A CONCEPTUAL MODEL FOR MANAGING SUPPLY NETWORKS FOR SIMULTANEOUS OPTIMISATION IN A COMPLEX ADAPTIVE ENVIRONMENT: A CASE STUDY OF THE FLORICULTURE INDUSTRY IN KENYA

by

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submitted in accordance with the requirements for the degree of

DOCTOR OF BUSINESS LEADERSHIP

At the

UNIVERSITY OF SOUTH AFRICA

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JUNE 2012

DECLARATION

I declare that; A conceptual model for managing supply networks for simultaneous optimization in a complex adaptive environment: A case of the floriculture industry in Kenya, is my own work and that all the sources that I have used or quoted have been indicated and acknowledged by means of complete references.

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DEDICATION

To my late uncle Domnic Awuor.

ACKNOWLEDGEMENT

Much thanks to my doctorate supervisor Dr. Ria Vosloo and the faculty of the Graduate School of Business Leadership, University of South Africa for their insights and feedback during the colloquium presentations. Special thanks to my beloved wife Rispar and sons Dickens, Leon and Lloyd for their love, patience and understanding during this journey toward a doctorate degree.

ABSTRACT

This thesis aims at developing a conceptual model for supply networks optimization in the floriculture industry in Kenya. In the literature review a detailed account of the evolution of supply chain management, the concept and the factors influencing simultaneous optimization of supply networks in the floriculture industry is given. The area of complex adaptive systems is explored and the link with the floriculture industry in Kenya is shown. A review of current studies is done on the subject of supply chain management and particularly the various conceptual frameworks/models developed by a number of researchers around the world. The supply chain performance measurement and the requirements for model building are also given.

The research methodology provides the research paradigm and research design and discusses the justification of the approach taken for the study. The target population consisted of all active cut flower exporting firms by 31st December 2009 as per the information provided by Horticultural Crops Development Authority (HCDA). This target population comprising of 412 active exporters was stratified in terms of: large, International, local, embedded, unimpeded, small and medium scale enterprises. Sampling was done through census sampling technique, in which case the entire population was considered. Data analysis is also discussed including the various tests to be carried out in relation to validity and reliability of data. There is a detailed presentation of principal factor analysis results. Finally there is a detailed discussion on the ethical considerations in the conduct of my data collection and research process.

Chapter four outlined the factors that are indeed useful to be considered when designing a conceptual model for managing supply networks for simultaneous optimization. Such factors included: country development; quality of inputs; financing; customer responsiveness; research and development. Also discussed are the factors that contribute to overall organizational performance which in this case included: return on trading investment, overall operational costs, overall productivity growth rates and outsourcing activities and decisions. The triple bottom line benefits encompassing environmental

audit, financial audit and social audit have also been discussed in relation to country specific benefits in relation to the floriculture industry in Kenya.

The revised conceptual model for simultaneous optimisation of supply networks in the floriculture industry is presented consisting of: key success factors; financing; information integration; country specific benefits; transport; research and development. These are the factors which contribute to enhancing performance of the floriculture industry in Kenya. The conclusion and recommendations of the study are made on the basis of these factors.

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LIST OF ABBREVIATIONS.

CAS	Complex adaptive system.
CAE	Complex adaptive environnent
ERP	Enterprise resource panning
DBL	Doctorate in business leadership
GDP	Gross domestic product.
HCDA	Horticultural crops development authority.
ISCM	Integrated supply chain management
ISCMM	Integrated supply chain management model
KFC	Kenya flower council
KARI	Kenya agricultural research institute.
FFP	Fair flower planters
PMS	Performance measurement system
PCA	Principal component analysis
SCM	Supply chain management
SCOR	Supply chain operations reference model
SOSN	Simultaneous optimization of supply networks.
USA	United States of America
UNISA	University of South Africa
UK	United Kingdom
VMI	Vendor managed inventory

DEFINITION OF OPERATIONAL TERMS

COMPLEXITY: Complexity results from inter-relationships, inter-actions and interconnectivity of elements within a system and between a system and its environment.

COMPLEX ADAPTIVE SYSTEMS: These are dynamic systems able to adapt in and evolve with a changing environment.

COMPLEX ADAPTIVE ENVIRONMENT: The environment within which complex adaptive systems operate.

ISCM: Is viewed as a set of approaches utilized to efficiently integrate suppliers, manufacturers, warehouses and retailers in order to minimise system wide costs while satisfying service level requirements.

OPTIMISATION: Has to do with increasing the level of efficiency and productivity of a given process or system.

RISK MANAGEMENT: Risk management is the process of planning, organising, directing and controlling the resources and activities of an organization in order to minimise the adverse impacts of accidental loses to that organisation at least possible cost

SCM: Supply chain management is the systematic, strategic co-ordination of the traditional businesses within the supply chain for the purpose of improving the long term performance of the individual companies and the supply chain as a whole.

CHAPTER ONE

RESEARCH ORIENTATION

Floricultural exports are the source of Kenya's biggest export earning, surpassing tourism as of the year 2008. The value of the exports rose from Ksh. 1 billion in 1990 to a record over Ksh. 43 billion in 2008. The annual growth in the sector has averaged over 10% for the past five years and is projected to continue. Hence, the economic stability of the country is dependent on the continued success of the industry (HCDA, 2008). Floriculture in particular is estimated to employ over 100,000 people directly, while indirect employees in transport, packaging, inputs etc are approximately 1.2 million people who derive a livelihood from the export industry. The fact that this employment are in the rural areas is very important, as it not only stems rural urban migration but also contributes to poverty alleviation, a major focus of the government (Kenya Economic Survey, 2009).

There is need to optimise supply networks in the floriculture industry from end to end horizontally, and vertically by ensuring country specific benefits. This will call for literature review on supply chain modeling and the benefits of simultaneous optimisation. It must also be established that there is a research gap on this area particularly in a developing economy, such as Kenya. Incidentally, the supply networks of the international firms are operational in a developing economy, which further bring in the issues complexity and creates a complex adaptive environment for the networks.

1.1 Introduction

This chapter is a discussion of the background of the study, the statement of the problem which addresses the business need as well as with the research need for the study. The underlying theory areas are then outlined with a brief discussion on each of the areas. The research scope and context are also outlined. The chapter concludes by discussing the research objectives, research questions, assumptions, and limitations. Finally, the chapter thesis outline is presented to give an overview of how the study will be undertaken.

1.1.1 Background of the study

The floriculture sub–sector has a steady 10 –20 % annual increase in production, exports and earnings. However, the potential to improve greatly still exists across the industry. It is to be appreciated that the private sector has contributed largely to this steady growth with the government providing structural macroeconomic reforms including a liberalized trading environment. There are however, still several constraints which deter the industry's performance. These include poor infrastructure, declining productivity, inadequate extension services provision and external market competition as well as market regulation.

The reasons that Kenya is a top producer of flowers are first and foremost because the climate is ideal for producing a wide range of top quality flowers. This is because the light levels at the equator are maximised and the high altitude keeps temperatures from exceeding optimum levels for temperate crops (KFC, 2008). Having the sun directly overhead produces straight stems naturally. There is also sufficient good quality water available and highly educated and trained work force at competitive wage levels. The availability of airfreight is also to be noted, Kenya being a "hub" for the airline industry in the East African region thereby providing very crucial cargo capacity needs, of which the government has focused on creating this.

Liberalisations of the economy over the years and the removal of exchange control and other constraints have also been critical in accelerating the growth of the industry. The Kenyan government has been facilitating trade through the provision of incentives in the form of nil or reduced duties and other taxes on imported inputs crucial to the sector e.g. greenhouse covers, refrigeration equipment for cooling and cold stores, dam construction lining, shade netting and related items.

There has been a lot of good will from the Kenyan government towards the floriculture sector. Currently, there are 400 plus active exporters of cut–flowers in Kenya (HCDA, 2008). Their total capital investment is more than USD 800 million. The government has invested over USD 70 million in market development activities, particularly to increase

the participation of small scale growers (Kenya Economic Survey, 2009). The total area under floriculture is estimated at close to 2000 hectares (HCDA, 2008). Roses dominate the export markets and these places great emphasis on the selection of varieties since the market follows distinct fashion trends. Flower bouquets are the next high demand, the trend has been toward adding value through bouquets labeled ready for supermarkets, and this also follows distinct fashion trends.

Kenya supplies about 38% of cut–flowers and bouquets to the world market. Of this 97% are exported to the European Union, which consume 50% of the world flowers. (HCDA, 2008). Major second tier markets are Netherlands, United Kingdom, Germany, France and other European Union countries. The balance, only 3%, is what is consumed locally. It is to be noted that the United States of America, Japan and the Middle East are coming up fast as significant markets, depending on development of infrastructure at destination point and direct transport.

To sustain and improve efficiency in production and marketing process, the industry needs to enhance production technology generation and dissemination. There has been emphasis on improving post harvest handling practices in recognition of the persistent occurrence of high loses at farm level and all through marketing chain both in the domestic and export outlets (HCDA, 2009). However, there is a need to establish the link from input acquisition to the distribution channel all the way through the supply pipeline to the customers, with a view to undertaking supply chain mapping through the entire process and developing an integrated supply chain management model for the industry. This view of supply chain optimization is referred to as end to end optimization in this study. This mapping may exist for the multinational companies that function in this market, but the focus of optimisation will only be on end to end in the supply networks.

Research on breeding, development and growth of new varieties and products is carried out continuously. Research to reduce freight costs is also a priority, for example, by using more efficient packaging by air. In addition to research by the “owners” of, or the main players in these end to end supply chains, additional research occurs in Kenya. The

country's top universities also produce more than 200 graduate horticulturalists each year and a large portion of this group find employment in the floriculture industry.

The complexity of the industry emanates from dealing with a fairly perishable product where delivery time to the end customer is of essence and, to dealing with part of a first world supply chain operational in a third world. Complexity within the country arises from having a diversity of firms: those with fully embedded supply chains to those with non-embedded supply chains; small and medium scale firms; free agents; large national and multinational firms. This makes the floriculture industry operate in a complex adaptive adaptive environment (CAE).

Significant benefits accrue to Kenya due to the floriculture industry, especially if this is evaluated superficially. However, there is need to consider real situation on the ground and if it can be improved by end to end supply networks optimization. Critical also is optimization within Kenya. Therefore, this calls for the participation of all key players in the floriculture industry in Kenya which includes: small and large firms; national and international firms; financial institutions; research institutions; universities; environmentalists; regulatory bodies; and civil societies.

1.1.2 Supply chain development

Increasing complexity in the global supply chains has made many companies realize that supply chain management (SCM) is a critical business element, and no longer the domain of the warehouse manager or logistics director. While much talk has surrounded the concept of supply chain management, very few companies are seizing the potential found in its broad scale adoption (Goldsby and Martichenko, 2005:12). The complexity of the floriculture industry calls for effective optimization of supply networks.

According to Goldsby and Martichenko (2005), the concept of supply chain management is not well understood or agreed upon. They affirm that much debate has surrounded the very meaning of the term, with lack of proper consensus existing even today. Even the

functions that belong in supply chain management are in debate. Managing supply chains is also a difficult undertaking to achieve since it involves coordination of planning and operational activities throughout the company as well as coordination with the activities of suppliers, customers and information, hence the evolution of the concept of integrated supply chain management.

Supply chains integrate all those processes required to obtain and deliver products to customers. They are based on establishment of systematic relationships in which the supply chain partners align their strategies, share their relevant systems and data, coordinate their organizations, and cooperate in each other's operations (Bender, 1997). It is to be appreciated that, despite the risks associated with it, global supply chains continue to grow longer and more complex as companies push deeper into uncharted territories in search of lower costs (Bovet, 2005).

Despite knowing all the benefits that accrue due to a well managed supply chain, it is only through leverage with advanced information technology that Kenya stands to gain more from the floriculture industry. What maybe called for is integration of all geographical areas associated in the global information network to enhance the end to end and within Kenya supply networks optimisation.

For the purposes of this study, the definition from the Council of Logistics of logistics Management will be adopted. It states that: ***supply chain management is the systematic, strategic co-ordination of the traditional businesses within the supply chain for the purpose of improving the long term performance of the individual companies and the supply chain as a whole*** **(CLM, 2008).**

1.1.3 Supply chain optimization

This study tries to develop a model for simultaneous optimisation of supply networks in the horticulture industry in Kenya. This is a wide industry dealing with the growing, processing and distribution of cut flowers, herbs, vegetables, nuts, and fruits, both in

Kenya and internationally. The study focus on the cut-flower sector as representative of the industry since it is the largest single contributor to the high export earnings from the horticultural industry, a record Ksh.43 billion in 2008 (HCDA,2008). Internationally, supply chains are getting more difficult to manage, the competitive environment means that most firms need to further reduce costs. In such an environment, successful SCM means getting better results with the same or fewer resources.

Studies such as the study by Halldorsson *et al.* (2007: 291) gives an insight into the concept of integrated SCM by proposing different theories to be applied when making decisions on the structure and the management of supply chains; i) transactional cost analysis (TCA), ii) the principal agent theory (PAT), iii) the network theory (NT) and ,iv) the resource–based view (RBV) theory.

The transactional cost analysis (TCA) and the principal agent theory (PAT) have limitations due to the embedded assumptions about human behavior and the static view of the firm's boundaries (Holldorsson *et al*. 2007). It is therefore, necessary to apply complementary theories which can explain power relationships and governance structures in explaining and understanding the concept of integrated supply chain management. Therefore, the study will seek to use a blend of network theory (NT) and resource based theory (RBT) in explanation of the concept of integrated supply chain management. The theoretical framework developed for this research is however, based on: analysis of supply chain networks, organization structure and design, Information communication technology, country industry development and the triple bottom line benefits.

Important management decisions in SCM, according to Holldorsson *et al.* (2007), involves determining: i) which activities should be kept in–house and which activities should preferably be outsourced to external partners in the supply chain; ii) what should be the role, position, and responsibility of participants in the supply chain; iii) how can the firm safeguard against the risk of opportunism from other participants in the supply chain?; and iv) how should the incentives be aligned internally and between the participants in order to further the outcomes of the supply chain?

According to Carey (2007), strategies for SCM in the next decade will include: developing robust and forward looking strategies; developing value–added relationships with suppliers; designing and operating multiple supply networks to meet the needs of specific market segments; leveraging technology for internal productivity and external effectiveness; collaborating internally across functions and externally with suppliers and customers; attracting and retaining supply management talent; and managing and enabling the global supply management organization.

Breakthroughs in technology, both in applications used to enable and improve supply management, and technologies which have altered the way goods and services are provided are shaping the future supply management job function (Carey, 2007). Technologies which emphasize collaboration such as enterprise resource planning (ERP) and electronic data interchange (EDI) are becoming exceeding important in integration of the supply chain management function. With the launch of optic fiber cables and the intercontinental connectivity across the Indian Ocean, internet access has become available and affordable even to small and medium scale firms.

Although optimization typically refers to end to end optimization, it is important in this study to consider in-country optimisation. This is possible due to the importance of Kenya as a geographic player in the integrated network. The success of the industry is thus dependent on: ***end to end optimisation of supply networks to achieve benefits to the individual firms; a need to achieve significant country specific benefits in terms of the triple bottom line. This calls for a need to establish exactly the specific aspects of the industry that are of benefit to Kenya and how to leverage it.***

1.2 Problem statement

The general research problem is identified as the development of a conceptual model for managing supply networks for simultaneous optimisation towards end to end and within country benefits. Kenya being a key play in this industry must provide benefit to the

individual firms as well as benefits for its citizenry. In as much as there is need to ensure that the bottom line is achievable by the various organizations in the supply networks, it must not be at the expense of the environmental and social considerations.

The industry is made up of a network of firms both in embedded and unimpeded supply networks. Those with the embedded supply networks are mainly multinational firms whereas the unimpeded are mainly small, national firms. Hence, optimisation within Kenya will involve all the different players in the industry. There is need to establish that the industry is not causing environmental pollution or if it does, the extent of pollution caused. It must also be determined to extent Kenyan growers are reducing carbon footprint, financial and social benefits trickling down to Kenya.

1.2.1 Country specific business need for the study

It is clear from statement of the problem that there is a need for end to end and within Kenya optimisation of supply networks in the floriculture industry. Issues that need to be considered include:

i) extent of environmental pollution caused by the industry;
ii) efforts for environmental conservation by industry players;
iii) social benefits of the floriculture industry in Kenya; and
iv) financial benefits of floriculture industry in Kenya.

Further studies may be necessary to show that the floriculture industry is neither polluting lakes nor encroaching on wetlands. The drying up of Lake Naivasha, which is situated in one of the most densely populated area with flower farms, has been attributed to the chemical effluents from the surrounding flower farms. It is to be appreciated that high altitude growing at equatorial latitudes produce quality flowers and vegetables without fossil fuels (heating and lighting) – Kenyan produce is grown under the sun.

There is need to examine the extent to which Kenyan growers are reducing carbon footprint by using geothermal and solar techniques for power generation. Carbon

footprint stands for certain amount of gaseous emissions that are relevant to climate change and associated with human production activities (Wiedmann and Minx, 2007). Currently, there is a debate on how to measure and quantify a carbon footprint. A survey of definitions, Scopus (2009), defines carbon footprint in terms of how much carbon dioxide emissions can be attributed to a certain product, company or organization. Carbon trading is already gaining foothold into the country, showing how critical it is environmental conservation.

The financial and social benefits should also be seen to trickle down to the communities where the flower farms are situated. This should be seen in the form of employment creation and improved standards of living. It needs to be observed that most workers in the flower farms are casual laborers earning at least one United State dollar (USD) per day (Fedha, 2009); this has had its consequences in low standards of living, proliferation of slums and prevalence of diseases such as human immunodeficiency virus (HIV) and acquired immune deficiency disease (AIDS).

The fact that the floriculture industry is at the moment one of the largest single export earner for Kenya as well as a major employer does necessitate a need for improvement on productivity. If each employee in this sector has four dependants then, the total beneficiaries are 4.8 million people or 13% of the population (Assumption based on average family size in the cut–flower growing areas in Kenya). ***These therefore necessitate the fact that Kenya has to retain its position in the supply chain network by providing end to end as well as within country optimization. Has to be seen in the backdrop of competition from other countries such as Ethiopia, Uganda, Zimbabwe and South Africa.***

The social condition is characterized by high poverty rates since most workers earn less than one USD per day. There is also high prevalence of human immunodeficiency virus (HIV) and acquired immune deficiency syndrome (AIDS). About 65% of the workers are casual laborers earning about UDD 30 per month. It is also to be noted that 75% of the casuals are women that have single parenthood families (Fedha, 2009).

The industry uses many chemicals such as fertilizers, insecticides, fungicides, nematocides etc. Some of these chemicals have potential to cause serious harm to the ecosystem and human health. Studies / statistics on pesticides use and pesticide related health effects in the floriculture industry in Kenya are very rare and incomplete (Fedha, 2009).

Most of the flower farms are situated around Lake Naivasha. Lake Naivasha is a Ramsar site. Implying that it is a protected wetland under the Ramsar convention in which Kenya is a signatory (HCDA, 2008). Therefore, Kenya has the international obligation to protect such a site from ecological damages. However, pesticides and the degradation products find their way into the lake. This has had serious consequences on pollution of the lake. There is also need to develop the road infrastructure in Kenya in order to make the industry more competitive. There is, however, reasonable investment in cold chain facilities at the airports. Liberalization of trade which has resulted in the removal of exchange control and other constraints has been instrumental in the success of the industry. The Kenyan government has tried to give incentives in the form of nil or reduced duties on inputs for the sector.

The business problem therefore is that: ***there exists a need to expand the theoretical body of knowledge that can be used and applied in supply chain management to optimise the chain end to end and there is a business need to increase efficiency, productivity of the floriculture industry in Kenya and thereby optimise the benefits for Kenya.***

Some questions of concern in the floriculture industry that exist in Kenya are: who benefits from the industry; is the industry fighting poverty among the poor in Kenya ; what are the long term effect of the pollutants from the industry on the environment; what are the long term effects of the industry on reproductive health, cancer related diseases, child health; where do the elderly workers go, and what health effects may manifest later; and what are the impacts of urbanisation with poor planning which indeed is a social problem? ***It is necessary for Kenya to stay competitive while addressing the***

possible problems that may be as a result of the mismanagement of the supply networks end to end and within the country.

1.2.2 Academic need for the study

The literature in this thesis originates from the academic discipline of supply chain management, supply chain networks, organization structure and design, country industry development and triple bottom line benefits. The complexities of the floriculture industry which includes: extremely short shelf life; very specific cycles with extreme peaks; mixing characteristics of service and product dimensions; and the challenge of operating part of 'first world' supply network in a developing economy. This creates the need for end to end optimisation of the supply networks.

In addition the conceptual model will be of benefit to supply chain practitioners in the floriculture industry and any other industry with similar peculiarities. It will also be of benefit to the academia interested in the subject of supply chain management and indeed contribute to the body of knowledge in the subject. Existing theory that would be used as a basis for this study is depicted in the Venn diagram in fig. 1.1.

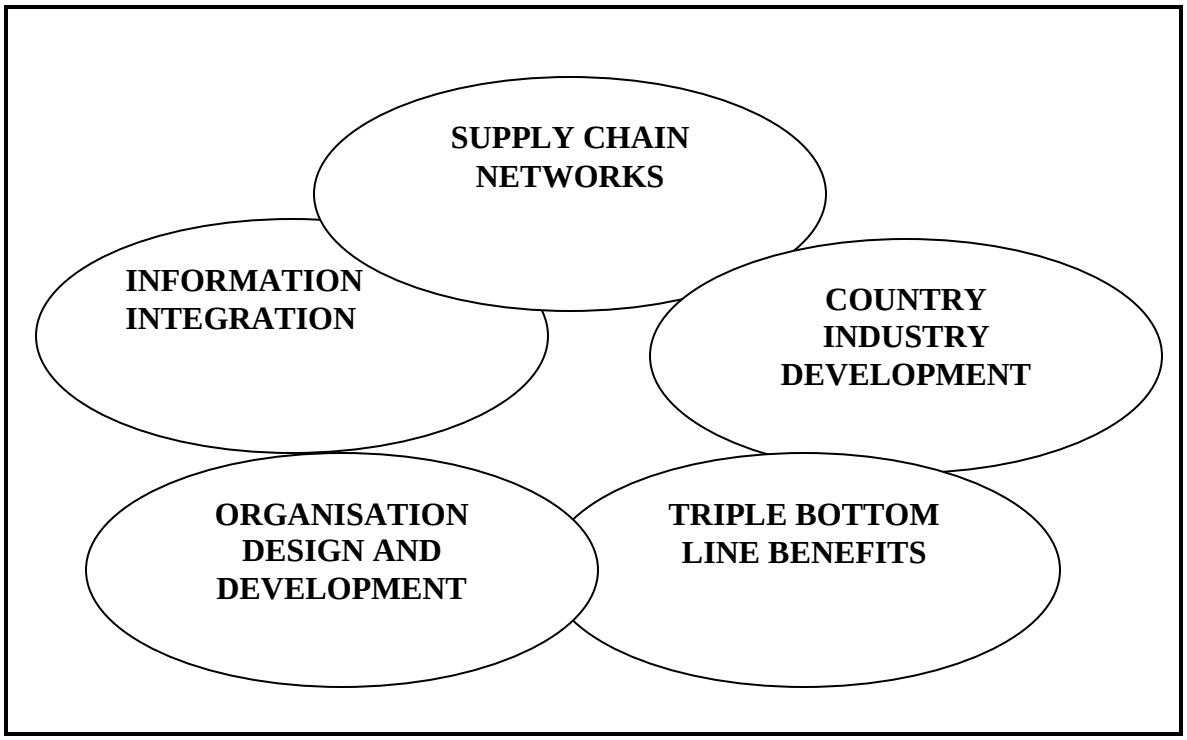


Fig. 1.1: Venn diagram illustrating theory covered

In order to consolidate further the research problem, a brief literature overview from the following five fields can be formulated as shown on the Venn diagram on fig. 1.1. These fields are: i) theory relating to supply chain networks; ii) theory on organisation design and structure; iii) issue to be addressed is theory related to Information communication technology; iv) country industry development; and v) triple bottom line benefits.

The supply chain network is the facet of the supply chain that translates organizational goals of the company. The network in this regard refers to the physical movement of the goods from suppliers' supplier to the company and ultimately to the customers' customer (Bolstorff, 2006). The factors considered in setting supply chain network goals include service level, order fulfillment cycle time, supply chain management costs and inventory days of supply.

Supply chain networks links to supply chain process which is in reference to the supply chain operations reference (SCOR) model (plan, source, make, deliver and return). Factors considered in setting supply chain process goals includes transactional productivity for sales orders, purchase orders, work orders, return authorization, replenishment orders and forecasts (Bolstorff and Rosenbaum, 2003).

Use of information communication and technology (ICT) software's such as enterprise resource planning (ERP), electronic data interchange (EDI) and warehouse management systems offer the obvious benefits of better, faster, more accurate information capture and sharing, but there are benefits found also in what it avoids: the human element (Goldsby *et al*.2005).

Organisation structure and design is important from the point of view of the individual firms and the industry at large. The organisation may refer to elements in a single company or to a bigger part of the complex system itself. It prioritizes organizational performance by balancing customer requirements for delivery reliability, responsiveness and flexibility with the internal needs of cost, profitability and asset utilization (Bolstroff,

2006). Organization structure will also involve determining the influence of power relationships in SCM. According to Bolstroff (2006), the following questions are important with regard to organization design: does your organization structure address centralization, globalization, and functional silos; are all relevant functions in place; are all the functions necessary; is the current flow of inputs and outputs between functions appropriate; and does your organization structure support your suppliers and customers organization structure?

However, the complexities of the industry discussed are not adequately addressed by the current literature. This calls for the development of a conceptual model that will cater for these complexities in order to achieve simultaneous optimisation of supply networks end to end and within Kenya itself.

1.3 Theoretical conceptualization

The attainment of efficiency, hence propelled growth in the industry is only going to be possible through effective integration of supply chain management function. In achieving that objective the research will establish the current structure of the supply chain in the industry which will be key in developing a proposed model. Resources are necessary to accomplish anything great or small, but problems arise from using resources unproductively, applying the wrong resources, failing to tap into necessary resources, or directing resources towards the wrong output (Goldsby *et al*. 2007). The underlying reason is to reduce waste created, costs incurred, wasting people's time, losing opportunities for value creation and growth and having less than satisfied customers.

The need of the research is to establish proper linkage from the sourcing of the inputs through processing and the subsequent distribution channel to the customers. The research will establish the sources of inefficiency in the current supply chain with respect to: inventory; transportation; space and facilities; time; and packaging administration and knowledge. The essence is to have a template that can easily be applicable in an industry as complex as the floriculture industry.

The theory to be covered in this research in addition to the areas illustrated in the venn diagram figure 1.1 is from the areas of complexity, integrated supply chain management and supply chain management. Within which issues to be considered shall include: factors affecting successful ISCM, impact of successful ISCM, performance measurement, risk management, models of ISCM and current levels of research in SCM.

1.4 Research scope

The study involved a survey of firms in the floriculture industry in Kenya of which the data is to be obtained from Horticultural Crops Development Authority (HCDA). The focus of the study is floriculture industry because of its being a major export earner and employer. It is the intention of the study to develop a conceptual model for simultaneous optimization of the supply networks end to end and within Kenya.

The emphasis is to concentrate on the part of the supply chain that is directly related to Kenya. The study is therefore restricted to the part of the supply chain operational in Kenya which involves focusing on the first tier levels of inbound and outbound supply chains. However, the integration of information flow will link to the second tier levels of both inbound and outbound supply chains within an integrated perspective. In figure 1.2 below, a diagrammatic representation of the supply networks constituted of both fully embedded and non–embedded supply networks is represented.

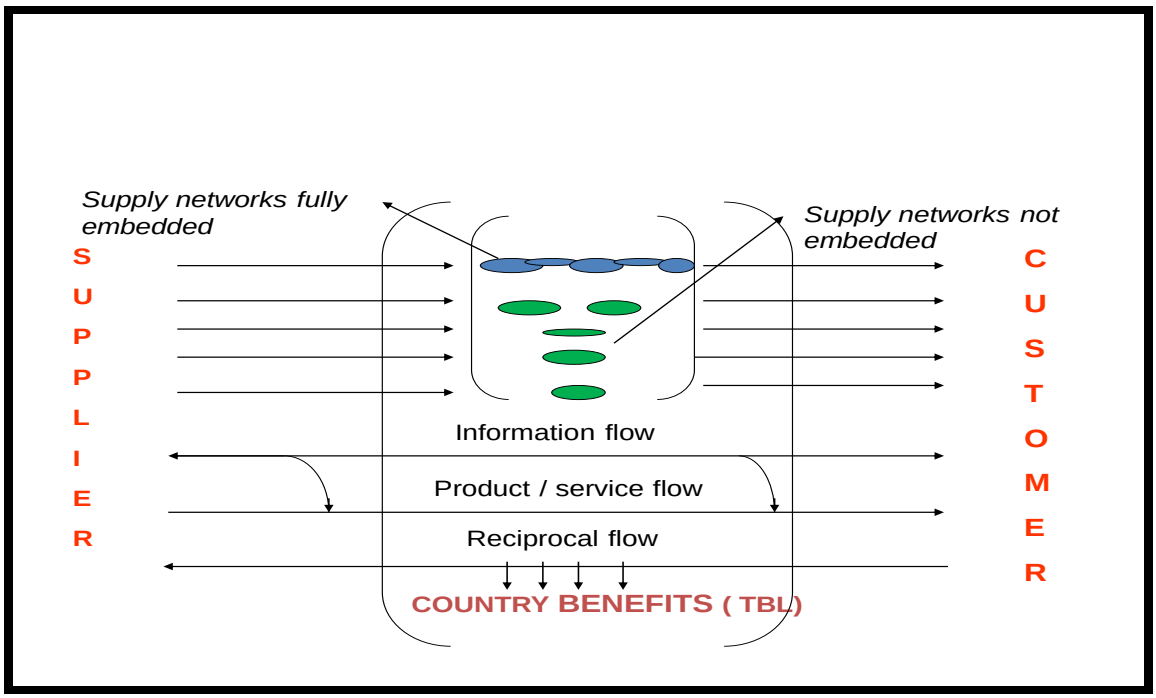


Fig. 1.2: Area of focus on supply networks optimization in the floriculture industry.

The research was carried out through a survey of all floricultural firms actively involved in export of cut – flowers by the end of the year 2008. This being the most current data obtainable from HCDA. The whole population was considered to increase on the validity of the research findings. This will be followed by the development of research instruments and subsequent data collection and analysis.

1.5 Research aim

The general research aim is to develop a conceptual model for managing supply networks for simultaneous optimisation as a tool for enhanced performance (competitiveness) of the floriculture industry end to end and within Kenya. This thesis will synthesize literature on integrated supply chain management and empirically explore the theoretical structure of this concept.

1.6 Research objectives

The objectives of this research are to:

i. to review literature in order to develop concepts and establish priorities;
ii. to review literature in order to develop operational definitions;
iii. use literature review to develop a priori model to illustrate interrelationships between various antecedents of simultaneous optimization of supply networks;
iv. to formulate a basic conceptual framework.
v. identify possible correlations within the conceptual model; and
vi. test the antecedents of retention empirically in order to present a conceptual model of the integrated supply chain management for the floriculture industry in Kenya.

1.7 Research question

The research question on which the study is based is: ***How can a conceptual model that focuses on the simultaneous optimisation (end to end and in country) of the supply networks benefit the floriculture industry in Kenya?***

Some questions that can be addressed within this question include:

i. What are the key success factors that influence the performance of the floriculture industry in Kenya?
ii. What are the relationships between the key success factors that influence performance of the floriculture industry in Kenya?
iii. What are the factors that will indicate the performance of the floriculture industry from a traditional perspective (supplier – customer)?
iv. Are there differences in factors to be considered for the embedded and free agents performance in the floriculture industry end to end and within Kenya?
v. What needs to be considered in developing a model for simultaneous optimization of the supply networks of the floriculture industry in Kenya?
vi. How does simultaneous optimization of supply networks affect performance of the floriculture industry, end to end and within Kenya?

vii. What needs to be considered in improving the performance of the non-embedded and free agents supply networks performance?

viii. What needs to be done in dealing with environmental challenges posed by the floriculture industry?

ix. How do the small and unimpeded floriculture firms in Kenya cope with the challenges affecting the performance of their supply networks?

x. What is the role of the government of Kenya in dealing with the challenges affecting the floriculture industry in Kenya?

1.8 Research delineation

The study restricted to the part of the supply networks operational in Kenya. These involves addressing the first tier inbound and outbound supply networks. These, however, is presumed to have no negative consequences to supply networks optimisation due to information integration from both end of the supply chain. The study does not focus on investigation of the practices of multinational firms but mainly on feedback through questionnaires and interviews on the various industry stakeholders, which include: regulatory bodies; civil society; commercial banks; research institutes; universities; and suppliers of farm inputs.

1.9 Research limitations

The study limitations are based on: i) the research questions; ii) the research design; and iii) the realities of the research process. The relationship between supply networks optimization and performance was not directly measured but was inferred. The assumptions being that performance levels can only improve as a result of supply networks optimization. Some of the respondents may not have been particularly knowledgeable on the issues addressed by the research instrument. This limitation being attributable to the research design having made use of qualitative methodology adopted in the phase one of the study.

The inability to quantify the percentage of financial benefits from the floriculture industry getting back to Kenya in terms of taxation and social welfare to the employees and communities around the flower farms. It was also difficult to quantify from the study the extent of damage posed by the industry to the environment and socially. This is a limitation attributed to the inability of the research questions to address the issues

1.10 Assumptions of the study

Principal research assumptions for this study include:

i. That simultaneous optimization of supply networks in the floriculture industry will enhance performance and competitiveness of the industry end to end and within Kenya,
ii. That simultaneous optimization of supply networks in the floriculture industry will result in the triple bottom line benefits for the Kenya, and
iii. That simultaneous optimization of the supply networks in the floriculture industry will result in sustainability of the industry with regard to the triple bottom line benefits.

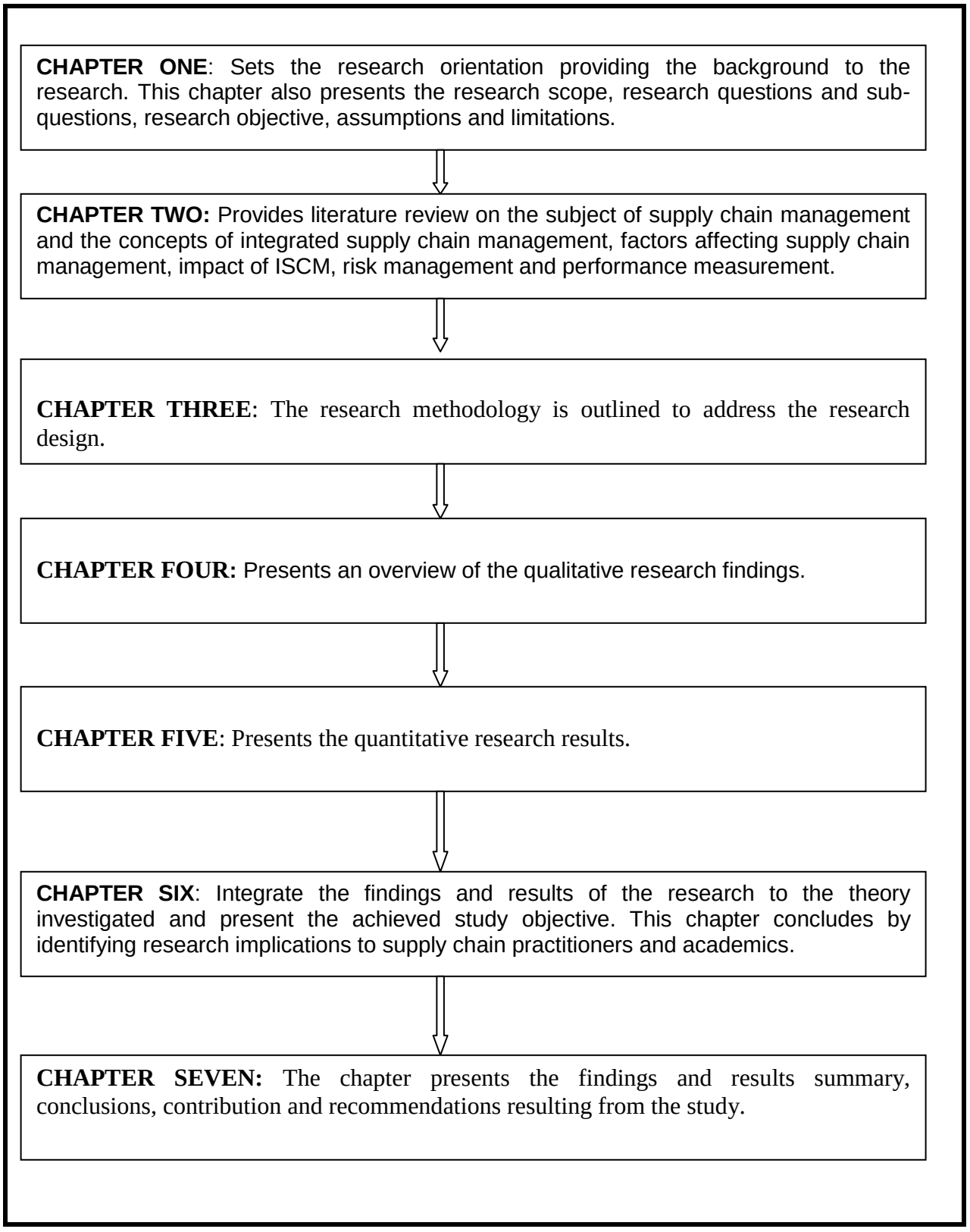
1.11 Intended study contribution

The outcome of this research is expected to be beneficial to floriculture industry in particular and Kenya in general. It is also expected to act as a template for supply chain practitioners in any industry with similar characteristics which include: dealing with a highly perishable product; operating part of a first world supply chain a third world country; and dealing with an industry that exhibits both the characteristics of providing a service and a product at the same time . The literature generated by the study will enable a wide view of supply chain networks across the globe.

1.12 Thesis chapters' outline

Table 1.1 is a presentation of the thesis chapter outline for this study: A conceptual model for managing supply networks for simultaneous optimization in complex adaptive environment: A case of the floriculture industry in Kenya.

Table 1.1: Summary of thesis chapters' outline


CHAPTER ONE: Sets the research orientation providing the background to the research. This chapter also presents the research scope, research questions and sub-questions, research objective, assumptions and limitations.
CHAPTER TWO: Provides literature review on the subject of supply chain management and the concepts of integrated supply chain management, factors affecting supply chain management, impact of ISCM, risk management and performance measurement.
CHAPTER THREE: The research methodology is outlined to address the research design.
CHAPTER FOUR: Presents an overview of the qualitative research findings.
CHAPTER FIVE: Presents the quantitative research results.
CHAPTER SIX: Integrate the findings and results of the research to the theory investigated and present the achieved study objective. This chapter concludes by identifying research implications to supply chain practitioners and academics.
CHAPTER SEVEN: The chapter presents the findings and results summary, conclusions, contribution and recommendations resulting from the study.

1.13 Conclusion

This study aims to develop a conceptual model for simultaneous optimization of supply networks in the floriculture industry end to end and within Kenya. The focus is on the cut-flower sector as it is the most representative in the industry. Internationally, supply chains are getting more complex and difficult to manage and the competitive environment means that focus is on further reducing costs. In such an environment, successful SCM means getting better performance with the same or fewer resources.

The available literature on SCM reveals several integrated supply chain models: Svensson (2007); McCormack *et al*. (2008); Burgess and Singh (2006); Stonebaker and Liao (2006); Halldorsson *et al*. (2007); and Trkman *et al*. (2007). However, these models do not address the problems specific to the floriculture industry in Kenya. Studies by Halldorsson *et al*. (2007: 291), gives an insight into the concept of integrated SCM by proposing different theories to be applied when making decisions on the structure and the management of supply chains. The theoretical framework developed for this research is however, based on; analysis of supply chain networks, organization structure and design, information communication technology, country industry development and the triple bottom line benefits.

The next chapter gives a detailed theoretical review of: concepts in supply chain management; factors that influence performance of supply networks; relationships and impact of key success factors that influence performance of supply networks; supply chain performance measurement; complex nature of the floriculture industry in Kenya; supply network's risk management; developing a conceptual model; and current levels of work on supply chain management in various countries and industries.

CHAPTER TWO

LITERATURE REVIEW

In the previous chapter the research orientation including both the business and the research need for the study was discussed. The study question was outlined together with the sub-questions which forms the basis of the research. The study is an endeavor to establish how a conceptual model that focuses on the simultaneous optimisation of supply networks, end to end within country can be beneficial to the floriculture industry in Kenya. The sub-questions to be addressed in answering the study question are: what are the key success factors that influence the performance of the floriculture industry in Kenya? what are the relationships between the key success factors that influence the performance of the floriculture industry in Kenya? what are the factors that will indicate the performance of the floriculture industry from a traditional perspective? what needs to be considered in developing a conceptual model for simultaneous optimizations of supply networks in the floriculture industry in Kenya?

2.1 Introduction

A theoretical review of concept of supply chain management will be discussed together with factors that influence performance of supply networks. Also discussed include: relationship between key success factors that influence performance of supply networks; supply chain performance measurement; floriculture industry in Kenya as operating in a complex adaptive environment; supply networks' risk management; developing a conceptual model for simultaneous optimization of supply networks; requirements to build a model; and the current levels of work on supply chain management in various countries and industries.

2.2 Theoretical review of concepts in supply management

Theoretical review of concepts revolves around a discussion on: evolution of supply chain management; supply chain management's various definitions; and integrated supply chain management. This is a preamble on literature review in an attempt to answer the study question; how can simultaneous optimisation of supply networks benefit the floriculture industry in Kenya?

2.2.1 The evolution of supply chain management

In giving a definition of SCM, Stock *et al.* (2005) asserts that it is first important to understand its historical perspective. Tracking how it has developed in recent years and furthering some appreciation for why it has become such an important topic. Practitioners at the beginning of the last century realized the importance of implementing basic concepts of SCM (Arnold and Faurote, 1919; Ford and Crowther 1922; Faurote 1928).

In the early 1950s, channels of distribution pioneers such as Wroe Alderson, Reavis Cox and Louis P. Bucklin first conceptualized the key characteristics and factors explaining why companies create distribution channels and how they could be structured for maximum efficiency and effectiveness (Alderson 1950; Cox and Alderson 1950; Bucklin 1966 in Stock *et al*. 2005). According to Cox and Alderson (1950), the important linkages are formed between business activities stating that a product: "*starts out as materials which are relatively raw and unspecialized and ends up as a relatively refined and specialized article, shaped to needs of the individual consumer who buys it".*

More than fifty years ago, Forester (1958), proposed that, *"there will come general recognition of the advantage enjoyed by (those) who are the first to improve their understanding of the inter-relationships between separate company functions and between the company and its markets, its industry, and the national economy*". It is to be noted that managers did not begin to recognize the need for a new perspective on managing their supply chains and scholars began to apply the concept of SCM until the mid 1980's (Jones and Riley, 1985; Haulihan 1985, 1987; Snowdon 1988).

It is espoused by Stock *et al.* (2005), that although the concept was first introduced half century ago, it seems ironic that the concept of integrating supply chains did not gain widespread popularity and adoption until the mid 1980s. The table below shows that there has been an exponential growth on SCM publications in the period between 1994 and 2004

Table 2.1: SCM publications (1994 – 2004)

Year	Journal Article*	Total Publication**
1994	9	50
1995	16	467
1996	49	343
1997	44	585
1998	83	945
1999	101	1070
2000	174	1309
2001	162	1782
2002	177	1626
2003	251	1705
2004	303	1788

* Referred academic journal articles
** Total of both practitioner publications and referred articles.

(Source: Stock *et al*. 2005).

The number of academic dissertations dealing with SCM has also shown a dramatic increase since the 1980s (Stock *et al*. 2005). During the period 1970 – 1991, no academic dissertations were cited in dissertation abstracts when searching on the keywords of "supply chain management", "supply chain" or SCM. From 1992 – 1998, 14 supply chain dissertations were published, and in the latest period from 1999 – 2004, 65 dissertations relating to SCM were identified (Stock, 2001; Stock and Broadus, 2005).

It is presumed that the interest in SCM domain will remain high for the period 2005 – 2011 for the following reasons:

i) firms increased reliance on global sources of supplies;

ii) tendency to purchase low cost, high quality materials and component parts from specialized supply partners;
iii) customers are demanding higher quality products that are delivered faster and made available for purchase quickly and on time; and
iv) advances in computer technology such as: enterprise resource planning (ERP), electronic data interchange (EDI), radio frequency identification (RFID), bar coding and electronic point of sale (EPOS).

2.2.2 Supply chain management's various definitions

At this point, it is vital to have a working definition of supply chain management. The essence of supply chain management is in the activities performed by the firm. It entails choosing to perform activities differently or to perform different activities than rivals (Porter, 1996). The Japanese triggered a global revolution in operational effectiveness in the 1970's and 1980's, pioneering practices such: as total quality management, and continuous improvement. Hence, they enjoyed cost and quality advantages for many years. However, Japanese firms rarely have a differentiating strategy; most firms imitate and emulate one another (Porter, 1996). Those that did have strategy such as Sony, Canon, and Sega e.t.c. were the exception rather than the norm. All rivals offer most if not all product varieties, features and services; they employ all channels and match one another's plant configuration.

Most companies seem comfortable defining their supply chains solely by product and financial definitions, regardless of the customer. This, however, can derail a supply chain. First, customer requirements are key factors that drive supply chain performance; while the gross margin may look good, the net profit might suffer due to high sales, general and administrative (SGA) costs of meeting customer requirements. The customer is core in managing of supply chains in the floriculture industry and this will be discussed further.

Manufacturers are often indiscriminate about what items of the total product line should be available to a particular customer segment. With a product only view, supply chain

costs can evolve to support the delivery requirements of the most aggressive customer – meaning the manufacturer provides superior delivery performance even where it is not needed or valued (Bolstroff and Rosenbaum, 2003).

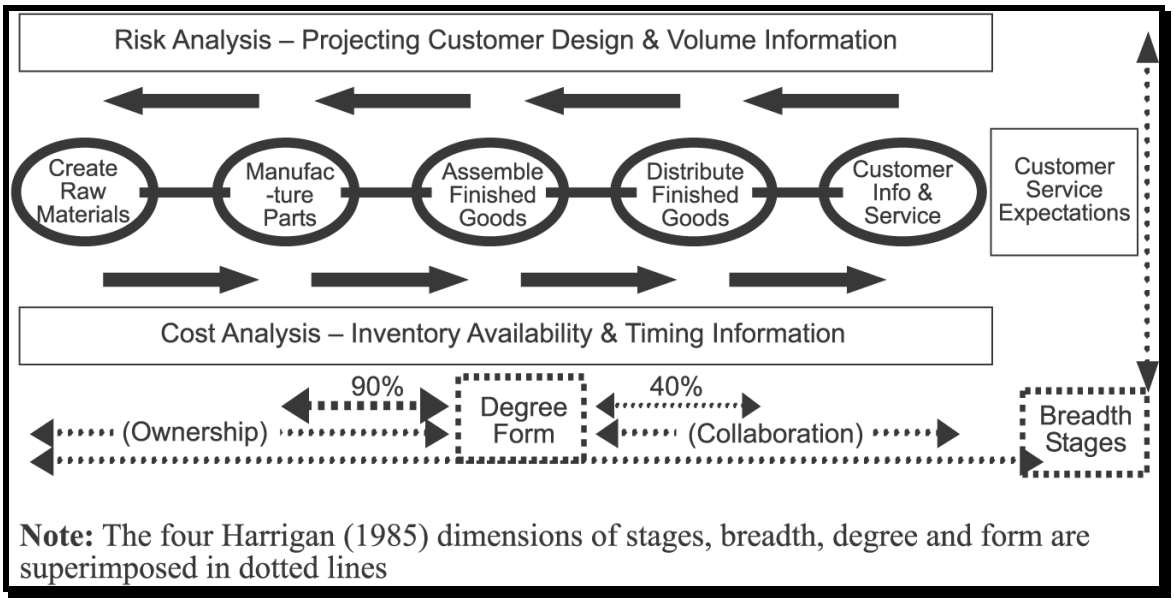


Fig 2.1: A stylized representation of the supply chain

(Source: Stonebraker, 2006)

A supply chain often involves five stages: a) creation of raw materials; b) manufacture of parts and components; c) assembly of finished goods; d) distribution of goods / services; and e) consumer service. Each stage may involve several serial production / distribution steps, and activities likely involve functions of purchasing, operations and logistics (Stonebraker *et al.* 2006: 36). Flow of information and exchange, including market research, demand forecasts, order flows and cash / credit, as well as design prototypes are included.

According to Stonebraker (2006), supply chain literature may be generally characterized as: a) describing the emergence and characteristics of the supply chain; b) focused on smoothing and integration, both vertical and horizontal, and either mathematically or

conceptually and often from a discipline specific perspective; and c) identifying the competitive priorities and their impact on integration. According to Svensson (2002) SCM is a business philosophy that simultaneously should address the overall bi – directional dependencies of activities, actors, and resources on an operational, tactical and strategic level, from the point of origin to the point of consumption in and between channels.

Varying definitions of SCM have been reviewed by Mentzer *et al*. (2001) in an effort to categorize and synthesize them. Unfortunately, they only examined a handful of select definitions. They proposed that SCM definitions could be classified into three categories: i) a management philosophy; ii) implementation of a management philosophy, and iii) a set of management processes. They synthesized these disparate aspects and defined SCM as*: " the systematic, strategic coordination of the traditional business functions and the tactics across these business functions within a particular company and across business within the supply chain, for the purpose of improving the long-term performance of the individual companies and the supply chain as a whole"(* Mentzer *et al*.2001). Two scholars, Larson and Rogers (1998), described SCM as: *"the coordination of activities, within and between vertically linked firms, for the purpose of serving end customers at a profit".*

It is clear that there is no universally accepted definition of supply chain management, hence for the purpose of the study a definition from the Council of Logistics Management will be used. It states: *"Supply chain management is the systematic, strategic co-ordination of the traditional business functions within a particular company and across businesses within the supply chain for the purpose of improving the long term performance of the individual companies and the supply chain as a whole" (CLM, 2008).* Certainly key assumptions are evident in this definition. A planned, coordinated approach; a longer – term, strategic approach; the importance of coordinating functions; and it is taken as given that supply chain members are business oriented, and therefore involved in commercial transactions (Oloruntoba and Gray, 2001).

According to Stock *et al*. (2005) a detailed analysis of the definitions and descriptions of SCM resulted in the identification of six free nodes. The nodes that best characterized aspects of SCM were labeled as: i) material/physical and information flows; ii) relationship networking; iii) value creation; iv) creation of efficiencies; v) customer satisfaction; and iv) constituent parts. Each node was determined to fall into one of three broad themes constituting the key activities, the benefits, or the constituents associated with SCM. The themes, nodes and frequency with which they occur are presented in the table 2.2 below:

Table 2.2: Themes derived from 129 SCM definitions

Theme	Free Nodes	Frequency	% of total
Activities	Material/Physical & Information flows	69	53
	Network of relationships	77	60
Benefits (Functions)	Adds value	31	24
	Creates efficiency	30	23
	Customer satisfaction	42	33
Constituent / Component parts	Constituent / Component parts	47	36

(Source: Stock *et al*. 2005)

This investigation reveals that the definitions of SCM is mainly centered on the activities of material / physical and information flows at 53% and network of relationships at 60%. This study will also attempt to investigate the critical role played by both two elements in supply chain management.

2.2.3 Integrated supply chain management

Having looked at the evolution and definition of supply chain management, it is important to explore the concept of integrated supply chain management (ISCM). ISCM can be defined "*as a set of approaches utilized to efficiently integrate suppliers, manufacturers, warehouses and retailers in order to minimize system wide costs while*

satisfying service level requirements" (Levi *et al.* 2000). Integrated Supply Chain Management requires the development of policies for efficient production and movement of products, for the efficient management of information that triggers product flows and for the development of appropriate cross – company management and organizational structure (Taylor, 1997).

Supply chain management today is more than the coordination of logistics, and the enhanced efficiencies of supply chain integration are central to success (Stonebraker and Liao, 2006: 34). The limit of supply chain integration is best captured in the concept of "focus", which states that a production activity must focus on one or a small number of products (or product lines), one or a few production processes, and one or two similar technologies. If a production activity attempts too many products, processes or technologies, it would become "unfocussed", ultimately ceding market share to more efficient, focused processes (Stonebraker and Liao, 2006: 26).

The figure below depicts a proposed theoretical model in which the product life cycle stage has a direct impact on the appropriate dimension of supply chain integration activity (Agarwal, 1997; Klepper, 1996; Birou *et al*. 1998).

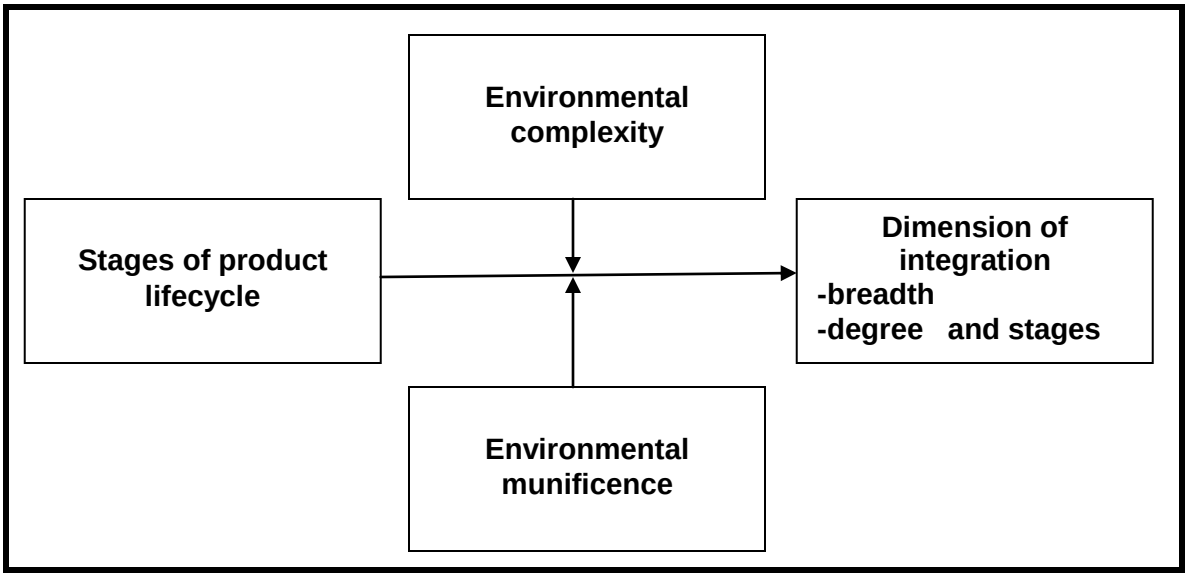


Fig. 2.2: An integrative model of supply chain management

(Source: Stonebraker and Liao, 2006)

It is also argued that the relationship between independent and dependent variables are moderated by the environment complexity and munificence (Aldrich, 1979; Dess and Beard, 1984; Keats and Hitt, 1979; in Stonebraker and Liao, 2006). Therefore, integrated Supply chain management evolved from the economic theory of vertical integration. Vertical integration refers to the degree to which a firm decides to produce in multiple values – adding stages from raw materials to the ultimate consumer (Cox and Blackstone, 2001).

Table 2.3: General classification of vertical integration and supply chain integration

	Vertical Integration	**Supply chain integration**
Emphasis	Theory	Application
Original discipline	Strategic management	Logistics management
Functional foundation	Economics, Finance	Distribution, Communication
Entity	Corporate	Activities or work cells
Entity size	Generally large	Any size
Measures	Efficiency of flow	Smoothness of flow
Integrating mechanism	Ownership, quasi ownership	Coordination
Process	More static	More dynamic
Rate of change	Consistency	Irregularity
Paradigm	Uniformity	

(Source: Stonebraker and Liao, 2006: 37).

Every company is seeking to eliminate manual intervention, expensive duplication and waste from its day to day operations. As a result, managing the supply chain efficiently has become the major weapon in maintaining profitability in a competitive environment (Sherman, 2001).Those manufacturers that redesign their processes to be more responsive to customer demand will be able to grow their business faster than their less agile competitors. Consequently, the solution which this study intends to establish is how the floriculture industry can re-engineering their supply chains to deftly balance, align and

seamlessly integrate demand, marketing, sales, distribution, production and supply in search of sustainable and competitively superior performance gains.

The objective of a supply chain is to deliver value to the customer at a lower cost than the competition. Value is a mixture of tangible and intangible benefits, specific product features and also image, reputation and responsiveness (Wilding, 1999). In his popular book, Business @ Speed of thought, Bill Gates states that: *"if the 1980's were about quality and the 1990's about re-engineering, then the 2000's will be about velocity"* (Gates, 2000). Customers are increasingly taking low cost and higher quality for granted, and moving their attention to the availability of the product or service as soon as the need arises. This change in demand pattern has a knock–on effect right through the business environment, from the service / retail end of the value chain through to the supply chain, and on to new product development. This change in customer requirement is forcing business to become much more agile in adapting their products and processes to changing market demand (Wilding, 1999).

It is not just a question of unexpected events, however, in being agile, companies which have many customers with different needs and geographies, will realize they can serve more customers with more customized solutions. Hence, the next major battle in all forms of retail is the critical last mile of the supply chain; from retailers to customers. By some estimation, over the next decade anywhere from 2% to 10% of all shoppers will opt for home delivery services (Boyer, Frolich and Hult, 2005).

Traditionally, performance improvement has been based on internally focused programs designed to improve operational efficiencies within individual departments or functions. While these programs may be able to generate continuous incremental improvements, achieving major changes and a significant competitive advantage can only be accompanied by; understanding the dynamics of process changes within the organization, integrating the activities and optimizing the metrics supporting the processes, strategically aligning the participatory functions and organizations within the structure of the market in which they operate (Sherman, 2001).

Adoption of appropriate supply chain management strategies will make Kenyan firms a direct threat to the Central and Southern African firms, and by extension, the Western and Asian economies. Emphasis should be on the improvement of the products manufactured. Africa has only about 2% share of the world's trade, hence the opportunities for enhancing that are potentially large (Ramsurrum and Dalrymple, 2000).Firms need to invest more on supplier relationship management to ensure that quality standards of the materials procured meet the right standards (Awuor, 2006).

Within businesses, the need for improvement with respect to the time based resource management is receiving increasing recognition. Research indicates that it is not uncommon for the time spent actually 'adding value' within a manufacturing environment to be as little as 5% of the total process time, and in the context of the total supply chain , things can even be worse – as little as one tenth of the 1% has been found to be 'adding value' time (Wilding, 1999).Hence, the need for time compression which in essence means the removal of wasted time throughout the business, which generally results in improved customer satisfaction, reduction in inventory levels and increased quality.

The manufacturing sector in the developing economies like those of Kenya, Uganda and Tanzania still hold the key to future employment opportunities and the ability of the nation to increase the living standards (Jones and Cockevill, 1984).In advanced industrialized economy, it is to be expected that the share of manufacturing industry in total output will diminish. This is because much of the investment in construction of business and domestic premises, in heavy industry and in communication systems (transport, telecommunications etc) has already taken place; also, as personal disposable incomes grow more, an increasing fraction of the total personal incomes and of additional income is spent on the output of the service sector e.g. travel, holidays, entertainment. In a developing and particularly a rapidly expanding economy (e.g. Japan between 1953 and 1970) it is possible for the output of all sectors to grow, but at different rates (Jones and Cockevill, 1984).

2.3 Factors that influence performance of supply networks

The factors influence the performance of supply networks are diverse and include but not limited to the following (Bolstoff,2006): i) Organizational structure and design; ii) power relationships; iii) job-task requirements; iii) supply networks design; iv) information integration; v) enterprise resource planning; vi) country industry development; and vii) Triple bottom line benefits of economic, social and environmental aspects.

2.3.1 Organisation structure and design

It encompasses organizational goals, organizational design and organizational management as important component of the supply chain management strategy formulation. Organizational goals is the facet of the supply chain strategy that prioritizes organizational performance balancing customer facing requirements for delivery reliability, responsiveness and flexibility with the internal needs of cost, profitability and asset utilization (Bolstoff, 2006).

Organizational design is the facet of supply chain strategy that has to do with assembling the most efficient and effective supply chain organization chart. It attempts to balance the major challenges of centralization versus decentralization, globalization versus regionalization, and process versus functional focus. Organizational measures (management) is the facet of the supply chain strategy that defines the overall supply chain matrix scheme including definition, data collection, data segmentation, reporting and analytics for defect analysis.

2.3.2 Power relationships

In a study on power imbalance relationships, Hingley (2006) asserts that: *"Given the scant and mostly negative treatment of the context of power in business relationships and the predominance of study on what are viewed as positive relational factors: trust, commitment and cooperation; there appears to be a gap in business relationships literature concerning the role of power and the ability of organizations to manage power*

imbalance". According to Maloni *et al*. (1999) power is defined as the ability of one firm (the source) to influence the intensions and actions of another firm (the target). Thus power can be understood to be the ability of one channel member to influence the marketing decisions of another channel member. It was illustrated by Cox (2001) that power is at the heart of trans – organizational relationships. According to Maloni *et al*. (1999) the following sources of power may make one party holds authority over another:

i. reverent and coercive power – this remains the most transparent and widely recognized of such power bases, indicating the ability of the source to mediate dividends (such as increased business or shared benefits from cost reduction) or punishment (such as decreased business or dictated cost reductions) to the target;
ii. expert power – refers to the fact that one firm holds information or expertise (such as product or process leadership that is valued by another firm;
iii. referent power – implies that one firm desires identification with another for recognition by association; and
iv. legal legitimate – indicates both its inherent and legal forms, infers that the target in the right of the sources to wield influence (such as via a sales contract).

About fifteen years ago Brown *et al*. (1995), found that the use of mediated (coercive, legal legitimate, reward) power will lower genuine commitment for the target due to the subordinate situation. Non – mediated power (expert, referent, legitimate) power sources increases commitment. However, according to Hunt *et al.* (1987), there is a positive relationship between non – mediated and cooperation.

Table 2.4: Definition of relationship elements

Relationship Element.	Description	Integrated relationship characteristic.
Commitment	Feeling of being emotionally impelled to maintain a long term relationship.	High level of commitment.
Conflict	Disunity caused by competitive or opposing action.	Low levels of conflict.
Conflict resolution.	Ability to relationally mitigate disunity through mutual solution.	Strong ability to resolve conflict.
Trust	Confidence in honesty and integrity of partner.	High levels of trust.

(Source: Maloni *et al.* 1999).

It has been established by Skinner *et al*. (1992), that coercive power holds a negative association with cooperation. According to Maloni and Benton (1999), the level of conflict between two firms is associated positively with mediated power and negatively associated with non – mediated power. It is argued by Kumar *et al*. (1995), that both trust and commitment are increased with expanded interdependence, but Anderson and Weitz (1992) found that inter – firm asymmetry will defeat both trust and commitment.

Table 2.5: Bases of inter – firm power

Power Base	Description	Automotive industry example.
Reward	Sources retains ability to mediate rewards to targets	Manufacturer awards additional business to supplier.
Coercive	Source holds ability to mediate punishment to target.	Manufacturer cancels business with suppliers.
Expert	Source has access to knowledge and skills desired by target.	Supplier desires participation with firm.
Referent	Target values identification with source.	Supplier desires association with the firm.
Legitimate	Target believes source retains natural right to influence.	Supplier views itself as direct subsidiary of manufacturer.
Legal Legitimate	Source retains judiciary rights to influence target.	Supplier and manufacturer maintain a formal sales contract.

(Source: Maloni *et al*. 1999).

The proactive approach to power relationships is that of partnerships and a win –win attitude. Some studies confirms that the role of power in business – to – business relationships has been either overlooked or dealt with as a side issue, whereby the concept of power is rarely discussed in supply chains except to deny its importance (Williamson, 1995; Cox, 1999). However, it should be realized that in any power relationship there is the existence of both conflict and cooperation.

The critical issues that my study will try to establish with regard to power relationships in the floriculture industry in Kenya include: i) power symmetry; ii) power and polarity;

and, iii) living with power imbalance. There is need for both symmetry and maturity in power relationships. Symmetry dependence structure foster long – term relationships based on trust, whilst asymmetric relationships are associated with less stability and more conflict (Rokkan and Haugland, 2002; Ganesan, 1994). Relationships that are power balanced tend to be more stable than unbalanced ones. When one party is threatened by the balance of power, that weaker party will be more likely to seek alternative alliances (Hingley, 2006).

With regard to power and polarity, Kumar (1996) assets that: *relationships are seldom fair in the division of power or reward, nor are all parties equally active in commitment to a relationship.* Therefore a general view is that such partnership arrangements tend to offer the most to the more powerful business partner (Christopher and Juttner, 2002). Power is an element of any relationship and is present even when not activated. Therefore it is not surprising that benefits are, or seem to be unevenly shared.

The fundamental challenge with regard to power relationships in the floriculture industry in Kenya is that a part of a developed economy's supply chain is operational in a developing country. Hence the power imbalance is in favor of the developed countries that are then in a position to dictate terms. However, Davies (1999) offers a workable compromise to this issue of living with power imbalance. He contends that the successful approach to partnering is through the admission that one channel member is normally in charge; the channel member that wish to cooperate to mutual advantage must focus on joint satisfaction of common objectives regardless of the background context of inevitable imbalance.

2.3.3 Job – task requirements

People-job goals are the facet of the supply chain strategy that defines the type of job requirements and goals necessary to execute supply chain processes and technology. People-job design defines the type of job requirements and goals necessary to execute supply chain processes and technology on the other hand; people-job measure

(management) defines the type of job requirements and goals necessary to execute supply chain strategy.

2.3.4 Supply networks design

Elements of supply chain network include; process goals, process design and process (measures) management. Process goals are the facet of supply chain strategy that translates organizational goals of the supply chain network and processes. Process design is the facet of supply strategy that has to do with defining the material, work, and information flows using a combination of three strategies including make-to-stock, make-to-order, and /or engineer –to-order. Process measures (management) is the facet of the supply chain strategy that defines the site, functional area and process metric scheme including definition, data collection , data segmentation, reporting and analytics for defect analysis.

2.3.5 Information integration

In recent years numerous studies have emphasized the importance of information sharing within the Supply Chain (Barratt, 2004; Lambert and Cooper, 2000; Stank *et al*. 1999; Mason – Jones and Towill, 1997). Information should be readily available to all companies in the Supply Chain and the business process should be structured to in a way so as to allow full use of this information (Trkman *et al*. 2007).

According to Bolstorff (2006), technology goal is the facet of the supply chain system requirements to enable planning and execution of the supply chain processes. Technology design has to do with defining the technical architecture, detailed requirements, and setting specific business configurations based on the process flow. A technology measure (management) does define the technology performance metric scheme including definition, data collection, data segmentation, reporting, and analytics for defect analysis.

2.3.6 Enterprise resource planning

Enterprise resource development (ERP) is the backbone of most firms' supply chain information management. ERP systems are designed as integrated transaction modules with a common and consistent database. It facilitates integrated operations and reporting to initiate, monitor and track critical activities such as order fulfillment and replenishment processing. Typical transactions can accommodate order entry and fulfillment, procurement, and production transactions (Bowersox *et al.* 2002).Beyond the operational applications, ERP systems typically include financial, accounting and human resource capability. To capitalize on the benefits of integration, headquarter systems are beginning to include two other systems components, forecasting and customer relationship management.

Table 2.6: Capabilities of ERP system

What do you get with ERP? As monolithic as ERP may sound, it isn't. In fact, the software is composed of many different modules (as many as 60) that connect to the company's financial system. That collected data is then used to project the performance of key corporate financials. This enterprise-centric model of ERP is now being expanded to include new modules that allow ERP to be part of the planning process by the company and its suppliers and customers.

Traditional Capabilities:	**Emerging Capabilities:**
• Bill of materials	-Enterprise application integration
• Accounts payable and accounts receivable.	-Visibility.
• Inventory control	-Collaborative planning, forecasting and replenishment.
• Order entry	-Customer relationship management.
• Purchasing	-Web enabled applications.
• Routing	-Hosting.
• Capacity requirement planning.	

(Source: Forger, 2000: 71)

Firms therefore need to make order, shipment and billing information available to suppliers, financial institutions, transportation carriers and customers (Bowersox *et al.*

2002). It is to be noted that typical supply chain communication technologies includes bar coding, scanning, Electronic Data Interchange (EDI), satellite communication and the internet.

2.3.7 Country industry development

It is vital for a country to invest in Telecommunications among other areas for and industry like the floriculture to thrive. The laying of the optic fiber cable is one positive development toward this end. High speed and easily accessible telecommunication technologies make it possible to communicate to suppliers and customers around the world almost as easily as with suppliers next door (Patti, 2006: 266).

Relatively easy access to air travel also creates a truly global business environment. In that regard, Nairobi being the main hub in East Africa has competitive airfreight costs with direct cargo flights to Amsterdam, Frankfurt, London and Paris amongst others. Of importance also is ready access to farm inputs and extension services. Kenya has international and local seed companies among them Kenya Seed Company, Pioneer, Panaar, Monsanto and Seminis, which readily provide a variety of high quality seeds to farmers. Government's investment in road infrastructure ensures that the flower gets to the destined market on time. Time being of essence in the floriculture industry.

2.3.8 Triple bottom line benefits

Studies suggest that increasingly there are health challenges associated with the floriculture industry in Kenya. There are unknown effects of pesticides and other agro-chemicals used in the industry (Shivoga, 2008). There is also concern that employment is mainly temporal and part time, targeting mainly the youth with gender bias toward women workers at seventy five percent. but the supervisors are mainly men (Shivonga, 2008). This suggests that job security is nearly nil. Hence questions on the economic and social benefits of the industry still lingers.

There are also challenges of environmental concern. The flower farms occupy about 2000 hectares (20 Kilometers Squared) which are mainly concentrated around lake Naivasha (KFC, 2008). The lake is currently shrinking mainly due to excessive abstraction of water for irrigation, industrial and domestic use. The southern shores of the lake are already blinded with algal bloom. The shrinkage of the lake is also attributable to pollution from pesticides and fertilizer run off. Cut – flowers are grown in greenhouses and the predominant pesticide used is methyl bromide (Shivonga, 2008).This chemical is a health risk when inhaled. Workers are exposed to these chemicals through transplanting, pruning, cutting, packing, spraying / fumigation and dusting. Also, through re-use of pesticide – saturated green house plastics for domestic purposes such as covering houses. Therefore, there is need for close collaboration between researchers and the floriculture farms and industry player to develop home – based solutions.

2.4 Relationships and impact of key success factors that influence performance of supply networks

Studies reveal that integrated supply chain management has significant impact on the organizational performance (Vickey *et al.* (2003), Kim (2006), Stevenson (2007)). Thirteen research questions were formed and used in guiding their investigation on the impact of ISCM:

i) Does the integrated supply chain management system achieve its stated objective of improving the level of the supply chain system efficiently?

ii) Does participation in the ISCM system influence the system's flexibility to accommodate schedule fluctuations?

iii) Does the ISCM system have the ability to meet special customer specification or non standard products and orders?

iv) Does ISCM system have the ability to rapidly introduce large numbers of product improvements or completely new products?

v) Does the ISCM system have the ability to respond to the needs and wants of the firm's target market?

vi) Does the ISCM system have" access flexibility" the ability to effectively provide widespread distribution coverage?

vii) Does the ISCM have a high degree of dependability in terms of delivery speed and reliability to respond to the needs of the firm's target market(s)?

viii) Does the ISCM system achieve its stated objective of improving the quality of products and services?

ix) Does participation in an ISCM system influence growth productivity of the firm?

x) Does the ISCM system achieve its objective of increasing return on trading?

xi) Do supplier power and characteristics positively influence organizational performance of lowering cost, providing higher quality, flexibility and dependability within the ISCM system?

xii) Do outsourcing activities and decisions within the ISCM system affect the organizational objectives to achieve cost reduction, higher quality, flexibility and dependability?

xiii) Will managers report positive assessments of the ISCM system contribution to the overall organizational performance?

According to Lockammy III (2008: 344 – 345), firms that have begun establishing partnerships and strategies for managing their supply chains have typically experienced 24 – 50 percent reduction in supply chain costs, a 25 – 60 percent in total inventories, a 25 – 80 percent increase in forecast accuracy, and a 30 – 50 percent reduction in order fulfillment cycle time. A study by Bowersox et al. (2002), revealed five different, but equally successful, supply chain strategies:

(1) Market saturation driven: Focusing on generating high profit margins through strong brands and ubiquitous marketing and distribution;

(2) Operationally agile: Configuring assets and operations to react nimbly to emerging consumer trends along lines of product category or geographic region;

(3) Freshness oriented: Concentrating on earning a premium by providing the consumer with product that is fresher than competitive offering;

(4) Consumer customizer: Using mass customization to build and maintain close relationship with end consumers through direct sales; and

(5) Trade focused: Prioritizing "low price, best value" for the consumer – as with the logistics optimizer strategy but focusing less on brand than on dedicated service to trade customers,

It has been noted by Quinn (2000) that supply chain management integration does add value to the firm in a number of ways, these include:
(1) Profitable growth- Supporting near perfect flow execution through the supply chain: proactively participating in product go-to-market strategy and execution;

(2) Quality maximization – raising quality of product, process and services; accelerating cycle time throughout the pipeline to market;

(3) Reduction in working capital – increasing inventory turns; minimizing days of supply needed in inventory;

(4) Fixed capital efficiency – determining right number, size and location of shipping points; productively and efficiently utilizing fixed asset investment; and

(5) Global cost optimization- leveraging customs duty alternatives; leveraging quota alternatives.

Studies by Bowersox *et al.* (2002) outlined the issues and risks that have been identified as those critical of supply chain arrangements including integration:
(1) Implementation challenges – leadership is at the core of implementation challenge. At the root of most leadership issues are power and risk. Power determines which firm

involved in potential supply chain collaboration will perform the leadership role. Risk issues related to supply chain involvement centre on who has the most gain or lose from the collaboration;

(2) Loyalty and confidentiality – firms that simultaneously engage in supply chains that are competitive must develop programs to foster loyalty and maintain confidentiality. The name used to describe such arrangement is partitioning. It involves the development of proprietary organization and information collaborations to accommodate the needs of specific relationships. Loyalty quickly comes into question during periods of short supply or otherwise threatened operations;

(3) Measurement – Supply chains do not have conventional measurement devices, an individual business has an income statement and balance sheet constructed in compliance to inform accounting principles, no such universal documents exist to measure supply chain performance. Process improvements benefiting overall supply chain performance may reduce costs of one firm while increasing costs of other participating firms; and

(4) Risk / Reward sharing – in traditional practice, the method by which risk and reward are shared is by transfer pricing.

2.5 Supply chain performance measurement

Performance measures include financial measures such as cost performance or profitability as well as operational measures such as quality performance or cycle time. Performance measure are used in several ways within the firm including as a basis for evaluation and reward of individuals, as a basis for allocation of scarce resources among strategic business units, and a basis for making decisions that increase future profitability.

A well-designed performance measurement system (PMS) is important in understanding and improving the performance of supply chain operations (Chan, Chan and Qi, 2006).

The following set of criteria and principles were proposed by Takle and Gabrielsen (2006), as supply chain performance measurement systems:

i) Holistic approach – performance measurement in the supply chain should take a holistic system perspective beyond the organizational boundaries. The performance of supply chains needs to be assessed across the organization in order to encourage global optimization along the supply chain channel;

ii) Process-based – successful supply chain management requires a change from managing individual functions to integrated activities within key supply chain business processes. Supply chains metrics should reflect this change and focus on supply chain processes rather than functions;

iii) Aligned with strategy – the performance measurement system must be consistent with the overall strategy of the supply chain. For instance, if the overall supply chain objective is short delivery times, logistic strategies that emphasized low cost could be in conflict;

iv) A dynamic system – an important criterion for performance measurement system is that the system needs to be dynamic. The supply chain is a dynamic system that evolves over time, and the performance measurement system must have the ability to change over time to incorporate the changes in the supply chain and to continually remain relevant;

v) Balanced approach – the purpose is to distribute performance measurement on a set of parameters that is representative for the most part of the business/supply chain. Supply chain performance measurement systems should provide a balance between financial and non-financial measures. Financial measures are important for strategic decisions and external reporting, while non-financial measures handle the day to day control of manufacturing and distribution operations;

vi) A managerial tool – the performance measurement system is supposed to be a managerial tool, and the system must be able to arrange the transition from

“measurement” to “management”. As a result, the performance measurement system needs to be simple to understand and provide timely and accurate feedback;

vii) Cover strategic, tactical and operational level – the performance measurement system should assess and give relevant information to the appropriate level of management. Strategic level measures influence the top level management decisions, tactical level deals with resource allocation and operational level measurements and metrics assess the results of decisions of low level mangers ;

viii) Provide a forward looking (leading) perspective – the performance measurement system should capture trends rather than snapshots of the business;

ix) Tool for improvement – the performance measurement system should focus on improvement. New methods and concepts like TPM (Total Productive Management) and TPS, emphasise continuous improvement, which should result in raising the performance expectation over time;

x) Provide drill-down functionality –the performance measurement system should give the managers the ability to pinpoint distinct areas for improvement;

xi) Handling conflicting objectives – the performance measurement system should assess the different trade-offs within a supply chain and visualizes the results to prevent sub-optimization;

xii) Simple – the performance measurement system should be easy to understand at all levels in the organizations and it should contain a limited number of relevant measures;

xiii) Comparability – the performance measurement system should enable the supply chain to benchmark its performance to a set of standards; and

xiv) Relevant metrics - the performance measurement system should only use relevant metrics that enable appropriate decision-making.

Although these criteria are all useful to practitioners it must be noted that they are a collection of criteria presented by different authors and in different models, and not meant to be accomplished in one PMS. However it is still important to consider and discuss these criteria thoroughly among the actors when designing a PMS for the supply chain (Fauske *et al*. 2007).

According to Van der Vorst (2000), distinction between performance indicators can be made on three main levels: i) the supply chain level (e.g. product availability, quality, responsiveness, delivery reliability and total supply chain cost); ii) the organization level (e.g. inventory level, through put time, responsiveness, delivery reliability and total organizational costs); and iii) the process level (e.g. responsiveness, through put time, process yield and process costs).

According to Armayan *et al*. (2007), measuring performance of agri – food supply chains is rather difficult, because they have many characteristics that set them apart from other types of supply chains which include:

i) Shelf – life constraints for raw materials and perishability of products;
ii) Long production throughput time;
iii) Seasonality in production;
iv) Physical product features like sensory properties such as taste, odor, appearance, color, size and image;
v) Requires conditioned transportation and storage;
vi) Product safety issues; and
vii) Natural conditions affect the quality and the quantity of farm products.

The floriculture industry is also subject to similar constraints in supply chain performance measurement. Consideration should also be made on the realization that consumers are increasingly putting new demands on different attributes of food such as quality,

integrity, safety, diversity and services (Van der Vorst, 2005).Hence, when developing PMS for the floriculture industry, there is need to have indicators that reflect quality aspects of products and processes together with other financial and non – financial indicators.

The Supply chain operations reference (SCOR) model, Supply chain council (2004), advocates for a set of supply chain performance as being a combination of; i) reliability measures (e.g. fill rates, perfect order fulfillment), ii) cost measures (e.g. cost of goods sold), iv) responsiveness measure (e.g. order fulfillment lead time) and; v) asset measure (e.g. inventories). The Agri- food supply chain performance indicators are grouped into four main categories as outlined by Aramyan *et al.* (2007): i) efficiency; ii) flexibility; iii) responsiveness and; iv) food quality. This conceptual framework of the agri – food industry is summarized showing key performance indicators as shown below:

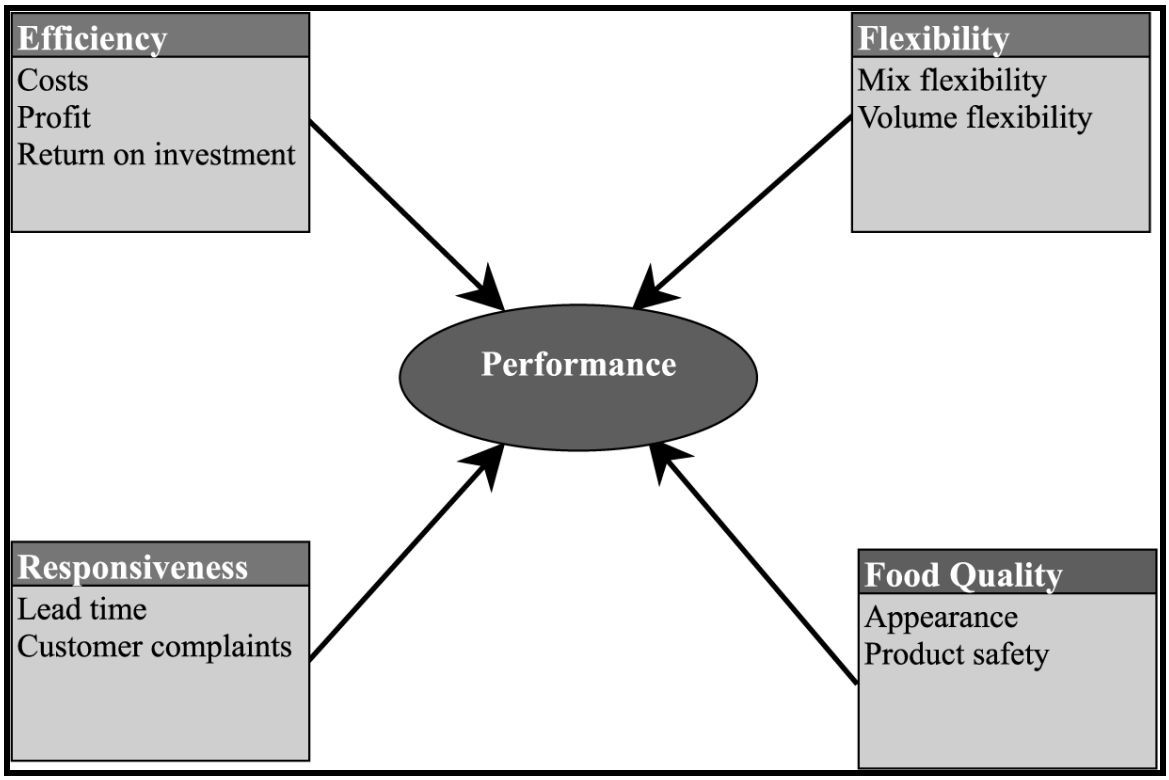


Fig 2.3: Framework of agri-food supply chain with key performance indicators

(Source: Aramyan *et al.* 2000).

According to a study by Aramyan *et al*. (2000), three indicators suggested for efficiency category received a high importance score (cost 4.47, profit 4.7, return on investment 4.04). With regard to flexibility, customer satisfaction received a high importance score (4.47) and is perceived to be a useful indicator of measuring performance of the entire supply chain. Two indicators in responsiveness category received importance score (lead time 4.3 and customer complaint 4.09). Finally, the two indicators considered to be important in the food quality category are; appearance 4.94 and product safety 4.69.

2.6 Floriculture industry in Kenya as operating in a complex adaptive environment (CAE)

2.6.1 Characteristics of a complex adaptive environment

Concepts that deal with complex adaptive systems (CAS),hence facilitating operation in a complex adaptive environment (CAE) have many names: chaos theory (Tetenbaum, 1998), complexity theory (Smith,2005), complex science (Kelly and Allison, 1999 in Stacey, 2003) and systems thinking (Senge, 1990). Complexity results from the inter-relationships, inter-action and interconnectivity of elements within a system and between a system and its environment (Chan, 2001). The meaning of complexity is traced to the word *plexus* meaning braided or entwined, from which derived complexus is meaning braided together (Gell-Mann, 1996). Hence, the word complex is derived from Latin. Complex adaptive systems (CAS) on the other hand results in a complex adaptive environments.

CAS are dynamic systems able to adapt in and evolve with a changing environment. It is important to realize that there is no separation between a system and its environment in the idea that there is no separation between a system and its environment in the idea that a system always adapts to a changing environment. Rather, the concept to be examined is that of a system closely linked with all other related systems making up an ecosystem. Within such a context, change needs to be seen in terms of co-evolution with all other related systems, rather than as adaptation to a separate and distinct environment (Chan,

2001). In reality change, especially large scale changes, defies logical rules and simple management actions (Stacey, 2003). Complex theory and a view of organizations as "complex adaptive systems", attempts to consider some of those realities and arguably provides a better model for change when considering the floriculture industry in Kenya.

According to Gisogon (2006), a system is considered to be complex when: i) Causality is complex and networked – i.e. simple cause – effect relationships does not apply. There are many contributing causes and influences to any one outcome; ii) The number of plausible options is vast – it is not possible to optimize (in the sense of finding the one best solution in a reasonable amount of time; iii) Systems behavior is coherent – there are recurring patterns and trends, but; iv) The system is not fixed – the patterns and trends vary, for example, the "rules" seem to keep changing. Something that "worked" yesterday may not do so tomorrow and; v) Predictability is reduced – for a given action option it is not possible to accurately predict all its consequences, or for a desired set of outcomes it is not possible to determine precisely which actions will produce it.

According to Stacey (1996): *"Most textbooks focus heavily on techniques and procedures for long-term planning, on the needs for visions and missions, on the importance and the means of securing strongly shared values, on the equation of success with consensus, consistency, uniformity and order. However, in complex environments the real management task is that of coping with the even using unpredictability, clashing and counter-cultures, disensus, contention, conflict and inconsistency. In short the tasks that that justifies the existence of all managers has to do with instability, irregularity, difference and disorder".*

The following propositions by Stacey as a basis for complex theory and indeed applicable to the floriculture industry in Kenya also needs to be considered:

i. All organizations are webs of non –linear feedback loops connected to other people and organizations by webs of non-linear feedback loops;

ii. Such non-linear systems are capable of operating in states of stable and unstable equilibrium, or in the borders between these states, that is far from equilibrium, in bounded instability at the edges of chaos;

iii. All organizations are paradoxes. They are pulled towards stability by forces of integration, maintenance controls, human desires for security and certainty and adaptation to the environment on the on hand. They are also pulled towards the opposite extreme of unstable equilibrium by the forces of division and decentralization, human desires for excitement and innovation and isolation from the environment;

iv. If the organization gives in to the pull of stability if it fails because it becomes ossified and cannot change easily. If it gives in to the pull of instability it disintegrates. Success lies in sustaining an organization at the border between stability and instability. This is a state of chaos and difficult to maintain dissipative structures;

v. The dynamics of the successful organization are therefore those of irregular cycles and discontinuous trends, falling within the quantitative patterns, fuzzy but recognizable categories taking the form of archetypes and templates;

vi. Because of its own internal dynamic, a successful organization faces completely unknowable specific futures;

vii. Agents within the system cannot be in control of its long-term future, nor can they install specific frameworks to make it successful nor can they apply step-by-step analytical reasoning or planning or ideological controls to long term development. Agents within the system can only do these things in relation to the short term;

viii. Long term development is a spontaneous self-organizing process from which new strategic directions may emerge. Spontaneous self organization is political interaction and learning groups. Managers have to pursue reasoning by analogy; and

ix. In this way managers create and discover the environments and the long-term futures of the organization.

According to Cilliers (2008), complex systems exhibit characteristics peculiar to themselves which are summarized below:

i) Complex systems consist of a large number of elements. When the number is relatively small, the behavior of the elements can often be given a formal description in conventional terms. However, when the number becomes sufficiently large, conventional means (e.g. a system of differential equations) not only becomes impractical, they also cease to assist in any understanding of the system;

ii) A large number of elements are necessary, but not sufficient. The grains of sand on a beach do not interest us as a complex system. In order to constitute a complex system, the elements have to interact, and this interaction must be dynamic. A complex system changes with time. The interactions do not have to be physical; they can also be thought of as the transference of information;

iii) The interaction is fairly rich, i.e. any element in the system influences, and is influenced by, quite a few other ones. The behavior of the system, however, is not determined by the exact amount of interactions associated with the specific elements. If there are enough elements in the system (of which some are redundant), a number of sparsely connected elements can perform the same function as that of one richly connected element;

iv) The interactions themselves have a number of important characteristics. Firstly, the interactions are non –linear. A large system of linear elements can usually be collapsed into an equivalent system that is very much smaller. Non –linearity also guarantees that small causes can have large results, and vice versa. It is a precondition for complexity;

v) The interactions usually have a fairly short range, i.e. information is received primarily from immediate neighbors. Long- range interaction is not impossible, but practical constraints usually force this consideration. This does preclude wide-ranging influence – since the interaction is rich, the route from one element to any other can usually be covered in a few steps. As a result, the influence gets modulated along the way. It can be enhanced, suppressed or altered in a number of ways;

vi) There are loops in the interactions. The effect of any activity can feed back onto itself, sometimes directly, sometimes after a number of intervening stages. This feedback can be positive (enhancing, stimulating) or negative (detracting, inhibiting). Both kinds are necessary. The technical term for this aspect of a complex system is recurrency;

vii) Complex systems are usually open systems, i.e. they interact with their environment. As a matter of fact, it is often difficult to define the border of a complex system. Instead of being a characteristic of the system itself, the scope of the system is usually determined by the purpose of the description of the system, and is thus often influenced by the position of the observer. This process is called framing. Closed systems are usually merely complicated;

viii) Complex systems operate under conditions far from equilibrium. There has to be a constant flow of energy to maintain the organization of the system and to ensure its survival. Equilibrium is another word for death;

ix) Complex systems have a history. Not only do they evolve through time, but their past is co –responsible for their present behavior. Any analysis of a complex system that ignores the dimensions of time is incomplete, or at most a synchronic snapshot of a diachronic process; and

x) Each element in the system is ignorant of the behavior of the system as a whole, it responds only to information that is available to it locally. This point is vitally important. If each element "knew" what was happening to the system a s whole, all of the complexity would have to be present in that element. This would either entail a physical impossibility in the sense that a single element does not have the necessary capacity, or constitute a metaphysical move in the sense that "consciousness" of the whole is contained in one particular unit. Complexity is the result of a rich interaction of simple elements that only respond to the limited information each of them are presented with. When we look at the behavior of a complex system as a whole, our focus shifts from the individual element in the system to the complex structure of the system. The complexity emerges as a result of the patterns of interaction between elements.

The general approach to complex adaptive environments can be visualized using the Stacey agreement vs certainty matrix (Stacey, 2003).

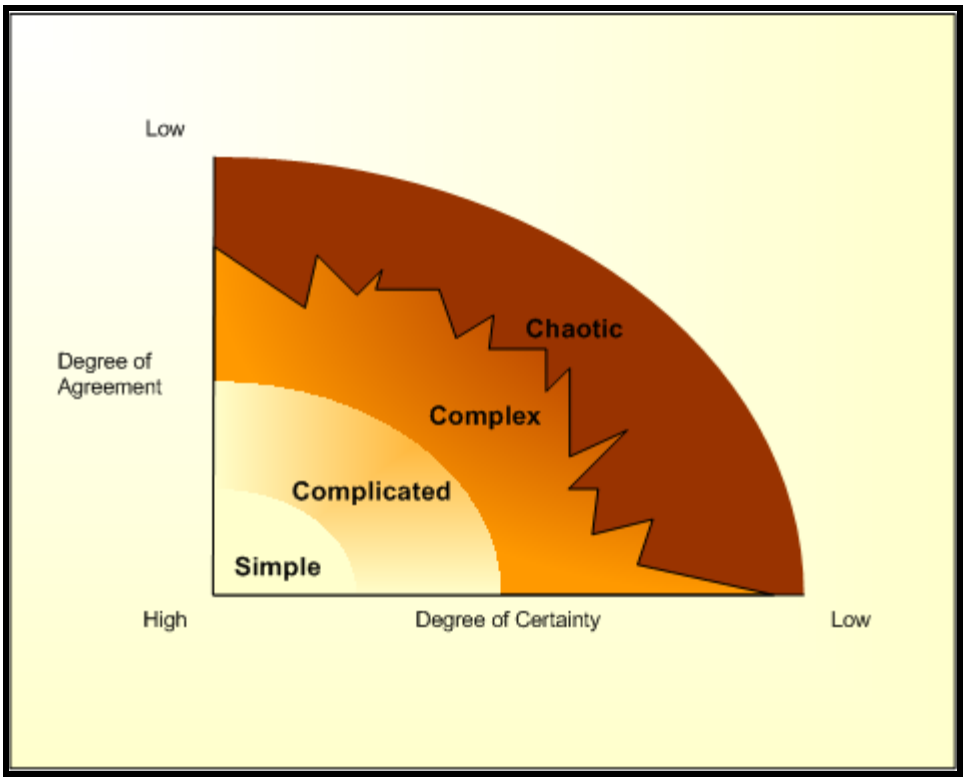


Fig 2.4: Stacey's agreement vs. certainty matrix

(Source: Stacey, 2003)

It is emphasized by Stacey that traditional decision making applies in the rational area of the matrix at the bottom left. The chaos area is the area to be avoided – the area of guess work and randomness. However, much decision-making takes place in the area of complexity where there are many alternatives with differing degrees of predictability (and little certainty).Operation in this area requires a high level of interaction amongst organizational agents – those involved in implementing change. Change in this case cannot be driven but must be fostered and supported (Stacey, 2003).

When analyzed, CAS are not predictable in detail, because of their interdependencies and non-linearity. However, it is still possible to find inherent order in the complex systems (Palmberg, 2009). It has been asserted that: "The art of systems thinking lies in seeing through complexity to the underlying structures generating change" (Senge, 1990:290).

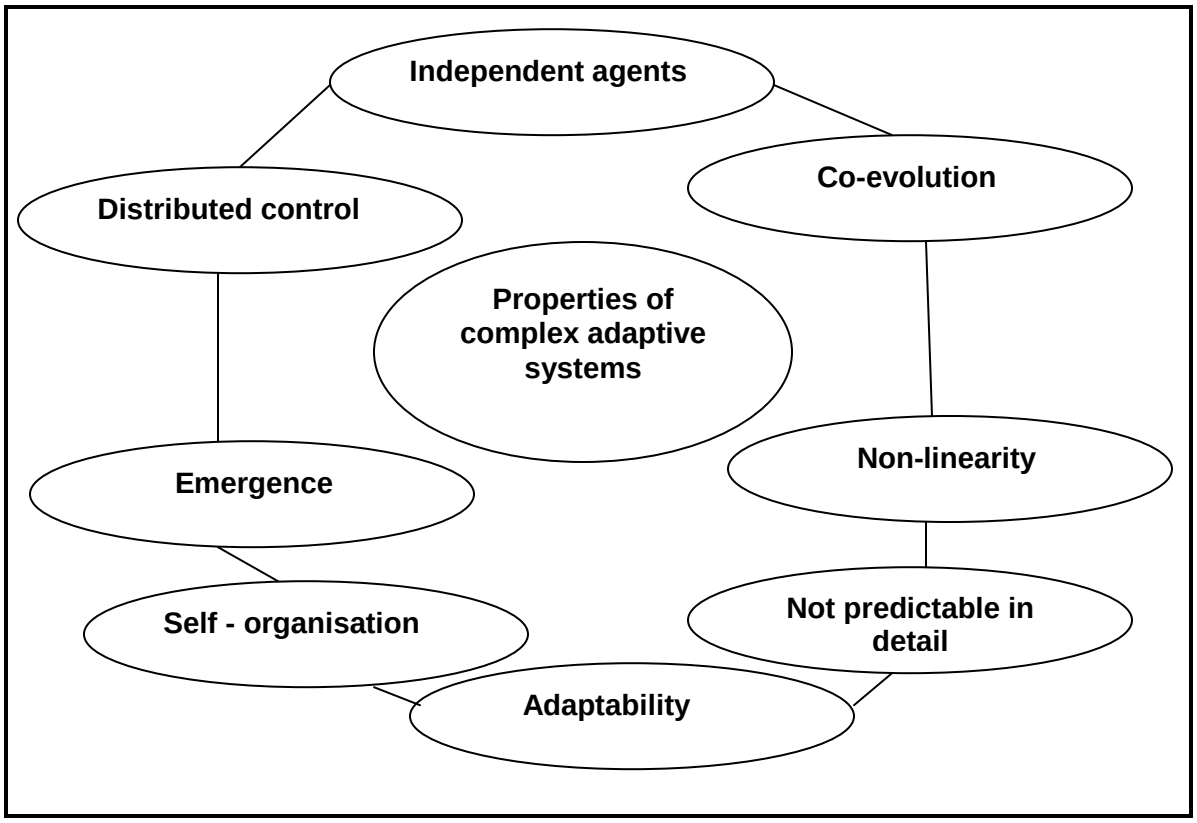


Fig. 2.5: An overview of the properties of CAS

(Source: Palmberg, 2009:485)

CAS are seen as adaptable, which means that they have the ability to learn from their own experience and adapt to new, unexpected conditions (Zimmerman, 1998). Further, Richardson (2008) defines the autonomy of each agent as the local memory of the agent and the ability to learn from his or her experience and to generate new response.

Quite a number of authors strongly agree that CAS cannot be controlled (Cillers, 2000). According to Tapscott and Williams (2006), even though a CAS cannot be controlled, as is assumed in the approach of the traditional management of hierarchical organizations, a CAS can be managed. It is asserted by Deming (1994) that: "A *system must be managed, and that it is the job of the management to direct the efforts of all the components towards the goals of the system".*

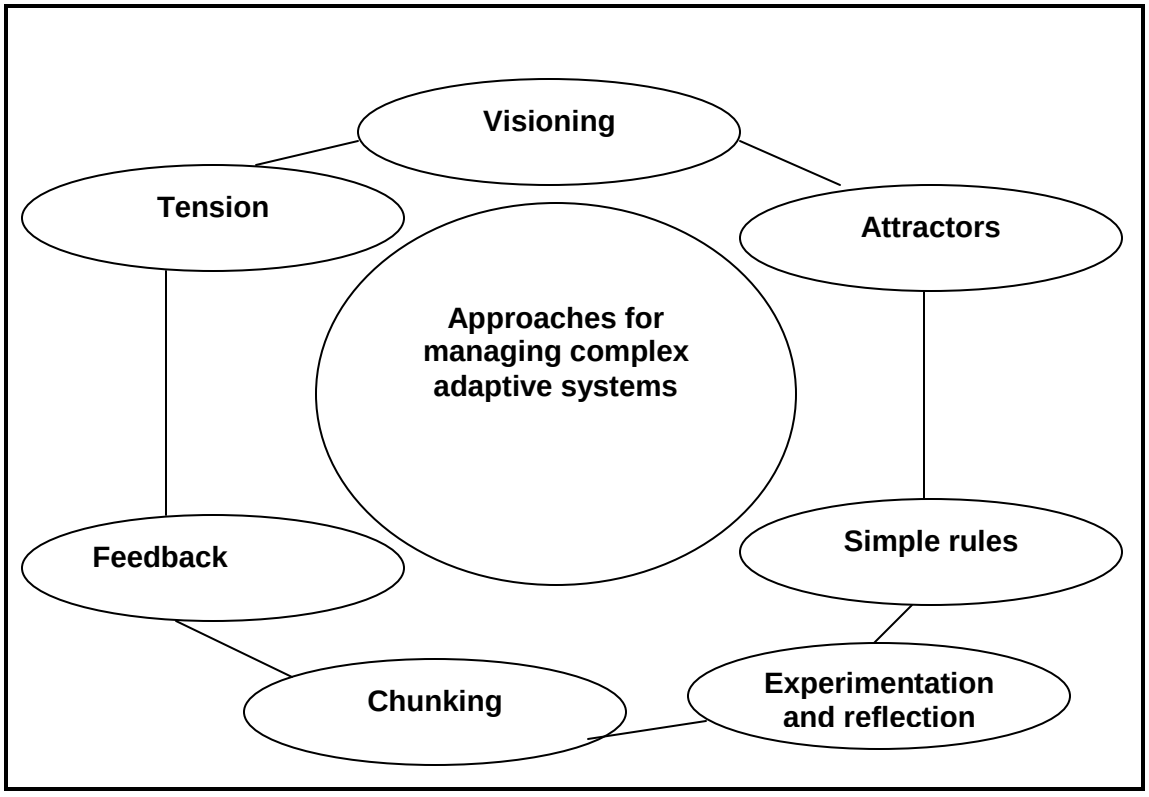


Fig. 2.6: Approaches to managing CAS

(Source: Palmberg, 2009: 485)

Palmberg (2009) argues that the one idea that has inspired organizations is the capacity to hold a shared picture of the future we seek to create – visioning. Another suggested approach is to use attractors (Gharajedaghi, 2007). According to Sandberg and Targama (2007), there is no such a thing as resistance – there is only attraction. To change something, all one has to do is create stronger attractors than the ones in place. The basic idea is to leave behind the principle of managing through detailed instructions, which decreases the freedom of individual agents, and, instead, to lead by making people embrace visions, creating attractors and stimulating individual agents and organizations to use their inherent abilities.

It is noted by Palmberg (2009) that: "*while the traditional approach to problem solving is to start with an extensive analysis of the problem, the approach when managing CAS is to experiment. To take an issue that is overwhelmingly complex and starts with small, simple experiments. Perform the experiments and reflect carefully. Adopt the good parts by dropping what clearly will not work and continue by linking the pieces that work together (chunking), and allow the solution to emerge. Feedback too is essential in managing CAS, it allows for emergence, self-organization, adaptability and learning.*

Though simplicity is advocated for by Palmberg in managing CAS, it does not mean that everything should be simplified indeed just the opposite is required. Traditionally, in industrial era, stability was a success factor among organizations. Today, with the pressure to remain innovative and flexible, managers instead need to create an environment of tension and instability. However, challenge is to keep the tension level where it generates dynamic imagination without exceeding people's ability to handle the stress generated (Tetenbaum, 1998).One approach to creating tension is to ensure that the organization is diverse (Zimmerman, 1998).

2.7 Supply networks risk management

According to Bowden *et al.* (2001), risk management is the process of planning, organizing, directing and controlling the resources and activities of an organisation in order to minimise the adverse impacts of accidental loses to that organisation at least possible cost. The floriculture industry is subject to a lot of business risks. The term "business risk" covers the full range of risks faced by today's companies that have potential to affect the triple bottom line. A company's business risk portfolio may include events with potential for impacts on the organization's investments, income, staff and local community welfare, occupational health and safety, the natural environment, company reputation, technological capability, security, political environment, property and legal liabilities (Bowden, Lane and Martin, 2001).

The industry is supply networks need to be very agile in order to deal with the variations in demand. In the flower industry the demand for cut flowers is never a constant. Sometimes farm have no idea what quantity is expected until 10am in the morning. Hence, as an element of risk management farms ensure that they cut and package according to demand. Otherwise there is a risk flowers being dumped either at the farm or at the pack houses in the airports. The complexity inherent in the floriculture industry necessitate that particular attention is given to risk management.

Although many managers use risk management principles both formally and informally in their day-to-day work, prudent managers will adopt a structured approach to risk management to ensure that risks are identified and addressed in a consistent manner (Bowden, Lane and Martin). In order to perform risk assessment and to develop a risk management strategy, business managers, especially in the flower industry need to understand the concept of risk and risk profile that businesses face.

It is to be noted that the general approach to risk management comprises a series of steps illustrated in figure 2.9.5 and listed below (Billows, 2009):

Step1. Define the context and risk management criteria;
Step 2. Identify the risks;
Step 3. Assess the significance of those risks;
Step 4. Identify, select, and implement risk treatment options; and
Step 5. Perform monitoring, review, and corrective actions.

According to Koller (2005), the steps of risk response and risk control are fundamental management steps. A person's or a company's aversion to risk (utility theory), available physical resources , cash reserves and credit line, political realities, partnerships, reputation concerns, and countless other tangible and intangible considerations influence the steps considered in the management process.

An overview of the risk management process as provided by Bowden *et. al.* (2001) is given in figure 2.7 below: The illustration goes a long way in showing that risk management is a systematic application of management policies, processes, and procedures to the tasks of identifying, analysing, assessing, treating, and monitoring risk. The aim of risk management is reduce exposure to consequences of risk events to levels that are considered acceptable by the business.

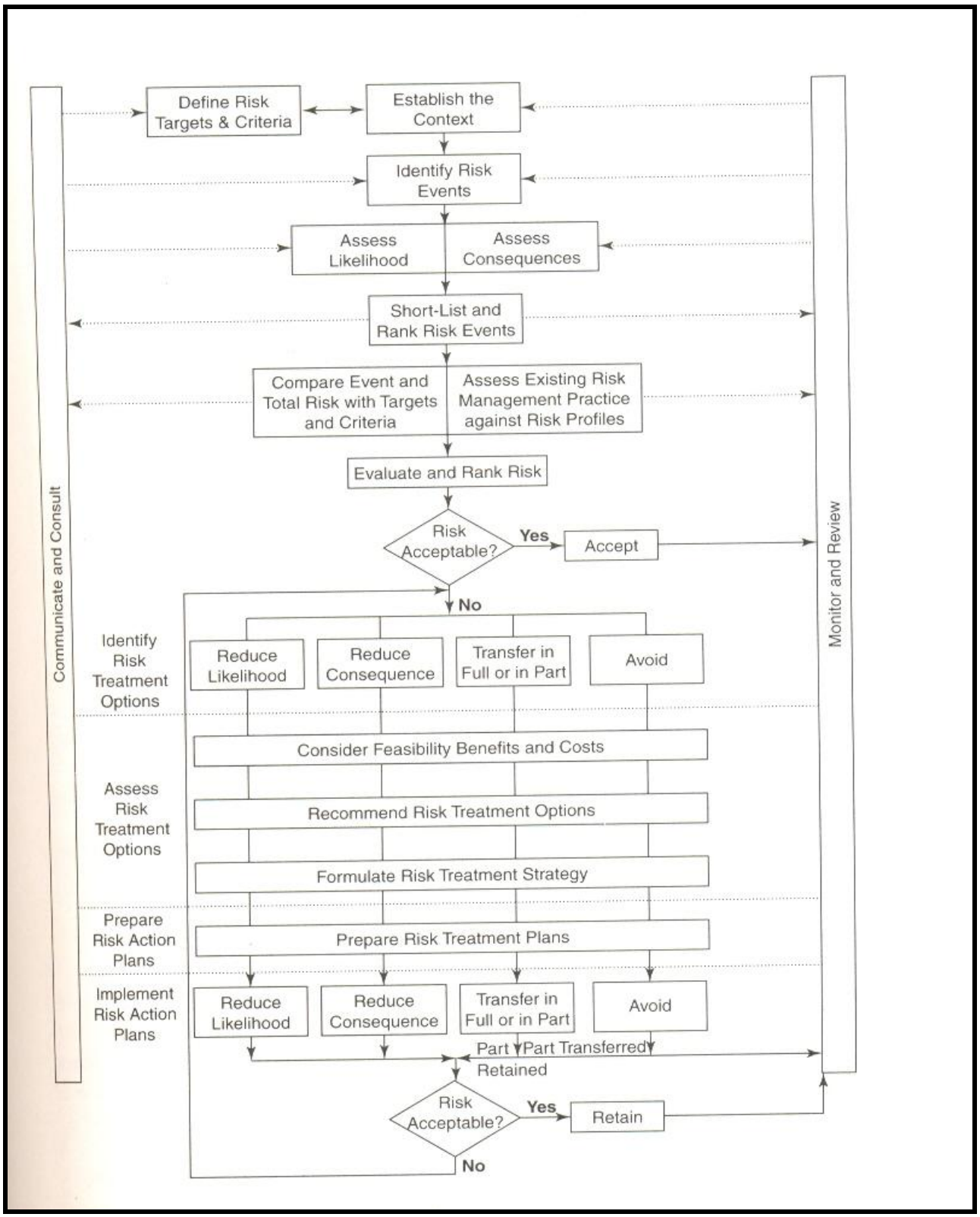


Fig. 2.7: Overview of the risk management process

(Source: Bowden *et al*. 2001: 9)

According to Bovet (2005) there are two ways to strategically address the burgeoning nature of risk: i) shorten the supply chain in order to reduce cycle time and disruption risk or ii) optimize the portfolio of supply chain sources and locations in order to gain flexibility through diversification. Many innovative companies have used the first approach effectively, but it does have its limitations- indeed, it prevents a company from taking full advantage of the economic benefits of extending the supply chain globally, the same argument can be raised for the floriculture industry.

Bovet (2005) lists the following as practical steps and company can take to manage risks:
i) Improve demand planning with distributors and retailers by being closely connected to the customers through shared demand forecasts, vendor-managed inventory, and other joint systems. The goal is to reduce the risk of being blindsided by demand shifts;

ii) Work with suppliers to create contingency plans. In the wake of 9/11, continental Teves, a major automobile supplier, activated existing contingency relationships with transport firms such as Emery to supplement air shipments of parts from Europe. After making a same-day assessment of parts flows at risk, Continental Teves was able to rely on prearranged ocean shipping space and increase inventories, thus allowing its customers, including Toyota, to continue operations with little disruption over the following weeks;

iii) Diversify sourcing to reduce the risk of catastrophic supply chain failure. Establish backup arrangements by qualifying additional suppliers, without necessarily awarding them significant volume. Geberit, a large Swiss sanitary fixture manufacturer, has adopted a dual sourcing policy. It either retains an existing supplier as a second source, or develops a second source in Asia. Companies can choose to meet 10 percent to 20 percent of their needs from a second supplier, which generally work hard in hopes of displacing the primary supplier. Service level agreements can call for rapid ramp-up if required;

iv) Extend insurance policies to cover overseas suppliers. Contingent business interruption coverage, for example, is typically limited to the United States and nearby countries; have it explicitly extended to cover major suppliers located in Asia and other low-cost geographies;

v). To deal with contingencies; employ a major third-party logistics provider with broad resources. One electrical manufacturer recently asked its freight forwarder to provide weekly updates on the best U.S. ports for its inbound product flows from Asia. In essence, the logistics provider becomes a key risk-mitigation agent by continually looking over the horizon on a company's behalf;

vi) Model and optimize inventories on a disaggregated basis, as all components are not created equal. Modeling supply susceptibility to delays leads to finer tuning of safety stocks, which may rise for some parts or finished goods (depending on which point in the supply chain one is looking at) but fall for others. A typical product with a one-week lead time and delivery variability of one day will require 15 percent more safety stock, for example, if supply variability increases by one day, and 175 percent more if variability increases by a week;

Vii) Increase product component standardization. The ability to mix and match components from multiple suppliers and plants allows such manufacturers as Dell, IBM, and Herman Miller to make their supply chains more flexible. Reducing product complexity shortens cycle times in normal conditions and speeds response to supply crises as well;

viii) Create a centralized product data management system. If the supplier is the only one who knows the actual specifications of products or components, rapid resourcing of products can be time-consuming, if not impossible, during an emergency. Centralized product data for immediate consultation or preemptive use helps reduce the risk of disruption. In practice, this means developing a database of product and component designs so that substitute suppliers can be rapidly brought up to speed. Companies that

have sole-sourced a key component for years, without maintaining control over drawings or other design characteristics, take heed;

ix) Raise visibility along the extended supply chain. When inventory is tracked from order placement to reception at a forward distribution center or customer, it can effectively become part of a company's safety stock. Achieving real-time knowledge of the location of parts and products as they flow from distant origins is not easy, to be sure, but trade management software can help track global goods flows and divert shipments when necessary; and

x) Monitor specific warning signs of trouble. Tracking a limited number of supply chain risk indicators, such as average train speed, weeks of orders outstanding, component delivery variability, and exchange rate movements, can provide a crucial warning as a problem approaches the tipping point and becomes a dangerous disruption. It is no longer sufficient to track just service levels, lead times, inventories, and logistics costs.

Hence, it is of prime importance through a process of risk assessment the supply chain managers are able to separate acceptable and unacceptable risk events and to derive information that assists in the development of a risk management strategy (Bowden et. al. 2001).

2.8 Developing a conceptual model for simultaneous optimization of supply networks

In understanding the development of a conceptual model, the following aspects of literature are explored: the requirements to build a conceptual model; modeling supply networks and supply chain modeling.

2.8.1 Requirements to build a conceptual model

Descriptions of models have largely focused on models as interpretations or components of theory, or generalizations of the empirical domain (Robinson, 2006). He further asserts that: it is useful to encourage modelers' to start with small models and to gradually add

scope and detail. Pidd (2003), however, adds more details to this by describing six principles of modeling: i) Model simple; think complicated; ii) Be parsimonious; start small and add; iii) Divide and conquer; avoid mega models; iv) Use metaphors, analogies and similarities; v) Do not fall in love with data; and vi) Modeling may feel like mudding through.

Working on modeling to manage the health care systems, Paul *et al*. (2002) suggest the following as the main steps taken with regard to a model. These steps are usually taken sequentially in a single modeling iteration, but not necessarily all of them. The intention is to seen the applicability of the same in modeling for simultaneous optimization of supply networks in the floriculture industry. These steps include:

i. Specification- the first cycle of modeling specifications represents the initial needs and ideas of the problem owners about the problem. From the second cycle on, specification represent refined requirements from the problem owners and validation notes from experts. It is to be noted that the requirements are not fixed and they change based on a refined understanding of the problem;

ii. Incorporation- this is for developing the model or modifying it, based on the new needs and thoughts from the problem owners. Incorporation also includes validation notes for the experts. Incorporation is concerned with all the activities that add new or alter existing features for either the conceptual or the time-based model (for example, structure, inputs and outputs);

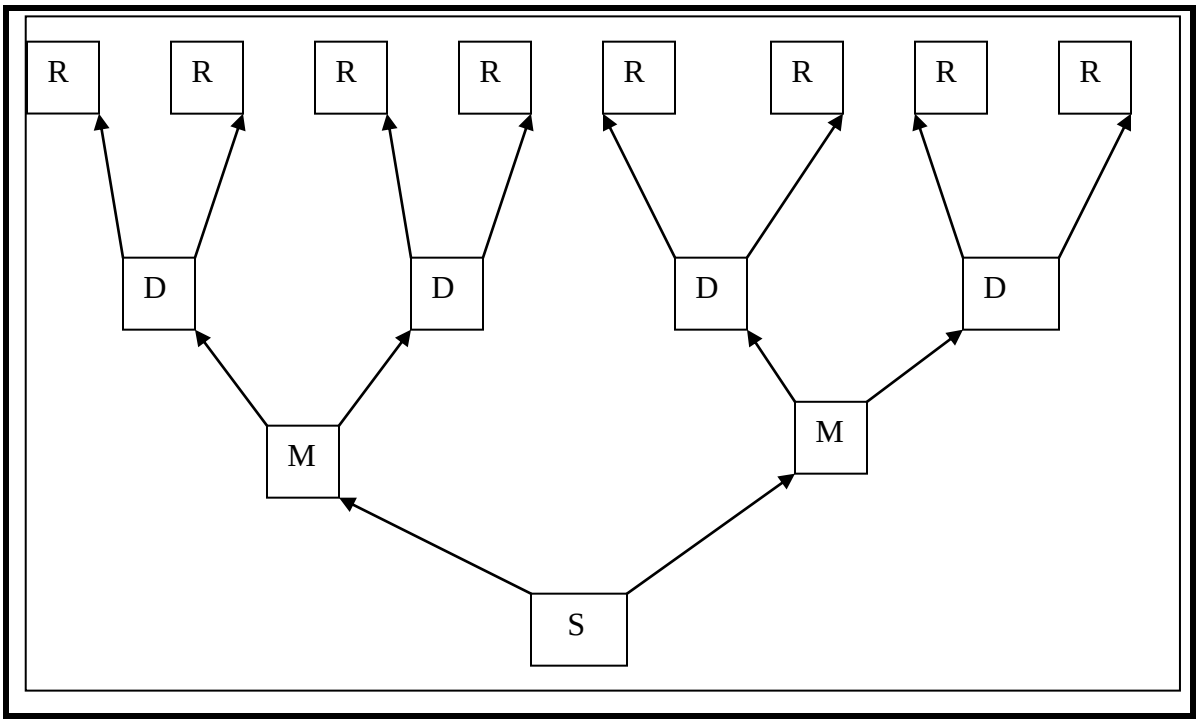
iii. Experimentation – this is concerned with altering the model's structure and the parameters and reflects on stakeholders' understanding. Experimentation is mainly conducted under direct authorization. It lies at the heart of the iterative process, as it represents a change in the model that has to be seen by the stakeholders. Experimentation is usually about "what-if" scenarios, identification of relevant variables, and conducting data collection when it is necessary;

iv. Communication – communication is divided into two categories: stakeholder-to-stakeholder (interpersonal communication) and stakeholder-to-model communication (intermodel communication): Stakeholder-to-model communication is between stakeholders and model, where the model either is a destination where requirements are fed into the model (such as in the case of incorporation) or could be a source where information is retrieved from the model, as in experimentation results. On the other hand, stakeholder-to-stakeholder communication is between the stakeholders and not directed to the model. The model could be used as a means of communication but not a source or a destination. It should be noted that this communication is mutual; and

v. Information – information in this case is divided into two categories: tangible and intangible information. Tangible information is defined as quantifiable, such as output figures from the model or even animated behavior in the model. The main principle for this type is the fact that it is gathered after the model is run (that is, incorporation of the time factor in the model) and this information is gathered is purposely retrieved from the model. Tangible information is mainly used for evaluative studies and direct experimentation;

2.8.2 Modeling supply networks

The importance of the supply chain networks is in providing that vital link between the suppliers and retailers in any industry. According to Lockammy (2008), analogous to manufacturing facilities, supply chain networks can be classified as being either V -, A – or T – networks based upon the nature of the dominant product flow within the network. The following list contains a summary of the primary characteristics associated with V-, A-, and T- networks. V- networks are characterized by: a) minimal or singular suppliers and manufacturers, b) multiple distributors and retailers, c) network divergence points among manufacturers, distributors and retailers.

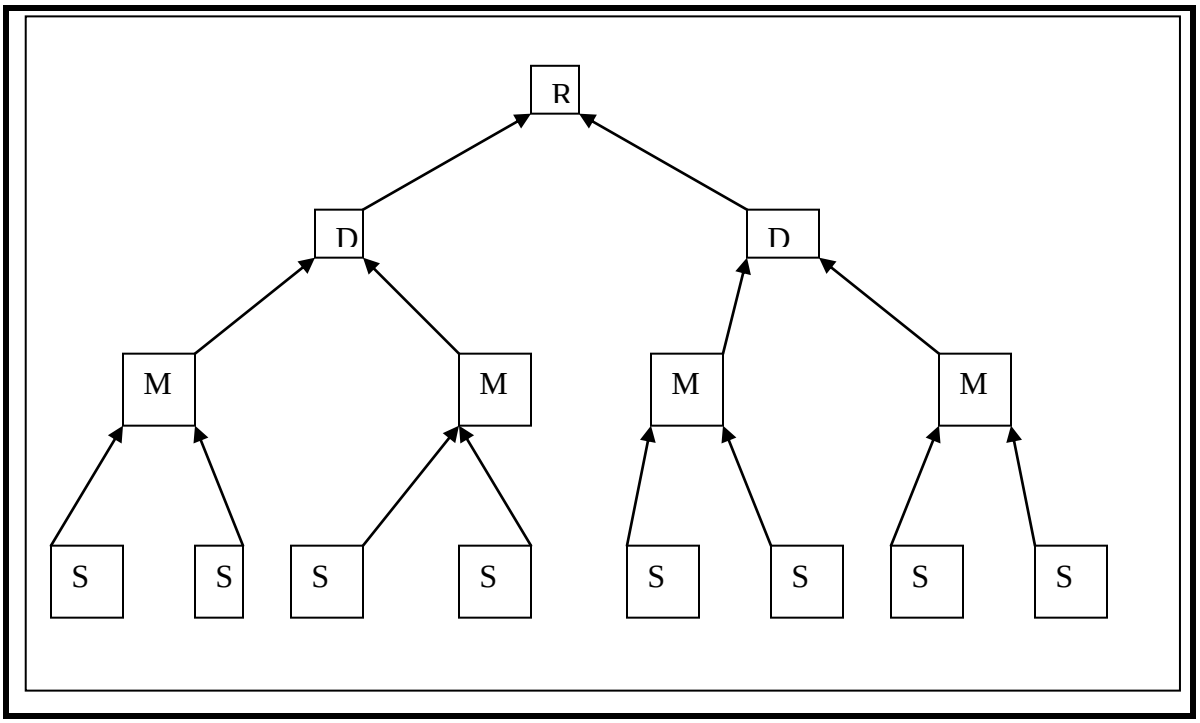


KEY: S = Supplier; M = Manufacturer; D = Distributor; R = Retailer

Fig 2.8: V – Supply chain network flow diagram

(Source: Lockammy, 2008: 346)

A – Networks are characterized by: a) multiple suppliers and manufacturers, b) minimal or singular retailers and distributors; and c) network convergence points among suppliers, manufacturers, distributors, and retailers.

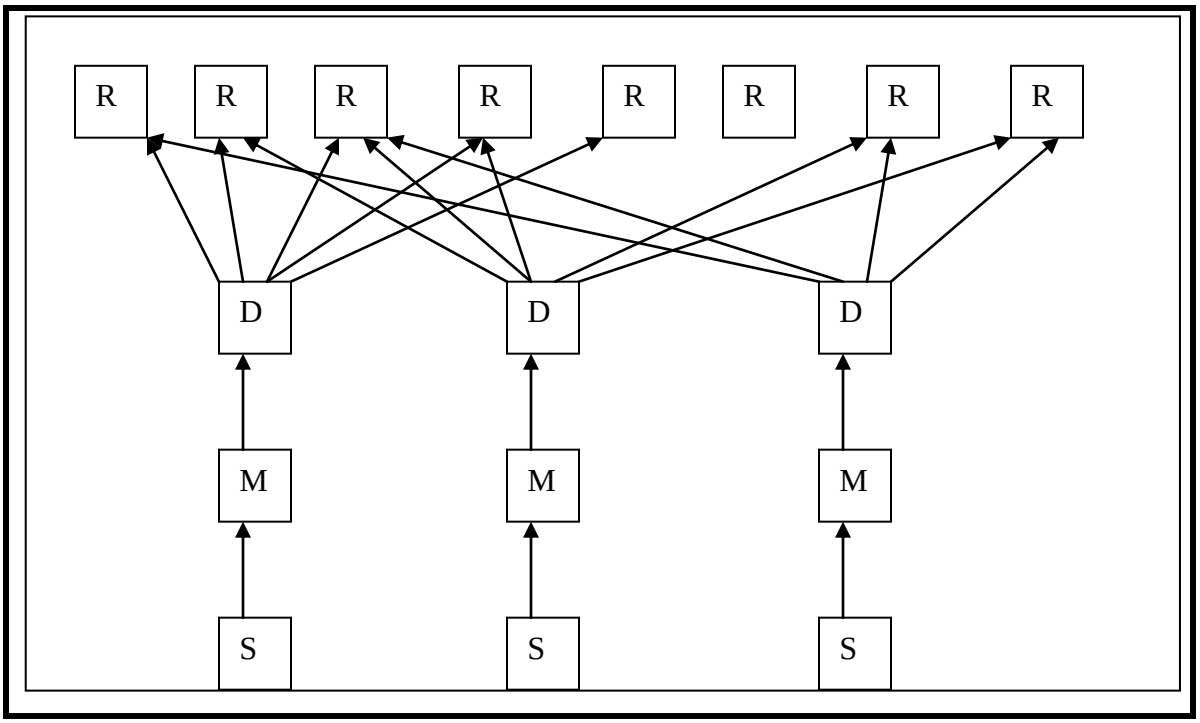


Key: S = Supplier; M = Manufacturer; D = Distributor; R = Retailer.

Fig 2.9: A – Supply chain network flow diagram

(Source: Lockammy, 2008: 346).

T-networks are characterized by; a) multiple suppliers and retailers b) minimal or singular manufacturers and distributors per each supplier, c) no significant divergence or convergence points among suppliers, manufacturers, and distributors; and d) network divergence points between distributors and retailers.



Key: S = Supplier; M = Manufacturer; D = Distributor; R = Retailer.

Fig 2.9.1: T-Supply chain network flow diagram

(Source: Lockammy, 2008).

V – A –T analysis is an appropriate tool for improved supply chain management. It has the capability of revealing critical supply chain control points which, if not properly managed could hamper network performance. V–A-T analysis can also provide guidance for the effective use of other Theory of Constraints (TOC) based tools and techniques such as Drum – buffer – rope (DBR) and buffer management. It is explained by Goldratt and Cox (1984) that DBR is a methodology which was developed to synchronize the use of resources and flow of materials in manufacturing operations. The "drum" represents the pace at which the system constraints operates, Buffer are the inventories placed at the system's control points to protect it from unanticipated variation, the "rope" provides communication among the control points to ensure system synchronization.

2.8.3 Supply chain modeling

Modeling of supply chain management is very vital. A reason for producing a business process model is highlighted by Ericksson and Penker (2000) includes:

i) A business process model helps us understand the business – one of the primary goals of business process modeling is to increase an understanding of the business and to facilitate communication about the business;

ii) A business process model is a basis for creating suitable information systems – descriptions of the business are very useful in identifying the information systems needed to support the business. Business process model also acts as a basis for engineering requirements when a particular system is being designed;

iii) A business process model is a basis for improving the current business structure and operation – as it shows a clear picture of the business current state, a business process model can be used to identify the changes required to improve the business;

iv) A business process model provides a polygon for experiments – A business process model provides a polygon for experiments – A business process model can be used to experiment with new business concepts and study the implications of changes for the business structure for the business structure; and

v) A business process model acts as a basis for identifying outsourcing opportunities – By using a business process model the core parts of a business system can be identified. Other parts considered less important can be delegated to external suppliers.

The SCM maturity model illustrated in figure 2.4 below conceptualizes how process maturity relates to the SCOR (Supply Chain Operations Reference Model) framework. SCOR is based on five distinct management processes; Plan, Source, Make, Deliver and Return (Bolstorff and Rosenbaum, 2003).

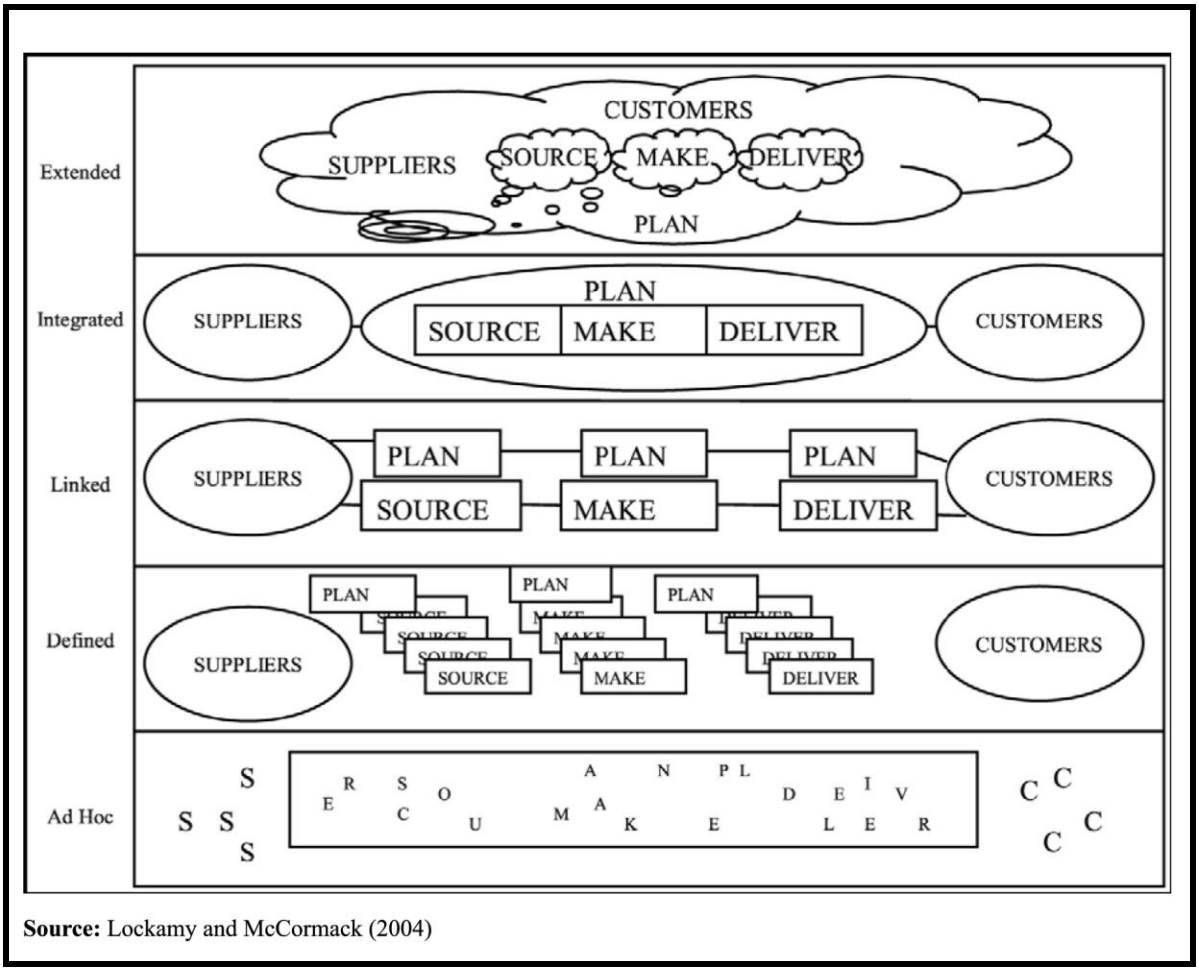


Fig.2.9.2: Supply chain maturity model

(Source: Lockamy and McCormack, 2004)

The model was developed based upon the process maturity model according to Lockamy and Mc Cormack (2004) and defines the following SCM maturity levels:

Level 1 – Ad hoc: The Supply chain and its practices are unstructured and ill defined. Processes, activities and organizational structures are not based on horizontal processes, while process performance is unpredictable. SCM costs are high, customer satisfaction is low, functional co-operation is also low.

Level 2 – Defined: Basic SCM processes are defined and documented, but the activities and organization basically remain traditional. SCM costs remain high; customer satisfaction has improved, but is still low.

Level 3 – Linked: This level represents the breakthrough. Cooperation between company departments, vendors and customers is established. SCM costs begin decreasing and customer satisfaction begins to show a marked improvement.

Level 4 – Integrated: The company, its vendors and suppliers cooperate on the process level. Organizational structures are based on SCM procedures, SCM performance measures and management systems are applied. Advanced SCM practices, like collaborative forecasting with other members of a supply chain form. As a consequence SCM costs are dramatically reduced.

Level 5 – Extended: Competition is based on supply chains. Collaboration between companies is on the highest level, multi – firm SCM teams with common processes, goals and broad authority form.

The supply chain maturity model as outlined by McCormack *et al*. (2008) expands upon earlier research suggesting higher levels of process maturity being related to superior performance. The five stages of maturity model as described above depicts groups of practices that are employed at different levels of the maturity, building upon each other and producing increasing level of supply performance. With each level of maturity come increasing levels of predictability, capability, effectiveness and control. However, the process maturity model does not address the complexities of economic, social and environmental aspects of an integrated supply chain management as is expected in the floriculture industry in Kenya.

The model by Svensson (2007) suggests that a first – order supply chain is used to denote that a substantial part of it is based on the use of non – renewable and non-recycled resources, while n-order ones (e.g. second order) are based on a larger share of renewable and / or recycled resources.

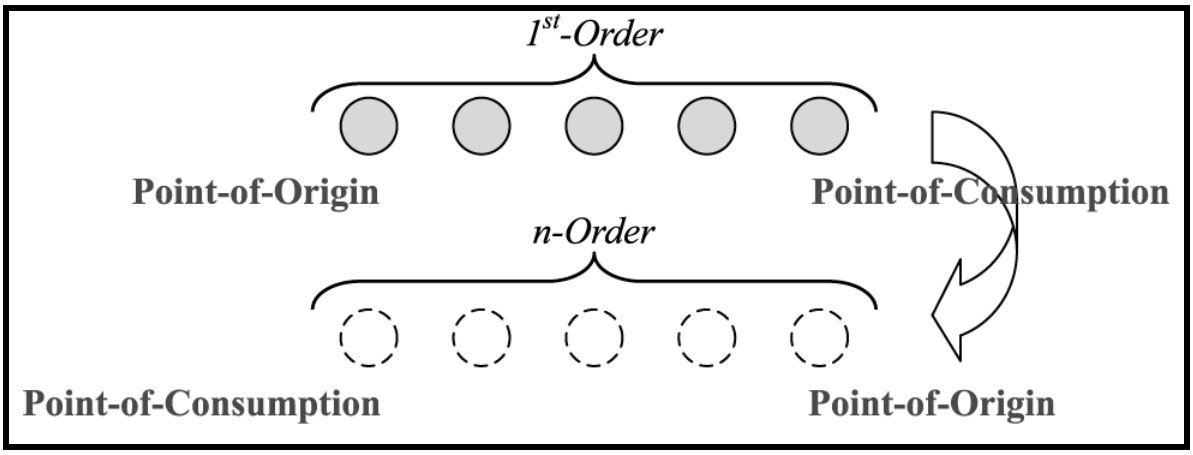


Fig. 2.9.3: First and n-order supply chain

(Source: Svensson, 2007: 264)

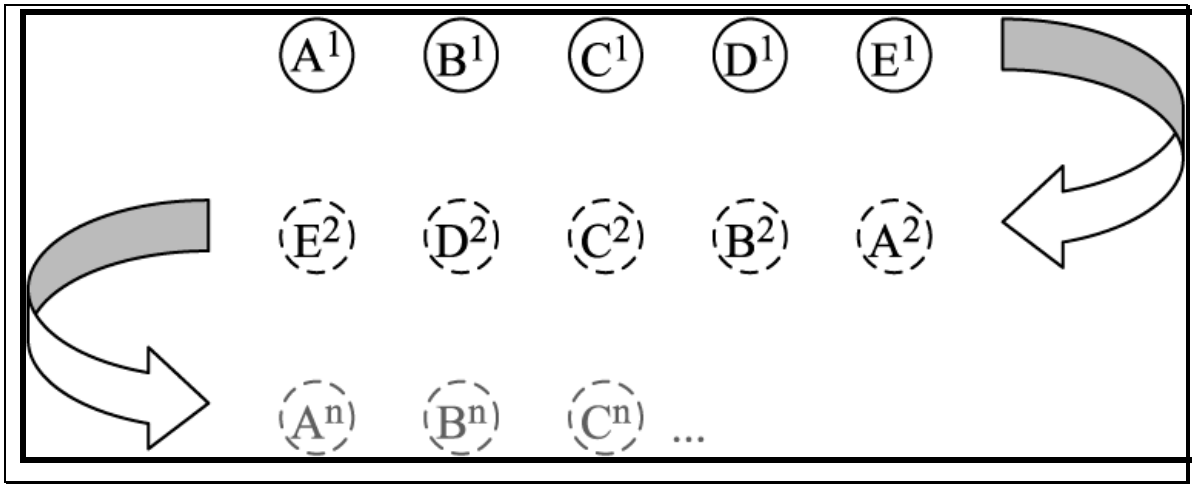


Fig: 2.9.4: Illustration of first-, second- and n-order supply chains

(Source: Svenssson, 2007: 264)

This research effort, however, stops at the point of consumption rather than being extended to the second – order supply chain. This model falls short of applicability in the floriculture industry in Kenya which will entail a look at the effects of the silo supply chains with respect to the triple bottom line benefits

This unbalanced focus on technical and rational perspectives has resulted in the ignorance of potential innovations that could result from understanding the complex social and political issues that are an integral part of any supply chain, especially the floriculture industry in Kenya. New methodologies that are able to integrate technical, economic, environmental, social and political factors would be of benefit to practitioners who have to deal with the complexities inherent in supply chains such as the floriculture industry in Kenya. According to Burgess and Singh (2006), the current methodologies that are used for analyzing supply chains fails to provide comprehensive accounts of the relationship between players in any given supply chain.

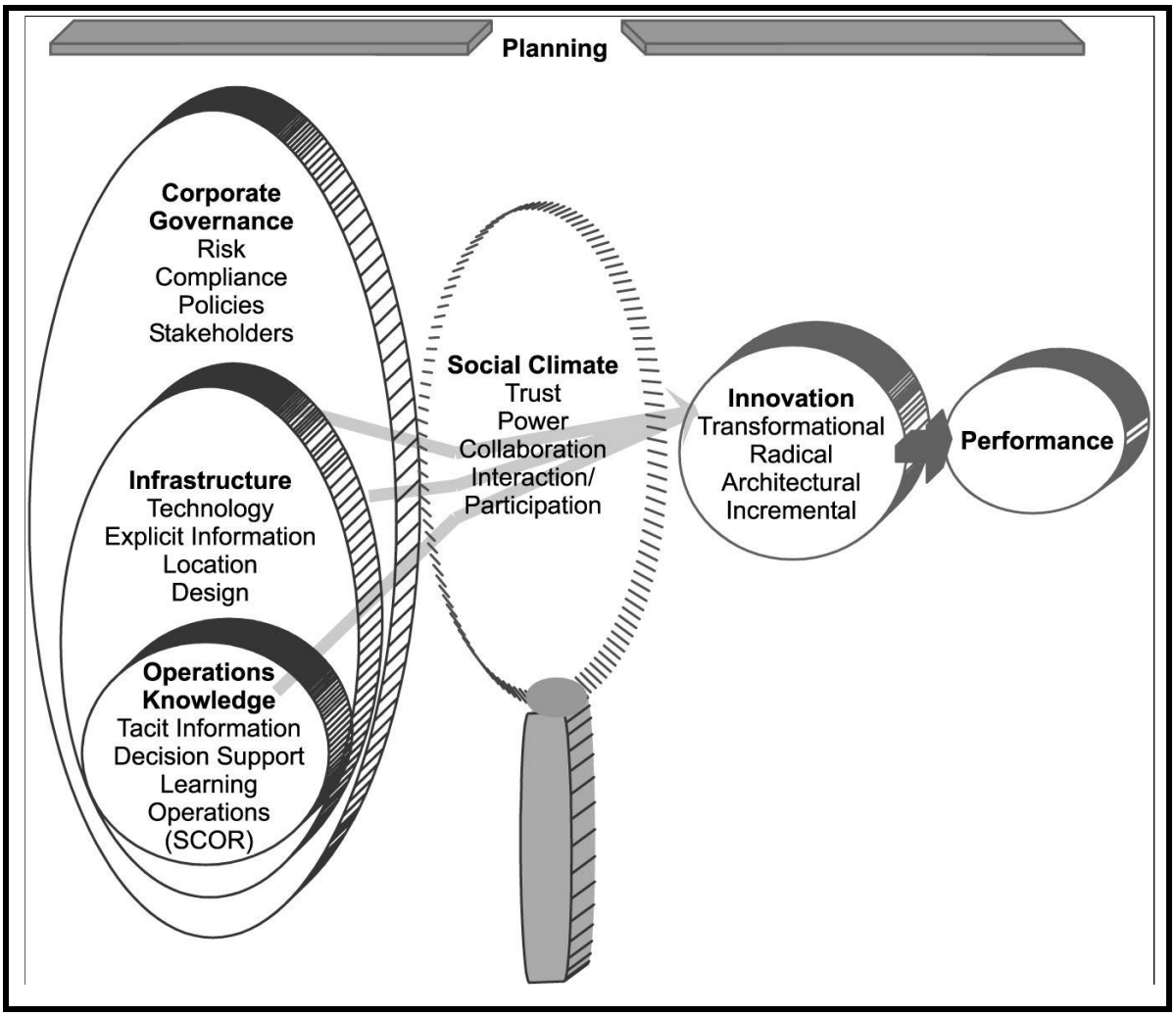


Fig 2.9.5: Underlying conceptual framework of the integrated methodology for analyzing supply chains

(Source: Burgess and Singh, 2006: 340)

According to this model corporate governance needs adjustment to free up innovation potential. The infrastructure addresses the role location and physical design play in supply chain management, whereas operational knowledge is important in speeding up learning and innovation. The model by Burgess and Singh (2006) though addresses corporate governance, infrastructure, operations knowledge, social climate and innovation fails to address the environmental issues typical for supply chain integration in the floriculture industry. The model shows three distinct forms of bias: displinary bias towards the field of economics, logistics and purchasing; industry bias towards the automotive, consumer goods and retail trade; and research bias towards the positivist tradition.

The model by Trkman *et al*. (2007) mainly tackles supply chain integration supported by information technology. Indeed there is no doubt that information technology can greatly reduce costs and needs to be addressed in supply chain management. The integrative model by Stonebraker and Liao (2006) addresses both vertical and horizontal integration of the supply chain but fails to address the social, infrastructural and information flow as it relates to the supply chain integration of the floriculture industry in Kenya.

Studies by Halldorsson *et al*.(2007), proposed four different theories to be applied when making decisions on the structure and the management of supply chains: i) Transaction cost analysis (TCA) ; ii) The principal agent theory (PAT);iii) The network theory (NT); and iv) The resource based view (RBV).

Both TCA and the PAT have their roots in neo – classical economic theory and are especially valuable when it comes to the issue of how to structure the supply chains. According to Halldorsson *et al.* (2007), important management decisions to make from this model includes: i) which activities should the firm keep in-house, and which activities should preferably be outsourced to external partners in the supply chain?; ii) What should be the roles, positions and responsibilities of the participants in the supply chain?; iii) How can the firm safeguard against the risk of opportunism from the other

participants in the supply chain?; iv) How should the incentives be aligned internally and between the participants in order to further the outcomes of the supply chain?

However, TCA and PAT have limitations due to the embedded assumptions about human behavior and the static view of the firm's boundaries. Hence, it is necessary to apply complementary theories, which can explain the dynamics in governance structure and inter – organizational relationships.

2.9 Current levels of work on supply chain management in various countries and industries.

This section of the literature review gives an insight into the current levels of work on supply chain management in various countries and industries. Working in the auto and engineering sector in India, a study by Jharkharia and Shankar (2006), resulted in the following conclusions: i) Dictatorial attitudes of the major stakeholders of the supply chain is more common in the auto sector, ii) Auto and engineering sector believe more in providing incentives to the supply chain partners, iii) Compared to the other sectors, the auto sector pays relatively more attention to improve the internal – business activities, iv) Auto and engineering sectors more frequently share product related information with the suppliers, v) Compared to other sectors, auto and engineering sectors make relatively more use of IT in sharing of design data and, vi) Compared to others, auto sector has made more investments towards the IT – enablement of the supply chain. This confirms the importance the SCM in the auto industry.

Pioneering studies on the human impact of supply chains by Stonebreaker and Shub (2009) assets that: *" human resources activities and organization variables proactively contribute t o supply chain integration and performance at all phases of supply chain integration and performance at all stages and all phases of supply chain development."* The literature review in the study suggests a transaction – based human resource strategy which emphasizes efficiency of operations, leading to simple jobs that can be performed in an expedient manner with a minimal amount of human resource investment.

Alternatively, a relationship – based human resource strategy which according to Stonebreaker *et al*. (2009): "emphasizes employee loyalty to the firm, leading to a long – term relationship (investment) between the firm and employees".

Working on the Pork industry in the UK, Womack and Jones (1996), adopted a value chain analysis approach based on the application of lean concepts and principles aimed at the development of an integrated supply chain. The study suggests the following approach:

i. specify what creates value from the end user perspective and not from the perspective of individual firms, functions and departments;
ii. identify all steps across the complete value stream and highlight non –value adding waste;
iii. make those actions that create value flow without interruption, detours, backflows, waiting or scrap;
iv. only make what is pulled by the customer rather than producing in excess of actual demand or to forecast; and
v. strive for perfection by continually removing successive layers of waste in both the product and process.

The development of integrated value chain is seen as a necessity by many people in the UK red meat sector. Not only do the farmers, processors and supermarkets chain see this to be the way forward, but the UK government also see this as a way of stemming the decline of Britain's food supply base (Curry, 2002; BPEX, 2002; in Taylor, 2006).

Studies by Vasileion *et al*. (2006), on the UK Potato industry showed the increasing importance of factors associated with the sustainability perceived by supply chain agents. It is apparent that objective, verifiable measures of the sustainability are required to guide and report supply chain performance, and that this requires the collaboration of all supply chain agents. Irish companies have shown that developing internal capability is necessary, Huber *et al.* (2003), for Ireland's Industrial base in order to; minimize the

impact of peripherality, enable small firms to take advantage of global supply chains; and exploit opportunities to manage virtual supply chains from Ireland.

The creation of a genuinely integrated product development teams, in key organizational functions in the prime contractor (design, engineering, production, materials management, procurement) and key suppliers work in parallel to deliver a more complete and fully tested design and therefore a more certain demand profile before the building phase commences (Sanderson and Cox, 2008: 23).

Another area of interest has been the healthcare supply chains. These have evolved from mass to focused marketing and the facilities in future must concentrate on single integrated supply chains in Singapore (Kumar *et al*. 2008: 94). According to the Singapore Ministry of Health (1993) activities related to the purchase, distribution and management of supplies account for about one third of the operating costs of healthcare facilities; hence there is much room for improvement.

Studies by Kumar *et al.* (2008) further suggests that the weakness in the Singapore healthcare supply chain seems to be in the difference between traditional buyer – seller relationship. These relationships are built up in partnering arrangements, where each party shares benefits and burdens over a long period of time so that all parties gain competitive advantage. A survey of healthcare supply chain in Singapore Healthcare revealed results shown in table 2.7.

Table 2.7: Survey of Singapore's healthcare industry

	Percentage of hospitals
Number of employees	
< 50	8.33
50 – 100	16.67
101 – 600	41.66
601 – 1000	16.67
> 1,100	16.67
IT implementation	
Ready	8.33
Future	25.00
Partial	41.67
Full	25.00
IT implementation benefits	
Improve productivity	58.33
Better integration	58.33
Reduce transaction time	50.00
Reduce cycle time	50.00
Improve customer service	41.67
Reduce supply costs	16.67
IT implementation hindrances	
Lack of management support	8.33
Unreliable system	25.00
Lack of supplier cooperation	41.67
Training needs	41.67
Lack of expertise	58.33
Initial cost	75.00

Interest in medical outsourcing	
Done	0.00
Interest	25.00
Little interest	8.33
No interest	50.00
Strictly no interest	16.67

(Source: Kumar *et al.* 2008: 96)

The benefits of IT are aggregated into six performance indicators, among which supply cost reduction gains the least recognition among respondents. The reason for this is partial electronic integration with suppliers.

Working on the healthcare industry in Malaysia, Muataffa and Potter (2006) assets that: *"within the healthcare industry, the supply chain associated with the pharmaceutical products is critical in ensuring a high standard of care for patients and providing adequate supplies of medication to pharmacies".* They explain that current management in the health care face a lot of problems both at the wholesales and clinics. They should take one step further and consider new approaches to control the inventory efficiently, which can lower the operating cost and generates more revenue and profit. *Literature review in the works of* Mustaffa *et al. (2009) reveals that the JIT, stockless and VMI approach are three strategies that been implemented within the healthcare supply chains in Malaysia.*

Studies in the USA auto- industry have focused on Just – in – time (JIT) implementation in two states of the Southern USA. The study sited the problem of poor quality of supplied parts, Matson *et al*. (2007), most companies tried to work with suppliers to identify problems and make corrective actions. Hence, the need for supply chain integration.

Table 2.8: Most frequently cited problems in JIT implementation

Problem	Alabama (%)	Tennessee (%)	Combined (%)
Poor production quality	84	88	86
Poor quality of supplied Parts.	68	88	78
Supplier inability to deliver material on time	72	80	76
Unstable customer Schedule / scheduling	72	76	74
Poor and / or inaccurate Data	68	64	66
Lack of supplier Support	52	76	64
Forecasting Inaccuracies	56	44	50

(Source: Matson *et al*. 2007: 439)

The following conclusion was made by Matson *et al.* (2007) based on their studies on Problems of JIT implementation in automotive industry in the Southern States of USA; a) Customers need to select and maintain reliable competitive supplier base to keep costs down and quality of the delivered products up, b) maintaining long term contracts with fewer companies can result in better channels of communication, require less follow up, and require less paperwork, c) long term commitments with fewer suppliers should result in higher quality parts and lower costs.

Still on the auto – industry in Brazil, at least seven large automobile plants (Ford in Camari, GM in Gravatai, VW in Curitiba, Renault in Curitiba, PSA in Porto Real, DaimlerChrysler in Juiz de For a, and Toyota in Indiatuba) focusing on the production of automobiles and light vehicles were established over the last ten years. Studies by Pines

and Neto (2008), confirms mainly that the configuration of the supply chain is indeed a determining element in the way the automaker's relationships with its suppliers is conducted. Strategic links in the supply chain receive greater investment in improvements and monitoring. Partnerships and cooperation emerge as important elements in the configuration and formation of supply chains.

Some studies in Pakistan indeed confirm that the concept of supply chain management is all embracing and the SME sector is not left out. A survey by Bhutta *et al*. (2007), on the SCM practices and the health of SME's in Pakistan indicates that the performance of SME's generally showed a downward trend, SME's do not seem to be too optimistic about their future as about 71 percent of them expect their sales to be either stagnant or decrease. A very small percentage (5%) of the SME's are in the export market, those that are in the exports are typically larger firms and their performance on the whole is better than those operating exclusively in the domestic market.

While looking at several industries, studies by Seuring (2006) on supply chain controlling in Germany concluded that the supply chain can be comprehended as a meta – system of companies that jointly operate within a competitive environment. Three issues are identified in relation to supply chain controlling – i.e. a) rationality, b) Integration, c) information flow.

Table 2.9: Relating supply chain management and controlling concepts

Question raised	Controlling concept	SCM debate
What is the performance Frontier of a supply chain and how is it reached in a rational manner	Rationality – oriented	Supply chain competitiveness and performance
Who manages the supply Chain and how is action Coordinated.	Coordination – oriented	Supply chain integration
What information is needed to manage the supply chain.	Information – oriented	Information distortion

(Source: Seuring, 2006)

This study does reflect the key issues to be addressed in modeling for simultaneous optimization supply networks for the floriculture industry in Kenya. This study is looking at the supply chain optimization and how it is achievable through supply chain integration, information flow being one of the critical elements.

A survey of companies in steel manufacturing, transport and public utilities in Australia was conducted by Burgess and Singh (2006). It revealed the need for an understanding of the following factors:

a) Corporate governance as it is presently practiced inhibits innovation so adjustments in this area could free up innovative potential;

b) Infrastructure may be placing too much emphasis on technology as a panacea for solving all of the communication data transmission, and information transfer

requirements of organizations involved in the supply chain. The introduction of feral systems in isolation with no integration across the network challenges much of the logic during the multi – million dollar investment both organizations are currently making in ERP systems. The role that location and physical design play in SCM is clearly not something managers appear to have thought about in any depth;

c) Operations knowledge appears to work well through social systems. The role of tacit knowledge and why it seems to be so highly valued needs more research. What is driving this approach needs to be determined. How it can be better utilized and supported by knowledge management human resources strategies in order to generate grater innovation also needs analysis. This in turn could assist in improving the speed at which players in a supply chain can 'learn' and improve;

d) Collaborative planning is another major issue requiring urgent attention. Little is known about how to do this successfully in any large organization, let alone between large corporations. There is a need to develop a comprehensive methodology that covers issues such as skills and competencies, social facilitation methods, technical processes, measurement systems, technical compatibilities and mutual decision support tools;

e) Architectural innovation represents the best opportunity for innovation in the type of supply chains studied. The companies cannot justify the costs of radical improvements in the respective industries and incremental improvements are often small to make a difference to the entire chain; and

f) The multi-displinary nature supply chains make it an imperative that different discipline areas find a common point of reference by which they integrate their findings into a coherent whole that managers can use in purposeful ways.

The following framework is suggested by Burgess and Singh (2006) from analyzing supply chains:

Step one: Produce a process map of the supply chain using the SCOR model to determine the technical and operational elements relevant to the supply chain, as well as to identify the key players in the chain.

Step two: Access the infrastructure that supports the activities in the supply chain and the corporate governance issues that control and regulate the behavior of parties in the supply chains. Operational knowledge, when combined with sound understanding of infrastructure and corporate governance issues will provide opportunities for innovative ideas for performance improvement. The framework also suggests that innovation can only take place if the 'social' climate is right.

Step three: Determine the social climate that exists in the supply chain by specifically accessing the strength of the various social relationships that exists between key players and how they are used to manage the chain.

Studies in Japan by Lin *et al*. (2006) affirms that; as far as subcontracting for Japanese automakers in China is concerned, three features are particularly notable: *the delegation of administrative authority, development competitions and the maintenance of competition between a small number of cooperative suppliers, and a relatively high interaction between buyers and suppliers.* Taken together, these characteristics have encouraged effective technological development and enabled a relatively rapid response to market conditions (Lin *et al*. 2006). Indeed it is in their approach to supply chain management that Japanese automakers, though latecomers in China have been very successful.

Indeed no study known to me has been done on supply chain management practices related to the floriculture industry in Kenya more so studies on simultaneous optimization of the supply networks. It is that realization that has prompted me to do a research on supply chain management practices in Kenya, in particular to develop a model for simultaneous optimization of the supply networks that can be used as a tool for competitive advantage. The approach i intends to take is to synthesize the various

models for optimization of supply networks used in other parts of the world and develop one that will be most applicable for the Kenyan Floriculture sector. This is as a result of the realization that the floriculture industry has a lot of potential economically and much room for improvement.

2.10 Critical review of literature

There is emphasis on the process of supply chain re-engineering to balance, align and seamlessly integrate demand, marketing, sales, distribution, production and supply in search of suitable and competitively superior performance gains. The concept may be quite generic but needs to be developed to suit the requirements of an individual industry. Hence, the need to critically examine the factors influencing ISCM and develop a model suitable for the floriculture industry in Kenya.

Agility in also a critical factor in the 21st Century, more customers in different geographical locations and with different needs can be served better with more customized solutions. That calls for the need for effective information exchange between the firm and the customers. The floriculture industry players need to be well versed with the needs of their clients from different geographical location in order to attain customer satisfaction. Indeed, customer satisfaction has been identified as the key driver of the supply chain.

Both supply chain networks and power relationships seem to have high impact on supply chain integration. However, it remains the duty of the firm to identify the most suitable supply chain networks and power relationships taking into account the firm's operating environment. Studies by Armyan *et al*. (2007), identified seasonality in production as a key characteristic of the agri-food supply chain. However, that is not an issue in the cut–flower industry in Kenya since farming is possible all year round. The key issue in the floriculture industry could rather be seasonality in demand. Flowers have peak demand during certain periods, for example, Valentine's Day (14th of February) and on mothers' day.

2.11 Summary of literature review

The literature review therefore has presented a detailed discussion on: theoretical review of concepts in supply chain management; factors that influence performance of supply networks; relationships and impact of key of key success factors that influence performance of supply networks; supply chain performance measurement; floriculture industry in Kenya as operating in a complex adaptive environment; supply networks risk management; developing a conceptual model for simultaneous optimization of supply networks; and current levels of work on supply chain management in various countries and industries.

Therefore, there is absolute need to focus on optimization of supply networks in the floriculture industry due to the expected gains as discussed in the literature. A review on requirements to build a conceptual model; modeling supply networks and supply chain modeling is thus presented.

2.12 Conclusion from literature review

Supply chain management enhances the competitiveness of firms. This is mainly as a result of emphasis on what adds value and through supply chain mapping. The emphasis is on creation of raw materials, manufacture of parts and components, assembly of finished including packaging, distribution of goods/ services, and consumer service. Integrated supply chain management leads to more business focus.

Integrated supply chain management has become the major weapon in maintaining profitability in a competitive business environment. Evidence from Hewlett – Packard (HP) showed that integration of the supply resulted in gains in terms of inventory reductions, improved manufacturing cycle times and customer service levels. These gains should be replicated in other sectors as well.

An integrated supply chain management model should emphasize on purchasing, inventory control, logistics and manufacturing / processing as the most important

functions to be integrated within the supply chain management paradigm. This should however, extend to building customer – supplier relationships, implementing information and communication technology, re-engineering material flows, creating corporate culture and identifying performance measurements.

Factors that will influence the development of a suitable integrated supply chain management model in the floriculture industry in Kenya will include:

i. organizational structure and design;
ii. information flow through the supply chain, hence, the role of information technology;
iii. supply chain networks;
iv. triple bottom line benefits, inclusive of financial, social and environmental benefits; and
v. country industry development – in terms of road infrastructure, cold chain facilities.

There is need to carry out a study on supply chain management in the floriculture industry in Kenya. The primary objective is to enhance performance and subsequently the competitiveness of the industry. Literature review reveals lack of studies targeting this very vital industry in Kenya.

The next chapter describes the research philosophy, approaches, strategies, choices, time horizon, techniques and procedures. The chapter presents a discussion of: overall design of the study; phase one research design; analysis of data for phase one; phase two research design; ethical considerations in undertaking research; phase two data analysis; and integration of phase one and two of research design.