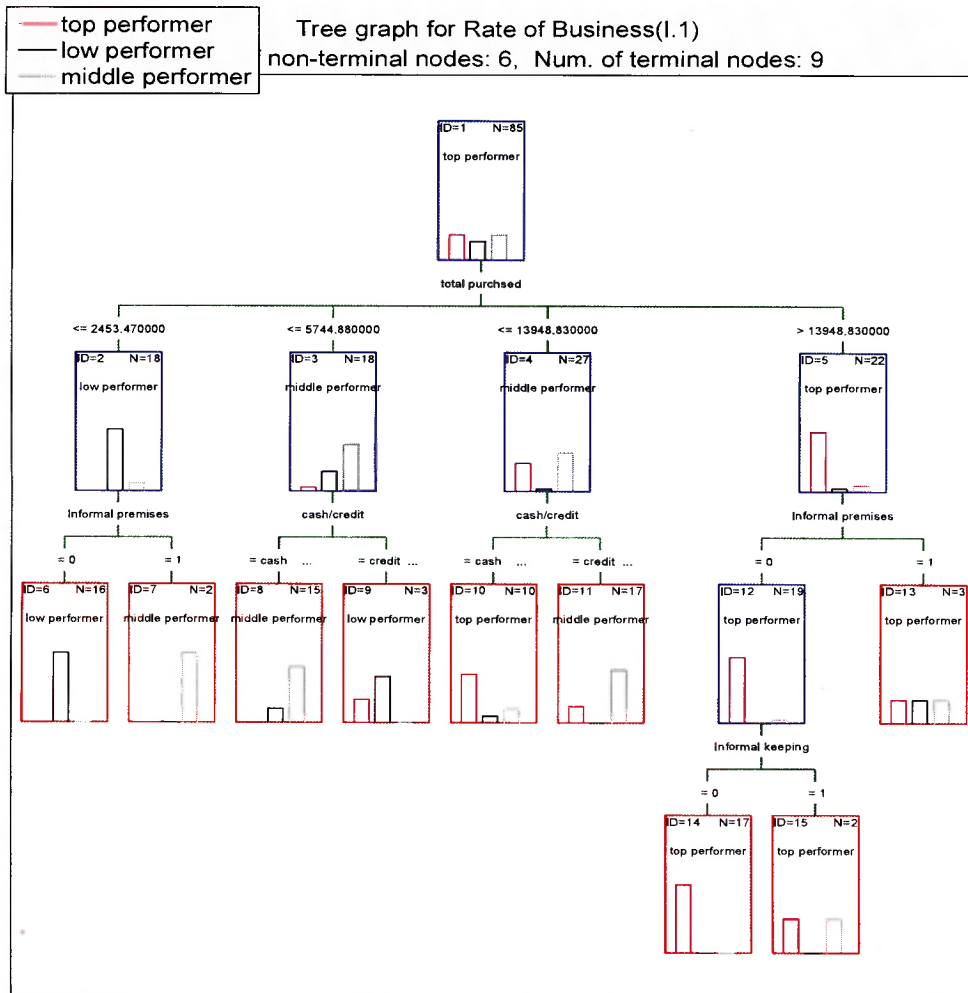


Figure 4.1: From left to right: Top, Low, and Middle performer

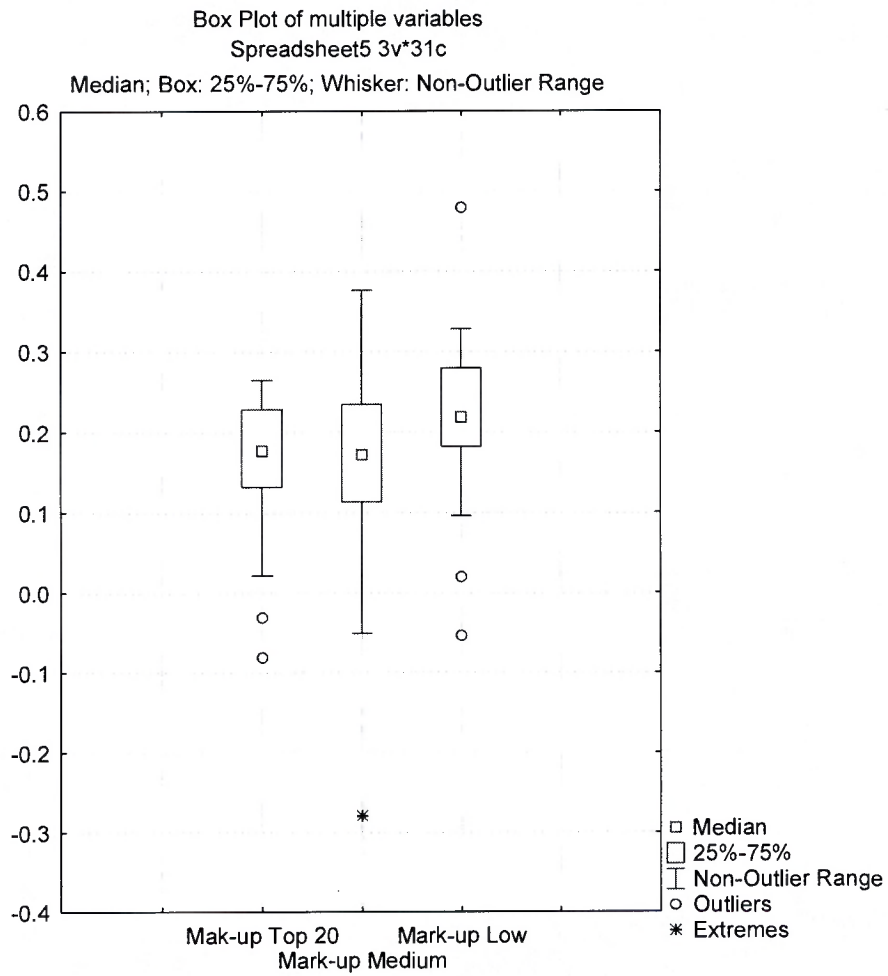
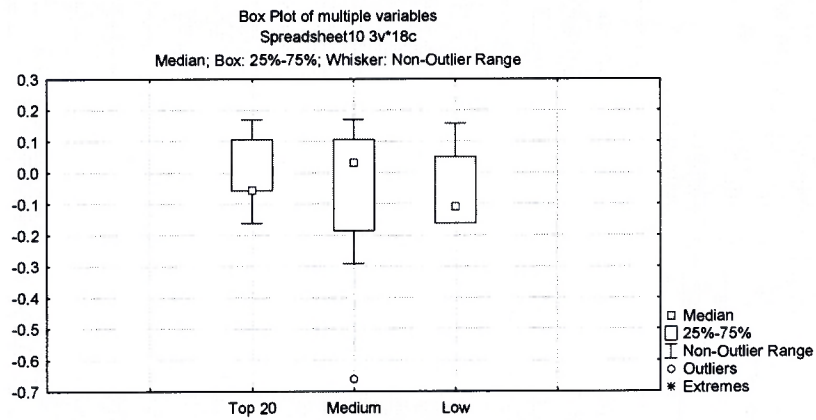
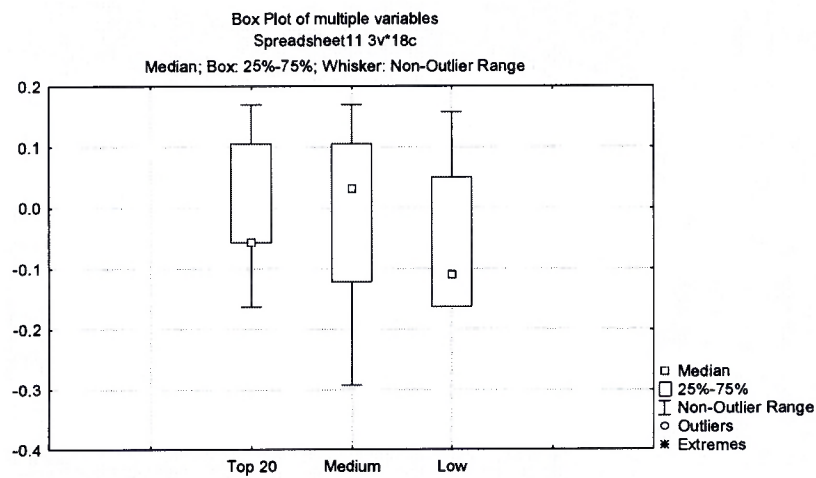


Figure 4.2: Averages mark-up before new classification

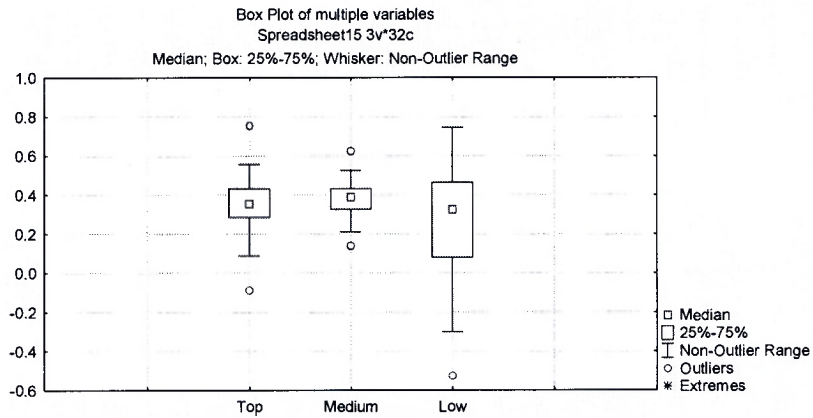


First average mark-up: fast moving- low contribution to marginal profit

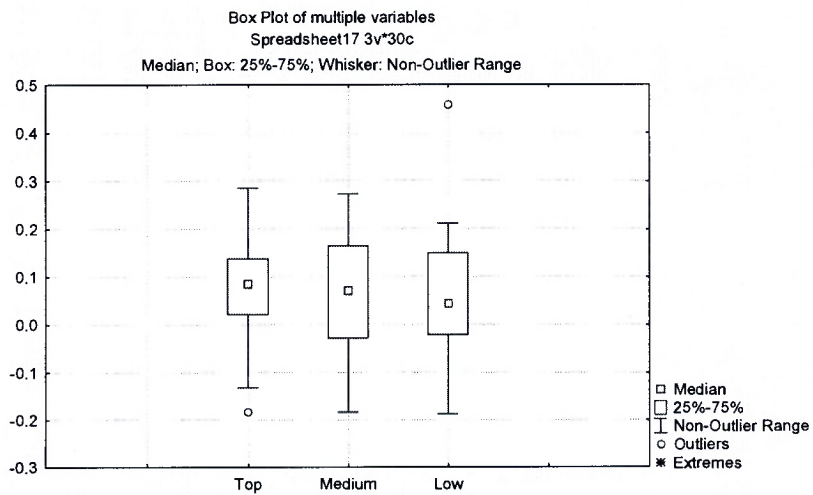


Second average mark-up: fast moving-medium contribution to marginal profit

Figure 4.3: Box plot of first two mark-ups

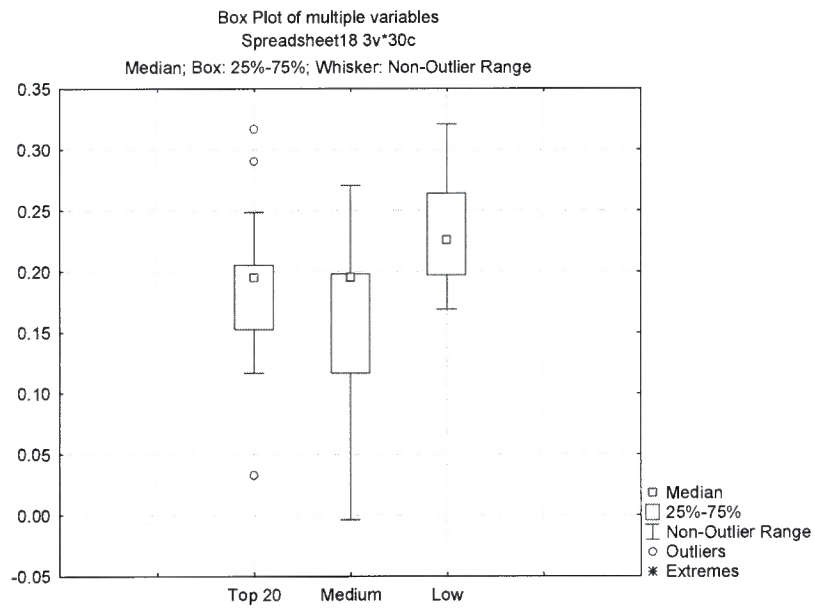


Third average mark-up: fast moving-high contribution to marginal profit



Fourth average mark-up: slow moving-low contribution to marginal profit

Figure 4.4: Box plot of third and fourth mark-up



Fifth average mark-up: slow moving-medium contribution to marginal profit

Figure 4.5: Fifth mark-up

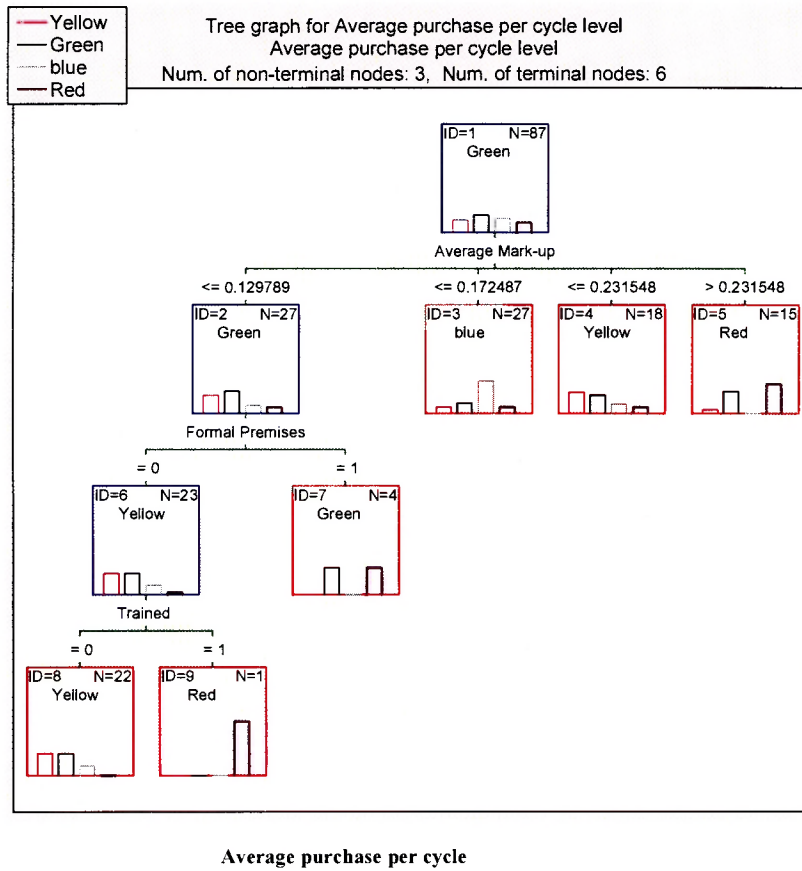
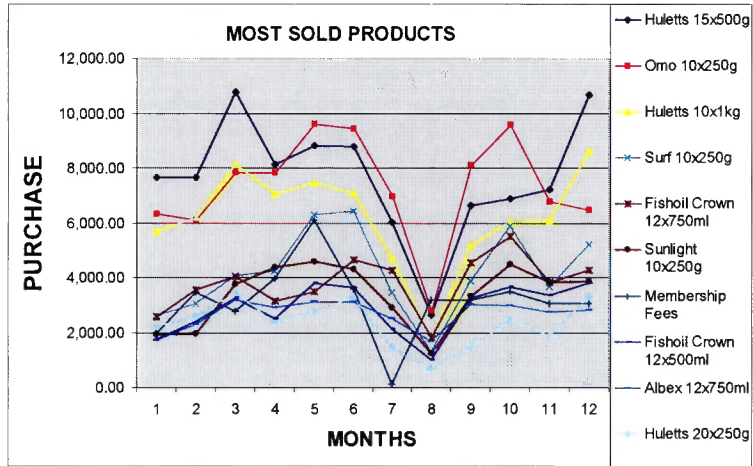
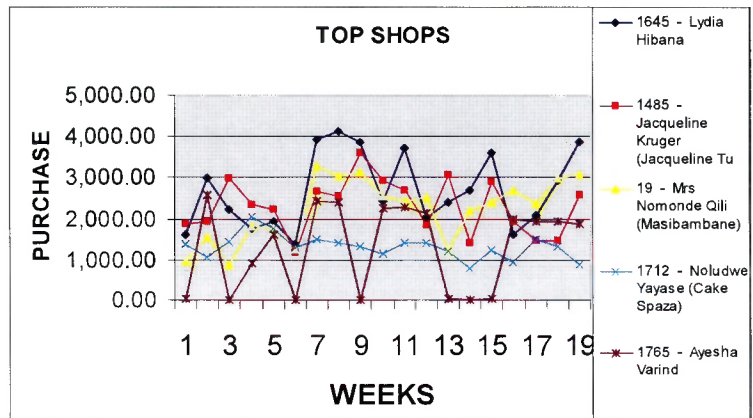


Figure 4.6: From left to right: yellow, green, blue and red



Products on a year period

From June 2006 to May 2007 (1 is June 2006, 2 is July 2006... 12 is May 2007)



Top shops

Figure 4.7: Trend of products in a year period

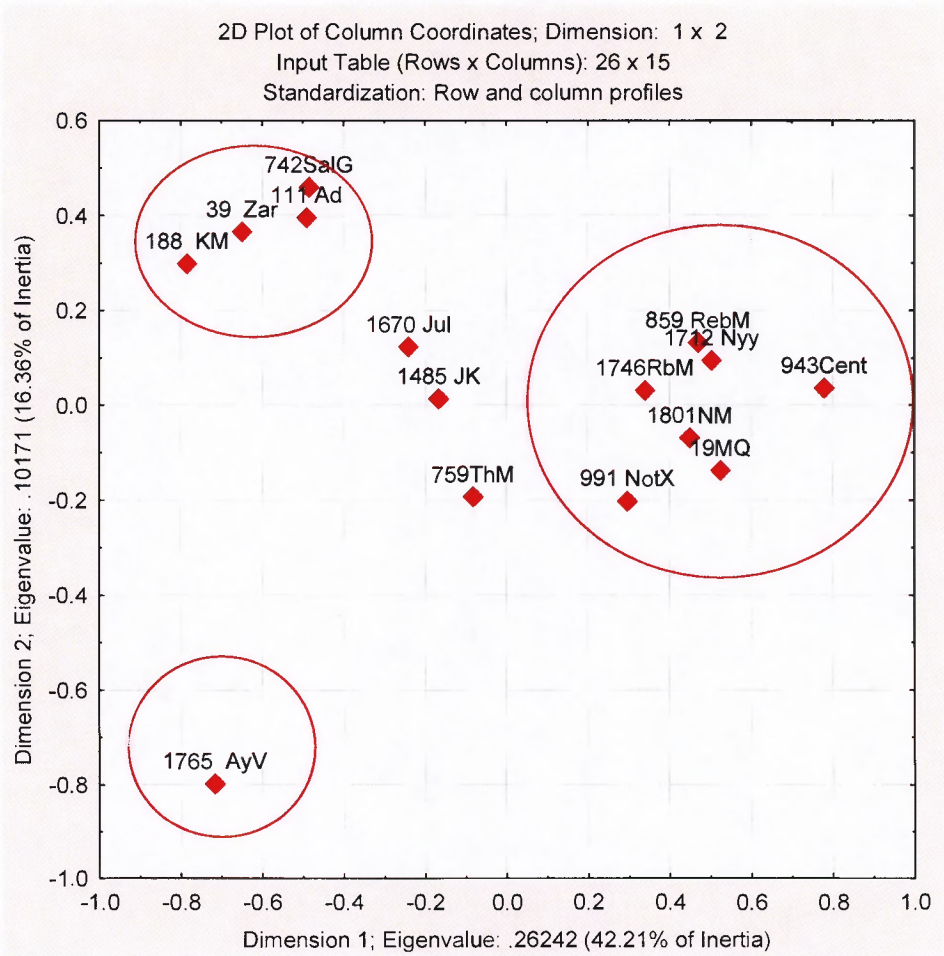


Figure 4.8: Patterns on area of business (Colored-African)

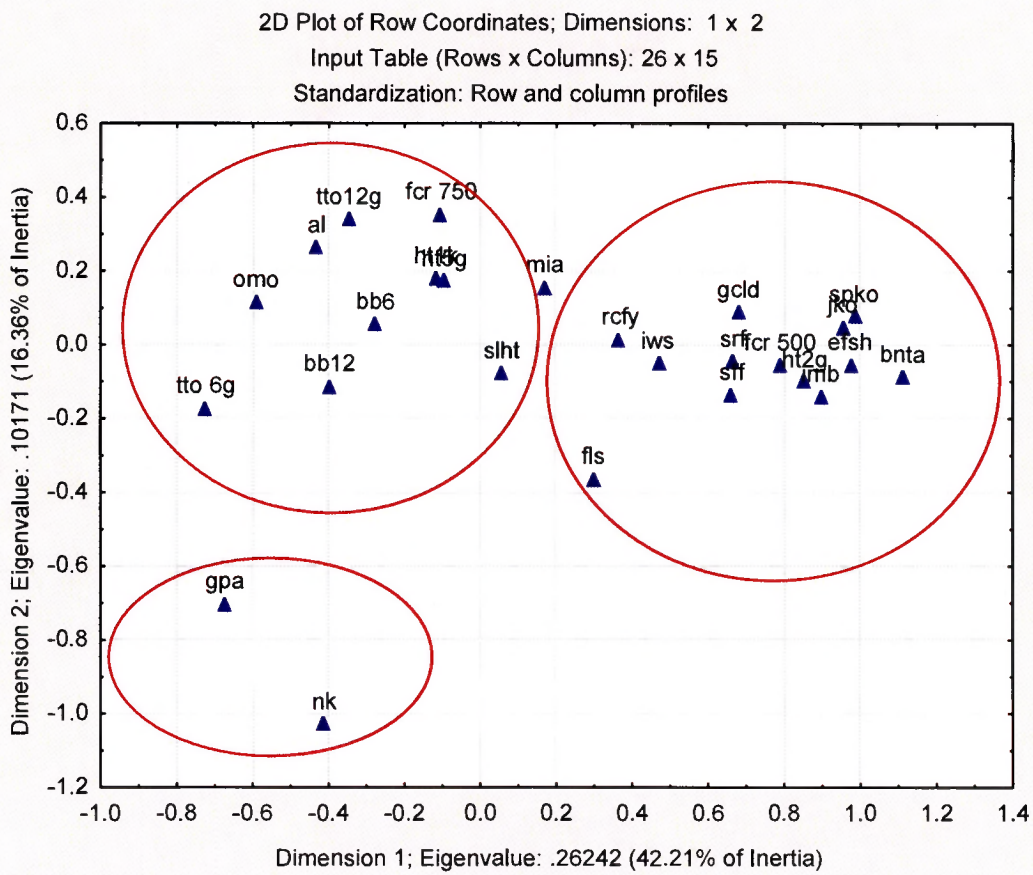
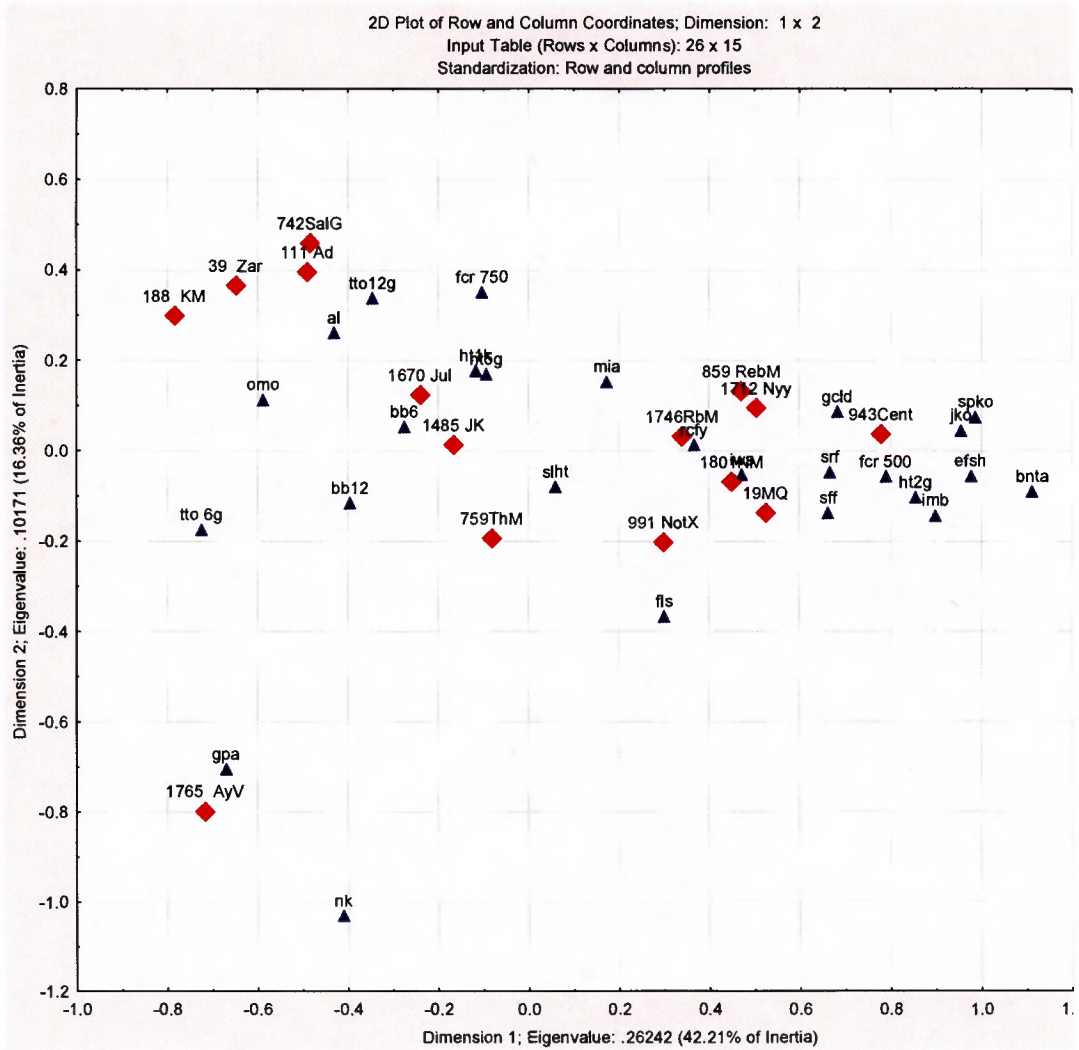


Figure 4.9: Products patterns



Triangles are products and squares are shops

Figure 4.10: Association products-shops into clusters

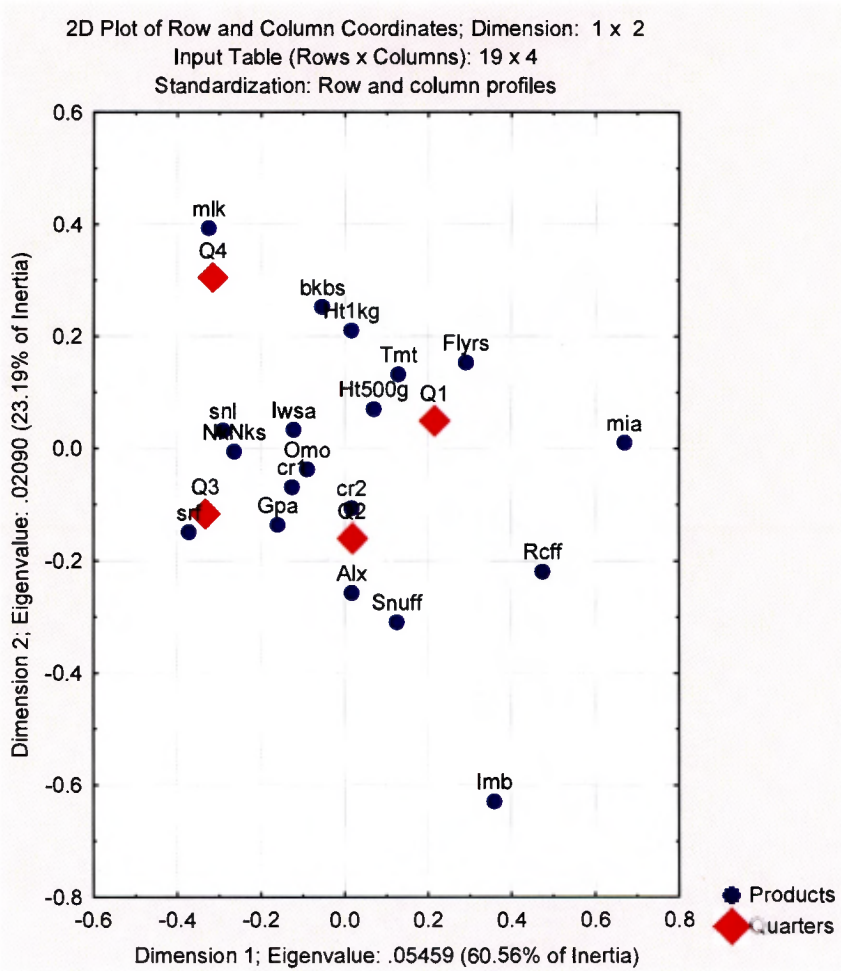


Figure 4.11: Time (in quarters) influence on products

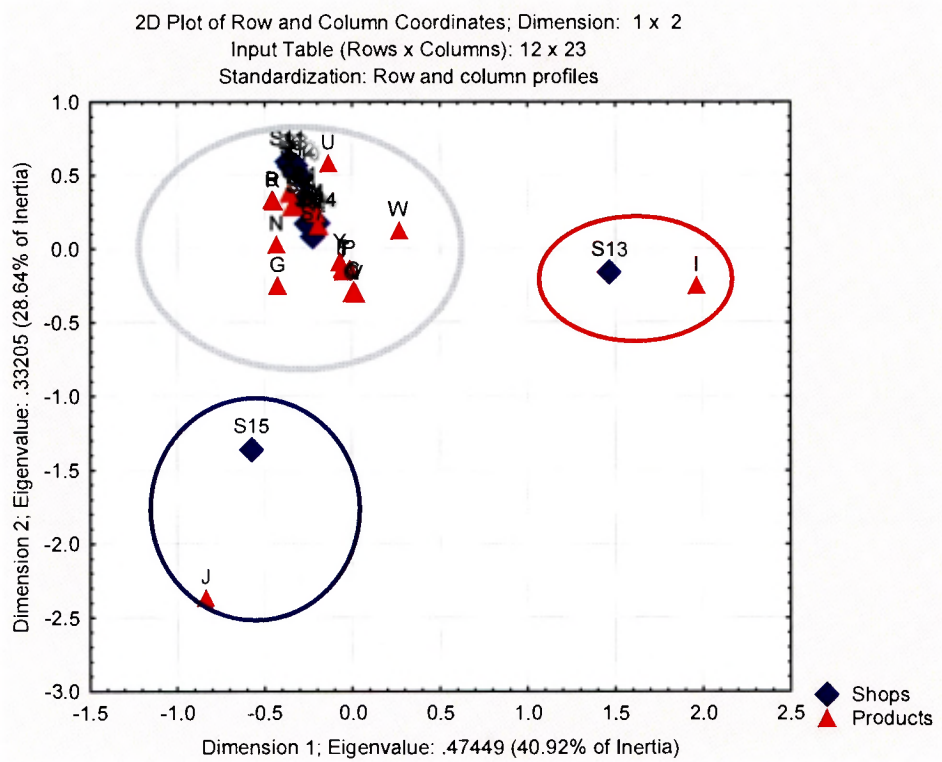


Figure 4.12: Prices clusters

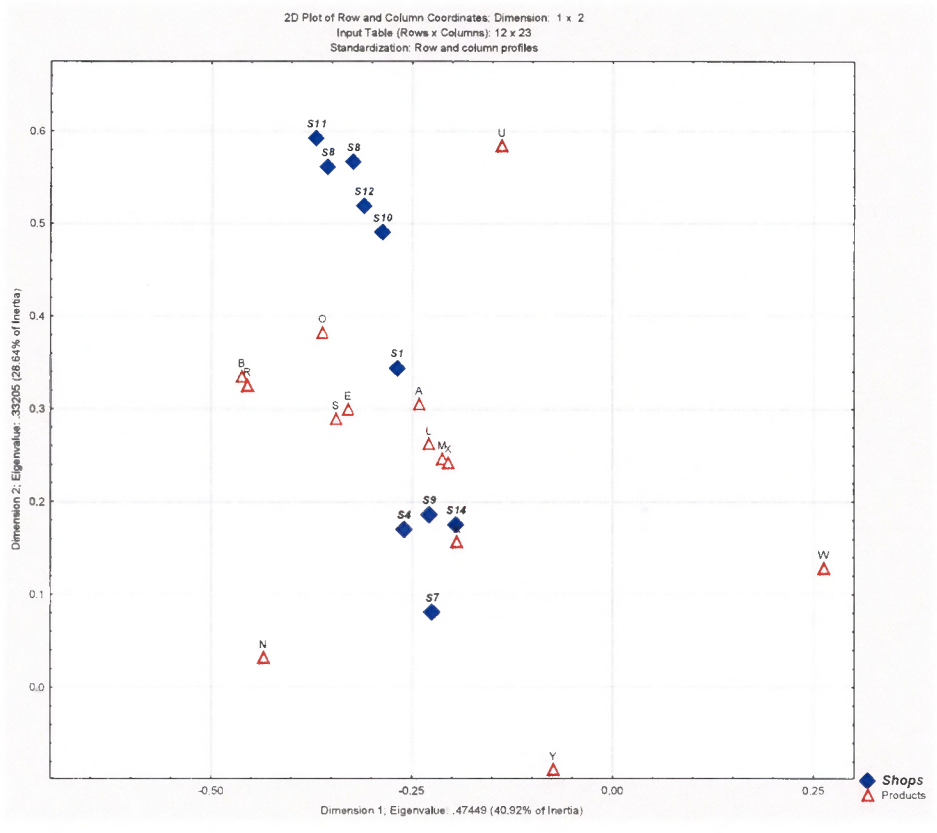


Figure 4.13: Shop-products based on prices

Chapter 5

SIMULATION MODELLING AS A DECISION SUPPORT TOOL

5.1 System

The use of the concepts and methods of mathematics as an aid to understanding problems arising in social sciences and in business is now a well established approach to gaining knowledge in these areas. One of the most important contributions that mathematics makes in the study of such situations and problems is through the constructions and analysis of models (Maki and Thompson, 2006). There are many types of models, specified as follows by Maki and Thompson (2006):

- Physical models which include miniature versions of real objects
- Theoretical models which are used as an attempt to explain or account for observed phenomena by creating a conceptual or hypothetical mechanism or process
- Logical models which are part of the abstract side of mathematics
- Mathematical models which consist of symbols, assumptions about symbols, assumptions about relations among symbols, and connection between the real model and these symbols and relations.

Simulation is part of mathematical models used to help the decision making process by understanding and predicting the situations. Simulation is a tool which in the appropriate circumstances can be of immense value to the system analyst. In general, simulation is used for selection, analysis and design of medium to large systems experiences. However, it can also be very valuable for certain aspects of

small business systems. Simulation is the creation of an artificial situation which is meant to represent the real situation and then testing this artificially created one as though it were real. It uses concepts and methods of mathematics as an aid to understanding problems arising in the life and social sciences and in the business sector to gain knowledge when planning in these areas. Clearly, the closer the artificial situation is to the real one the more useful the simulation could be. But it is usually expensive and difficult (and sometimes impossible) to use anything even approaching the real situation. So the skill in simulation lies in putting together a limited but reasonable representation of the real situation as simply as possible, so that it may be tested easily and modified easily, but at the same time give meaningful results.

The main steps of a simulation run are as specified by Bingham and Davies (1972):

- identify possible systems to be tested
- create representative simplified systems to be tested
- identify situations to be tested
- create input data representing situations to be tested
 - test system A with input data
 - test system B with input data
- print output from system A, B
- compare results indicated on reports A, B

We could feed this simplified system, which does, however, represent the real system in those aspects in which we are interested, with input data representing the different situations we wish to test e.g: periods of low demand, high demand, isolated large orders, etc. The output from the simulated system would be the numbers of each product in the store at chosen intervals of time. This could show us how much money we have invested in stocks, how often we experience a stock-out, etc. In this way we can decide which of the re-order rules we tried is the best. This last point brings out the big weakness of simulation. It can only give comparative results among the systems it is used to compare. It can not give a guaranteed of “best” solution, like optimal solution. The successful use of simulation depends therefore very much on the ability of the systems analyst to foresee all the possible alternatives. What makes simulation a modern tool is its connection with computer. First, the sheer speed with which a computer can work allows one to try out thousands or millions of possibilities which just could not have been humanly feasible. So the computer makes simulation of a large range of possibilities a practical proposition. Secondly, as computer systems are expensive, it is important to select the right one. So one tries to approach the selection task with all the analytical aids possible.

5.2 Model

In this chapter we propose a simple simulation model of the operation of an ordering-inventory system to a typical product given a specific shop. The purpose of the model is to develop an understanding of ordering, inventories, stockages strategies within the specific context faced by a Spaza shop owner. The simulation model will be used to complete the statistical analysis on strategic policies to be adopted after patterns on products and shops are raised.

As an attempt on improvement of Spaza shop operations, this model will describe the situation where total sales may be high assuming high profit and low assuming low profit. The simulation model will help to predict the level at which the stock on hand can not exceed in order to maximize the total sales. The maximization of volume sales is one of aims of the project in order to improve the Spaza shops business. The model will help to detect other factors that contribute to the increase or decrease of volume sales.

For this model, the following variables were considered:

- Order deliveries
- Order placed
- Stock quantity available
- Days out of stock
- Delays in deliveries
- Total sales
- Wastage
- Order level
- Daily demand

A VBA listing of the model code is given in the appendix.

5.2.1 Description of the model

The model assesses effects of different ordering policies and factors such as demand, delays in delivery and wastage on total sales, stock levels and time out of stock. The approach is to vary the ordering policies and external factors in a “What if” type analysis. We seek an optimum ordering policy giving high sales without excessive stock.

The following parameters and assumptions were selected for illustration and testing of the model, based loosely on experience at a typical shop (Dube's Spaza) for which data were available from TTO.

- We assume a log-normal distribution of demand because the demand is always positive
- The mean of log demand is set at 3.06 unit, corresponding to a daily median demand of 21.4
- Maximum storage capacity was set at 810 (the highest level of three weeks of operation at Dube's Spaza shop)
- Daily wastage is assumed log-normally distributed with a log-mean of -3, corresponding to a median of 0.05 (a fraction of stock)
- Delays in delivering of orders were assumed log-normally distributed
- We set the number of simulation periods and repetitions respectively at 300 and 100.

Values for sales, wastages, and delays were generated randomly from the corresponding normal distribution on the logs (see program listing). The Excel EXP() function converts these to the required variables. For purposes of the simulation, values were finally rounded to the nearest integer.

The simulation process then proceeded as follows:

- At the beginning of each simulation run total sales, mean stock, days out of stock, and total on order were set to 0
- For each week, sales are generated, stock levels and wastage updated, taking in account new order received (see tables 5.2 and 5.3). Note sales are not allowed to exceed stock on hand
- If stock (on hand and or order) falls below the stated order level, then an order is generated of the stated quantity
- The delay is generated and arrival of stock is scheduled
- The process continues for 100 weeks and following are recorded: sales, stock levels, wastages and days out of stock.

This model is run for various values of the following parameter:

- The order quantities ranged from 100 to 700
- The order levels will vary from 100 to 450
- Median delays were set at 2.7 or 4 days

5.2.2 Results of simulation model

1. Order quantity versus days out of stock

From Figure 5.1 it is clear that if the order quantity increases, the number of days out of stocks decreases, but the quantity ordered can not be increased indefinitely because, for this specific shop beyond 500 articles ordered, the days out of stocks are zero; so there is no need to increase the order level. To avoid other expenses linked to order quantity and storage of merchandise, it is advised to order not more than 450 articles per time.

2. Order quantity and mean remain stock

From Figure 5.2, it is shown that when the shop increases its order level, the number of quantity in stock after sale will increase also. The Figure 5.2 does not show us where to situate Dube's optimum order level; we need to investigate taking into account other information; what we are going to do later.

3. Order quantity and mean total sales

The Figure 5.3 show us that increasing order level, also implies an increase in the sales (in rand), but not indefinitely; when the order level is above 500 articles the number of sales will remain the same, which means that we do not need to order more than 500 articles, as has already been shown in Figure 5.1 Further investigations will reveal to us later the exact number of unit to order. The increase from 100 units to about 400 units implies an increase in the mean total sales and then as the order quantity increases further, no increase can be expected for units sold.

4. Order quantity and mean wastages

Figure 5.4 shows us that increasing the order quantity implies increases also in number of wastages in quantity in the stock.

From the above analysis, some recommendations and suggestions could be done, but we wanted to make sure by also bringing in the delay effect. The question is, will the order quantity influence the other variables in the same way we have seen above if we can decrease the delay time ? We decreased the time delay from 4 days (which is $e \exp 1.4$) to 2.7 days (which is $e \exp 1$), and we observed the following in the tables Table 5.1 and Table 5.2.

1. 4 days delay
2. 2.7 days delay

Order Quantities	Mean Days Out	Mean Remain Stock	Mean Total Sales	Mean Wastage	Mean Quantity Sold
100	152.32	31.38	3955.19	1.86	12.93
150	87.6	45.6	5182.08	2.24	17.79
200	44.51	77.15	5925.06	3.92	19.93
250	19.47	102.56	6360.34	5.78	21.55
300	9.8	136.24	6539.29	7.71	21.5
350	5.04	161.91	6617.07	9.45	21.94
400	2.07	207.62	6648.22	10.81	21.66
450	1.06	238.67	6666.48	13	21.83
500	0.88	265.63	6681.81	14.63	22.4
550	0.77	289.78	6697.67	16.54	22.32
600	0.42	302.81	6687.16	16.72	21.94
650	0.4	318.16	6688.54	18.61	21.65
700	0.37	347.23	6676.88	19.52	22.43

Table 5.1: Optimal mean total sales given 4 days delay

Order Quantities	Mean Days Out	Mean Remain Stock	Mean Total Sales	Mean Wastage	Mean Quantity Sold
100	93.51	36.17	2.13	5684	17.37
150	29.33	62.63	6281.91	3.55	21.79
200	8.19	98.12	6568.11	5.51	21.4
250	2.49	139.76	6644.18	7.80	21.71
300	0.69	172.84	6677.54	10.06	22.17
350	0.26	214.26	6714.13	12.04	23.15
400	0.06	248.76	6682.17	14.31	22.34
450	0.05	282.34	6707.2	16.65	22.36
500	0.01	317.16	6684.27	18.24	22.61
550	0.04	320.92	6686.82	18.61	21.63
600	0	357.42	6706.64	20.30	22.04
650	0.01	367.8	6680.71	20.61	22.15
700	0	393.43	6696.55	22.59	22.10

Table 5.2: Optimal mean total sales given 2.7 days delay

- When the time delay is 4 days, the optimum order quantity is 550 units; this is in regards to the high sales (R 6697.67), high number of mean units sold (22.32), less than 1 day (0.77) of day out of stock and less wastage number (16.54) comparing to order quantity above 550 (see Table 5.1).
- But when delay time decreases from 4 to 2.7 days, we found that the order quantity is 350 units with high sales of R 6714.13 and high number of units sold (23.15). Even the wastages at this stage are less (12.04) with run out of 0.26 day (see Table 5.2).

From the two tables 5.1 and 5.2, we can see that if something can be done to decrease sensibly the delay time, it will boost the business, but unfortunately it is a factor outside of the control of individual shop management. This problem can be addressed by the network (organization) of shops or by TTO with factories and wholesalers, even other partners that may organize transport. The situation is illustrated by the following figures, when comparing:

- Order quantity and stock on hand Figure 5.5 shows that, the decrease of time delay has an impact on boosting the business, resulting in a decrease of days out of stock. It shows again that, as the time delay decreases, the quantity to order (order level) has to decrease from 450 to 350 units in the stock. From 350 units onward the mean days out of stock is 0, so no need to order more than 350 as the shop will not run out of stock. Here it is obvious; the increase of order quantity will definitely also increase the number remaining in the stock. From Figure 5.5, decreasing time delay, will lead the shops to hold extra stock which increases the stock on hand (or remaining stock).
- Order quantity and mean total sales
From Figure 5.6, we can see that increasing the order level (order quantity) will not absolutely increase the sales indefinitely. At the beginning the increasing order quantity increases the total sales but after certain amount, the sales will be influenced by other factors as well. The important point is to see that, when the delay is decreased to 2.7, the total sales are higher than at 4.
- Order quantity and mean quantity sold

1. 4 days delay

We investigate at which order level the total sales would be high, given different levels of stock on hand. This investigation is done comparing the two time delay on the total sales. Tables 5.3 and 5.4 show us where to situate the optimum order level, when we want to have high sales while taking into account the different stocks on hand (remaining stock).

Sales	Order level									
stock on hand	150	200	250	300	350	400	450	500	550	600
100	4994	5158	5522	5684	5848	6110	6010	6060	6074	6155
150	5182	5904	6057	6182	6223	6417	6340	6349	6424	6427
200	5157	5908	6305	6390	6439	6547	6510	6512	6531	6566
250	5146	5922	6323	6525	6531	6631	6598	6585	6624	6588
300	5179	5915	6332	6475	6590	6662	6639	6641	6611	6615
350	5172	5958	6318	6521	6581	6688	6649	6636	6666	6647
400	5173	5977	6349	6493	6588	6673	6643	6613	6645	6640
450	5164	5935	6327	6482	6593	6653	6625	6637	6657	6661

Table 5.3: Optimal total sales given order level and Stock on hand with 4 days delay

Sales	Order level									
stock on hand	150	200	250	300	350	400	450	500	550	600
100	6026	6148	6285	6367	6401	6455	6479	6492	6483	6506
150	6285	6517	6574	6568	6600	6608	6642	6620	6640	6636
200	6258	6554	6629	6648	6668	6656	6652	6650	6673	6663
250	6276	6555	6650	6686	6678	6657	6677	6672	6674	6677
300	6250	6560	6676	6688	6689	6693	6684	6674	6707	6697
350	6267	6551	6645	6680	6685	6680	6678	6693	6675	6669
400	6255	6564	6653	6663	6681	6684	6681	6678	6692	6689
450	6251	6591	6651	6682	6684	6666	6692	6695	6669	6689

Table 5.4: Optimal total sales given order level and Stock on hand with 2.7 days delay

Each entry in this table is the mean of 100 iterations for the specific order level and quantity of stock. From the table 5.3, the sales are high (R 6688.24) when the order level is 400 and the stock on hand is at 350. This is an optimal quantity that might be suggested to Dube in order to keep the stock quantity under the storage capacity and avoid extra expenses and avoid wastages which increases as stock increases.

2. 2.7 days delay

From the table 5.4, the sales are at the most high with R 6707, when the order level is 550 and the stock on hands is at 300. The simulation model shows that when decreasing the delay time from 4 to 2.7, the sales tend to be high, but this also results in holding big stocks.

5.3 Conclusion

The use of this model is to set up some strategies that may be important for this business as advice to the shop owners. We have used the VBA (Visual Basic for Applications) code in appendix with 300 number of periods and 100 repetitions; level of command is fixed at 400 and the opening stock at 810. Different results are illustrated in tables and figures at the end of chapter. Simulation illustrated how the optimum is found and characteristics for the solution in one particular context; these results were indentified:

- Storage capacity:

To avoid wastages and excessive storage cost, as in Dube's case, two optimal options might be adopted. With his storage capacity, he may opt for ordering each time not more than 400 units and this order should be placed when the stock on hand has reached the level of 350 units. In this case the orders placed would only be received after 4 days. On the order hand, Dube has the option of ordering and receiving the goods after 2.7 days. This late option will increase the total sale, but with an extra cost on wastage and storages.

- Quantity to order:

To avoid supporting transport and ordering cost that results on each cost, each Spaza shop should have an optimal order quantity. In Dube case, the only options is to order not more than 400 units. This will help avoid more wastages, also transport and stocking costs.

- Total sales:

In order to plan and manage correctly, knowing the amount of sales per time period (day, week or month) would raise awareness on the expenditure and profit. In the case of Dube's Spaza shop, the owner will be aware that his sales on average will vary in the range of 6697.78 to 6714.13 (see table 5.1 and 5.2).

This exercise was to show that a simple simulation model of this kind can be easily set up with appropriated data and extended to each shop to allow owners to see effects of management strategies. The simulation can be done on an individual product than in a group of products as it is in Dube's case. The task is subjective, but helpful in the way that is raises the possibilities that help Dube' Spaza shop owner to manage the business. Our investigations were to find at which ordered quantities and order levels the sales could be optimal in comparison with other factors (quantity sold, number of quantity in stock, days out of stock as well as the number of wastages quantities). The same can be done for each Spaza shop and it requires the owner to have a minimum of management skills.

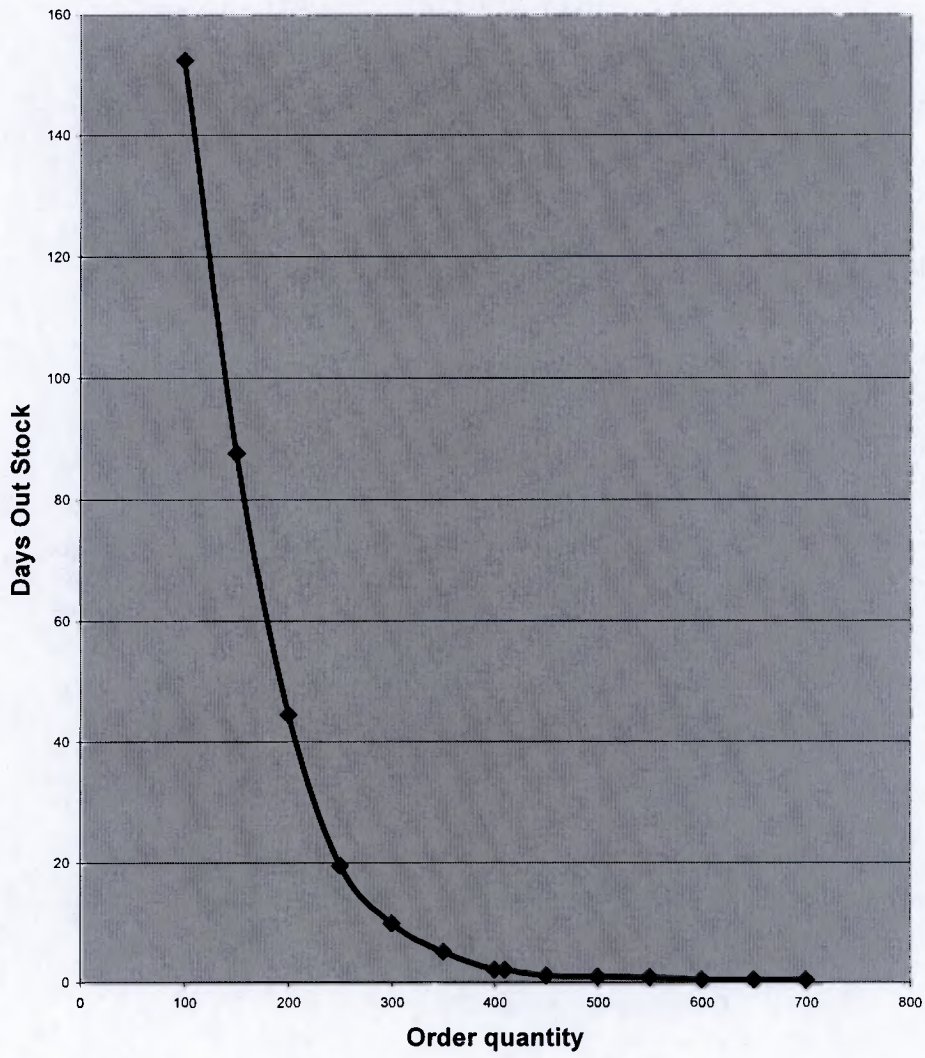


Figure 5.1: Order quantity versus mean day out of stock

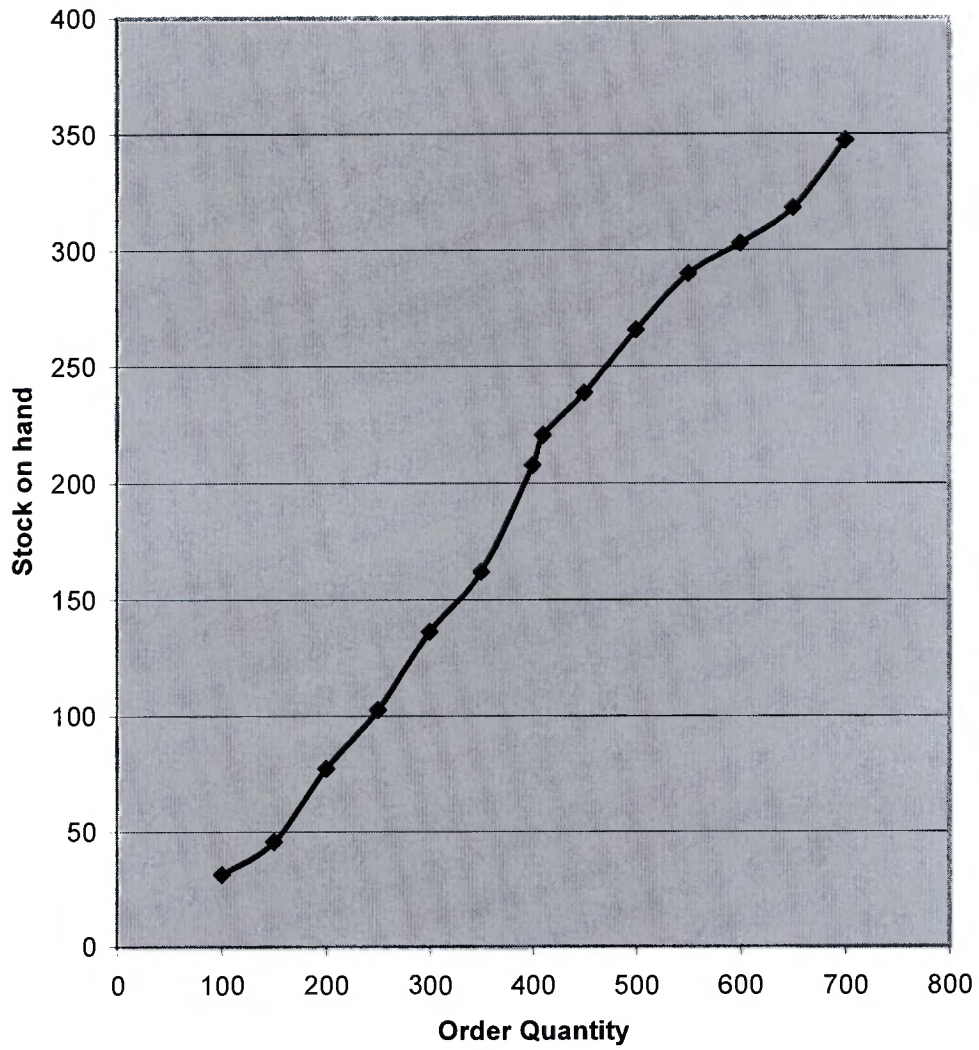


Figure 5.2: Order quantity and mean stock on hand

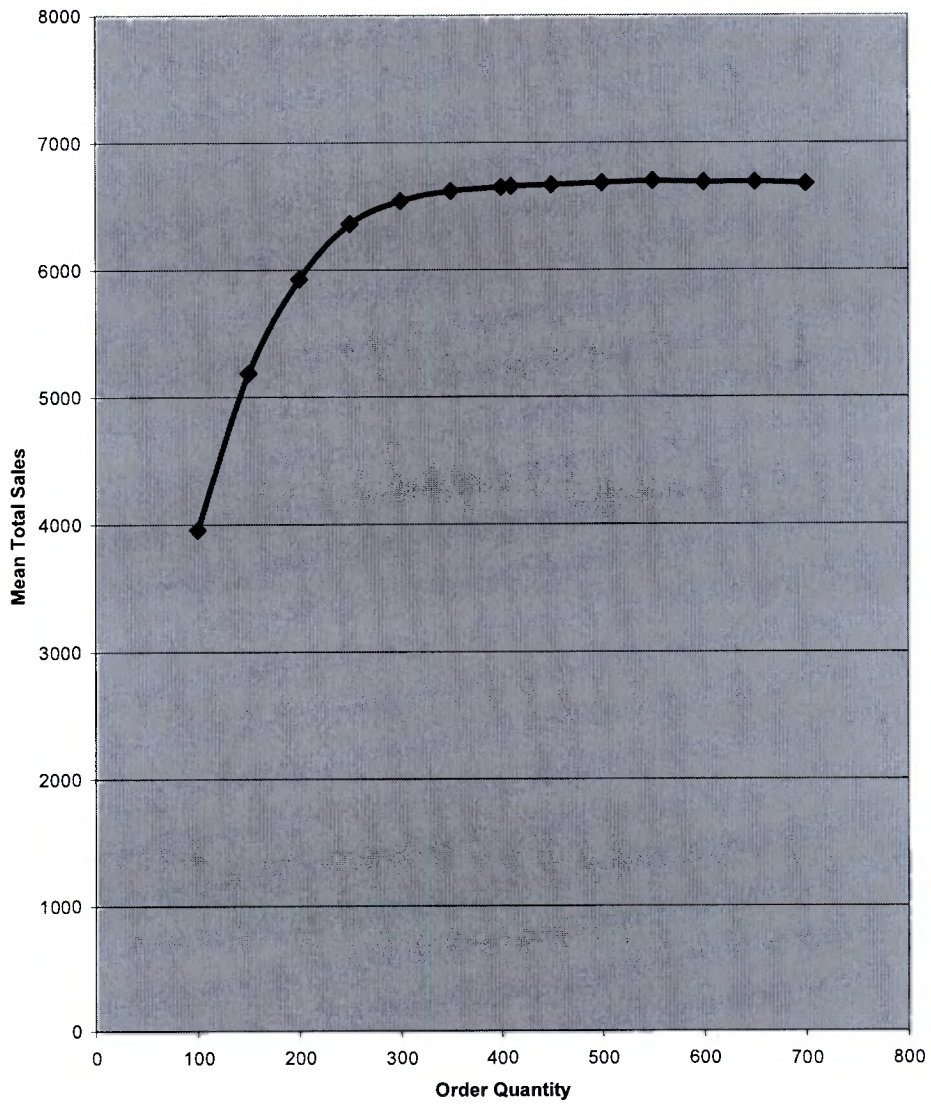


Figure 5.3: Order quantity and mean total sales

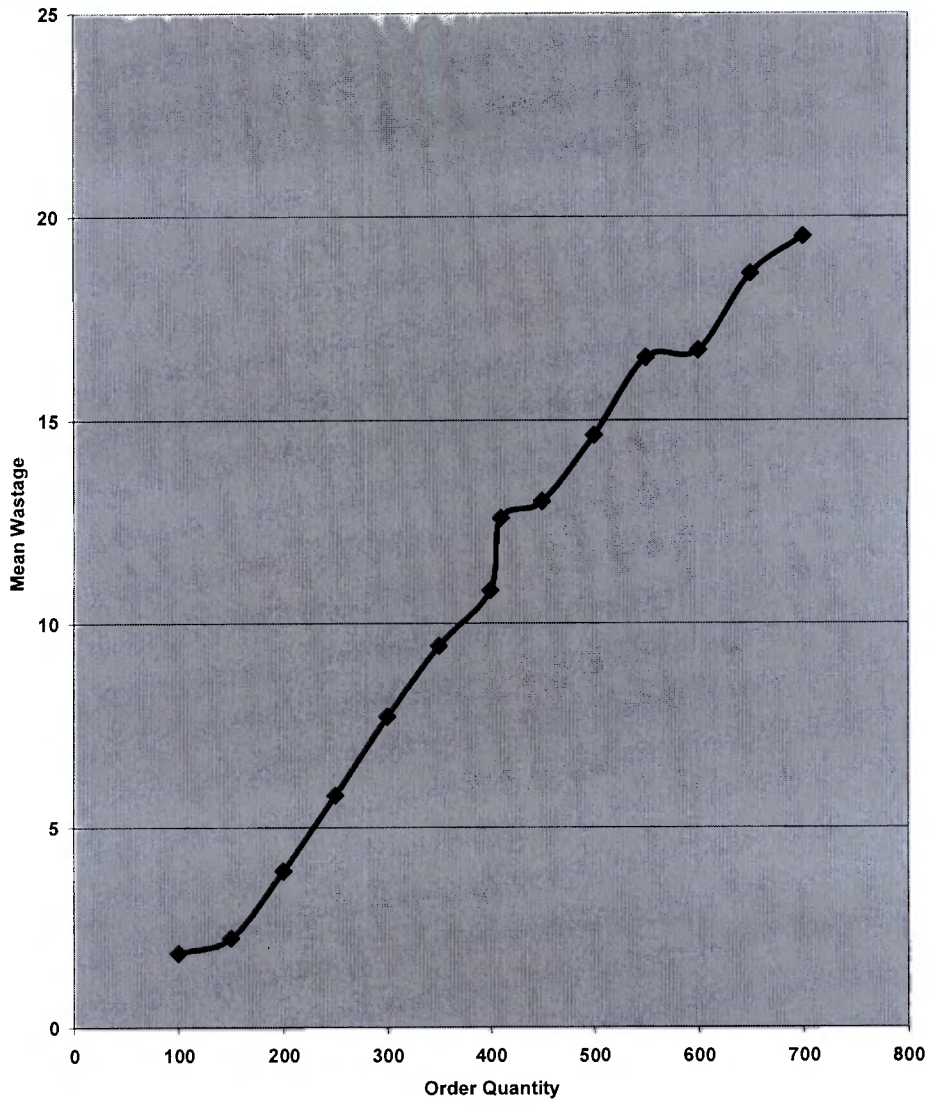


Figure 5.4: Mean wastage

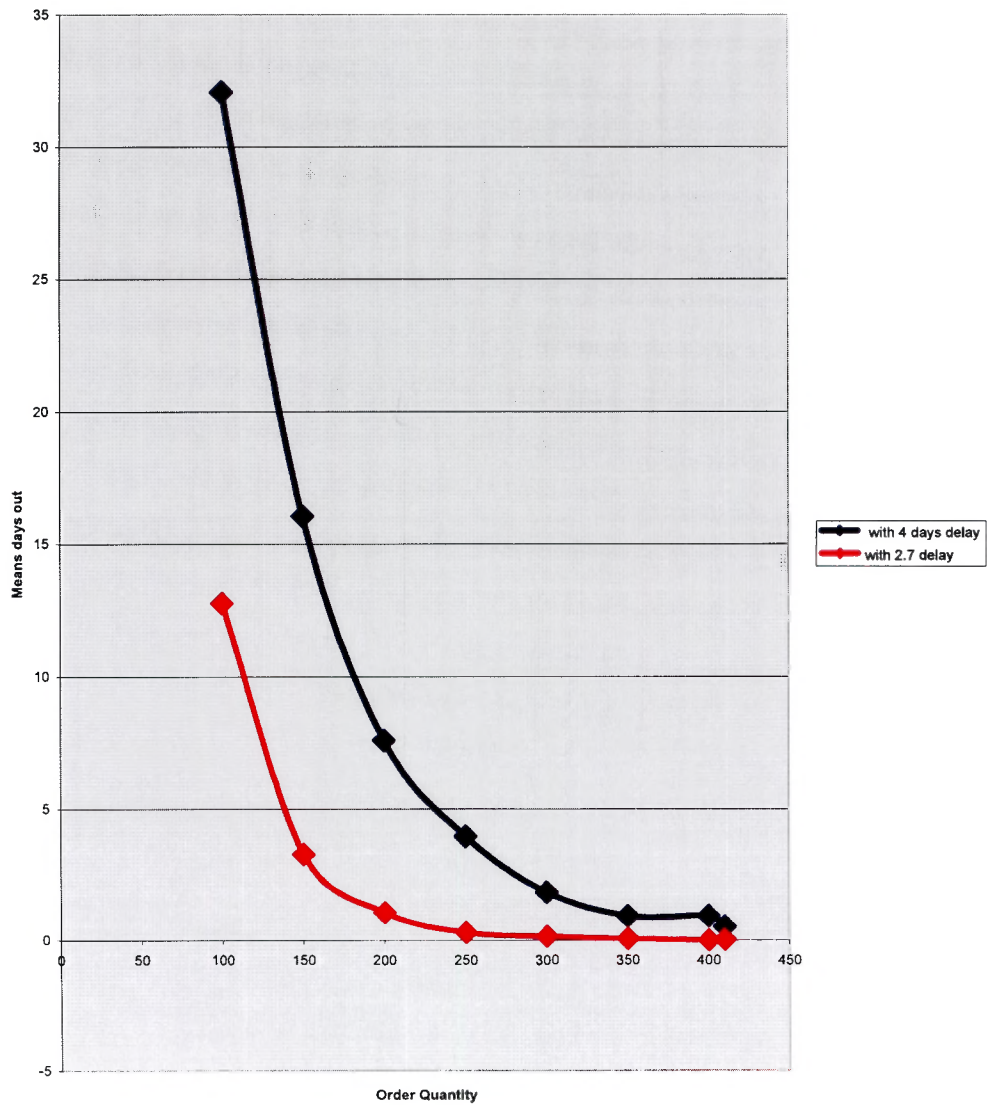


Figure 5.5: The impact of two time delay on stock on hand

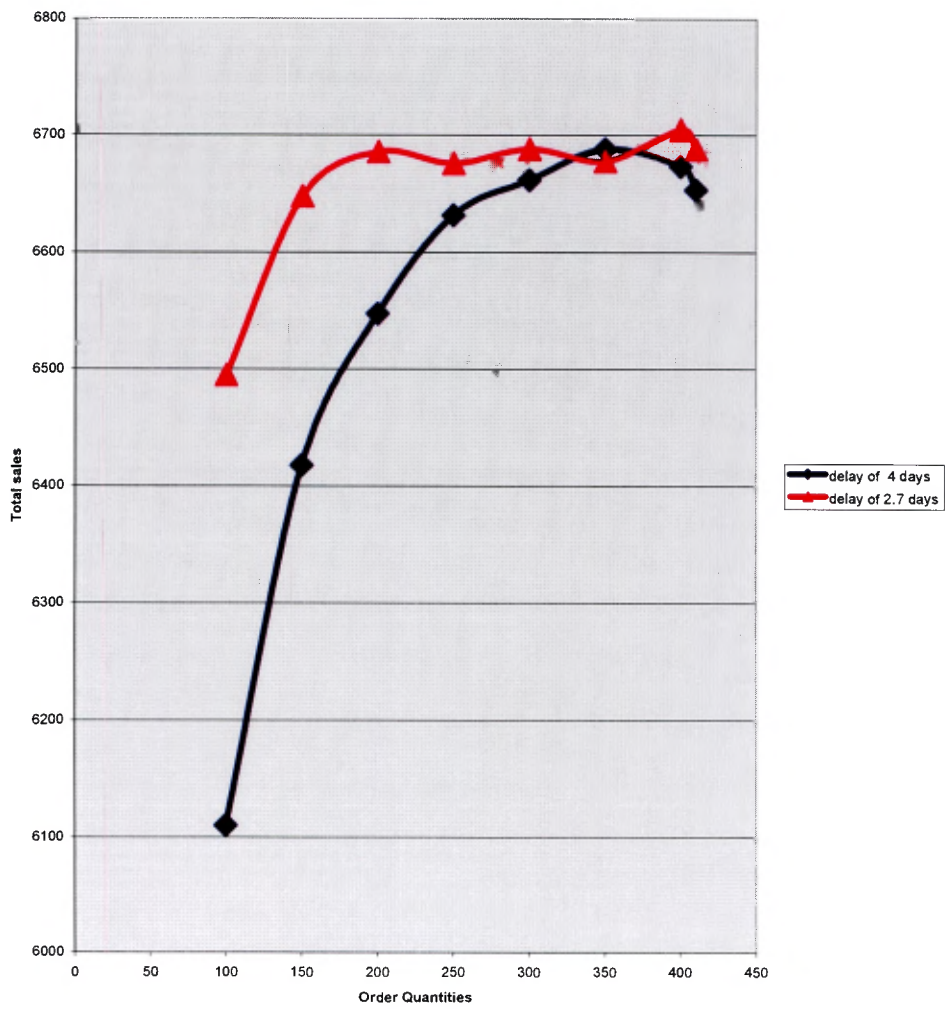


Figure 5.6: The impact of two time delay on mean total sales

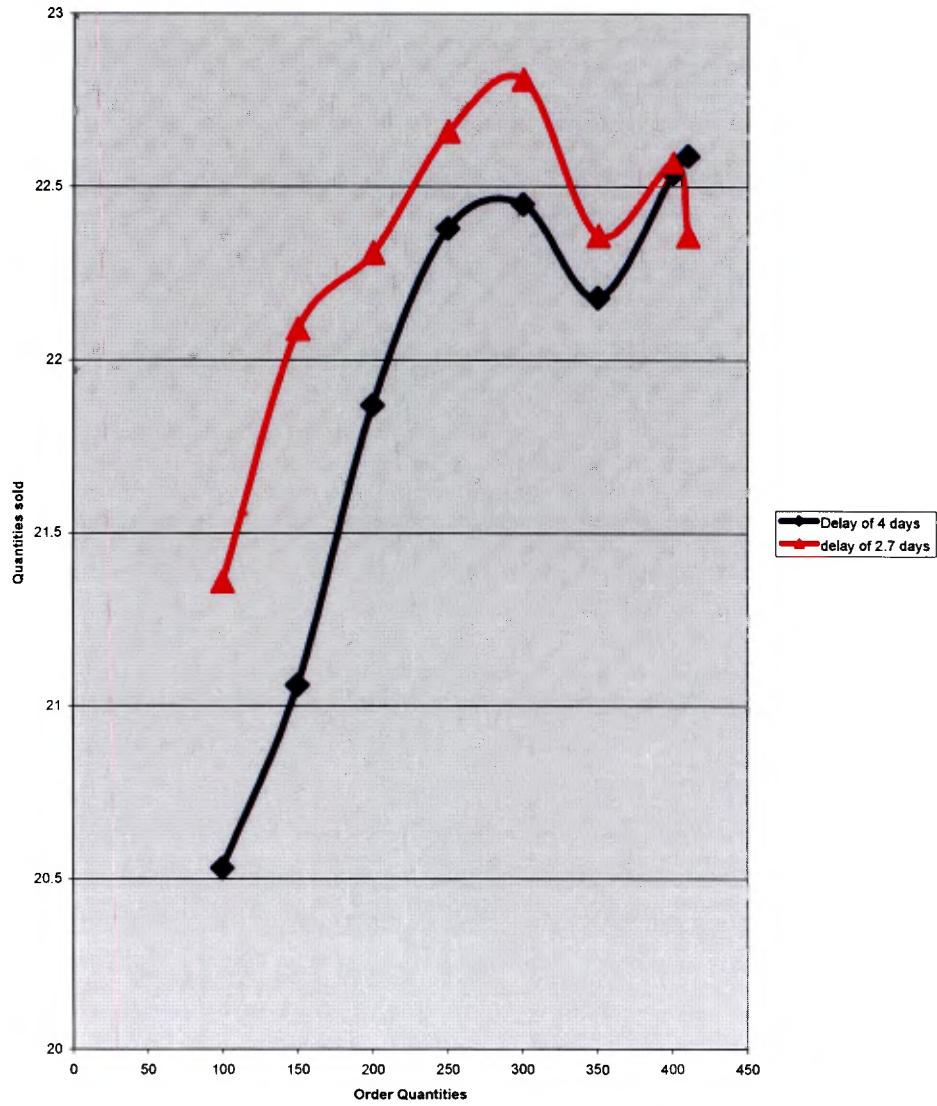


Figure 5.7: The impact of two time delay on mean quantity sold

Chapter 6

GENERAL CONCLUSION

There has not been much research done on Spaza shops (in western Cape), the example used to tackle the performance problem of micro enterprises. While Ligthelm (2002); Ligthelm and Masuku (2003); Ligthelm and Cant (2002); Bear et al. (2005) have gone to an exhaustive analysis of characteristics of Spaza shops; they have not offered solutions in a sustainable way. The performance of micro enterprises world wide is questionable and organizations are dealing with this issue trying to effect improvements. We focused mostly on endogenous factors, because they are manageable at the Spaza level and they are key to the improvement of the business as well. In one of the aims of this study we addressed the performance problems that are faced by Spaza shops. It was to offer the model of intervention of concerned stakeholders to improve the business on one hand. On the other hand the study attempted to determine the indicator (s) of performance in these businesses and set up some of strategic measures on stocking, ordering issues. At the later stage patterns were raised on areas, shops and products to raise awareness of owner-manager (and decision-makers) on these issues.

The other aim of this study was to show successful use of both Soft and Hard (or traditional) OR in one case study. Many authors have suggested combining these methods by using different terminologies: complementarity Pidd et al. (2005); multimethodology Mingers and Brocklesby (1997); coherent pluralism Jackson (1999), etc, but they have not suggested how to achieve a combination. But Pidd et al. (2005) suggest that in an application based on combined soft and hard approaches, the soft should precede the hard. Soft approach will be used to make sense of things and will help to establish the proper context within which the hard approach is used. That is the route followed in this study where soft approaches have been used to clear the sense of what could be the real problem faced by Spaza owners and how to deal with it. The majority of combinations are either of hard methods together or of soft methods together, but not both together (Mingers and Munro, 2002). In this study we have shown that the use of both approaches to address a business case study could be successful.

The soft approach of OR helped to tackle the problem of micro-enterprises in general and of Spaza shops in particular as "PERFORMANCE PROBLEM". In the case of Spaza shops on Western Cape South Africa, three main issues have to be dealt with in order to improve the performance: management skills, networking of Spaza shops and partners, and help on how to raise the volume of sales. The soft model of intervention on how the stakeholder may take action has been proposed. This model is flexible and is a base that could be modified, adapted as the exogenous factors are changing. But this model is well adapted to address the problems of endogenous factors that Spaza owners are facing.

The hard approach of OR helped us to show the influence of seasonality on the Spaza businesses. Although it was anticipated by TTO, the profit was not retained by the method as an indicator of performance, but the total volume of sales and purchase that the method revealed to be the first indicator of business performance. This goes along with findings in soft model, one of the issues was "volume sales" that need to be improved. Shops in black areas have some similarities and at the same time were opposed to the ones in coloured areas. The statistical analysis revealed that the areas environment tends to have influence on the businesses. The behaviour is influenced by culture (which has influence on kind of food and products needed). The analysis was very important as it captured the main patterns on products, shops, areas and time. The analysis revealed the period of normal and low sales which is necessary and "an add in " for planning strategy of each Spaza shop. Similarities between and among products were raised, bringing the issue of shop shifting products according to the profit margin on fast and slow moving. A product that is slow moving might be replaced by the one (having same characteristics or similarities) by fast moving. This shifting can be done after investigation on profit; that is why the owner-manager needs to have the required skills for this kind of decision. As a strategic plan, a Spaza owner willing to make lot of profit could run his/her business during the period of low business while his/her competitors close their businesses.

As future work, we suggest the genre of simulation model done in this study to be extended to each and every shop (or to a category of shops) to help substantially improve the growth of this important business market, which is neglected. It is hard work, it demands financial and human resources, but if the stakeholders and different organizations involved in helping micro enterprises want they can make the resources available. It has been proved by many studies that micro and small businesses are actually very important both in offering employment and developing economies, as they are not affected on the same scale by the world crisis as the big firms. So the South African government is encouraged to help.

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Appendix 1: VBA listing for simulation model of chapter 5

```
Sub SpazaSim()  
  Dim r, t, i, j, n As Integer  
  Dim maxr, maxt As Integer  
  Dim stock, opstock, sales, olev, oquant As Integer  
  Dim mdem, mdelay, mwaste As Single  
  Dim sddem, sddelay, sdwaste As Single  
  Dim u, x, totsales, meanstock As Single  
  Dim daysout, totorder, orderrecd As Integer  
  Dim nextdel(10), nextorder(10) As Integer 'assuming never more than 10 orders outstanding  
  Worksheets("SimSummary").Activate  
  
  maxt = Cells(19, 3).Value 'Total number of time periods modelled  
  maxr = Cells(19, 9).Value 'Number of repetitions of simulation  
  opstock = Cells(16, 5).Value 'opening stock  
  olev = Cells(7, 5).Value 'Stock level at which to order  
  oquant = Cells(8, 5).Value 'Quantity to order up to (order level)  
  mdem = Cells(4, 6).Value 'mean of log demand (for log-normal)  
  mdelay = Cells(10, 6).Value 'mean of log time delay for order to arrive  
  mwaste = Cells(13, 6).Value 'mean of log proportion waste  
  sddem = Cells(5, 6).Value ' std dev of log demand  
  sddelay = Cells(11, 6).Value ' std dev of log delay  
  sdwaste = Cells(14, 6).Value ' std dev of log proportion wasts  
  
  ' Start simulation  
  
  Worksheets("SimCheck").Activate  
  For r = 1 To maxr  
    totsales = 0  
    meanstock = 0  
    daysout = 0  
    stock = opstock  
    totorder = 0  
    n = 0 'number of outstanding orders  
    For t = 1 To maxt  
      orderrecd = 0  
      If n > 0 And nextdel(1) = t Then  
        orderrecd = nextorder(1)  
        stock = stock + orderrecd 'new order arrives  
        totorder = totorder - orderrecd  
        n = n - 1  
        For i = 1 To n 'which may be 0 now!!  
          nextdel(i) = nextdel(i + 1)  
          nextorder(i) = nextorder(i + 1)  
        Next i  
      End If  
  
      u = Rnd()  
      x = Exp(WorksheetFunction.NormInv(u, mdem, sddem))
```

```

sales = Round(x) 'to get demand as integer
If sales > stock Then sales = stock
totalsales = totalsales + sales
If r = 1 Then 'start check report
    Cells(5 + t, 1).Value = t
    Cells(5 + t, 2).Value = orderrecd
    Cells(5 + t, 3).Value = stock
    Cells(5 + t, 4).Value = sales
    Cells(5 + t, 5).Value = stock - sales
    Cells(5 + t, 6).Value = 0 'May be overwritten later
End If

stock = stock - sales
meanstock = meanstock + stock
If stock = 0 Then daysout = daysout + 1
If stock + totorder <= olev Then 'place an order
    n = n + 1
    u = Rnd()
    x = Exp(WorksheetFunction.NormInv(u, mdelay, sddelay))
    j = t + 1 + Round(x)
    nextdel(n) = j
    nextorder(n) = oquant - stock - totorder
    totorder = totorder + nextorder(n)
    If n > 1 Then
        If nextdel(n) <= nextdel(n - 1) Then
            n = n - 1
            nextorder(n) = nextorder(n) + nextorder(n + 1)
        End If
    End If
    'Above is assumption that no order arrives before the previous
    '... Not essential but makes this model easier!!

    If r = 1 Then Cells(5 + t, 6).Value = nextorder(n) 'Check report
End If
'Now the wastage before next time period!
u = Rnd()
x = Exp(WorksheetFunction.NormInv(u, mwaste, sdwaste))
x = x * stock 'actual stock lost
stock = stock - Round(x)
If r = 1 Then 'continue check report
    Cells(5 + t, 7).Value = Round(x)
    Cells(5 + t, 8).Value = stock
End If
Next t
Worksheets("SimSummary").Activate
Cells(26 + r, 1).Value = r
Cells(26 + r, 2).Value = totalsales
Cells(26 + r, 3).Value = Round(meanstock / maxt, 2)
Cells(26 + r, 4).Value = daysout
Next r
End Sub

```

Appendix 2: Selecting and recoding variables for CHAID and Correspondence Analysis of chapter 4

```
Sub formt()  
  Dim lst(6) As Integer  
  'Headings in the first row  
With Worksheets("output")  
  .Cells(1, 1).Value = "Client-Number"  
  .Cells(1, 2).Value = "Formal Premises"  
  .Cells(1, 3).Value = "House"  
  .Cells(1, 4).Value = "Informal"  
  .Cells(1, 5).Value = "Perc"  
  .Cells(1, 6).Value = "Perch-Price"  
  .Cells(1, 7).Value = "Selling-Price"  
  .Cells(1, 8).Value = "Gross1ProfitMargin"  
  .Cells(1, 9).Value = "Perch-Price"  
  .Cells(1, 10).Value = "Selling-Price"  
  .Cells(1, 11).Value = "Gross2ProfitMargin"  
  .Cells(1, 12).Value = "box-Price"  
  .Cells(1, 13).Value = "Pack-Price"  
  .Cells(1, 14).Value = "UnitSel-Price"  
  .Cells(1, 15).Value = "MrgnProift"  
  .Cells(1, 16).Value = "Sngl-Price"  
  .Cells(1, 17).Value = "SnglSell-Price"  
  .Cells(1, 18).Value = "SnglMrgnProift"  
  .Cells(1, 19).Value = "Mlkpp"  
  .Cells(1, 20).Value = "MlkSp"  
  .Cells(1, 21).Value = "MlkMrgnProift"  
  .Cells(1, 22).Value = "Slw"  
  .Cells(1, 23).Value = "No-records"  
  .Cells(1, 24).Value = "Cashbkkin-out"  
  .Cells(1, 25).Value = "specific-Mth"  
  .Cells(1, 26).Value = "twobook-sales"  
  .Cells(1, 27).Value = "twobook-purchases"  
  .Cells(1, 28).Value = "twobooks-balance"  
  .Cells(1, 29).Value = "usebankAcc"  
  .Cells(1, 30).Value = "Bookkeeping-service"  
  .Cells(1, 31).Value = "TrainingPrgm"  
  .Cells(1, 32).Value = "Atschool"  
  .Cells(1, 33).Value = "AtUniver"  
  .Cells(1, 34).Value = "FromAdvisor"  
  .Cells(1, 35).Value = "From-Family"  
  .Cells(1, 36).Value = "Myself"  
  .Cells(1, 37).Value = "Hpersbnk"  
  .Cells(1, 38).Value = "Hbuspln"  
  .Cells(1, 39).Value = "Hinsur"  
  .Cells(1, 40).Value = "Hnotdone"  
  Row% = 0  
  For Each v In ActiveWorkbook.CustomViews
```

```

Row% = Row% + 1
.Cells(Row, 1).Value = v.Client - Number
.Cells(Row, 2).Value = v.FormalPremises
.Cells(Row, 3).Value = v.House
.Cells(Row, 4).Value = v.Informal
.Cells(Row, 5).Value = v.Perc
.Cells(Row, 6).Value = v.Perch - Price
.Cells(Row, 7).Value = v.Selling - Price
.Cells(Row, 8).Value = v.Gross1ProfitMargin
.Cells(Row, 9).Value = v.Perch - Price
.Cells(Row, 10).Value = v.Selling - Price
.Cells(Row, 11).Value = v.Gross2ProfitMargin
.Cells(Row, 12).Value = v.box - Price
.Cells(Row, 13).Value = v.Pack - Price
.Cells(Row, 14).Value = v.UnitSel - Price
.Cells(Row, 15).Value = v.MrgnProfit
.Cells(Row, 16).Value = v.Sngl - Price
.Cells(Row, 17).Value = v.SnglSell - Price
.Cells(Row, 18).Value = v.SnglMrgnProift
.Cells(Row, 19).Value = v.Mlkpp
.Cells(Row, 20).Value = v.MlkSp
.Cells(Row, 21).Value = v.MlkMrgnProift
.Cells(Row, 22).Value = v.Slw
.Cells(Row, 23).Value = v.No - records
.Cells(Row, 24).Value = v.Cashbkkin - out
.Cells(Row, 25).Value = v.specific - Mth
.Cells(Row, 26).Value = v.twobook - sales
.Cells(Row, 27).Value = v.twobook - purchases
.Cells(Row, 28).Value = v.twobooks - balance
.Cells(Row, 29).Value = v.usebankAcc
.Cells(Row, 30).Value = v.Bookkeeping - service
.Cells(Row, 31).Value = v.TrainingPrgm
.Cells(Row, 32).Value = v.Atschool
.Cells(Row, 33).Value = v.AtUniver
.Cells(Row, 34).Value = v.FromAdvisor
.Cells(Row, 35).Value = v.From - Family
.Cells(Row, 36).Value = v.Myself
.Cells(Row, 37).Value = v.Hpersbnk
.Cells(Row, 38).Value = v.Hbuspln
.Cells(Row, 39).Value = v.Hinsur
.Cells(Row, 40).Value = v.Hnotdone

Next
End With
Row% = 4
Do Until IsEmpty(Worksheets("sheet1").Cells(Row%, 7))
' Client Number
Client% = Worksheets("sheet1").Cells(Row%, 7).Value
Worksheets("output").Cells(Row% - 2, 1).Value = Client%
' Premises
cod = Worksheets("sheet1").Cells(Row%, 31).Value
For i% = 1 To 3
lst(i%) = 0

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```

Next i%
Select Case cod
  Case 1 To 2 'Formal premises
    lst(1) = 1
  Case 3 To 5 'House or part of house
    lst(2) = 1
  Case 6 To 9 'Informal
    lst(3) = 1
  Case 999 'Missing
    For i% = 1 To 3
      lst(i%) = 999 ' Missing in all columns
    Next i%
End Select
For i% = 1 To 3
  Worksheets("output").Cells(Row% - 2, i% + 1).Value = lst(i%)
Next i%
'Percent of purchases prices
Perc% = Worksheets("sheet1").Cells(Row%, 58).Value
Worksheets("output").Cells(Row% - 2, 5).Value = Perc%
'Purchasing and Selling Prices as well as Gross Margin Profit
'Brown bread
'Purchasing Price
Brwn1brd% = Worksheets("sheet1").Cells(Row%, 59).Value
Worksheets("output").Cells(Row% - 2, 6).Value = Brwn1brd%
'Selling price
Brwn2brd% = Worksheets("sheet1").Cells(Row%, 60).Value
Worksheets("output").Cells(Row% - 2, 7).Value = Brwn2brd%
'Margin Profit
Mrgn1Pft% = Worksheets("sheet1").Cells(Row%, 61).Value
Worksheets("output").Cells(Row% - 2, 8).Value = Mrgn1Pft%
'White Bread
Wht1brd% = Worksheets("sheet1").Cells(Row%, 62).Value
Worksheets("output").Cells(Row% - 2, 9).Value = Wht1brd%
'Selling price
Wht2brd% = Worksheets("sheet1").Cells(Row%, 63).Value
Worksheets("output").Cells(Row% - 2, 10).Value = Wht2brd%
'Margin Profit
Mrg2Pft% = Worksheets("sheet1").Cells(Row%, 64).Value
Worksheets("output").Cells(Row% - 2, 11).Value = Mrg2Pft%
'Cigarette Carton Purchase price
Cgrtt% = Worksheets("sheet1").Cells(Row%, 65).Value
Worksheets("output").Cells(Row% - 2, 12).Value = Cgrtt%
'Pack purchase price
kgr% = Worksheets("sheet1").Cells(Row%, 66).Value
Worksheets("output").Cells(Row% - 2, 13).Value = kgr%
'Unit selling price
Ukgr% = Worksheets("sheet1").Cells(Row%, 67).Value
Worksheets("output").Cells(Row% - 2, 14).Value = Ukgr%
'Gross margin profit
Gkgr% = Worksheets("sheet1").Cells(Row%, 68).Value
Worksheets("output").Cells(Row% - 2, 15).Value = Gkgr%
' cigarette single purchase price

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SPPgr% = Worksheets("sheet1").Cells(Row%, 69).Value
Worksheets("output").Cells(Row% - 2, 16).Value = SPPgr%
' cigarette Single selling price
SSkgr% = Worksheets("sheet1").Cells(Row%, 70).Value
Worksheets("output").Cells(Row% - 2, 17).Value = SSkgr%
'Margin Profit
PMr% = Worksheets("sheet1").Cells(Row%, 71).Value
Worksheets("output").Cells(Row% - 2, 18).Value = PMr%
'Milk/sachette purchase price
Mlkip% = Worksheets("sheet1").Cells(Row%, 72).Value
Worksheets("output").Cells(Row% - 2, 19).Value = Mlkip%
'Milk/sachette selling price
mklsp% = Worksheets("sheet1").Cells(Row%, 73).Value
Worksheets("output").Cells(Row% - 2, 20).Value = mklsp%
'Milk Margin profit
Mmpp% = Worksheets("sheet1").Cells(Row%, 74).Value
Worksheets("output").Cells(Row% - 2, 21).Value = Mmpp%
'Do anything special to sell old or slow moving stocks
Slw% = Worksheets("sheet1").Cells(Row%, 91).Value
Worksheets("output").Cells(Row% - 2, 22).Value = Slw%
'No financial records used
Nfclrcd% = Worksheets("sheet1").Cells(Row%, 98).Value
Worksheets("output").Cells(Row% - 2, 23).Value = Nfclrcd%
'Use cash books for money in money out
Mnyio% = Worksheets("sheet1").Cells(Row%, 101).Value
Worksheets("output").Cells(Row% - 2, 24).Value = Mnyio%
'Have a specific costing or pricing method
Cpmth% = Worksheets("sheet1").Cells(Row%, 102).Value
Worksheets("output").Cells(Row% - 2, 25).Value = Cpmth%
'Keep two books of account sales
BksSl% = Worksheets("sheet1").Cells(Row%, 104).Value
Worksheets("output").Cells(Row% - 2, 26).Value = BksSl%
'Keep two books of account purchases
BksPrchs% = Worksheets("sheet1").Cells(Row%, 105).Value
Worksheets("output").Cells(Row% - 2, 27).Value = BksPrchs%
'Keep two books of account balance cash in and out daily or weekly
Fbaltcash% = Worksheets("sheet1").Cells(Row%, 107).Value
Worksheets("output").Cells(Row% - 2, 28).Value = Fbaltcash%
'Use bank account
Frebank% = Worksheets("sheet1").Cells(Row%, 108).Value
Worksheets("output").Cells(Row% - 2, 29).Value = Frebank%
'Use bookkeeping or accounting services
Fcntsv% = Worksheets("sheet1").Cells(Row%, 109).Value
Worksheets("output").Cells(Row% - 2, 30).Value = Fcntsv%
'Business learnt from training
Sklstrn% = Worksheets("sheet1").Cells(Row%, 122).Value
Worksheets("output").Cells(Row% - 2, 31).Value = Sklstrn%
'Business skills learnt at school
Sklschool% = Worksheets("sheet1").Cells(Row%, 123).Value
Worksheets("output").Cells(Row% - 2, 32).Value = Sklschool%
'Business skills learnt at school
SklsUnivr% = Worksheets("sheet1").Cells(Row%, 124).Value

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Worksheets("output").Cells(Row% - 2, 33).Value = SklsUnivr%
'Business skills learnt at school
  SklsAdvisor% = Worksheets("sheet1").Cells(Row%, 125).Value
  Worksheets("output").Cells(Row% - 2, 34).Value = SklsAdvisor%
'Business skills learnt at school
  SklsFamil% = Worksheets("sheet1").Cells(Row%, 126).Value
  Worksheets("output").Cells(Row% - 2, 35).Value = SklsFamil%
'Have Open a personal bank account
  Bnkacc% = Worksheets("sheet1").Cells(Row%, 136).Value
  Worksheets("output").Cells(Row% - 2, 36).Value = Bnkacc%
'Have a complete business plan
  Busplan% = Worksheets("sheet1").Cells(Row%, 137).Value
  Worksheets("output").Cells(Row% - 2, 37).Value = Busplan%
'Have jioned a business association
  Busass% = Worksheets("sheet1").Cells(Row%, 138).Value
  Worksheets("output").Cells(Row% - 2, 38).Value = Busass%
'Have insured anything in your business
  Insur% = Worksheets("sheet1").Cells(Row%, 139).Value
  Worksheets("output").Cells(Row% - 2, 39).Value = Insur%
'Nothing done
  Nthng% = Worksheets("sheet1").Cells(Row%, 141).Value
  Worksheets("output").Cells(Row% - 2, 40).Value = Nthng%
  Row% = Row% + 1
Loop
End Sub

```