İSTANBUL TECHNICAL UNIVERSITY ★ INSTITUTE OF SCIENCE AND TECHNOLOGY

DETERMINATION OF OPTIMAL SUPPLY CHAIN MANAGEMENT STRATEGY: A CONCEPTUAL FRAMEWORK

M.Sc. Thesis by
Begüm ELLİALTIOĞLU

Department : Management Engineering

Programme : Management Engineering

JANUARY 2009

İSTANBUL TECHNICAL UNIVERSITY ★ INSTITUTE OF SCIENCE AND TECHNOLOGY

DETERMINATION OF OPTIMAL SUPPLY CHAIN MANAGEMENT STRATEGY: A CONCEPTUAL FRAMEWORK

M.Sc. Thesis by
Begüm ELLİALTIOĞLU
(507051001)

Date of submission : 29 December 2008
Date of defence examination: 19 January 2009

Supervisor (Chairman) : Assist. Prof. Dr. Hür Bersam BOLAT
Members of the Examining Committee : Prof. Dr. Seçkin POLAT
Assist. Prof. Dr. Mehmet ERÇEK

JANUARY 2009

İSTANBUL TEKNİK ÜNİVERSİTESİ ★ FEN BİLİMLERİ ENSTİTÜSÜ

OPTİMAL TEDARİK ZİNCİRİ YÖNETİMİ STRATEJİSİNİN BELİRLENMESİ: KAVRAMSAL BİR YAKLAŞIM

YÜKSEK LİSANS TEZİ
Begüm ELLİALTIOĞLU
(507051001)

Tezin Enstitüye Verildiği Tarih : 29 Aralık 2008
Tezin Savunulduğu Tarih : 19 Ocak 2009

Tez Danışmanı : Yrd. Doç. Dr. Hür Bersam BOLAT
Diğer Jüri Üyeleri : Prof. Dr. Seçkin POLAT
Yrd. Doç. Dr. Mehmet ERÇEK

OCAK 2009

FOREWORD

I would like to express my thanks for my advisor Assist. Prof. Dr. Hür Bersam Bolat for her support and advice during my study. I would also like to thank Prof. Dr. Seçkin Polat and Assist. Prof. Dr. Mehmet Erçek for their contribution in my seminar, as well as in my defence examination. I would like to thank research assistant Dilay Çelebi for her advice and motivation.

I would like to state my deep appreciation and love for my mother and my father who gave me their great support and understanding while I had been studying for my thesis, as well as, during all my life. I would also love to express my love and thanks for my sister and my brother in law who are always here for me. Finally I would love to thank all my friends and my relatives for being next to me.

January 2009

Begüm Ellialtıoğlu

Industrial Engineer

TABLE OF CONTENTS

Page

ABBREVIATIONS

APS : Advanced Planning and Scheduling
ATO : Assembly-to-order
CPFR : Collaborative Planning Forecasting Replenishment
CRP : Continuous Replenishment Planning
DC : Distribution Centre
DSS : Decision Support Systems
DP : Decoupling Point
ECR : Efficient Consumer Response
EDI : Electronic Data Interchange
ERP : Enterprise Resource Planning
FMS : Flexible Manufacturing Systems
ICT : Information and Communication Technology
IT : Information Technologies
IS : Information Systems
ISO : International Standards Organization
JIT : Just-in-Time
LT : Lead-Time
MRP I : Material Requirements Planning
MRP II : Manufacturing Resource Planning
MRO : Maintenance, Repair and Operating
MTO : Make-to-order
MTS : Make-to-stock
OE : Operational Effectiveness
OEM : Original Equipment Manufacturer
POS : Point-of-Sale
R&D : Research and Development
RBPE : Rate-based Planning and Execution
RFID : Radio-Frequency Identification
QR : Quick Response
SC : Supply Chain
SCC : Supply Chain Council
SCM : Supply Chain Management
SCP : Supply Chain Planning
SKU : Stock Keeping Unit
SRM : Supplier Relationship Management
TMS : Transportation Management System
TQM : Total Quality Management
UK : United Kingdom
USA : United States of America
VMI : Vendor Management Inventory
WIP : Work-in-process
WMS : Warehouse Management System

LIST OF TABLES

Page

LIST OF FIGURES

Page

DETERMINATION OF OPTIMAL SUPPLY CHAIN MANAGEMENT STRATEGY: A CONCEPTUAL FRAMEWORK

SUMMARY

Over last two decades, a new approach has emerged: competitive advantage lies through the supply chain. Especially unique set of relations between organisations in a supply network can enable the achievement of competitive advantage through lower costs and/or greater differentiation. The success and failure of supply chains are ultimately determined in the marketplace by the end consumer. Delivering the right product, at the right time, at the right price to the consumer is vital not only to achieve competitive success but also to survive in today's marketplace. Hence, customer satisfaction and marketplace understanding are crucial elements to consider for devising/revising the right supply chain strategy.

Since "strategy" is creating a unique and valuable position by having a different set of activities and "one doesn't fit all", it is essential for companies to operate based on a particular business strategy and to focus on meeting the needs of target customers. In order to achieve an optimal supply chain performance, designing the supply chain linked to the needs of the marketplace is very fundamental, in accordance with the business strategy.

In the first chapter, introduction of the thesis, the hypothesis and the background of the study are given.

In the second chapter, the supply chain concept, its evolution throughout the time and other general information are given related to supply chain management. Supply chain structure is highlighted and the factors affecting it are explained.

In the third chapter, the importance of the strategy and the competitiveness concepts are discussed, generic business strategies are defined.

In the fourth chapter, supply chain strategy was clarified. The influence of demand patterns (e.g. predictability) and supply chain uncertainty on supply chain strategies are discussed. The need for trade-off between efficiency and responsiveness is pointed out. The importance of competitive capabilities is explained. Finally the generic supply chain strategies, which have been identified in the literature, are summarized.

In the fifth chapter, the conceptual framework related to supply chain strategies is demonstrated while proposing some of the appropriate supply chain practices which can be adopted in order to meet the marketplace needs. The supply chain strategy proposals are given based on the combinations of the chosen aspects of demand. The interpretations are made regarding the right supply chain strategy for each.

OPTİMAL TEDARİK ZİNCİRİ YÖNETİMİ STRATEJİSİNİN BELİRLENMESİ: KAVRAMSAL BİR YAKLAŞIM

ÖZET

Son yıllarda rekabet avantajını elde etmenin tedarik zincirini iyi yönetmekle ilgili olduğuna dair genel bir kanı oluşmuştur. Özellikle, tedarik zinciri ağındaki organizasyonların birbirlerini tamamlayan ilişkiler bütünü halinde olmalarının rekabet avantajını kazanmada önemli rol oynadığı keşfedilmiştir. Tedarik zincirlerinin başarı ve başarısızlıkları tamamen pazardaki hedef müşteri kitlesinin istek ve beklentilerine göre şekillenmektedir. Günümüz pazar koşullarında ayakta kalmanın ve başarılı olmanın koşulu doğru ürünü, doğru zamanda, doğru yerde, doğru müşteriye sunmaktan geçmektedir. Dolayısıyla tedarik zinciri stratejisini oluştururken veya revize ederken, hedef müşteri beklentilerini biliyor olmak çok önemlidir. Tedarik zinciri stratejisi ancak firmanın belirlemiş olduğu rekabetçi stratejisiyle uyumlu olduğu taktirde en iyi şekilde uygulanabilir.

Tezin ilk bölümünde konuya genel bir giriş, öne sürülen hipotezler ve teorik altyapı hakkında genel bir özet verilmiştir.

Ikinci bölümde, genel tedarik zinciri kavramı, zaman içerisindeki gelişimi, önemli özellikleri ve yapısına ait bilgiler sunulmuştur.

Üçüncü bölümde, strateji ve rekabetçilik kavramları tanımlanmış ve jenerik rekabetçi stratejiler açıklanmıştır.

Dördüncü bölümde ise, pazar talep yapısının ve tedarik zinciri belirsizliğinin tedarik zinciri stratejilerine etkisi açıklanmış olup, literatürden jenerik tedarik zinciri sınıflandırmaları sunulmuştur.

Beşinci bölümde, seçilen bazı talep ve tedarik özelliklerine gore oluşturulmuş kavramsal bir çerçeve gösterilmiş, bunlara bağlı olarak farklılık gösterebilecek tedarik zinciri yönetimi stratejileri açıklanmıştır.

1. INTRODUCTION

Over last two decades, a new approach has emerged: competitive advantage lies through the supply chain. Especially unique set of relations between organisations in a supply network can enable the achievement of competitive advantage through lower costs and/or greater differentiation. Additionally, complexity of supply chains due to "out-sourcing" and "globalisation", the way in which these relationships are structured and managed can make the difference between profit and loss.

The success and failure of supply chains are ultimately determined in the marketplace by the end consumer (Schnetzler et al., 2007; Mason-Jones et al., 2000). Delivering the right product, at the right time, at the right price to the consumer is vital not only to achieve competitive success but also to survive in today's marketplace. Hence, customer satisfaction and marketplace understanding are crucial elements to consider when it comes to devise/revise the right supply chain strategy. Only when the constraints of the marketplace are understood can an enterprise attempt to develop a strategy that will meet the needs of both the supply chain and the end consumer.

On the other hand, managers have been focused to improve operational effectiveness for the last two decades. The quest for productivity, quality, and speed has triggered a remarkable number of management tools and techniques to be developed such as total quality management, benchmarking, time-based competition, outsourcing, partnering, reengineering, and change management. Hence, managers have changed how the activities are performed in order to eliminate inefficiencies, improve customer satisfaction, and achieve best practice. Hoping to keep up with the best practices of productivity, they have embraced continuous improvement and empowerment.

However, nowadays, after two decades of remarkable gains in operational effectiveness, many companies are facing diminishing returns. Although the resulting operational improvements have often been impressive, many companies have been disappointed by their inability to translate those gains into sustainable profitability.

The root of the problem is to fail in distinguishing operational effectiveness and strategy. Depending on this mislead, management tools have taken the place of strategy. Since "strategy" is creating a unique and valuable position by having a different set of activities and "one doesn't fit all", it is essential for companies to operate based on a particular business strategy which is focused on meeting the needs of the market, in other words, how to play the game. In order to achieve an optimal supply chain performance, it is a fundamental requirement to design supply chain as linked to business strategy, hence, to the needs of the marketplace.

1.1 Purpose of the Thesis

In this thesis, it is aimed to detail the specific supply chain tools and techniques, as well as decisions which are required to service each supply chain process distinguished according to customer needs. A conceptual framework is built for supply chains in order to meet marketplace requirements in alignment with business strategies.

1.2 Background

In literature, supply chain management (SCM) has been discussed through the perspective of many academic disciplines such as marketing (Canever et al., 2007), operations management (Lamming et al., 2000; Li and O'Brien, 2001), management science (Lee, 2002), purchasing (Cagliano et al., 2004; Giunipero and Brand, 1996; Harland, 1996) and logistics (Christopher et al., 2004; Christopher et al., 2002; Pagh and Cooper, 1998). Tan (2000) underlines that SCM has been examined basically through two different perspective in the literature; "purchasing and supply" and "transportation and logistics". Thus, when those two are integrated into one structure which embodies all the value-added activities on the value chain, SCM has significant importance in overall business planning process.

At the strategic level of SCM are the supply chain strategies that establish and prioritize the objectives and means. Empirical studies have pointed up the significance of supply chain strategy for business strategy and for competitiveness, or competitive advantage, but the reality is that supply chain strategies are mostly inadequately articulated and defined (Schnetzler et al., 2007).

Operational effectiveness has been perceived as very important by many companies, especially after the success of Japanese companies by 1980s. Recently, it has been recognised that supply chains are not satisfying enough as it is expected (Fisher, 1997). This situation can be seen as a result of a lack of strategy (Porter, 1996). Operational effectiveness focus has been taking the place of strategy, thus, traditional supply chain acceptance is not sufficient to meet the requirements of sustainable success which may be described as sustainable competitive advantage.

Also it is necessary for firms to have a set of activities supporting each other with consistency (Porter, 1996) with respect to their business strategy (Chopra and Meindl, 2004). A supply chain strategy devised according to the competitive advantage of a firm as well as its business strategy shall bring the success.

Additionally it has been also discussed that supply chains should be interpreted from the perspective of marketplace (Christopher and Towill, 2002; Mason-Jones et al., 2000; Ayers, 1999). Today's marketplace is characterized with some new rules of competition. Competitive pressure forces more frequent product changes. Due to customers changing needs and wants, product life cycles are shortening, so does the technology life cycles. High levels of variety and products' rapid growth increase business risk. All those changing conditions stress that forecast-based management is no longer viable as it used to be. New approach is forecasting for capacity, then executing against real demand. This calls for more responsive supply chains.

Many organizations have adopted the lean thinking paradigm in their drive to optimize performance and improve competitive position. Recently, the paradigm has been highlighted as an alternative to leanness. However, many discussions took place proposing that those two paradigms can complete one after the other (Christopher and Towill, 2002; Towill and Christopher, 2001; Mason-Jones et al., 2000; Childerhouse and Towill, 2000; Naylor et al., 1999). Hence, due to the quest for a new paradigm to cope with changing needs and conditions of marketplace, a new approach combining lean and agile paradigms has been brought front: leagile. This approach is known also as postponement of activities or mass customization. Its characteristics and categorization have been discussed in the literature as well (Pagh and Cooper, 1998; Van Hoek et al., 1999).

The challenges encountered within the marketplace dragged many academicians to propose different supply chain processes with respect to different attributes. Table 1.1 summarizes related criteria and classifications made by some academicians.

Table 1.1: Some supply chain classifications in the literature.

Author(s)	Criteria	Classification
Fisher (1997)	Product innovation Product life cycle duration Profit margin Product variety Demand predictability Market standards for lead-times & services	Physically efficient process Market responsive process
Pagh and Cooper (1998)	Product life cycle Product customisation Product variety Product value Relative delivery time Delivery frequency Uncertainty of demand	Full speculation Logistics postponement Manufacturing postponement Full postponement
Naylor et al. (1999)	Stability of demand	Lean Agile Leagile
Lamming et al. (2000)	Product innovation Product uniqueness Product complexity	Innovative-unique and complex Innovative-unique and non-complex Functional and complex Functional and non-complex
Mason-Jones et al. (2000)	Product life cycle duration Demand uncertainty Marketplace characteristics	Lean Agile Leagile
Li and O'Brien (2001)	Product innovation Product variety Profit margin	Physically efficient process Physically responsive process Market responsive process
Morash (2001)	Competitive strategy Supply capabilities	Operational excellence Customer closeness
Christopher and Towill (2002)	Product characteristics Demand characteristics Replenishment lead-time	Lean Agile
Christopher et al. (2004)	Predictability of Demand Variability of Demand Replenishment Lead Time	Lean: Continuous Replenishment Lean: Plan and Execute Agile: Quick Response Leagile: Postponement
Wong et. al (2006)	Forecast Uncertainty Contribution Margins Demand Variability Time Window for Delivery	Physically Efficient Process Physically Responsive Process Market Responsive Process

In the literature, a big attention has been given to supply chain management processes. Many classifications have made with respect to some particular criteria very familiar for companies.

Although the operations aspects of SCM have been examined for a long time, SCM strategy is a new concept. Much researches needs to be performed on methodologies for successful implementation of strategic SCM (Ross, 1998). Hence, it is necessary to operate researches undertaken on the integration of SCM with company marketing, financial, manufacturing, and logistics strategies.

In this study, it is intended to give a generic and exhaustive framework for the right supply chain and operations strategy according to some characteristics while abided by the business (competitive) strategy of firm. Another emphasis of this study is the necessity of having a set of activities supporting each other based on the strategy selected by the firm so as to achieve success and sustainable competitive advantage in the marketplace.

1.3 Hypothesis

This study proposes that supply chains shall be operated under a determined strategy which actualizes the consistency of activities within supply chain. With respect to the competitive advantage that a firm keeps, a generic business (competitive) strategy shall be followed encompassing supply chain and operations strategy. Thus, the claim of this thesis is the necessity of the alignment between business and supply chain strategies.

The supply chain strategy shall be determined according to some criteria associated with needs of customers, in other words, the order winners of the market and customers. Additionally, demand patterns and the supply chain uncertainty encountered by the manufacturing firms have influence on supply chain structures, which usually require a trade-off between efficiency and responsiveness.

Strategic fit between customer needs and supply chain capabilities is critical for the success of supply chains. Hence, supply chain and operations objectives should be aligned with the competitive objectives as well as demand and supply patterns, and then operating policies developed to address these objectives.

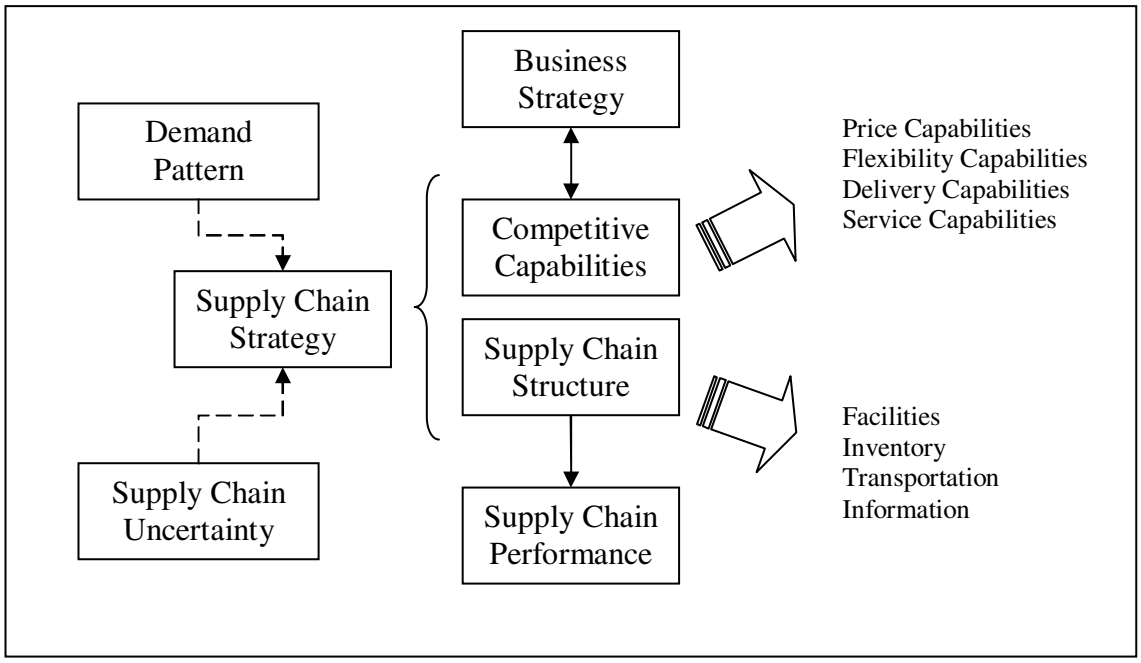

Figure 1.1: The hypothesis of the thesis.

2. SUPPLY CHAIN MANAGEMENT

2.1 Supply Chain Concept

Over last two decades, the traditional purchasing and logistics functions have evolved into a broader strategic approach to materials and distribution management known as supply chain management (Tan, 2000) which is a hot topic in business nowadays. In the literature, there are many definitions of this management philosophy.

According to Supply Chain Council (SCC) “the supply chain encompasses every effort involved in producing and delivering a final product or service, from the supplier's supplier to the customer's customer”. Thus, supply chain management includes managing supply and demand, sourcing raw materials and parts, manufacturing and assembly, warehousing and inventory tracking, order entry and order management, distribution across all channels, and delivery to the customer.

Ketchen and Giunipero (2004) describe a supply chain as an organization which is a relatively enduring inter-firm cooperative that uses resources from participants to accomplish shared and independent goals of its members and highlight that a supply chain is a network of actors that transform raw materials into distributed products.

The term supply chain comes from a picture of how organizations are linked together as viewed from a particular company. Chase et al. (2001) underlines that the idea is to apply a total system approach to managing entire information, materials, and services throughout the chain.

Harland (1996) states that supply chain management (SCM) is a sum of managing business activities and relationships (1) internally within an organization, (2) with immediate suppliers, (3) with first and second-tier suppliers and customers along the supply chain, and (4) with the entire supply chain. The chain contains all the processes that put the product in the hands of end users. This includes numerous transactions involving physical movement, exchange of information, and the flow of money (Ayers, 1999).

SCM has been defined as a loop which starts with the customer and ends with the customer and it requires perceiving the business as a continuous process which absorbs such traditionally distinct functions as forecasting, purchasing, manufacturing, distributing and sales and marketing into a continuous flow of business interaction (Gattorna and Walters, 1996).

SCM connects, aligns, and coordinates processes in supply chains as well as flows of material and information between suppliers and customers. SCM is the coordination of a strategic and long-term cooperation among co-makers in the global logistics network for the development and production of products, both in production and procurement and in product and process innovation (Schnetzler et al., 2007).

SCM has been also described in the literature as the chain linking each element of the manufacturing and supply process from raw materials through to the end user encompasses several organizational boundaries. According to this broad definition, supply chain management surrounds the entire value chain and addresses materials and supply management from the extraction of raw materials to its end of useful life.

Figure 2.1 (Tan, 2000) demonstrates the activities and the partners take part in such a value chain. It starts with taking out the raw materials from the earth and includes all the movements of them through manufacturers, wholesalers and retailers till they are delivered to final consumers. It also includes recycling and reuse of products and materials where it is possible.

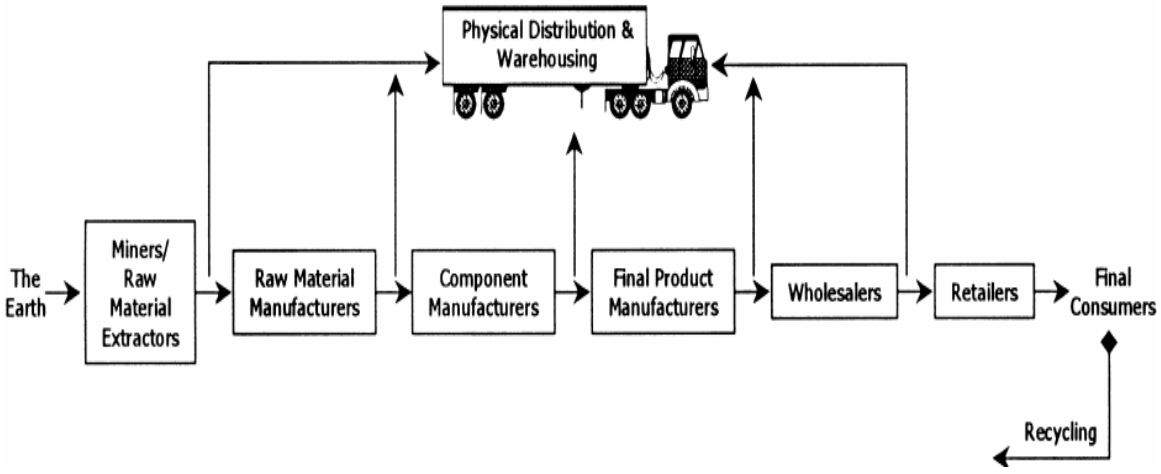

Figure 2.1 : Activities and partners in a supply chain.

Supply chain management philosophy considers all organizations within the value chain as a unified "virtual business" entity. It includes activities such as planning, product design and development, sourcing, manufacturing, fabrication, assembly, transportation, warehousing, distribution, and post delivery customer support. As Lamming et al. (2000) state; supply networks encompass not only the "upstream" network of suppliers but also the "downstream" network of distributors and customers.

In a traditional organization, each supply chain participant generally specializes in the activity that best aligns with its distinctive competencies. As such, a supply chain is characterized by a number of entities pursuing goals that can be achieved more efficiently through the concerted and synergistically collective actions of its participants (Ketchen and Giunipero, 2004).

However, technically the value chain is too complex to achieve a full integration of all business entities within it. Therefore, a narrower definition of supply chain management can be made as "the integration of the various functional areas within an organization to improve the flow of goods from immediate strategic suppliers through manufacturing and distribution chain to the end user". Tan (2000) points out that when all strategic organizations in the value chain integrate and act as a single unified entity, performance is enhanced throughout the system of suppliers. This leads us a new concept: integrated supply chain.

A well-integrated supply chain involves coordinating the flows of materials and information between suppliers, manufacturers and customers (Harland, 1996). Higher level of integration with suppliers and customers in the supply chain is expected to result in more elective competitive advantage. A global strategy must take into account all the company's markets and operations together, viewing them within an integrated framework (Harland et al., 1999).

Therefore, by establishing supply chain integration, firms obtain sustainable competitive advantage. According to Kim (2007), companies can have a stronger market position and greater customer satisfaction from better responsiveness to customers, and economies of scale from the best and stable relationship through long-term strategic alliances and networks with suppliers.

Integrated SCM can be understood as the long-term and cooperative design, steering, and development of value-added chains and networks (Schnetzler et al., 2007):

- Design: configure, define cooperation and coordination.
- Steering: formulate and implement a supply chain strategy to achieve strategic goals of the enterprise and to capitalize on improvement potentials and gain competitive advantages.
- Develop: long-term orientation to changes in customer needs and in the procurement and sales markets.

The goal of the integrated supply chain strategy is to create manufacturing processes and logistics functions seamlessly across the supply chain as an elective competitive weapon that cannot be easily duplicated by competitors.

According to Porter (1996), competitive advantage comes from the way of the company's activities fit and reinforce one another. Thus, fit locks out imitators by creating a chain that is as strong as its strongest link.

SCM provides a new way for firms to integrate key business processes from end users through original suppliers (Wang et al., 2007), and has led managers to spend vast sums to improve SCM process (Ketchen and Giunipero 2004).

The effective SCM may improve the performance of an individual organization and improve the performance of the whole supply chain. But managing supply chain is so complex that often makes the promised improved outcomes go unfulfilled (Ketchen and Giunipero 2004). Therefore, understanding what distinguishes effective and ineffective SCM is a critical issue.

According to Chase et al. (2001) today's popularity of SCM is due to the fact that many companies achieve significant competitive advantage by the way they configure and manage their supply chain operations.

2.2 Evolution of SCM

SCM is not new; companies have had to do it for years. From 1950s to today, managing philosophy of companies has changed over time. With little product and process flexibility, most companies' focus was to minimize unit production cost while operating mass production. Sharing technology and expertise with customers or suppliers was considered too risky and little emphasis was given to cooperative and strategic buyer-supplier partnership.

In the 1970s, "material requirements planning" (MRP) was introduced and managers realized the impact of huge "work in process" (WIP) on manufacturing cost, quality, new product development and delivery lead-time (Tan, 2000). Manufacturers were willing to improve performance by new materials management concepts, but still within the organization.

Differentiation in operational effectiveness was at the heart of the Japanese challenge to Western companies in the 1980s. The Japanese were so far ahead of rivals in operational effectiveness that they could offer lower cost and superior quality at the same time (Porter, 1996). This forced many worldwide companies to offer low cost, high quality and reliable products with greater design flexibility at the same time in order to compete in the intense global competition environment. Hence; manufacturers utilized "just-in-time" (JIT) and other management tools to improve manufacturing efficiency and cycle time (Tan, 2000).

In order to reduce production and scheduling problems, manufacturers realized the importance and potential benefits of strategic and cooperative buyer-supplier relationship. The concept of supply chain management emerged as manufacturers experimented with strategic partnerships with their immediate suppliers. There was realisation by a number of these organisations of the benefit of integration of functions such as product design and manufacturing. Various quality initiatives, such as the total quality management (TQM), philosophies of Deming, Juran, and Crosby, and ISO Standards for quality measurement were initiated by many organisations (Al-Mudimigh et al., 2004). Manufacturing systems were focused on MRPII.

Starting in 1990, organisations all over the world have been experiencing increasing national and international competition. Strategic alliances among organisations have been growing. Organisation structures are starting to align with processes (Al-Mudimigh et al., 2004). The development of supply chain management continued as organizations include suppliers and the logistics functions into the value chain. Manufacturers started to make alliances with qualified and certified suppliers and built more reliable relationships. They abandoned duplicating non-value-added activities such as receiving inspection (Tan, 2000); suppliers undertook the responsibility of quality control. Manufacturing systems have been enhanced with information technology tools such as Enterprise Resource Planning (ERP), distribution requirements planning, electronic commerce, product data management, collaborative engineering, etc.

Today's tempting trend is off-shore sourcing and with the effect of globalisation, the value chain enlarged and became more complex than ever. Design for disassembly, synchronous manufacturing, and agile manufacturing are some of the new paradigms in manufacturing (Al-Mudimigh et al., 2004). Hence, there is a need for new organisational paradigms to provide for the increasingly complex supply chain (Christopher, 2002). Furthermore, it is vital to determine the right strategy for particular supply chain based on the market needs and product/demand characteristics.

2.3 The Goal of SCM

The goal of the supply chain management is to manage supply chain flows and assets in order to maximize overall supply chain value. Supply chain value implies the difference between the worth of the final product to the customer and supply chain costs of in filling the customer's request (Chopra and Meindl, 2004). In other words, it is the surplus of the supply chain which refers to;

Surplus of SC = what the customer has paid - total cost expended by supply chain in filling order

Value is correlated to supply chain profitability which is the difference between revenue generated from the customer and the overall cost across the supply chain. In fact, supply chain profitability is total profit to be shared across all stages of the supply chain. Hence, supply chain success should be measured by total supply chain profitability, not profits at an individual stage.

Traditionally logistics and supply chain management has been measured in terms transportation and inventory costs and the administration required managing both. Traditionally firms would have an inventory manager and a transportation manager. This view is very narrow and causes significant problems in the proper functioning of the supply chain.

Table 2.1: Total value of a product.

Costs as % of sales	Share
Profit	4%
Logistics Cost	21%
Marketing Cost	27%
Manufacturing Cost	48%

According to the traditional view, logistics costs are a significant fraction of the total value of a product. The problem here is that this is a purely cost based view of the supply chain and drives a firm to simply reducing logistics costs. This is an incomplete picture.

By using effective logistics and supply chain strategies, it is possible to save big amounts and meet today's customer needs. When responsiveness is needed, margins shall be high enough to compensate the responsiveness cost.

2.4 Problems Related to SCM

Main problem related to SCM is its complexity due to its structure since SCM encompasses the organization of all business activities and the relationships between all firms within the chain. In this definition, logistics remains as a function of SCM which deals with the delivery of products to the right place through the integration of transportation, storage, customs clearance etc.

In the literature there are different approaches to the supply chain complexity. The structural complexity of SC is related internally to integration between departments and levels within an organization and externally to informational, product and service transactions and relationships with other organizations involved in the supply chain. Supply chain complexity is associated with the level and variety of interactions between and within the organizations. These interactions are defined by the business processes which lead us to business rules.

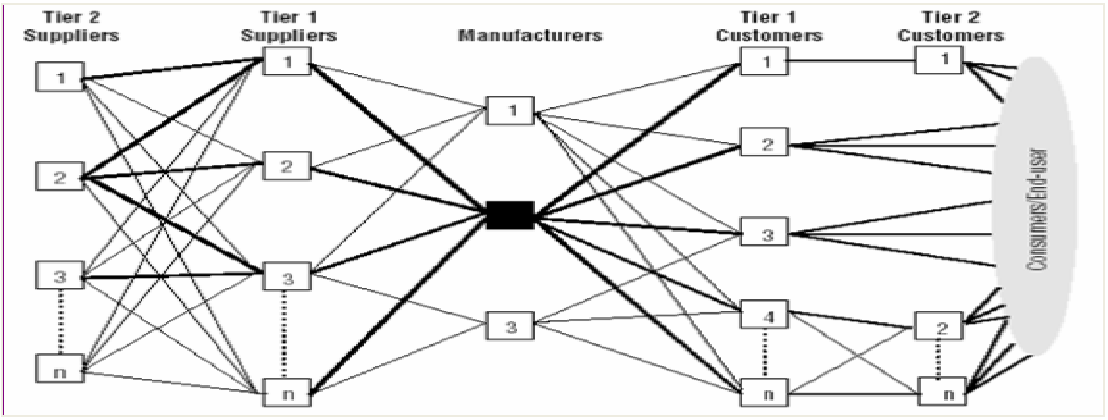

Figure 2.2 : Complex structure of supply chain.

The complexity encountered within the chain causes deviations in the flow of materials and information throughout the chain. Thus, the complexity throughout the chain shall be decreased so as to achieve cost reduction, performance improvement and higher flexibility. This phenomenon of variability magnification as we move from the customer to the producer in the supply chain is often referred to as the "bullwhip effect". The effect indicates a lack of synchronization among supply chain members. Even a slight change ripples backward in the form of magnified oscillations upstream, resembling the result of a flick of a bullwhip handle (Chase et al., 2001).

Because the supply chain patterns do not match the demand patterns, inventory accumulates at various stages, and shortages and delays occur at others (Fisher, 1997; Mason-Jones et al., 2000) as a result of bullwhip effect.

In order to deal with the complexity of SC, these activities are proposed in the literature;

- Increasing integration and coordination throughout the chain
- Synchronization of demand, planning, manufacturing and supply processes

- Implementation of visibility
- Standardization of process and data
- Upgrading automation
- Reduction of non value-added operations
- Using decision support systems (DSS)

Supplier selection is a matter should be dealt with by the firms. There are main criteria suggested for supplier selection which go parallel with the manufacturing performance and competitive priorities; cost, quality, delivery and flexibility (Harland et al., 1999). With respect to traditional procurement strategies, cost is the criterion adopted in either local or global scale and it implies supplying materials at the lowest cost. However, many authors underlined that other criteria (i.e. quality, delivery and flexibility) are equally or more important in most cases when supply has a direct impact on competitive performance, like in the case of innovative products (Cagliano et al., 2004).

Other problems to solve regarding SCM are about sharing the inventory within the chain, establishing a chain culture instead of a firm culture, adequate information systems, and so on.

2.5 The Structure of Supply Chain

Supply chain structure is consisted in activities related to facilities, transportation, inventory and information, in other words, its drivers. A supply chain structure is affected by those drivers and the decisions made related to them (Chopra and Meindl, 2004).

Figure 2.3 demonstrates the supply chain structure which is composed of its drivers, as well as the relation between supply chain and business strategies with the supply chain structure with respect to the necessary responsiveness level.

Facilities imply the places where the inventory is stored, assembled or fabricated such as production sites and storage sites of a supply chain.

Inventory signifies the raw materials, work-in-process (WIP), finished goods within a supply chain. They are determined by the inventory policies chosen according to the supply chain priorities.

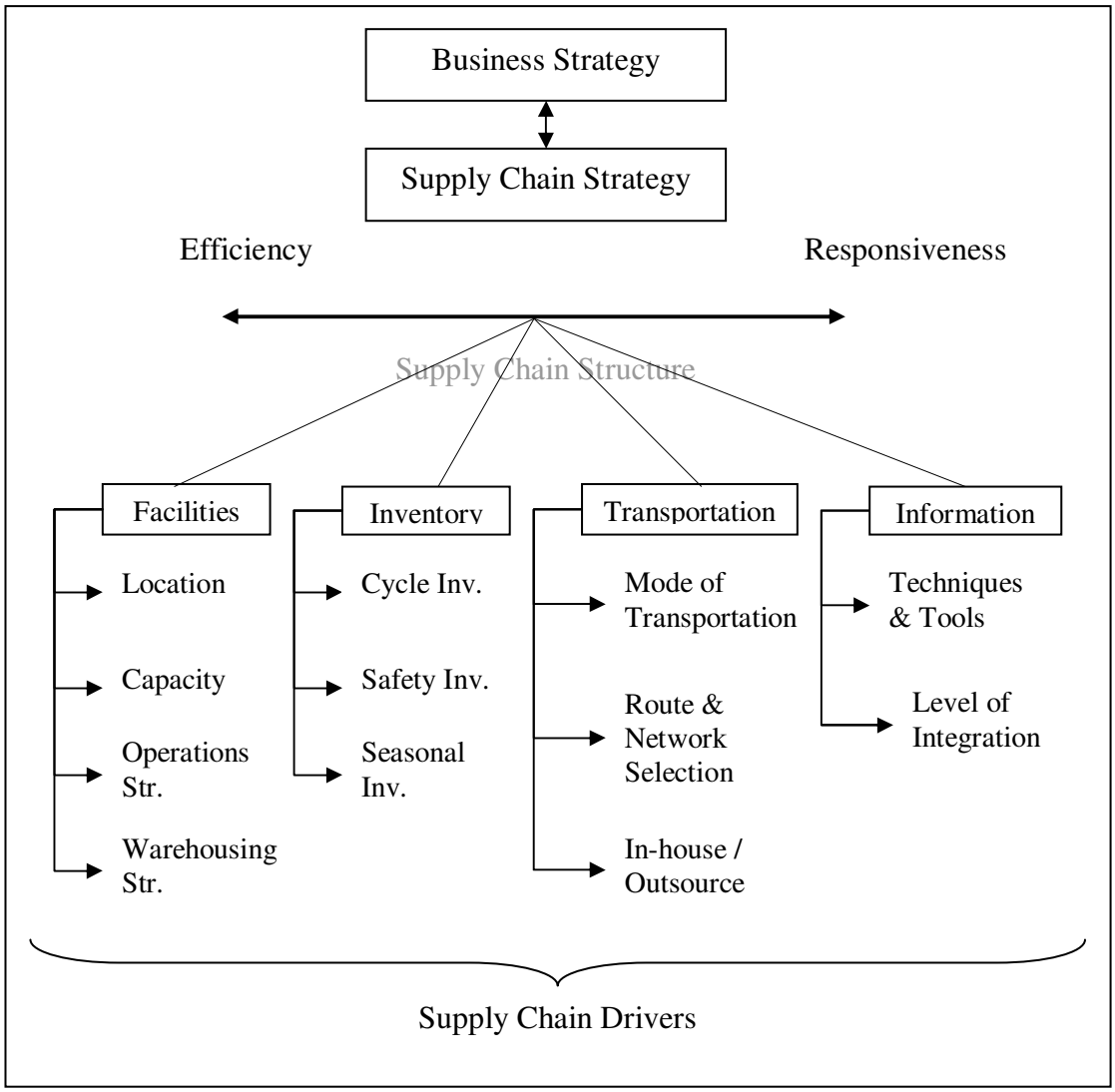

Figure 2.3 : Supply chain structure and its value drivers.

Transportation is moving inventory from one point to another in a supply chain. It is carried out depending on the combinations of transportation modes and the routes.

Information driver refers to the data and analysis regarding inventory, transportation, facilities throughout the supply chain.

2.5.1 Facilities

Regarding the facilities (infrastructure) decisions, there are three fundamental questions to be addressed. “How many facilities are needed?”, “where should they be located?” and “what types of facilities are required?” Accordingly, there are essential functions formed by facilities decisions (Gattorna and Walters, 1996):

- to create stockholding from which to service the needs of production and customers

- to act as an assurance against production failures
- to absorb the benefits of economic production runs
- to provide buffer stocks to meet fluctuating and uncertain sales demands
- to maximize the benefits of procurements economies
- to provide support for marketing and sales activities

The type of warehouse facility required mostly depends on product characteristics (i.e. special conditions to keep a breakable good), market demand volume and customer service requirements (Gattorna and Walters, 1996). Product characteristics determine storage and handling methods. Rate of sale and sales volumes influence the methods used to process and progress orders. Customer service requirements influence lead time responses which in turn can influence the selection of materials handling equipment.

The basic reasons of warehouse facilities are:

- to reduce transportation costs
- to coordinate supply and demand
- to assist in the production process
- to assist in the marketing process so as to provide customer service

Marketing channels relate to the management of stocks and flows within the physical transfer of products between supplier, distributor and consumer. Intermediaries exist in order that the process of exchange can be made more efficient. Warehousing facilities and the role of intermediary are used as a part of service package.

The design of the warehouse facility reflects the nature of the major service performed. Those services can be classified as: (1) holding, (2) consolidation, (3) break bulk and transhipment, and (4) mixing (Gattorna and Walters, 1996).

Holding can be described as stockholding in the warehouses to balance the imbalances between production and demand. The size of warehouse and its characteristics are determined by the nature of the products, the length of time stock will be held and the characteristics of demand/order patterns.

Consolidation is generally undertaken to consolidate lot sizes to take advantage of transportation rates and to perform sorting activities – i.e. sorting out which is breaking down heterogeneous stocks into separate, homogeneous stocks and accumulation which implies bringing together similar stocks from a number of sources so as to create a larger homogeneous supply.

Breaking bulk refers to breaking large homogeneous lots into smaller, commercial, lot sizes. After creating assortments from large input loads, transhipment activities occur when product is to be redistributed subsequent to a break bulk activity.

Mixing is also a part of the sorting process; assorting. Homogeneous lots are converted into heterogeneous lots in response to customer orders.

The way in which the channel is structured is largely determined by where inventories should best be held in order to deliver to customer service specifications. This required a combination of inventory and warehouse facilities to provide appropriate availability which refers to service levels, fulfil sorting function processes, and compensate channel intermediaries. Thus, the principle of postponement and speculation are developed to explain the process (Pagh and Cooper, 1998). Marketing channels is promoted by postponement of changes in the form and identity of a product to the latest possible point in the marketing process, and inventory location to the latest possible point in time (Yang and Burns, 2003; Van Hoek et al., 1999).

For facilities decisions from a logistics perspective, manufacturing/operations strategy should be considered as well. From a marketing view, also available market-based opportunities should be taken under consideration (Gattorna and Walters, 1996):

- process structure/process life cycle stage (varies depending on lot size and product variety)
- demand characteristics (customer service expectations)
- product characteristics (different handling characteristics)

Likewise, decisions associated with capacity, operations strategy and warehousing methodology are made in consistency with each other, trading off responsiveness versus efficiency.

Table 2.2: Components of facilities' decisions.

Components	Decisions
Location	Centralization versus Decentralization
Capacity	Efficiency, Flexibility
Manufacturing Methodology	Process Focused, Product Focused, Market Focused
Warehousing Methodology	Cross-Docking, SKU storage, Job Lot Storage

2.5.2 Inventory

Supply chain management has a large impact on inventory levels throughout manufacturing and logistics systems. A coordinated effort to maximise inventory flows through the supply chain with inventory-holding points specifically tasked to respond customer service requirements is a widely accepted service objective to achieve (Chopra and Meindl, 2004).

Inventory is traditionally regarded as an unwelcome, but often essential, aspect of manufacturing and supply activity. On the one hand, it serves as a buffer to failures in both external and internal supply systems and facilitates the achievement of effective customer service; however the holding of inventory is costly and inefficient (Webster, 2002).

The strategic choices related to inventory management decisions are (Gattorna and Walters, 1996):

- Who is the materials and component supplier to be?
- Who will hold the inventory, and where?
- How much inventory is required to be held?
- Where or with whom will the customer place orders; directly with the supplier or through an intermediary?
- How will orders be delivered, directly to the customer by an intermediary, or by a dedicated service company?

There are three basic reasons for keeping an inventory:

Time - The time delays present in the supply chain, from supplier to user at every stage, requires maintaining a certain amount of inventory to use in this "lead time"

Unpredictability - Inventories are maintained as buffers to meet uncertainties in demand, supply and movements of goods.

Economies of scale - Ideal condition of "one unit at a time at a place where user needs it, when he needs it" principle tends to incur lots of costs in terms of logistics. So bulk buying, movement and storing brings in economies of scale, thus inventory.

Inventory driver encompasses different types of inventory decisions regarding different inventory types; cycle inventory, safety inventory and seasonal inventory.

“Cycle inventory” implies average inventory that builds up in the supply chain because a supply chain stage either produces or purchases in lots that are larger than those demanded by the customer (Chopra and Meindl, 2004). It results from the replenishment process and characterized by predictable demand and replenishment rates (Gattorna and Walters, 1996). In a certain world with a constant demand, no inventory is needed other than this one. Thus, cycle inventory is held primarily to take advantage of economies of scale in the supply chain.

“Safety inventory” refers to the inventory held in case demand exceeds expectations (Chopra and Meindl, 2004). It is held over and above the levels of cycle inventory because of uncertainties that occur in the demand pattern or lead time. Thus, there is a proportion of the average inventory holding at any stockholding point which will be devoted to short-term variations in either demand and/or replenishment lead time (Gattorna and Walters, 1996). This decision is made by comparing the cost of carrying too much inventory and cost of losing sales.

“Seasonal inventory” is the inventory built up to counter predictable variability in demand (Chopra and Meindl, 2004). It involves the accumulation of inventory prior to a season starts and this provides continuity of merchandise and economies of production for producers. It is also held to process seasonally produced items when they are available and to hold inventories for consumption throughout the year. This may also maintain production capacity at more even levels together with maintaining stable levels of employment. It can be so as to take advantage of some quantity discounts if larger than average orders are placed (Gattorna and Walters, 1996). This decision is made by comparing the cost of carrying additional inventory and cost of flexible production.

Excessive inventory within a logistics pipeline will increase the overall working capital requirements of the pipeline and may put a large cost burden on one or more member companies (Christopher et al., 2004; Gattorna and Walters, 1996). If it can be reduced the level of inventory throughout the logistics pipeline, a more effective operation will be occurred.

In case it is needed to increase the customer service level, there are three solutions to try. Firstly, to identify the inventory items for which high levels of availability is necessary due to the nature of customer demand requirements and/or to the extent of competition within the industry for which availability may be seen as an element of competitive advantage. Another solution is to use rapid transportation as a substitute. Another is to examine rates of sale and demand patterns of inventory items and to stock high volume, short lead-time items close to those customers most likely to require high levels of availability.

The inventory type mix will vary among different businesses. Commodity and fashion items will have a different inventory mix due to the fact that they have different demand patterns.

Table 2.3: Components of inventory's decisions.

Components	**Decisions**
Cycle Inventory	Depends on lot size (quantity that a supply chain stage either produces or orders at a given time)
Safety Inventory	Cost of carrying too much inventory versus cost of losing sales
Seasonal Inventory	Cost of carrying additional inventory versus cost of flexible production

Constant predictable demand which is easily managed can be described as inventory with "base flow" characteristics. Seasonal demand products, which may be relatively easy to predict but which reflect high levels of demand in specific periods, are described as wave flow product characteristics. Seasonal fashion wear can be given as an example. "Surge flow" products are those with highly unpredictable levels of demand and they are special products for which there is often no repeat purchasing. However, a standard product which is suddenly required takes on surge characteristics as well.

Base flow inventory is likely to be cycle inventory, whilst wave flow inventory aligns with seasonal inventory, and surge flow has common points with safety stock and in some cases with seasonal inventory (e.g. postponement).

The inventory should be classified in such a way that reflects patterns of customer demand in market. These patterns of demand are usually accompanied by different levels of margins reflecting the risk involved in the stockholding. Low risk profile business represents commodity-like products and high risk profile business refers to fashion and innovative products.

As a result of unpredictable and volatile demand, responsiveness at supply is very much related to inventory policies. As much as inventory influences the responsiveness, it is the source of the high costs generated as well.

More inventory causes greater responsiveness but greater cost as well. On the contrary, fewer inventories lead to lower cost but lower responsiveness. Depending on the competitive priorities determined through customer desire, overall trade-off between responsiveness and efficiency the inventory policies shall be determined. The demand characteristics of the target customer group play a very important role.

2.5.3 Transportation

Transportation implies the moves of the product between stages in the supply chain. There are three factors to be considered related to transportation: operational factors, transport mode and channel strategy (Gattorna and Walters, 1996).

Operational factors include customer characteristics, environmental issues, product characteristics, company characteristics and philosophy. Transport mode is influenced by load size, density, value, competitive necessity, cost structures. Channel strategy considerations include the identification of available channels and the interfaces within each channel.

In order to make an appropriate transport selection decision, it is necessary to consider about the interface areas with other elements of the logistics system since transportation with facilities create time utility value in the supply chain. Additionally, transportation creates place utility value by delivering product to locations that are convenient to customers (Gattorna and Walters, 1996).

The time and place utilities created by transportation are an important aspect of customer satisfaction, as well as are important aspects of the overall marketing offer. Through the trade-off analysis, the appropriate or relevant involvement of transportation can be decided. However, to do so requires an understanding of the scope of the transportation/logistics/marketing interface. According to Gattorna and Walters (1996), there are a number of interface areas, and therefore decisions shared by transportation which should be explored by first identifying the areas of flexibility and inflexibility of the decisions but most importantly, that of the customer service objectives.

The decisions influenced by transportation considerations are:

- Customer communications
- Market coverage (level of flexibility, reliability and availability, and product characteristics)
- Sourcing decisions
- Processing/manufacturing
- Pricing decisions
- Customer service decisions

Mode of transportation can be air, truck, rail, ship, pipeline, electronic transportation. Each mode varies in cost, speed, size of shipment, and flexibility. Hence, according to the primary emphasis in business strategy, they are selected and/or combined. Depending on the acceptable response time within the market, the mode of transportation selection is made. A comparison between the expenses of transportation modes and the cost of obsolesce and stock-out should be done. Accordingly, an optimum decision should be made.

Route and network selection is also very much related to the responsiveness versus efficiency selection. Route refers to the path along which a product is shipped and network is the collection of locations and routes.

In-house versus outsource decision affects the responsiveness as well. As largely discussed in the literature, “either out-sourcing or in-house manufacturing” is an important decision to make for firms. An ideal supply chain shall capture the advantages of “make” and “buy” operations and avoid the risks of each as well.

For instance, long-term supplier relations are developed to provide stability, but such links are often severed when needs change. Predictability is desired, but not at the expense of creating inflexibility that prevents the ability to react to customer changes (Ketchen and Giunipero, 2004).

In conclusion, transportation affects the level of responsiveness and efficiency of the supply chain as well as the other drivers do. For example, faster transportation allows greater responsiveness but lower efficiency within the supply chain. Inventory and transportation can be considered together in order to determine the right balance for the purpose of satisfying the customer needs (Chopra and Meindl, 2004).

2.5.4 Information

The origins and the continuous development of the SCM concept are directly dependent on the capabilities of today's information and communication technologies (ICT). The integration of channel strategies and operations, communication technologies providing connectivity between companies, planning systems that facilitate inventory management integration across the supply channel pipeline and so on would be impossible without effective ICT systems. SCM provides such a critical management and operational approach for competitive advantage because it is inherently intertwined with the networking power to be found in today's computerized information and communication systems (Ross, 1998).

Relevant information available throughout the supply chain allows managers to make decisions that take into account all stages of the supply chain (Chopra and Meindl, 2004). It allows performance to be optimized for the entire supply chain, not just for one stage – leads to higher performance for each individual firm in the supply chain.

Information leads a supply chain to become more efficient and more responsive at the same time; it reduces the need for a trade-off. Hence, information technology is very important for supply chains and it is vital to find out which information is most valuable for the chain's value.

At the core of the concept of SCM stand two critical dimensions of information management. The first is “integration”, which refers to the existence of a technical infrastructure that links computer systems and people, linking the business functions together. It includes connecting processes together (connectivity) and bringing information from one system to another as its input (interfacing). The second dimension is “networking” which implies the activation of integrated links by enabling and empowering the cutting across functional and company barriers so as to solve a wide range of competitive problems (Ross, 1998). Integration and networking are complementary activities.

The literature widely explored the different mechanisms that are put in place by firms to achieve integration between customers and suppliers. In particular, two different areas of customer–supplier integration have been defined: operational integration and technological integration (Cagliano et al., 2004).

The first area refers to the integration of operational activities such as planning, production, delivery and quality. The wide set of techniques that can be traced back to the Just-in-Time approach are aimed at obtaining operational integration between customers and suppliers (Harland, 1996; Kim, 2007). Similarly, new techniques and methodologies have been proposed recently, which put more emphasis on information sharing or joint decision-making, rather than on the redesign of internal operations. Examples of these techniques are vendor-managed inventory (VMI) or collaborative planning and forecasting. In this direction, the development of information and communication technology (ICT), and especially the Internet, is expected to play a very important role in supporting supply chain integration (Lee, 2002).

Technological integration, instead, refers to collaboration in designing and developing new products. Co-design, early supplier involvement and rapid prototyping are just some examples of techniques used for this purpose. In the concept of operational integration, there are two distinctive elements to recognise. Some practices are aimed at integrating the forward physical flows, while other practices are more oriented towards the coordination and integration of backward information and data flows from customers to suppliers (Cagliano et al., 2004). These two ways of integrating supply chain processes are different in nature.

The first type of integration requires a closer coupling of the production systems between the customer and the supplier, and even the co-location of plants (Lee, 2002). As a consequence, often the integration of physical flows is closely related to purchasing practices.

The second type of integration mechanisms is instead aimed at leveraging on information from the counterpart to improve internal activities and operations management. Cagliano et al. (2004) point out that despite the interest devoted by the literature to operational integration techniques, there is a lack of studies that try to understand how these techniques are put together and are coupled with other supply management choices in a coherent strategy.

Additionally, collaborative relationships could give companies many opportunities for functional command and control (Ayers, 1999). It is certain that throughout the supply chain, working together and strengthening partnerships would be more beneficial for all partners. Moreover information management throughout supply chain could lead a better communication and collaboration between the partners. By exchanging of information between supply chain partners and operating as an extended enterprise, the way of measurement and management of pricing and costs would be different. According to Fisher (1997), for example, a cooperative model allows manufacturers and retailers to cooperate in order to cut costs throughout the system. Too often costs in the chain are assumed to be fixed, and the manufacturer and the retailer compete through price negotiations for a bigger share of the fixed profit pie. However by liaising with each other, it is possible to increase the size of the pie.

2.6 Strategic Management and SCM

Instead of considering individual operations or departments separately, companies can improve their competitive strategies by thinking in terms of supply chains. Supply chain thinking brings change to the tasks managers perform in dealing with issues include products, markets, people and skills, operations, and finance. Thus, this leads to more competitive strategies and supply chain thinking should be brought to the task of strategic planning.

Ayers (1999) points out that although strategic planning seems to go on mostly in operational fields, gaining advantage from supply chains requires cross-functional thinking that is uncommon in most companies. Today's success stories show that innovation in supply chain design is vital to competitive advantage and it is necessary that companies should devise their supply chains for strategic advantage.

Multidisciplinary approach has been given to supply chain management since supply chains involve many functional areas of an organization (Ketchen and Giunipero, 2004). However an aspect of strategic management upon SCM has not been encountered frequently. The authors claim that strategic management can contribute SCM.

For competitive advantage, the most important assets are strategic resources that are rare, valuable, and difficult to purchase or imitate. In order to maximize the chances of good performance, a firm needs to occupy a proper strategy according to its positioning within an industry. That strategy shall provide the firm consistency, in other words, a fit between its whole activities. According to Porter (1980), apart from the positioning of a firm within an industry, its position within a group of firms pursuing a common strategy is also considerable. Strategic management may contribute SCM at this point by asking its main question: "why some firms outperform others?".

3. STRATEGY AND COMPETITIVENESS

In order to achieve productivity, quality and speed, many management tools and techniques were brought front. According to Porter (1996) they have taken the place of strategy; hence many companies have not been able to translate the remarkable gains of operational improvement into sustainable profitability. Fisher (1997) and Mason-Jones et al. (2000) explain this situation as a result of a failure in matching demand with supply. Consequently, supply chain performances are not satisfying enough without a particular strategy depending on characteristics of marketplace and customer needs. Achieving the superior performance is the primary goal of any company. In order to match supply and demand and succeed a high performance, both operational effectiveness and strategy are needed.

3.1 Operational Effectiveness

"Operational effectiveness" (OE) refers to perform similar activities better than rivals do. For instance, reducing defects in products or developing better products faster. In contrast, "strategic positioning" refers to perform different activities from rivals' or to perform similar activities in different ways.

When a company manages to improve its operational effectiveness, it can often improve on many dimensions of performance at the same time. For example, it is possible to achieve lower cost levels and to improve differentiation simultaneously. Though, this may require capital investment, different personnel, or simply new ways of managing (Porter, 1996). Companies which can get more out of their inputs than their rivals usually employ more advanced technology, eliminate wasted effort, motivate employees better, or have greater insight into managing particular activities or sets of activities.

It is certain that constant improvement in operational effectiveness is necessary for companies in order to achieve superior profitability. However, it can not be claimed that it is sufficient. Few companies have competed successfully on the basis of operational effectiveness only over a period, and staying ahead of rivals gets harder every day. The most obvious reason for that is the rapid diffusion of best practices. Rivals can quickly imitate management techniques, new technologies, input improvements, and superior ways of meeting customers' needs (Fisher, 1997; Ayers, 1999). Consultancy support also accelerates imitation and homogeneity among companies.

Furthermore, improved operational effectiveness causes competitive resemblance between companies. For instance; benchmarking, which is a recently popular management tool, leads enterprises to look alike. Besides, outsourcing activities to third parties, usually the same ones, gives rise to those activities become more generic. As rivals imitate one another's improvements in quality, cycle times, or supplier partnerships, strategies converge and competition becomes a series of races that no one can win (Porter, 1996). All those consequences trigger some mergers driven by performance pressure, and some companies decide to purchase its rivals. However, too often this decision lacks strategic vision and it is not a real advantage in the end.

The best practices of productivity are also improving over time as new technologies and management approaches are developed and as new inputs become available (Fisher, 1997). Similarly, lean production, which involves a group of activities, has let remarkable improvements in manufacturing productivity and asset utilization (Porter, 1996). Operational effectiveness competition pushes the best practices of productivity up, in other words raising the bar for everyone. But although such competition produces absolute improvement in operational effectiveness, it leads to relative improvement for no one since the best practices in market are also improving and profits stay low. As long as managers allow operational effectiveness take the place of strategy, the competition will not be improving for any, prices will be static or even declining, and pressures on costs will force companies to do sacrifices their ability to invest in the business for long term.

In conclusion, operational effectiveness is the improved performance of operational processes through best practices, benchmarking, and continuous improvement and it is not a strategy because it alone does not yield sustainable competitiveness. With a supply chain strategy, the objective is, therefore, to create sustainable competitive advantages and to position the firm opposite the competition. This means deliberately designing SCM activities in order to offer unique value, by weighing up the various positioning options with regard to SCM objectives (trade-offs) (Schnetzler et al., 2007). Thus, it is vital to perform different activities within the SC from what rivals do or to perform similar activities in a different way through strategic positioning.

3.2 Strategic Positioning

Mostly "strategic positioning" is described in terms of customers. But the essence of strategy is in the activities; choosing to perform activities differently or to perform different activities than competitors. Otherwise, a strategy can not be more than a marketing slogan that will not stand against competition.

Porter (1996) describes strategy as the creation of a unique and valuable position, involving a different set of activities. The author emphasizes that "one does not fit all" and there is no "one ideal position". Otherwise, there would not be any need for strategy and performance would be depending highly on operational effectiveness. Too often companies try to be all things to all people and fail to choose how one will compete means there is no strategy (Ayers, 1999). Additionally, trying to satisfy everyone will lead not to satisfy anyone at all. It is not possible to produce all varieties, meet all needs and access all customers by using the same set of activities. Thus, companies should discover and be the first to meet the needs of their customers.

Positioning choices determine not only which activities a company will perform and how it will configure individual activities but also how activities relate to one another. While operational effectiveness is about achieving excellence in individual activities, or functions, strategy is about combining activities (Porter, 1996).

Ryanair Airline Company, for example, offers short-haul, low-cost, point-to-point service between 516 routes across 26 countries from 26 bases. The company was established in 1985 and 6 years later it started to follow the “low fares/no frills” model being used by Southwest - an American airline company.

Its costumers are generally infrequent travellers paying from their own pockets, mainly leisure travellers but increasingly cost-minimizing business travellers. Ryanair targets a distinctive strategic segment and a distinctive value network is required for this.

Its flights are scheduled into regional airports, which offer lower landing and handling charges than larger established international airports. This approach provides mutual benefit for both sides because secondary airports become more running and the airline company can operate with minimum airport costs and taxes.

The key factor of offering low-cost service is to implement quick turn-around times for aircraft, "no frills", and no business class, as well as operating a single model of aircraft. Ryanair operates only Boeing 737-800 series aircraft and its maintenance crew is specialized on this type. Hence, repairing and maintenance operations can be coped with very effectively. Ryanair does not offer meals, assigned seats, baggage checking, or premium classes of service. The airline operates only with direct sales by online booking since 2000. This leads to exclude the costs imposed by travel agents. Due to the fact that the company does not have any office operating for sales and tickets to press, sales crew and paper expenses are eliminated. Hence, it offers lower cost flights to its customers. Additionally, the customers are able to reach the service information such as flight time, duration and prices online. Ryanair has occupied a unique and valuable strategic position based on a tailored set of activities.

Ryanair’s core competence is how it combines its activities and how its value chain shows consistency. The company’s strategy includes a whole system of activities which fit and reinforce one another. Hence, this generates its competitive advantage. By creating a chain that is as strong as its strongest link, it prevents imitators from copying its activities.

Having a good strategy contributes Ryanair to create a real economic value due to the fact that its activities complement each other. One activity's cost lowered because of the way other activities performed and one activity's value to customers can be enriched by other activities. Consequently, strategic fit creates competitive advantage and superior profitability. By having a particular value chain strategy, which also implies supply chain strategy, it can be possible to deliver a unique value to the end customer and prosper in marketplace.

3.3 Competitive Advantage

Supply Chain Management concept has been an important field for companies' performance and competitiveness. With today's technology and accumulated knowledge, companies endeavour to improve their supply chain performance. Flexibility to respond rapidly to competitive and market changes, benchmarking continuously to achieve best practices, outsourcing to gain efficiencies, strengthening a few core competencies in order to leave the rivals behind have become a must for companies. Thus, establishing a sustainable competitive advantage over rivals is the key to succeed in the market, as well as to survive.

"Competitive advantage" is a position a firm occupies against its competitors. When a firm sustains profits that exceed the average for its industry, the firm is said to possess a competitive advantage over its rivals. The goal of much of business strategy is to achieve a sustainable competitive advantage.

The two forms of competitive advantage are cost advantage and differentiation advantage. "Cost advantage" occurs when a firm delivers the same services as its competitors but at a lower cost. "Differentiation advantage" occurs when a firm delivers greater services for the same price of its competitors. They are collectively known as positional advantages because they denote the firm's position in its industry as a leader in either superior services or cost.

Many forms of competitive advantage cannot be sustained indefinitely because the competitors duplicate the competitive advantage held by any one firm (Fisher, 1997). A firm possesses a "sustainable competitive advantage" when its value-creating processes and position have not been able to be duplicated or imitated by other firms (Porter, 1996).

A resource-based view emphasizes that a firm utilizes its resources and capabilities to create a competitive advantage that ultimately results in superior value creation. Figure 3.1 combines the resource-based and positioning views to illustrate the concept of competitive advantage.

The firm's resources and capabilities together form its distinctive competencies. “Competencies” (or core capabilities) are the skills that differentiate the manufacturing or service from its competitions (Chase et al., 2001). These enable innovation, efficiency, quality, and customer responsiveness, all of which can be leveraged to create a cost advantage or a differentiation advantage. In the end, it leads the value creation with respect to the firm’s customers’ desires.

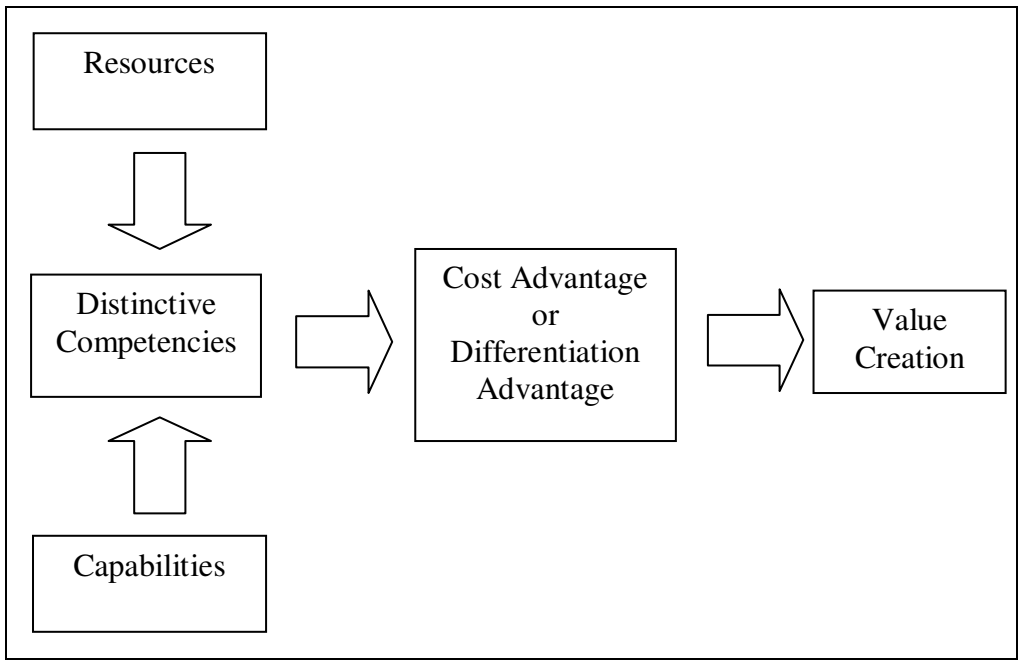

Figure 3.1: A model of competitive advantage.

Outsourcing a significant portion of production work causes dependency on the supplier base. This results in loss of control over key capabilities which can affect a company’s ability to introduce changes in response to shifts in the marketplace or simply in serving customers. Hence, it becomes vital to find ways to manage “extended enterprise” to build collaborative relationships and improve the flow of both materials and information throughout the value creating pipeline.

Today, competitive advantage belongs to those supply channels that can activate concurrent business processes and core competencies that merge infrastructures, share risk and costs, leverage the shortness of today's product life cycles, and reduce time to market, and that gain and anticipate new perspectives for competitive leadership (Ross, 1998).

According to Chase et al. (2001) shaping a strategy reflects the reality of the downstream marketplace often leads to new approaches to upstream supplier management. Therefore, within the supply chain, both downstream and upstream parts shall be supporting the same competitive advantage emphasis. The value chain which consists of the activities within and around an organization shall be performed to manage the linkages between these activities as a source of competitive advantage.

3.3.1 Value creation

"Value creation" occurs each time products pass through all activities of the chain in order and at each activity the product gains some value. The chain of activities gives the products more added value than the sum of added values of all activities. It is important not to mix the concept of the value chain with the costs occurring throughout the activities. A diamond cutter can be used as an example of the difference. The cutting activity may have a low cost, but the activity adds much of the value of the end product, since a rough diamond is significantly less valuable than a cut diamond. In addition to the firm's own value-creating activities, the firm operates in a value system of vertical activities including those of upstream suppliers and downstream channel members.

The idea of the value chain is based on the process view of organisations, the idea of seeing a manufacturing (or service) organisation as a system, made up of subsystems each with inputs, transformation processes and outputs. Inputs, transformation processes and outputs involve the acquisition and consumption of resources -- i.e. money, labour, materials, equipment, buildings, land, administration and management (Chase et al., 2001).

Similarly in a supply chain, suppliers provide inputs, manufacturing or service support operations that transform the inputs into products and services, the distribution and local service providers localize the products which can involve just the delivery of the product or some more involved process that tailors the product or service to the needs of the local market.

Michael Porter (1985) has proposed the “value chain analysis” which is a well known strategic concept with the aim of assisting companies to achieve a sustainable competitive advantage by optimising those aspects of the value chain that have greatest impact in the market.

Value chain analysis describes the activities within and around an organization, and relates them to an analysis of the competitive strength of the organization. Therefore, it evaluates which value each particular activity adds to the organizations products or services. Only if these things are arranged into systems and systematic activates it will become possible to produce something for which customers are willing to pay a price. Porter argues that the ability to perform particular activities and to manage the linkages between these activities is a source of competitive advantage.

The value chain categorizes the generic value-adding activities of an organization, as figure 3.2 demonstrates it. Porter distinguishes between primary activities and support activities. Primary activities are directly concerned with the creation or delivery of a product or service. They can be grouped into five main areas: inbound logistics, operations, outbound logistics, marketing and sales, and service. Each of these primary activities is linked to support activities which help to improve their effectiveness or efficiency. There are four main areas of support activities: procurement, technology development (including R&D), human resource management, and infrastructure (systems for planning, finance, quality, information management etc.).

The aim of such analysis is to establish whether further costs can be saved with a view to the company achieving the status of 'lowest cost supplier', or whether it can work towards a unique offer which can command a premium within the market.

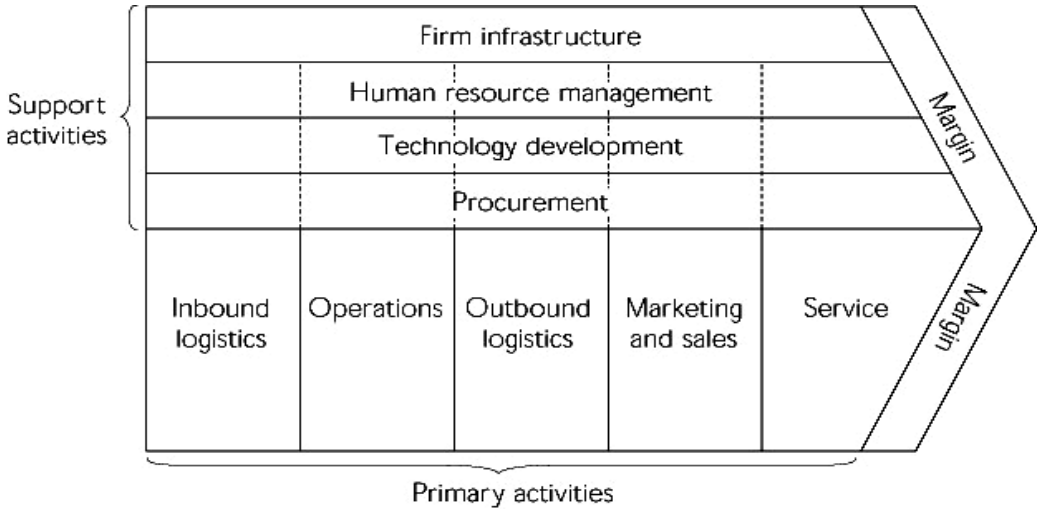

Figure 3.2: The value chain.

Within the whole value system, there is only a certain value of profit margin available. This is the difference of the final price the customer pays and the sum of all costs incurred with the production and delivery of the product/service (e.g. raw material, energy etc.). It depends on the structure of the value system, how this margin spreads across the suppliers, producers, distributors, customers, and other elements of the value system. Each member of the system will use its market position and negotiating power to get a higher proportion of this margin. Nevertheless, members of a value system can cooperate to improve their efficiency and to reduce their costs in order to achieve a higher total margin to the benefit of all of them.

No longer is SCM regarded as a cost driver, but rather as a value driver for high customer satisfaction and high business success. Consistently gearing all activities in SCM towards value creation is still at an early stage (Schnetzler et al., 2007). However, some concepts have been developed. Chopra and Meindl (2001), for instance, identified value drivers that impact the responsiveness and efficiency of a supply chain: inventory, transportation, facilities (infrastructure), and information.

To achieve a competitive advantage, a firm must perform one or more value-creating activities in a way that creates more overall value than competitors do. Superior value is created through lower costs or superior benefits to the consumer through differentiation and/or focusing.

3.3.2 Cost advantage and differentiation advantage

Competitive advantage is created by using resources and capabilities to achieve either a lower cost structure or a differentiated product. A firm positions itself in its industry through its choice of low cost or differentiation. This decision is a central component of the firm's competitive strategy.

Cost or price differences come from many activities operated to produce, sell and deliver the products or services. While performing activities, “cost” emerges inherently. On the other hand, “cost advantage” can be achieved by performing particular activities more efficiently than competitors. Similarly, “differentiation” arises from both the choice of activities and how they are performed. When companies stress effectiveness rather than efficiency, they are not necessarily trying to reduce costs, but rather to create the highest value for the customer which is not always the lowest cost approach (Chase et al., 2001).

In order to achieve sustainable competitive advantage over rivals, it is vital for companies to deliver a set of supporting activities which are compatible with the competitive advantage. This can be generated only by adopting a competitive (business) strategy shaped by the competitive advantage. For a better demonstration, Porter (1996) has introduced a diagram called activity-system map that shows how a company’s strategy is delivered through a set of supporting activities.

3.4 Business Strategy

Chopra and Meindl (2004) specify that “business strategy” defines the set of customer needs a firm seeks to satisfy through its products and services. Porter (1996) describes business strategy as about being different which means deliberately choosing a different set of activities to deliver a unique mix of value. So it is possible to describe competitive strategy as choosing a different set of activities to deliver a unique mix of value in order to satisfy our particular customers’ needs.

Moreover Porter (1996) underlines that outperforming competitors is possible if only a company can differentiate and more importantly sustain it. Differentiation can be accomplished simply in three ways:

- delivering greater value to customers
- creating comparable value at a lower cost
- doing both

Delivering greater value lets a company to charge higher average unit prices; greater efficiency results in lower average unit costs. In both cases, there is a competitive advantage which can be exploited by the firm.

In accordance with this aspect, Porter (1985) has described a category scheme consisting of three general types of strategies that are commonly used by businesses to achieve and maintain competitive advantage. These three generic strategies are defined along two dimensions: strategic scope and strategic strength. “Strategic scope” is a demand-side dimension and looks at the size and composition of the market it is intended to target. “Strategic strength” is a supply-side dimension and looks at the strength or core competency of the firm. In particular he identified two competencies as the most important: product differentiation and product cost.

Figure 3.3 demonstrates the three best strategies of Porter; cost leadership, differentiation, and market segmentation (or focus). Market segmentation is narrow in scope while both cost leadership and differentiation are relatively broad in market scope.

According to Porter (1985), notion underlying the concept of generic strategies is that competitive advantage is at the heart of any strategy, and achieving competitive advantage requires a firm to make a choice about the type of competitive advantage it seeks to attain and the scope within which it will attain it.

	Differentiated Position	Low Cost Position
Broad Scope (Industry-wide)	DIFFERENTIATION	OVERALL COST LEADERSHIP
Narrow Scope	FOCUS (Market Segmentation)	

Figure 3.3: The generic business strategies.

“Strategic strength” can be mentioned as "market differentiation" which depicts the perceived requirement of the firm to distinguish itself from competitors by attributes of its products and services (Frohlich and Dixon, 2001). For market differentiation, there is a relative importance given to product performance, conformance quality and after-sales service (Miller and Roth, 1994).

“Strategic scope” can be defined as “market scope” which reflects the magnitude of the customer base served by the business unit (Frohlich and Dixon, 2001). Broad distribution and volume flexibility are positively correlated with it while design flexibility is negatively associated (Miller and Roth, 1994).

Accordingly, firms must decide whether to stress cost or differentiation. The chances of achieving cost leadership while maintaining a highly differentiated offering at the same time are remote. Further, firms must decide whether to pursue competitive advantage across a broad range of industry segments or to focus on a narrow segment. A focused strategy exploits either low cost or differentiation within a specific industry segment or target customer group (Bowersox and Daugherty, 1995).

3.4.1 The cost leadership strategy

This generic strategy calls for being the low cost producer in an industry for a given level of quality. A firm following this strategy hopes to take advantage of economies of scale and experience curve effects by producing high volumes of standardized products and sells them either at average industry prices to earn a profit higher than rivals, or below the average industry prices to gain market share.

The sources of cost advantage vary with industry but may include;

- No-frills product/service,
- Product design,
- Favourable access to raw material,
- Location advantage,
- Production process innovation,
- Automation,
- Proprietary technology.

When a firm designs, produces and markets a product more efficiently than competitors such firm has implemented a cost leadership strategy and maintaining it requires a continuous search for cost reductions in all aspects of the business. Attempts to reduce costs will spread through the whole business process from manufacturing to the final stage of selling the product. Any processes that do not contribute towards minimization of cost base should be outsourced to other organisations with the view of maintaining a low cost base. One of the examples as a low-cost airline is EasyJet.

To be successful, this strategy usually requires a considerable market share advantage or access to raw materials, components, labour, or some other important input advantage over competitors (Porter, 1985). Without one or more of these advantages, the strategy can easily be imitated by competitors.

Successful implementation also benefits from:

- process engineering skills,
- products designed for ease of manufacture,
- sustained access to inexpensive capital,
- close supervision of labour,
- tight cost control,
- incentives based on quantitative targets,
- always ensure that the costs are kept at the minimum possible level.

New entrants or firms with a smaller market share may not benefit from such strategy since mass production, mass distribution and economies of scale will not make an impact on such firms. Low cost leadership becomes a viable strategy only for larger firms.

Further in consideration of factors mentioned above that facilitate a firm in maintaining a low cost base; some factors such as technology which may be developed through innovation and some may even be resources developed by a firm such as long term healthy relationships build with distributors to maintain cost effective distribution channels or supply chains.

Similarly economies of scale may be an ultimate result of a commitment made by a firm such as capital investments for expansions. Also raising barriers for competition by virtue of the low cost base that enables the low prices will result in strong strategic positioning in the market.

However, low cost leadership is attached to a disadvantage: less customer loyalty. Relatively low prices will result in creating a negative attitude towards the quality of the product in the mindset of the customers. Customer's impression regarding such products will enhance the tendency to shift towards a product which might be higher in price but projects an image of quality. Considering analytical in depth view regarding the low cost strategy, it reflects capability to generate a competitive advantage but development and maintenance of a low cost base becomes a vital.

Another disadvantage of this strategy is the possibility of other firms being able to lower their costs as well. As technology improves, the competition may be able to improve the production capabilities, thus eliminating the competitive advantage. Additionally, several firms following a focus strategy and targeting various narrow markets may be able to achieve an even lower cost within their segments and as a group gain significant market share.

Sustainability of the competitive advantage reached through low cost strategy will depend on the ability of a competitor to match or develop a lower cost base than the existing cost leader in the market.

3.4.2 Differentiation strategy

Differentiation is aimed at the broad market that involves the creation of a product or services that is perceived throughout its industry as unique. The company or business unit may then charge a premium price for its product (Lamming et al., 2000). This specialty can be associated with design, brand image, technology, features, dealers, network, or customer service.

Briefly, potential forms of differentiation are;

- Product range variety,
- Unique product features,
- Product reliability,

- Distribution channels,
- Flexible response,
- Additional services,
- Technical service,
- Brand name,
- Delivery time.

Differentiation is a viable strategy for earning above average returns in a specific business because the resulting brand loyalty lowers customers' sensitivity to price. Increased costs can usually be passed on to the buyers. Buyer loyalty can also serve as an entry barrier. New firms must develop their own distinctive competence to differentiate their products in some way in order to compete successfully. Examples of the successful use of a differentiation strategy are Nike athletic shoes, Apple Computer, and Mercedes-Benz automobiles.

A differentiation strategy is more likely to generate higher profits than a low cost strategy because differentiation creates a better entry barrier. A low-cost strategy is more likely, however, to generate increases in market share (Porter, 1985).

The risks associated with a differentiation strategy include imitation by competitors and changes in customer tastes. Additionally, various firms pursuing focus strategies may be able to achieve even greater differentiation in their market segments.

3.4.3 Focus strategy

The focus strategy concentrates on a narrow segment and within that segment attempts to achieve either a cost advantage or differentiation. The premise is that the needs of the group can be better serviced by focusing entirely on it. A firm using a focus strategy often enjoys a high degree of customer loyalty, and this strong loyalty discourages other firms from competing directly (Porter, 1985).

With this strategy, it is needed to be selected;

- segment,
- geographical area,
- product line.

It is similar to “niche strategy” in marketing and because of its narrow market focus; firms pursuing a focus strategy have lower volumes and therefore less bargaining power with their suppliers. However, firms pursuing a differentiation-focused strategy may be able to pass higher costs on to customers since close substitute products do not exist.

Firms that succeed in a focus strategy are able to tailor a broad range of product development strengths to a relatively narrow market segment that they know very well.

Some risks of focus strategies include imitation and changes in the target segments. Furthermore, it may be fairly easy for a broad-market cost leader to adapt its product in order to compete directly. Finally, other focusers may be able to carve out sub-segments that they can serve even better.

3.4.4 Combinations of generic strategies

These generic strategies are not necessarily compatible with one another. If a firm attempts to achieve an advantage on all fronts, in this attempt it may achieve no advantage at all. For example, if a firm differentiates itself by supplying very high quality products, it risks undermining that quality if it seeks to become a cost leader. Even if the quality did not suffer, the firm would risk projecting a confusing image. For this reason, Porter (1985) has argued that to be successful over the long-term, a firm must select only one of these three generic strategies. Otherwise, with more than one single generic strategy the firm will be "stuck in the middle" and will not achieve a competitive advantage. Porter assumes that unless a firm selects a specific strategic orientation it will end up "stuck in the middle" and almost always experience inferior performance.

An empirical research on the profit impact of marketing strategy (see Buzzell and Gale, 1987 for more details) has indicated that firms with a high market share were often quite profitable, but so were many firms with low market share. The least profitable firms were those with moderate market share. This was sometimes referred to as the hole in the middle problem.

Porter's explanation of this is that firms with high market share were successful because they pursued a cost leadership strategy and firms with low market share were successful because they used market segmentation to focus on a small but profitable market niche. Firms in the middle were less profitable because they did not have a viable generic strategy. With respect to this approach, combining multiple strategies is successful in only one case. It is combining a market segmentation strategy with a product differentiation strategy which is an effective way of matching the firm's product strategy (supply side) to the characteristics of the target market segments (demand side). But combinations like cost leadership with product differentiation are hard to implement due to the potential for conflict between cost minimization and the additional cost of value-added differentiation.

Porter (1985) has pointed out that firms that are able to succeed at multiple strategies often do so by creating separate business units for each strategy. By separating the strategies into different units having different policies and even different cultures, a corporation is less likely to become "stuck in the middle."

3.4.5 Generic strategies and industry forces

These generic strategies each have attributes that can serve to defend against competitive forces. The following table compares some characteristics of the generic strategies in the context of the Porter's five forces (Porter, 1985).

Entry barriers, buyer power, supplier power and threat of substitutes determine the intensity of competition which is important to characterize the competitive situation of a market. Moreover, it is important to determine a business strategy which will be the response of a company against the competitive situation of a market.

Industry Force	Cost Leadership	Differentiation	Focus
Entry Barriers	Ability to cut price in retaliation discourages potential entrants.	Customer loyalty can discourage potential entrants.	Focusing develops core competencies that can act as an entry barrier.
Buyer Power	Ability to offer lower price to powerful buyers.	Large buyers have less power to negotiate because of few close alternatives.	Large buyers have less power to negotiate because of few alternatives.
Supplier Power	Better isolated from powerful suppliers.	Better able to pass on supplier price increases to customers.	Suppliers have power because of low volumes, but a differentiation-focused firm is better able to pass on supplier price increases.
Threat of Substitutes	Can use low price to defend against substitutes.	Customer's become attached to differentiating attributes, reducing threat of substitutes.	Specialized products & core competency protect against substitutes.
Rivalry	Better able to compete on price.	Brand loyalty to keep customers from rivals.	Rivals cannot meet differentiation-focused customer needs.

Figure 3.4: Generic strategies and five forces.

4. ALIGNING SUPPLY CHAIN STRATEGY WITH BUSINESS STRATEGY

Traditional supply chain thinking has been efficiency-oriented which refers to a cost reduction and productivity sort of thinking. On the other hand, value chain thinking represents an effectiveness-oriented approach (Chase et al., 2001). In case, a supply chain could link with business strategy which aims to answer the question: "how should we compete in a given business?" value chain thinking may be achieved.

Furthermore, many companies are achieving significant competitive advantage by the way they configure and manage their supply chain operations (Chase et al., 2001). Thus, supply chain should be structured to meet the needs of different products and customer groups, which requires linking supply chain and operations with business strategy.

Business strategy defines the set of customer needs that a firm seeks to satisfy through its products and services (Chopra and Meindl, 2004). The business strategy is defined based on how the customer prioritizes product cost, delivery time, variety, and quality. It targets one or more customer segments aims to provide product and services that meet these customers' needs.

In order to see the relationship between business and supply chain strategies, it is necessary to consider the value chain of an organization. The value chains starts with new product development, which creates specifications for the product. Marketing and sales generate demand by publicising the customer priorities that the product and service will satisfy. Marketing also brings customer input back to new product development. While using new product specifications, operations transform inputs to outputs so as to create the product. Distribution either takes the product to the customer or brings the customer to the product. Service responds to customer requests during or after sales. All those are core functions that must be performed for a successful sale. Meanwhile, finance, accounting, information, technology, and human resources support and facilitate the functioning of the value chain.

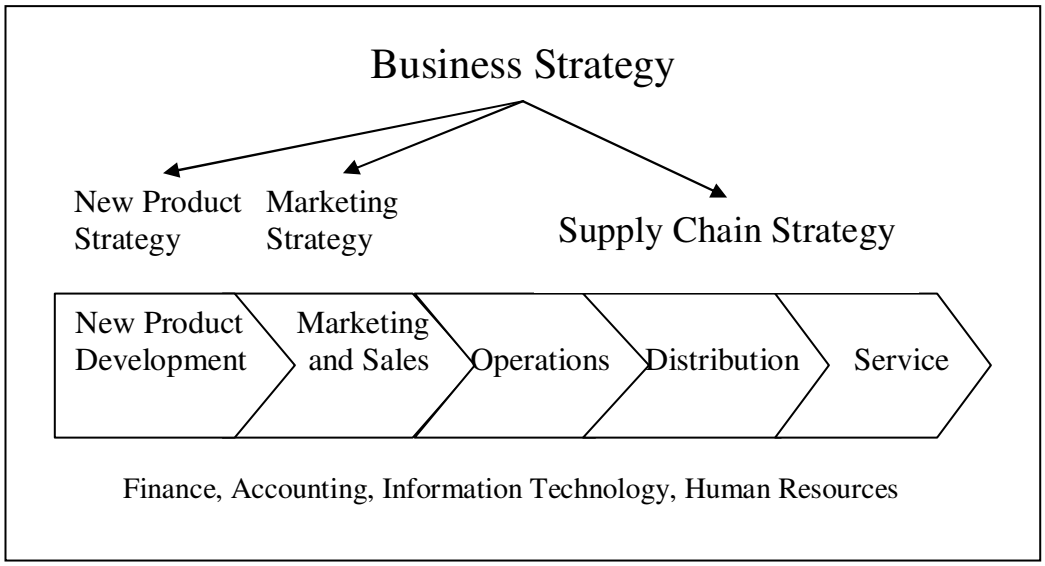

Figure 4.1 : Linking functional strategies with business strategy.

In order to execute a business strategy, all these functions play a role and each must develop its own strategy which refers to what each function will try to do particularly well.

Product development strategy specifies the portfolio of new products that the company will try to develop. Marketing and sales strategy implies how the market will be segmented and product positioned, priced, and promoted. Supply chain strategy determines the nature of material procurement, transportation of materials, manufacture of product or creation of service and distribution of product (Chopra and Meindl, 2004).

Additionally, strategies will also be devised for finance, accounting, information, technology, and human resources which are defined as supporting activities of a value chain by Porter (1985).

Consistency and support between supply chain strategy, business strategy, and other functional strategies, in other words achieving the strategic fit is very vital. Functional objectives should be derived from business (competitive) objectives, and then functional policies should be developed to address these objectives. This requires matching customer priorities with functional capabilities. Thus, for a given business strategy, a company should devise or revise its supply chain strategy.

Strategic fit implies that business strategy and supply chain strategy have the same goal. It means that consistency between customer priorities that the business (competitive) strategy aims to satisfy and the supply chain capabilities that specified by the supply chain strategy.

All the functions in a company's value chain operate together so as to achieve success in the chain. Accordingly, each functional strategy should support other functional strategies – i.e. new product strategy, marketing and sales strategy, operations strategy, supplier strategy, logistics strategy so on, and help a firm to reach its business goal. Besides, the different functions in a company must appropriately structure their processes and resources to be able to execute these strategies successfully (Chopra and Meindl, 2004). A company may fail because of a lack of strategic fit or because its processes and resources do not provide the capabilities to support desired strategic fit. Since processes and resources are structured to support functional goals, a conflict in functional goals leads to conflicts during execution.

A company must understand the customer needs for each targeted segment and the uncertainty the supply chain faces in meeting these needs helping the company define the desired cost and service requirements. On the other side, the supply chain uncertainty helps companies to identify the extent of disruption and the delay the supply chain must be prepared for (Lee, 2002).

There are many types of supply chains and each of them designed to perform different tasks well. A company must understand what its supply chain is designed to do well. In case there is a mismatch between what the supply chain does particularly well and the desired customer needs, the company will either need to restructure the supply chain to support the business strategy or change its strategy.

4.1 Supply Chain Strategy

Supply Chain Management concept has been an important field regarding companies' performance and competitiveness. With today's technology and accumulated knowledge, companies endeavour to improve their supply chain performance. Whilst point-of-sale scanners let companies to hear customer's voice, electronic data interchange (EDI) helps companies and all supply chain partners to satisfy customers according to their needs and wants. Fisher (2007) points out that usage of flexible manufacturing, automated warehousing and rapid logistics lead companies to be more responsive to customer demands. New concepts such as efficient consumer response, accurate response, mass customization, and agile manufacturing offer models for applying the new technology to improve performance.

Nevertheless, the performance of many supply chains is not satisfying enough. In many cases, the costs of supply chain have risen to very high levels. Fisher (1997) explains this as a result of adversarial relations between supply chain partners and some dysfunctional industrial practices such as price promotions. There is a fact that many supply chains struggle with a shortage or an excess of goods. This situation is basically caused due to an inability to predict demand in today's changing competition conditions.

Some companies are choosing to rely on price promotions, for instance, in order to cope with the mismatch between supply and demand. However, this can be seen only as a temporary solution for such a problem and in long term it might cause many negative effects on companies. While companies are aiming to clear unwanted products through this action, many customers might leave the stores empty-handed because the specific products they want to buy are out of stock.

Intangible assets of companies should be taken under consideration such as "brand equity" and "company image" in costumers' minds. In order to cope with supply chain problems, companies should devise or revise the right supply chain for their products and supply chain decisions should be taken according to the particular situation for each company depending on some criteria.

While supply chain solutions are determined, the characteristics and the positioning of the product in the market should not be ignored, as well as the maturity and competitiveness of the market being operated.

In a competitive situation where market uncertainty and competitive intensity are high the valuable assets would be; creativity, innovation and flexibility within the chain. On the other hand, where market uncertainty and competitive intensity are low, then accuracy and efficiency, productivity, control systems would be appropriate characteristics (Gattorna and Walters, 1996).

Companies should determine strategies for each particular situation in order to achieve sustainable profitability and cope with supply chain problems effectively. Thus, today's one of the most important questions of supply chain concept is to choose the right supply chain strategy. According to Chopra and Meindl (2004), a supply chain strategy determines what should be of special benefit in operations, distribution, and service. Traditionally, it includes "suppliers' strategy", "operations strategy" and "logistics strategy" regarding inventory, transportation, operating facilities, information flows.

Schnetzer et al. (2007) define supply chain strategy as a set of prioritized SCM objectives, i.e., strategic priorities, and a way to generate them, i.e., to determine appropriate measures for success in business performance. Strategic priorities mean the prioritization among the general target areas of SCM which are quality (meeting higher customer demands), delivery reliability (punctuality, delivery reliability rate), delivery lead time (delivery times, high fill rate), flexibility (managing changes and uncertainties), and costs (logistics costs, infrastructure, inventory). The target areas also include, however, collaboration, coordination (exchange and availability of information), and transformability. Logistics success potentials represent specific capabilities and resources in the area of logistics, or SCM, that a company can build up in the long term and that are an enduring success factor as to the objectives of logistics, or SCM.

According to Ross (1998), SCM strategies require firms to identify themselves and the bases of competitive advantage less by the products/services they offer to their customers, more by the processes that they use to create marketplace value as it moves through the organisation and out into the supply channel system. Some attributes regarding products/services cannot attain the same range of competitive force as the ones with the same attributes which are linked together with allied partners to form a comprehensive supply chain network strategy.

Another aspect is today's changing market conditions. With the need for improved responsiveness to customer demand, the choice of supply chain strategy should be based on a careful analysis of the demand/supply characteristics of the various product/markets served by a company (Fisher, 1997; Mason-Jones, 2000; Christopher and Towill, 2002). A dilemma is scheduling production and distribution to maximize capacity utilization and minimize inventory levels while achieving high levels of customer service (Vitasek et al., 2003).

Those appealed the attention of academicians, thus, in the last two decades many authors dealt with the topic of SC management: some of them developed models for a proper SC strategy (strategy formulation), others focused on the identification of the available techniques and tools for SC configuration and management (strategy implementation) (Caniato et al., 2008).

The approach to matching the supply chain to the market is becoming increasingly important and the latest researches indicate that supply chain strategy impacts competitive performance of a company (Christopher et al., 2004). The challenge to business organisations that seek to improve their competitiveness in its sector is to find the supply chain solution that best fits the demands of the market place.

Christopher et al. (2004) noted that the idea of aligning the firm's operations with market place requirements has not always been extended to the wider supply chain. It is logical that sourcing strategy, operations strategy and route-to-market need to be appropriate to specific product/market condition. The selection of suppliers, the location of facilities and the choice of distribution channels should all be driven by the goal of enabling the marketing objectives of the organisation to be achieved. The right supply chain decisions should be made which will enable the defined business and marketing strategy to be enacted.

According to Caniato et al. (2008), it is necessary to explore the business field and identify the contingent aspects that set the requirements for choosing the right SC strategy, according to the competitive priorities of the specific industry.

4.2 Marketplace and Competitive Capabilities

Today's marketplace is characterized by severe global competition and one of the problems of companies is an excess of supply over demand. In order to solve this problem, many approaches have been introduced such as "just-in-time" concept. The trend towards just-in-time and lean practices have led to a focus on efficiency rather than effectiveness. Subsequently, the trend towards reducing costs has led to a globalization of supply chains, more complex and hence more vulnerable. Accordingly, economies of scale have led to centralized distribution and manufacturing, which has lowered costs but at the same time also made the supply chain less flexible. Outsourcing non-core business activities in order to gain market competitiveness has led to loss of control of the supply chain when it may be most needed. On the other hand, the changing customer needs asking for more responsiveness. Table 4.1 summarizes how customer needs call for high levels of responsiveness.

Table 4.1: Impact of customers needs on supply chain behaviours.

Customer Need	Corresponding Supply Chain Behaviours
Range of quantity increases	Wider range of quantity implies greater variance in demand, volume flexibility is needed
Lead time decreases	Less time to react to orders, delivery dependability is needed
Variety of products required increases	Demand per product becomes more disaggregated, design flexibility is needed
Number of channels increases	Total customer demand is now disaggregated over more channels, more complex supply chain networks
Rate of innovation increases	New products tend to have more uncertain demand, introducing high performance products quickly is needed
Required service level increases	Firm now has to handle unusual surges in demand, delivery speed is needed

There is wide agreement on the nature and the effects of the major economic trends of the last decade: the globalization of markets; the extreme level of outsourcing of activities; the evolution of consumers who require a growing number of innovative and customized products in small volumes, with high quality and high service level, in an unpredictable way. All these changes had a major impact on both managerial research and practice, leading to the birth and growing importance of supply chains and networks (Gunasekaran et al., 2004).

For competitive advantage, getting the right product, at the right place, at the right time to the consumer is strongly required. Hence, the success and the failures of supply chains are determined by the end user within the marketplace (Schnetzler et al., 2007). A firm's ability to develop, manufacture and market attractive products is fundamental in the market economy. In competition with other firms it offers its products to customers and they make their choice among the offered products. The ability of a firm to attract the interest of the customer and to make a better offer than its competitors is fundamental for the survival and positive development of a firm (Hörte and Ylinenpää, 1997). The competitiveness of a firm could be described in terms of its ability to win orders on the market, in other words, its competitive capabilities.

Hill (2005) distinguishes between three types of criteria; qualifying, order-losing and order-winning. "Qualifiers" are those criteria that a firm must meet to have a customer consider it to be a possible supplier, while the "order-winners" are those criteria that win orders.

Chase et al. (2001) describe order-winner as a criterion that differentiates the products or services of one firm from another. Depending on the situation, the order-winning criterion may be cost of the product (price), product quality and reliability, or any other competitive dimensions -- i.e. flexibility, delivery and so on. On the other hand, an order qualifier is a screening criterion that permits a firm's products to even be considered as possible candidates for purchase. Some qualifiers are more sensitive than others, because if the firm does not meet the necessary standards on such a criterion, it will lose the order and most likely also potential future orders (Hörte and Ylinenpää, 1997).

However, the roles of order winners and qualifiers are not stable. They change over time, they work in combinations, and they work in different ways on different markets and with different customers (Mason-Jones et al., 2000; Hörte and Ylinenpää, 1997). This asks for a better understanding of customer needs in order to appeal the target customers and to succeed a better performance.

4.3 Understanding the Customer Needs and Demand Predictability

Unearthing and responding to the needs, desires, and expectations of the customer is very important since providing the products and services that customers really want leads an edge over the competitors (Ross, 1998), hence; the competitive advantage which causes the customers buy the product/service and improved demand signal is necessary from the marketplace so as to make correct decisions related to supply chain (Reeder and Rowell, 2001).

In order to understand customer, a company should identify the needs of the customer segment being served carefully. Why do customers choose to buy this product, why do they go to a specific place to buy it? Briefly, what does drive the customers in their purchasing decision is the concern of this step. Customer demands vary along several attributes for each segment (Chopra and Meindl, 2004):

- *The quantity of product needed in each lot*

A repair emergency order is smaller than a construction material order.

- *The response time that customers willing to tolerate*

An emergency order requires shorter response time than a construction order.

- *The variety of products needed*

Serving emergency order requires more availability of parts, while a construction order is more tolerant to backorders.

- *The service level required*

Long lead times are more tolerated in construction orders than in emergency orders.

- *The price of the product*

Emergency orders are less sensitive to prices than construction orders.

- The desired rate of innovation in the product

High-end departmental store customers demand more innovation and new designs than discount stores.

Each customer in a particular segment will tend to have similar needs, thus, a supply chain strategy satisfying their needs should be devised.

There are two principles suggested by Wong et al. (2006) to be guided by while choosing the right supply chain strategy; customer needs and investment risk. Customer requirements are very vital for supply chain devising/revising since satisfying customers is the priority of every business. Investment risk should be considered as well, because firms will need to make trade-off decisions regarding capacity, production, inventory so on, in order to have the most appropriate supply chains.

"Forecast uncertainty" is the level of uncertainty that a demand forecast can be realized. It can be accepted as a consideration for supply chains because it influences investment risk directly by affecting the levels of obsolete inventory, lost sales and forced markdowns (Fisher, 1997). The risks of lost sales and inventory obsolescence increase whenever forecast uncertainty increases. Therefore, forecast uncertainty is the main risk factor for making investment decisions on production and inventory. Generally forecast errors occur due to the unexpected customer trends, competition and supply uncertainty (Wong et al., 2006).

Another consideration can be "demand variability" which refers to the changeability of demand faced by manufacturers and retailers within a unit time. Levels of demand variability influence the choices of inventory policies and production strategies -- i.e. "Just-In-Time" or "Batch Production". Demand for the firm's products varies widely. Some of the products with less demand volume experience significant demand fluctuations, which has led to an increase in inventory. Other products are the exact opposite, experiencing stable demand with very little variation (Vitasek et al., 2003). If demands vary greatly from one period to another, the need for volume flexibility is certain. Demand variability is measured by the coefficient of variant (c.o.v.) of demand. For instance, if there is a high-volume demand, then lean production can be adopted (Childerhouse et al., 2002), so does make-to-stock (MTS) (Li and O'Brien, 2001).

Volume and demand variability are very much related to each other and understanding them enables the separation of base and surge demands (Vitasek et al., 2003; Christopher and Towill, 2001).

A high "contribution margin" is an important motive for investing decisions (Wong et al., 2006). In the literature (Fisher, 1997) it is stated that innovative products have higher contribution margins but higher forecast uncertainty as well. High levels of forecast uncertainty force companies for shorter lead times so as to obtain the high contribution margins. This situation requires a higher level of responsiveness which obliges lead time reduction and excess buffers, thus, investing in.

"Time window for delivery" refers to the lead-time given by the retailers from order to delivery. It can be named as "response time" as well. Time window for delivery is an important aspect of demand as it reflects one of the customer requirements (Fisher, 1997). It shows also the extent to which production can be postponed (or speculated otherwise), visibility and lead-times of demand information.

Moreover, Christopher et al. (2004) suggested "replenishment lead-time" as one of the considerations which imply the time measured which would take the system to respond to an increase in demand. In other words, the responsiveness of supply when there is a need to replenish the product.

The stage of the "product life cycle" influences the volume and requirements on lead-time and service levels (Pagh and Cooper, 1998). It can be a consideration for supply chain devising as well.

"Product variety" is another important consideration for the supply chain because it influences the extent to which postponement can be achieved (Pagh and Cooper, 1998; Wong et al., 2006).

"Innovativeness" or "uniqueness" of a product is a consideration suggested by Lamming et al. (2000) which refers to "product specifications" or "innovation level". This is important in indicating the order winners of a market.

Chopra and Meindl (2004) proposed one key measure combining all of these attributes. They suggested that each customer need can be translated into the metric of "implied demand uncertainty". Implied demand uncertainty refers to the uncertainty that exists due to the portion of demand that the supply chain is required to meet.

Demand uncertainty is different than this definition. Whilst demand uncertainty is the uncertainty of customer demand for a product, implied demand uncertainty is the resulting uncertainty for the supply chain given the portion of the demand the supply chain must handle and attributes the customer desires. For example, as a supply chain raises its service level so as to meet its customers' needs, and then it must be able to meet a higher percentage of actual demand. This forces the supply chain to be ready for rare surges in demand. Even though the underlying demand uncertainty of the product is the same, the implied demand uncertainty increases due to the increased service level.

Implied demand uncertainty refers to "predictability" which has been emphasized by many academicians in their supply chain classifications such as Fisher (1997). Each attribute listed above has an effect on predictability of demand; hence, firms should understand the overall attributes of customer needs. For instance, if a firm supplying only emergency orders for a product, then unpredictability should be expected in comparison to a firm supplying the same product with a long lead-time as a construction order.

Predictability which implies the demand pattern has seen as a main consideration when it comes to choose the right supply chain strategy because it affects the forecasting reliability. Where demand is stable it will generally be easier and proper to use forecast-based solutions, particularly where lead-times are long. However, when demand is volatile, forecast-based management becomes less beneficial. Hence the need in those situations is for agile supply chain strategies. Agility implies end-to-end time compression or postponement of final product configuration (Christopher and Towill, 2002).

Christopher et al. (2004) pointed out that "predictability" will probably represent the product type. Fisher (1997) pointed out that attributes of demand are often correlated with product type as well; hence, he classified products as primarily "functional" and primarily "innovative" products with respect to those attributes such as product life cycle, product variety, and market standards for time window for delivery. In the literature, they are also mentioned as "standard" or "commodity" products and "special" or "innovative/unique" respectively (Towill and Christopher, 2001; Morash, 2001; Lamming et al., 2000).

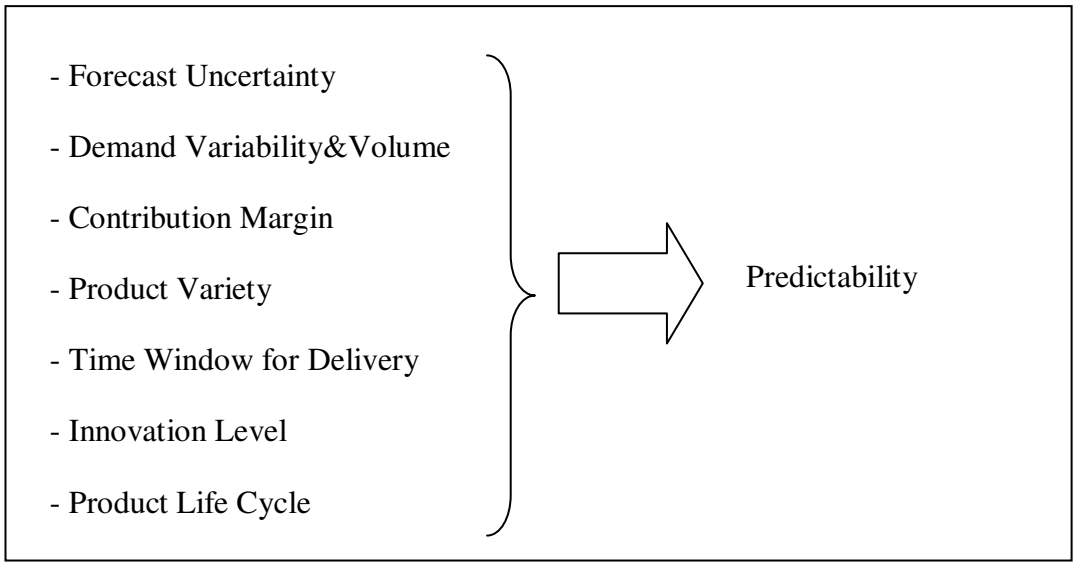

Figure 4.2 : Attributes of demand and the predictability concept.

Stability in demand with long life cycles can be proposed as the basic characteristics of functional products (Christopher et al., 2004; Mason-Jones et al., 2000; Fisher, 1997). These products satisfy the basic needs and don't change much over time. However this stability might trigger price competition, therefore low profit margins. Functional products tend to have less product variety than innovative products, where variety is introduced due to the fashion-oriented nature of the product or the rapid introduction of new product options due to product technology advancements (Lee, 2002). On the other hand, innovative products are mostly characterized by lower volume, variable demand structure and shorter life cycle (Christopher et al., 2004). Their innovativeness enables the company to achieve higher profit margins (Fisher, 1997). However, because imitators erode the competitive advantage, the life cycle of innovative products are short and companies are forced to continue innovations with these products (Chase et al., 2001).

Li and O'Brien (2001), and Wong et al. (2006) extended the product classification of Fisher by introducing "intermediate" products. Table demonstrates the correlation between demand's attributes and product types (adopted from Wong et al., 2006).

Fashion apparel, high-end computers, the latest integrated circuits, and mass customized goods are examples of innovative products, while household consumable items, basic foods, oil and gas, and basic clothing are examples of functional products (Lee, 2002).

Table 4.2: Correlation between attributes of demand and product types.

Product Type	Functional	Intermediate	Innovative
Forecast Uncertainty	Low (< 20%)	Medium (20%-40%)	High (> 40%)
Demand Variability (c.o.v.)	Low (c.o.v.<0,5)	Medium (0,5<c.o.v.<1,5)	High (c.o.v.>1,5)
Contribution Margin	5% to 20%	20% to 40%	40% to 100%
Product Variety	Low (10 to 20 variants per category)	Medium	High (often million of variant per category)
Time Window for Delivery	Long (>4 weeks)	Short (<5 days)	Short (<5 days)
Duration of Product Life Cycle	Long (>2 years)	Medium (1-2 year)	Short (3 months-1 year)

The industrial parts, components, intermediate goods, basic goods such as chemical, paper, primary metals and consumer packaged goods such as foods, cosmetics, and pharmaceutical manufacturers can be called as intermediate products (Miller and Roth, 1994).

Clearly, different supply chain strategies are required for functional, innovative and intermediate products. It is widely accepted that customer needs can be primarily price focused or primarily responsiveness focused. The level of predictability has a strong relation with the priorities of customers, as well as the product type. Hence, with respect to Fisher's approach, primarily price focus indicates functional products, whilst it is primarily responsiveness for innovative products. Furthermore, intermediate products are located somewhere on the spectrum between the two edges.

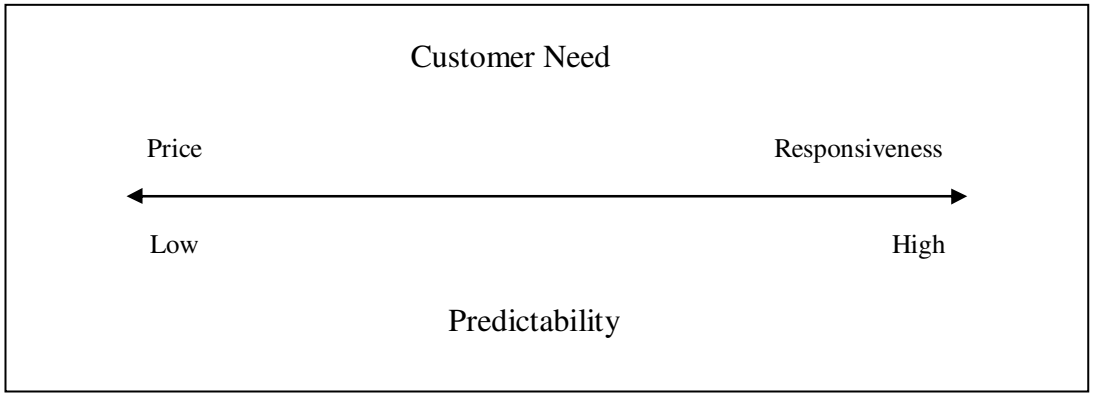

Figure 4.3 : Levels of predictability and corresponding supply chain focus.

4.4 Supply Chain Predictability

According to Lee (2002), supply chain strategies that are based on a one-size-fits-all or a try-every-thing mentality will fail, and the right supply chain strategy is dependent on a number of factors:

- The strategy needs to be tailored to meet specific needs of the customers.
- A product with a stable demand and a reliable source of supply should not be managed in the same way as one with a highly unpredictable demand and an unreliable source of supply.

A "stable supply process" is one where the manufacturing process and the underlying technology are mature and the supply base is well established. An "evolving" supply process is where the manufacturing process and the underlying technology are still under early development and are rapidly changing, and as a result the supply base may be limited in both size and experience.

In a stable supply process, manufacturing complexity tends to be low or manageable. Stable manufacturing processes tend to be highly automated, and long-term supply contracts are prevalent. In an evolving supply process, the manufacturing process requires a lot of fine-tuning and is often subject to breakdowns and uncertain yields. The supply base may not be as reliable, as the suppliers themselves are going through process innovations. Table 4.3 summarizes supply processes and their basic characteristics (adopted from Lee, 2002).

Table 4.3: Supply processes and their basic characteristics.

Stable Supply Process	Evolving Supply Process
Less breakdowns	Vulnerable to breakdowns
Stable and higher yields	Variable and lower yields
Less quality problems	Potential quality problems
More supply sources	Limited supply sources
Reliable suppliers	Unreliable suppliers
Less process changes	More process changes
Less capacity constraint	Potential capacity constrained
Easier to changeover	Difficult to changeover
Flexible	Inflexible
Dependable lead time	Variable lead time

Briefly, other kinds of uncertainties around the supply side of the product are equally important drivers for the right supply chain strategy.

Along with demand predictability, it is important to consider uncertainty resulting from the capability of the supply chain. As the production technology matures and yields improve, companies are able to follow a fixed delivery schedule, resulting in predictable supply.

When a company moves in to new markets or new technologies, it must have its supply chain prepared for the new business challenges and opportunities (Lee, 2002). Following supply source capabilities increase the supply uncertainty and hence cause lower predictability of demand (Chopra and Meindl, 2004);

- Frequent breakdown
- Unpredictable and low yields
- Poor quality
- Limited supply capacity
- Inflexible supply capacity
- Evolving production process

Other factors, for instance the weather for agricultural products, can cause a significant supply uncertainty while the demand predictability is at a high level. This leads an intermediate level of predictability for companies. Seasonal products can be given as an example of intermediate products based on the characteristics defined by Wong et al. (2006).

Chopra and Meindl (2004) created a spectrum of predictability, which combines demand and supply predictability, is demonstrated in figure 4.4.

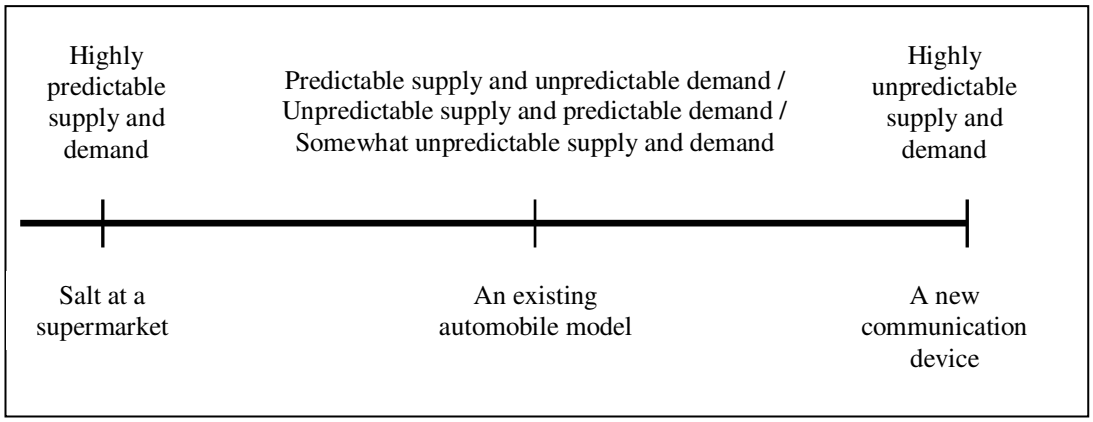

Figure 4.4 : The predictability spectrum of demand and supply.

In order to achieve the strategic fit between business and supply chain strategies, it is very important to understand customers, as well as the supply chain predictability. Predictability from the customer and the supply chain can be combined and mapped on the predictability spectrum so as to see in which life cycle stage the product is located.

In the early stages of a product introduction it is important that the product is available to the innovator customer group that will account for the success of the product. Costs are not important as much as it will be in the growth stage where the channels of distribution are expanded as demand grows. The availability and delivery reliability are also important for high levels of performance. As the product reaches to the maturity while sales volumes are high and competition is intense, ways and means of maintaining margins must be investigated. In the decline stage, typically customers may become highly price sensitive (Gattorna and Walters, 1996).

An innovative/fashionable product will tend to have more frequent new product entrances, which will probably bring “rapid changes in industry and technology” and “rapid changes in customer expectations”. This high uncertainty in supply chain, as well as in demand patterns, indicates high levels of unpredictability. In terms of product life cycle, this presents the introduction stage of the product with high rivalry and high risk in business.

A functional product will probably have “stability in industry and relatively mature technology” which indicates a stable supply chain. “Stabilized customer preferences” will be another characteristic of functional products referring more predictable demand patterns. In terms of product life cycle perspective, this represents the maturity stage of a product with low rivalry and low risk in business.

4.5 Efficiency versus Responsiveness Paradigms

After understanding customer needs and the unpredictability that a company faces, it is needed to find out how to meet customer needs in the best way in that uncertain environment. Creating strategic fit is all about creating a supply chain strategy that best meets customer needs that a company has targeted given the unpredictability it faces.

Like customer needs, supply chain processes have many different characteristics. In order to reach a single idea to which all characteristics of the supply chain contribute, a trade-off between responsiveness and efficiency may be needed. The supply chain’s responsiveness influences the supply chain strategy. Responsiveness implies supply chain’s ability to do the following (Chopra and Meindl, 2004);

- Respond wide ranges of quantities demanded
- Meet short lead times
- Handle a large variety of products
- Build highly innovative products
- Meet a very high service level
- Handle supply unpredictability

The more of these abilities that a supply chain has, the more responsive it is. However, achieving responsiveness can have a great cost depending on to the extent of responsiveness level. For instance, to respond a wider range of quantities demanded, capacity must be increased, which increases costs as well. Hence, right level of responsiveness should be addressed to the customers because it might generate high costs when there is no benefit from this.

As it was declared in the previous sections, the competitive advantage of a firm has a great importance on the determination of operating value chain activities. With the same logic, it is necessary to pay attention to what the competitive advantage of a product for a customer segment is when it comes to choose a supply chain strategy. This leads firms to make a trade-off between efficiency and effectiveness.

Achieving the strategic fit ask for abilities which can be called as supply chain capabilities. Certain supply chain capabilities especially distinguish and support particular supply chain processes. After understanding the customer needs and the supply chain predictability, it is needed to provide necessary capabilities in order to meet the customer demand. For a high level of responsiveness, the required supply capabilities also can be listed as it follows (Morash, 2001);

- Responsiveness to key customers
- Special value-added customer services
- Customization and innovative solutions
- Flexibility
- Proactive quality and communications
- Inter-modal transfers
- Dependability

On the other hand, for an efficient emphasis, the necessary supply capabilities can be listed as;

- Low logistic costs
- Distribution coverage
- Dependability
- Standardization of operations
- Time-definite deliveries
- Delivery speed

"Supply chain efficiency" is the cost of making and delivering the product to the customer (Chopra and Meindl, 2004) and increasing responsiveness results in higher costs that lower efficiency. In case, the product has high margins (Fisher, 1997) then higher costs of increasing effectiveness can be justified. So when companies choose to stress effectiveness rather than efficiency, they are not necessarily trying to reduce costs, but rather to create the highest value for the customer which is not always the lowest cost approach (Chase et al., 2001).

Cost-responsiveness efficient frontier is the curve showing the lowest possible cost for a given level of responsiveness. Lowest is defined based on existing technology since not every firm is able to perform on the efficient frontier. The efficient frontier represents the cost-responsiveness performance of the best supply chains.

A firm that is not located on the efficient frontier can improve both its responsiveness and its cost performance by moving toward the efficient frontier. In contrast, a firm on efficient frontier can improve its responsiveness by increasing cost and becoming less efficient (Chopra and Meindl, 2004). Such a firm must then make a trade-off between efficiency and responsiveness.

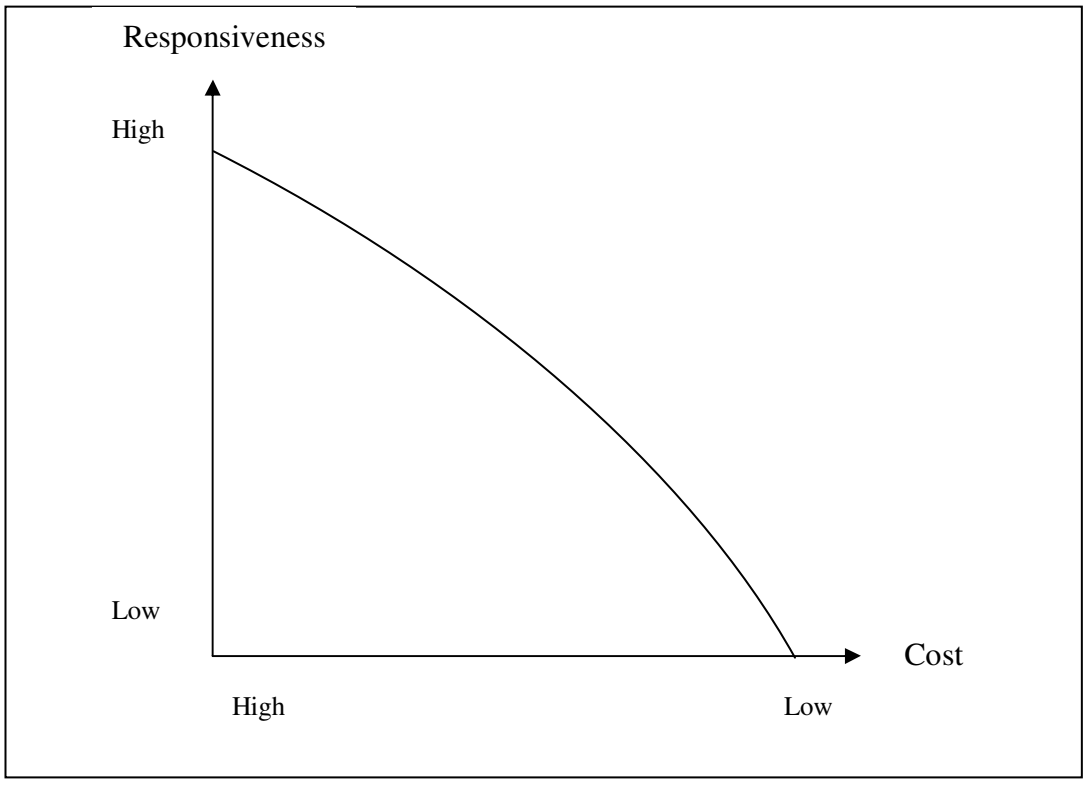

Figure 4.5 : Responsiveness – efficiency frontier.

Firms on the efficient frontier are also continuously improving their processes and changing technology to shift the efficient frontier itself. The key strategic choice for any supply chain is the level of responsiveness it seeks to provide when it comes to make a trade-off.

A long standing concept is the importance of balancing cost to service trade-offs. Trade-off has critical importance because it is not feasible to implement cost-minimizing strategies in conjunction with maximum service strategies. The balancing of effort toward cost or differentiation and the potential for segmental focus are consistent with Porter's typology (1985).

There are two generic types of supply chains described in the literature (Fisher, 1997; Pagh and Cooper, 1998; Naylor et al., 1999; Lamming et al., 2000; Mason-Jones et al., 2000; Li and O'Brien, 2001; Morash, 2001; Chase et al., 2001; Christopher and Towill, 2002; Lee, 2002; Childerhouse et al., 2002; Christopher et al., 2004; Chopra and Meindl, 2004; Wong et al., 2006): efficient supply chains and responsive (effective) supply chains.

According to the competitive advantage, which is based on customer priorities, the supply chain type should be aligned. If primarily availability is needed in order to satisfy the needs of the customer, then responsive supply chains should be operating. If primarily low price is the need of the customer, then efficient supply chains are better to manage.

Because each product type (as well as each predictability level) requires a distinctly different kind of supply chain, the root cause of supply chain problems is a mismatch between the type of product and the type of supply chain. Fisher (1997) has developed a framework to help managers understand the nature of demand for their products and then devise the supply chain that can best satisfy that demand. This framework has been further developed and refined by many authors during the last decade (Ayers, 1999; Lamming et al., 2000; Mason-Jones et al., 2000; Li and O'Brien, 2001; Chase et al., 2001; Wong, 2006).

Fisher's taxonomy suggests that functional products should be supplied with an efficient supply chain, while innovative products should be supplied with a responsive one. Other combinations would lead a mismatch, thus, unsatisfying supply chains. For intermediate products, a combination of efficiency and responsiveness may be needed depending on the predictability of demand and supply.

	Functional Products	Innovative Products
Efficient Supply Chain	MATCH	MISMATCH
Responsive Supply Chain	MISMATCH	MATCH

Figure 4.6 : Fisher's product/supply chain taxonomy (Fisher, 1997).

For functional products physical function of supply chain dominates, whilst for innovative products; market mediation function of supply chain dominates. Hence, a "efficient process" implies supplying predictable demand efficiently at the lowest possible cost. The goal is to maximize production efficiency and minimize inventory and coordination of supplier, manufacturer and retailer are necessary in order to meet predictable demand at the lowest cost.

On the other hand, a "responsive process**"** implies providing quickly response to unpredictable demands. The goal is to determine where in the chain to position inventory and available production capacity in order to hedge against unpredictable demand. Thus, supplier selection is based on speed and flexibility, not low cost. Production process has to be more responsive, thus more expensive. However, customers are willing to pay for high margin and this compensates the investments for responsiveness.

Li and O'Brien (2001), and Wong et al. (2006) defined another supply chain process called "physically-responsive process" for intermediate products. The forecast uncertainty and demand variability are not as high as the innovative products. This situation allows for investing in adequate level of finished good inventory based on a forecast at bearable risks so as to meet high service level and lead time.

Chopra and Meindl's (2004) responsiveness spectrum demonstrates where some supply chains fall on this spectrum.

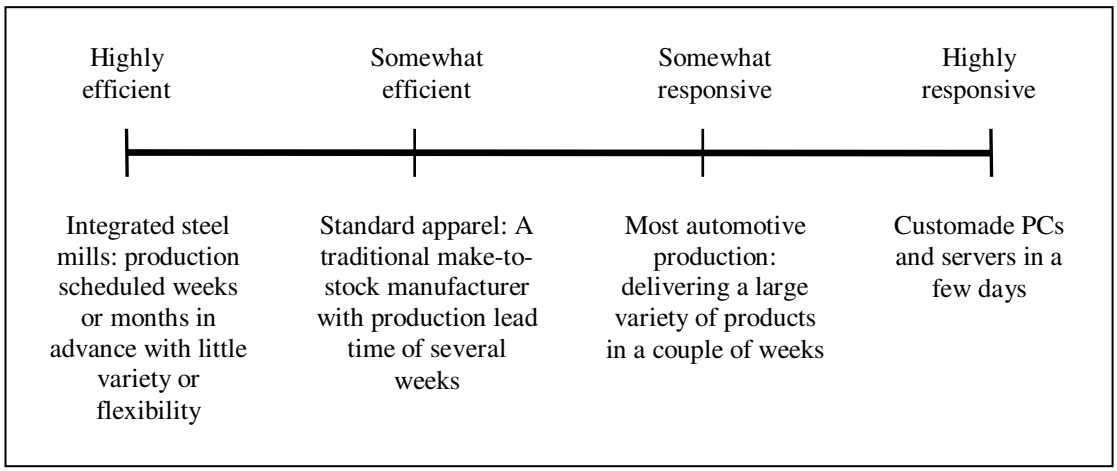

Figure 4.7 : The responsiveness spectrum.

After examining customer needs, demand and supply predictability, and the responsiveness of the supply chain, what the supply chain does well should be consistent with target customer's needs and the predictability of the supply chain. The degree of supply chain responsiveness should be consistent with the demand predictability. Predictability/Responsiveness map is a combination of the predictability spectrum and the responsiveness spectrum.

A point in this graph represents a combination of predictability and supply chain responsiveness. The predictability represents the customer needs or the firm's strategic position and the capability of supply sources. The supply chain's responsiveness represents the supply chain strategy (Chopra and Meindl, 2004). If the customer segment of a product demands high variety, high level of innovation, rapid delivery, then this product can be characterized with unpredictability, thus it can be called as "innovative product". Newly introduced components will also lead high supply unpredictability.

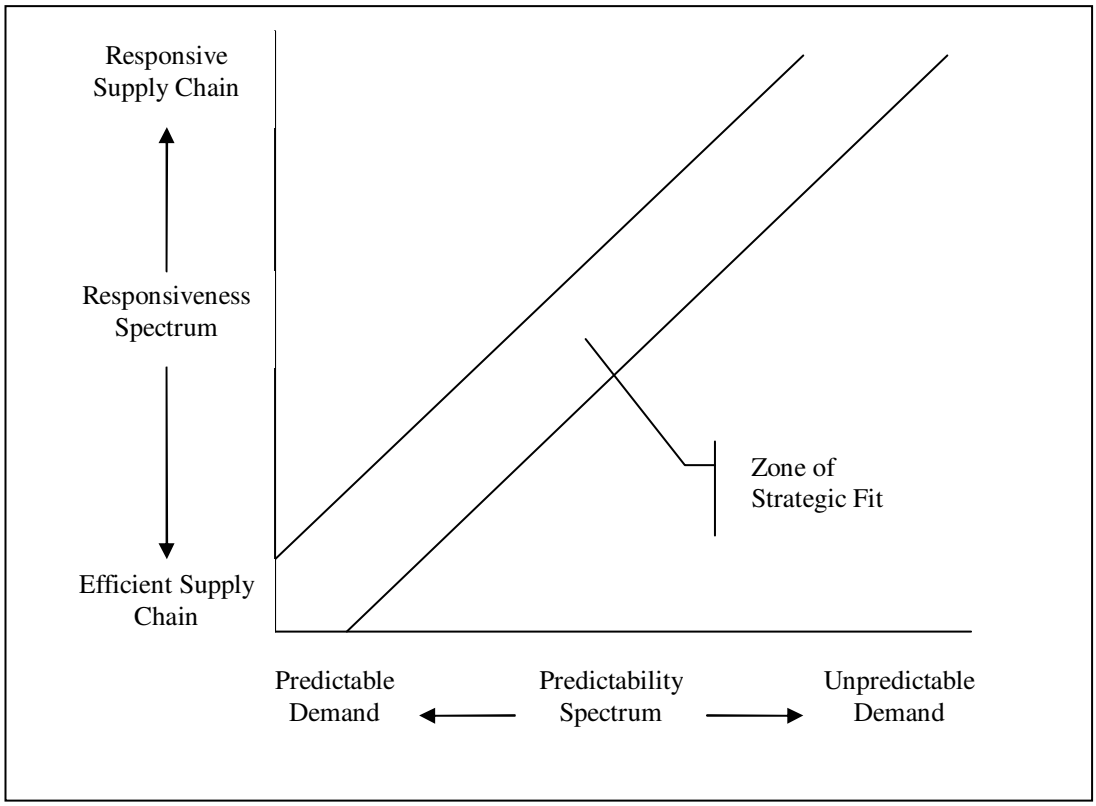

Figure 4.8 : The predictability/responsiveness map.

An efficient supply chain which may use slow but cheaper transportation modes and economies of scale in production would have difficulties in supporting the customer desire for rapid delivery and a wide variety of customizable products. Thus, a responsive supply chain strategy would be suited to meet the needs of those targeted customers.

On the other hand, a product with a relatively stable customer demand would have a predictable demand, as well as a predictable supply. A responsive supply chain strategy would cause higher price resulting in a loss of customers. A more efficient supply chain with a focus of cost reduction would be more suitable for such a product which can be called as “functional product”.

As a result, the greater the unpredictability, the more responsive the supply chain should be. Increasing unpredictability from customers and supply sources is best served by increasing responsiveness from the supply chain. This relationship is represented by the “zone of strategic fit” illustrated in the figure 4.8.

For high level of performance, companies should move their business strategy (and resulting predictability) and supply chain strategy (and resulting responsiveness) towards the zone of strategic fit. Otherwise a company will probably face the pressure of excessive inventory, degraded customer service, escalating costs and declining profits, or a poor return on assets, which indicates its supply chain is out of control (Lee, 2002).

4.6 Supply Chain Classification

Lee (2004) developed the concept of 'supply chain alignment,' which approaches the problem of supply chain design and operation from the customer's dominant buying behaviour perspective. By segmenting markets for a wide range of product categories he observed patterns which can be used to reverse-engineer the equivalent supply chain configurations. According to his studies, he found four main customer-buying behavioural segments which can be met by four different supply chain configurations: continuous replenishment, lean supply, agile supply and fully flexible.

Christopher et al. (2004) made a supply chain classification as well. According to them, there are four supply chain configurations depending on market predictability and replenishment lead time expectation. Replenishment lead time indicates the time needed for a system to respond the changes in demand.

Where predictability is high and replenishment lead time is long, then lead supply chain is appropriate. In case predictability is high and replenishment lead time is short, then continuous replenishment is proper. When predictability is low and replenishment lead time is short, then agile solutions are needed. Relatively long replenishment lead time and low predictability can be satisfied with postponement strategies.

According to those four SC configuration and the general characteristics explained in previous sections, it can be possible to say that continuous replenishment (i.e. time-based strategies) and lean supply chains are efficient processes, whilst agile quick response and postponing supply chains are responsive processes.

4.6.1 Efficient supply chains

The objective of efficient supply chains is usually to lead an industry in price, reliability, convenience, and speed. For customers, this means efficiently delivering reliable products and services at competitive prices and with minimal difficulty and inconvenience. This reflects total cost minimization for customers, not only because of lower prices but also because of reductions in customer costs from optimal order fulfilment and supply chain time compression (Morash, 2001). As such, efficient supply chains (operational excellence) may emphasize using total supply chain cost as a marketing weapon both to retain existing downstream customers and to attract new customers.

In the literature, efficient supply chains, which are also called as physically efficient supply chain processes, aim supplying predictable demand efficiently at the lowest possible cost (Fisher, 1997). Examples of efficient supply chains include time-based strategies such as just-in-time (JIT) deliveries and lean supply chains.

4.6.1.1 Lean network supply chains

For those customers who primarily seek lowest cost product (and fulfilment), “lean” is the solution. By definition generally dealing with a relatively predictable market environment; a risk-averse customer with a transactional mindset are ordinary, so there is a lot of emphasis on making and fulfilling to forecast; creating scale; and using process improvement techniques such as Six Sigma to lower cost (Lee, 2004).

Lean is about doing more with less, a reasonable business objective as long as customer satisfaction is maintained. The focus of the lean approach has essentially been on the elimination of waste or “muda” (Christopher and Towill, 2002). Hence, lean supply chains reduce all types of waste, errors, unnecessary assets, and cycle times by continuously seeking perfection and operational efficiencies throughout the supply chain network. Types of logistics-related waste that can add cost but no value include waiting, rectification of mistakes, excess processing, unnecessary warehousing, extra handling, excess transport and terminals, and excess stock (Morash, 2001).

If lead-times are long but demand is predictable, then there is an opportunity to follow "lean" type of strategies. The UK retailer Woolworths which sells a million plastic Christmas trees each year is a good example for this type of pursuit. They source these mainly from China and have to place their order over six months ahead of the season. However, they see little risk in this strategy given their prior experience of demand for the product (Christopher et al., 2004). Long lead-times and the predictable structure of demand enable them to outsource and to minimize the costs.

Lean concepts work well where demand is relatively stable, hence predictable and where variety is low. Conversely, in those contexts where demand is volatile and the customer requirement for variety is high, a much higher level of agility is required (Towill and Christopher, 2001). Leanness may be an element of agility in certain circumstances, but by itself it will not enable the organisation to meet the precise needs of the customer more rapidly.

Cost-efficiency is the dominant value shared by both customers and the supplying organisation in this environment. More importantly, the underpinning sub-culture essential to successfully execute a low-cost solution for the customer is one which demands removal of all waste; involves routine processes, backed up by a 'cost-controller' leadership mentality. But the more you cut cost, the more fragile the supply chain becomes, and the less its ability to respond rapidly to sudden changes in demand. Fortunately, there is likely to always be a sizable segment of customer-markets that demand a consistent low-cost response (Gattorna, 2008).

4.6.1.2 Time-based supply chains

The developments in IT have led much more control over production operations and the development of JIT and QR systems. Time based strategies have been developed within the concept of supply chain and because of the benefits that IT developments offer (Gattorna and Walters, 1996).

Time-based strategies place greater emphasis on inventory throughput or velocity. As such, compared to lean networks, time-based strategies are more strongly related to flow-through cross docking, lead time improvement, quick replenishment, and performance measurement.

Within the JIT approach, progressive reduction of inventory levels allows an enterprise to identify opportunities for operational improvement, thus reducing costs and improving efficiency while still achieving effective customer service. It has been argued that, in the emerging arena of global competition in which supply chain competes with supply chain, a key approach is the substitution of information for inventory (Webster, 2002). JIT supply chains emphasize time-definite deliveries -- i.e., known lead-times of low variability. This can reduce buffer inventory and safety stocks. JIT may also involve more frequent deliveries of smaller shipments, which can increase inventory throughput or velocity. In turn, this can lower in-transit inventory and cycle stocks. Other contemporary logistics operations that can facilitate JIT and thereby also reduce inventories include cross-dock operations, synchronizing and sequencing transportation with production, delivering commodities to exact points on the production line using flexible transportation equipment and containers, in-transit acceleration and deceleration to regulate the flows, and direct delivery (Morash, 2001).

In those situations where demand is predictable and replenishment lead-times are short, then a 'continuous replenishment' strategy may be appropriate. Companies like Procter & Gamble manage their supply chain for volume products (which are also called as functional products) to Wal-Mart in the USA by following this strategy. By using point-of-sale data, they can rapidly replenish individual stores through a process of Vendor Managed Inventory (VMI) (Christopher et al., 2004).

Referred to as either Continuous Replenishment Program or Continuous Replenishment Planning, CRP is considered an important tool in the implementation of an Efficient Consumer Response (ECR) strategy. CRP and VMI are essentially the same process. Continuous Replenishment is the practice of partnering between distribution channel members that changes the traditional replenishment process from distributor-generated purchase orders, based on economic order quantities, to the replenishment of products based on actual and forecasted product demand (Source: The Council of Supply Chain Management Professionals).

With VMI, the right products are continually pulled into the right places at the right time with continuous replenishment at the point of consumer purchase or usage. This fundamental pull process combined with the market visibility it provides makes VMI an indispensable element of any company's demand-driven supply chain program.

The goal of VMI is to align business objectives and streamline supply chain operations for both suppliers and their customers. The business value is a direct result of increased information flow:

- Improved inventory turns
- Improved service
- Increased sales

Although vendor-managed inventory (VMI) concepts were originally developed for high-volume environments, particularly retail and automotive OEM applications, and have been adopted widely in these industries since, they are not limited to high-volume situations. The key factor underlying VMI in low-volume applications is that responsibility for management of inventories of specific products is transferred to the party that, presumably, has the greatest expertise in doing so. Both buyer and supplier can benefit as a result of this shift in responsibilities (O'Brien, 2003).

While high volume VMI environments are typically supported by specialized information systems that efficiently manage the transfer of information between customer/buyer and the supplier/vendor (e.g., EDI) as well as the inventory management functions, low volume VMI environments may rely on adaptations to existing business systems and processes (O'Brien, 2003).

In particular, companies have found that VMI offers a number of advantages for both buyer and supplier when managing MRO (maintenance, repair & operating) supplies and other indirect materials, such as office supplies, packaging materials, printed literature and similar products. These commodities, by their nature, tend to be lower volume applications, although not necessarily so.

In many low-volume VMI environments, this may be as simple as a weekly check of stock levels with replenishment of needed items during the next week's review (contrast this with the two times per day EDI data transmissions one might expect in a high-volume VMI environment). For the supplier, this usually is a sole-source arrangement that yields lower costs related to revenue generation, as well as a smoother. Demand pattern that enables lower overall inventory investment.

4.6.2 Responsive supply chains

Major examples of effectiveness focus (responsive) as supply chain strategies include mass customization (postponement) and agility. Those strategies are also called as market-responsive processes which aim providing quickly response to unpredictable demands (Fisher, 1997) in order to minimize stock-outs, forced markdowns, and obsolete inventory.

4.6.2.1 Agile supply chains

Agility takes one step further from postponement by quickly and flexibly adjusting supply chain capabilities and their combinations to changing customer needs and evolving competitor offerings over time. This may require a flexible and dynamic supply chain network that can recombine, reconfigure, and re-sequence logistical capabilities and participating firms in changing and creative ways (Morash, 2001).

For those customers (it can be the same cost-driven customers in a different situation) with values that are dominated by a requirement for speed; taking risk; who place low importance on relationships, and are time-sensitive, it is needed something very different — an ‘Agile‘response (Lee, 2004).

Since transportation and third-party logistics firms may operate throughout the supply chain, they may be in the best position to coordinate and integrate capabilities in the network. Information on customer required capabilities and performance tracking become critical to success, possibly necessitating high levels of communications and collaborations with customers (Morash, 2001).

Agility is a business-wide capability that embraces organisational structures, information systems, logistics processes and in particular, mindsets. A key characteristic of an agile organisation is flexibility (Christopher et al., 2004). Agility implies the ability of the supply chain to react quickly to changes in market demand and changes in volume, variety or mix (Mason-Jones et al., 2000). Indeed, the origins of agility as a business concept lie in flexible manufacturing systems (FMSs) (Towill and Christopher, 2001).

Initially it was thought that the route to manufacturing flexibility was though automation to enable rapid changeovers -- i.e. reduced set-up times, and thus, enables a greater responsiveness to changes in product mix or volume. Later this idea of manufacturing flexibility was extended into the wider business context and the concept of agility as a supply chain philosophy was born (Christopher and Towill, 2002).

When demand is unpredictable but lead-times are short, then "agile" solutions will be required based on rapid response. The case of Zara, the Spanish fashion garment manufacturer and retailer, can be a good example for this strategy. They can move products into their stores across Europe in three to four weeks after they have been designed. They do this by using cross-functional teams to manage the end-to-end process and by using numerous small workshops in Spain and Portugal to give them a high level of flexibility (Christopher et al., 2004).

True agility requires rapid and appropriate responses to fluctuating consumer demand. This, in turn, requires much greater "visibility" through the supply chain than has conventionally been the norm. Ideally this would enable all players in the supply chain to see from one end of the pipeline to another in as close to real time as possible. These characteristics are also predicated on the full exploitation of information and technology through inter-organisational collaboration and co-operation (Storey et al., 2005).

4.6.2.2 Postponing supply chains

Mass customisation (postponement) is the strategy where the key idea is to postpone the task of differentiating a product for a specific customer until the latest possible point (Yang et al., 2004). In other words, final customisation is postponed until customers specify the exact mix and match. This allows a manufacturer to achieve the marketing benefits of customisation while reaping the cost benefits of standardised production in anticipation of future customer orders (Lampel and Mintzberg, 1996).

The concept of postponement is about delaying activities as to the form and/or place of goods until the latest possible point in time when exact attributes of demand can be identified. Faced with constant changes such as volume change and variety change, it is a natural option for a company to seek opportunities for delaying some activities like the final processing or manufacturing of product to as late a time as possible and hence reduce the risk. Postponement can enhance a company's flexibility to effectively meet the requirements of the growing product variety and quick response (Yang et al., 2004).

Customization tailors supply chain capabilities and value-added services to specific customer needs. These distinct and responsive offerings represent specific solutions directed at what individual customers or segments want, rather than general solutions reflecting what the market wants (Morash, 2001).

When the demand is unpredictable and lead-times are long, the ideal solution is to adopt the "postponement" concept. In classical meaning; to carry strategic inventory in some generic form and assemble/configure/distribute as required when actual demand is encountered.

Hewlett Packard follows this strategy for their range of DeskJet printers. They build a semi-finished product at their central facilities in North America and then ship it to four regional centres around the world which are run for them by third-party logistics service providers. At these centres the product is finally configured and delivered when actual customer orders are received (Christopher et al., 2004).

In today's highly competitive environments, companies have to achieve agility in order to better respond to the rapidly changing customer-driven markets. With a high degree of conformance to the customers' ultimate requirements, postponement has been identified as an important approach for contributing to the attainment of agility, through its contribution to the:

- Customisation of products and services;
- Use of customer order information through the supply chain; and
- Cross functional efforts (Van Hoek et al., 1999).

Companies should first consider every possible postponement opportunity along the supply chain and then balance the trade-off not from an individual player, but the whole supply chain.

Postponement fosters a new way of thinking about the supply chain (Yang and Burns, 2003) and it has been identified as an important characteristic of modern and competitive supply chains (Van Hoek et al., 1999). For example, considering the potential of postponement in saving inventory holding and carrying costs, the longer and wider the supply chain, the greater the potential benefits of postponement.

In the literature, much is written to generate insights into the relevance of such factors for the implementation of postponement as high sales fluctuation and short product life cycles (marketing characteristics), high degree of customisation, commonality or modularity (product characteristics) and decouplability of product process (production characteristics).

Considering the application of postponement, there should be postponable points. Modular/standard design in product and production is conducive to creating postponable points. For postponement to work, product design may need to further isolate the most variable portion of the functionality from other functions in order to be added last. Besides moving the decoupling point closer to the end-user and increase the efficiency and the effectiveness of the supply chain (Naylor et al., 1999).

Before establishing postponement strategies, companies need to identify and fully understand the marketplace requirements. There are certain conditions and situations where the implementation of postponement is more likely to succeed. Its benefits vary with the competitive environment.

The degree of uncertainty, for instance, is significant for selecting an appropriate postponement strategy. The strength of postponement lies in its capability of coping with those uncertainties inherent in dynamic and changing markets, which companies may have to accommodate in their business strategies (Yang et al., 2003). In easily predictable environments, companies would obviously gain little from postponement. In new product development, postponement is favourable due to uncertainty about customer requirements and technical evolution during the development process.

For innovative products, the supply chain should respond quickly to the unpredictable demand to minimise stock-outs, forced markdowns, and obsolete inventory (Fisher, 1997). In this situation, it will be appropriate to postpone the final manufacturing and logistics operations (Pagh and Cooper, 1998).

Postponement is a strategy to intentionally delay the execution of a task instead of starting it with incomplete or unreliable information input. At this stage, it is essential to anticipate the extent of the variability of those unpredictable items. The logic behind this is to delay commitment of the most uncertain items to a later time when these could be defined more efficiently in response to such possible major changes in customer needs, technologies and competitor's action. Once companies choose to target certain markets, the extent of product variability is clear and forecasting is easier at the generic level than at the level of the finished item.

Further information such as information on local demands must be available in the delay period. Postponement is valuable only if the information about the customers' need can be captured quickly and accurately.

Postponement does not necessarily rely on advanced IT (Van Hoek et al., 1999) and companies can combine postponement with simple information sharing to achieve low supply chain costs and high customer service level.

Companies have to understand how to tackle obstacles in the way to an effective adoption of postponement. An organisation's administrative heritage and the lack of an overall supply chain vision can be a major bottleneck (Van Hoek et al., 1999). Thus, even though now it is possible for companies to capture, validate, and forward information in real time, the players upstream in the supply chain may receive distorted information.

The latest techniques like the Internet, electronic data interchange (EDI) and point-of-sale system may improve the information flow by reducing the data collection errors and moving data quickly (Morash, 2001). To further enhance information flow towards postponement strategies, companies need to recognise the need for open communication, and manage the information whilst being willing to act as partners in the supply chain (Mason-Jones and Towill, 1999).

Companies implementing postponement may need to modify their postponement strategies over time, according to changes in the competitive environments, stages of product life cycle, technological advances and so on. Typically the implementation of postponement might lead to reducing economies of scale and increasing cycle time. There is a need for integrating other related concepts/strategies into postponement, supplementing rather than replacing each other. This is consistent with the increasing calls for a supply chain wide perspective in postponement research.

- Logistics Postponement

Reducing logistics costs is often the central goal of companies implementing postponement. Postponement in logistics enables a company to keep its options open as to where inventory should be finally deployed, thus greatly reducing the risk of wrong time and place utility of products. The benefits of postponement also include reducing inventory levels across the supply chain while improving customer responsiveness.

In the distribution channel, postponement is also involved in the repositioning of manufacturing activities, not limited to the relocation of inventories. This thinking depends on where in the process generic products should take on the form of specific end products. Postponement may relocate final configuration from manufacturer plants closer to the end-use customer, allowing for rapid delivery of customised products and quick responsiveness to changes in display mixes. For example, packaging/labelling (as one of the variables in differentiating generic goods for different brands and geographic markets) may be delayed (until customer commitments are received) and be better carried out by local based distributors before distribution and delivery to the customer.

It is viable to delay a product's variety, value, volume and weight increases through the implementation of postponement to save on inventory carrying and holding, assorting, stock-out and obsolescence costs (Pagh and Cooper, 1998; Van Hoek et al., 1999).

Postponement is valuable when capacity is unresponsive (i.e. supplier lead times are long, production scheduling is inflexible, or manufacturing volumes are constrained). However, in many cases, postponement in logistics requires a fast and responsive transportation system and it can thus lead to a significant increase in transport cost. Its applications are also constrained by time windows specified by the market. Its maximum benefits are obtainable when the distribution is not only physical transportation, but also contains a product customisation component.

Transhipment can also lead to cost reductions and improved services by enabling the sharing of stock among different locations, thereby reducing the inventory in the supply chain. Further, transhipment can be viewed as logistics postponement, because it delays the point of differentiation which transforms a generic item (an item at any location) into a specific item (an item at a specific location).

- Manufacturing Postponement

The concept of postponement, as applied to manufacturing, retains the product in a neutral and non-committed status as long as possible in the manufacturing process. Because the inventory is generic, its flexibility is greater, meaning that the same components, modules or platforms can be embodied in a variety of end products.

Thus, postponement is one of the most beneficial strategic mechanisms to manage the risks associated with product variety and uncertain sales. In addition, since manufacturing postponement allows companies to operate with no finished inventory, companies may benefit from maintaining the bulk of their inventories in the cheaper and/or pre-customised form by delaying expensive operations and point of product differentiation.

In a global scenario of postponed manufacture, the production of high-volume standard components and sub-assemblies is carried out wherever the greatest cost efficiencies can be achieved. These parts are then distributed according to demand to transhipment centres close to the final assembly facility and often also close to the customer. Here, they are sorted and consolidated for delivery to assembly lines. Final assembly is only undertaken in response to direct customer orders and consists of configuration to an individual specification (Webster, 2002).

It is crucial for a company engaged in postponement strategies to consider product families and generations, and explore the commonality/modularity of products and processes as much as possible. Using common components and processes from initial stages implies that the products assume their unique attributes as late as possible. Additionally, component commonality results in inventory pooling effects (e.g. lower inventory levels and reduced risk of obsolete inventories). Leveraging commonality in parts may further enable purchasing postponement.

However, introducing too much commonality (e.g. part standardisation which is easily perceived by the customer) can reduce product differentiation, leading to a cannibalisation effect. In general, one wants to communize/standardise features that have long lead times early and differentiate late those that have short lead times closer to the customer. Recent years have seen that short lead-time customisable features are postponed in the clothing industry, such as printing logos with T-shirts.

Modularity can take different forms as follows:

(1) Modularity in design refers to defining the design boundaries of a product and of its components so that design features and tasks avoid creating strong interdependencies among specific components (modules) design. A fully modular architecture means that a change made to one component does not require a change to other components.

(2) Modularity in production refers to designing the production process in order to make complicated products by designing and developing modules at different sites and then bringing them together to create a complete system. This modularity breaks down the whole production process into sub-processes that can be performed concurrently or in a different sequential order.

A prerequisite to manufacturing postponement is modularity in production (decoupling the process in at least two sub-processes, separated in time and/or place) (Van Hoek et al., 1999). The choice of different postponement strategies depends on the extent to which it is possible for a company to modularise its products and processes.

Manufacturing postponement may also influence supplier relationships since manufacturing postponement means that customer orders will be fulfilled through production rather than through stockholding finished products, a reliable supplier network that can supply parts and services plays a key role in its application. The extensive use of manufacturing postponement leads the suppliers to take over part of the assembly factory, where they supply components directly into the final assembly line from their workshop adjacent to the factory (Van Hoek et al., 1999).

In manufacturing postponement, manufacturers may require distributors to take on additional responsibilities (due to the relocation of final manufacturing downstream to distributors/retailers). Manufacturers may also need to foster and develop manufacturing capabilities (e.g. skills to assemble the products) within a particular distributor/retailer, since a company's success is partly tied to the strength of its weakest supply chain partner. However, in many industries like the automotive, aerospace and personal computer industries, many original equipment manufacturers share common distributors/retailers. The existence of common or overlapping distributors/retailers in different supply chains may limit the manufacturer's ability to invest in the related facilities and human training programs of distributors/retailers. The reason for this is that any investment in this will provide a free benefit for competitors (manufacturers in other supply chains). Obviously, this added competitive aspect of the relationship sometimes complicates the effective employment of postponement strategies.

4.7 Linking Customer Needs with Capabilities through Business Strategies

Significant differences in capabilities and resource allocations could exist across individual companies pursuing the same strategies, and such differences might have a critical effect on corporate performance. In other words, firms operating in the same market segment and following similar strategies could have dramatically different levels of performance which could be explained by differences in strategies and supporting capabilities between the corporate and functional levels (Kim, 2006).

Thus, the alignment between functional-level supply chain capability and corporate-level competitive capability is very significant. All functions in the value chain must support the business strategy to achieve strategic fit. There is no right supply chain strategy independent of business strategy. There is a right supply chain strategy for a given business strategy (Chopra and Meindl, 2004).

Morash (2001) made a conceptual proposition related to the relationship between business strategies and supply chain processes. The academician points out that "operational excellence" can support business strategies of overall cost leadership through total cost reduction, efficient and reliable supply, and high levels of basic service. Here the operational excellence may be accepted as the efficient strategies.

On the other hand, "customer closeness" can support business strategies of differentiation through high levels of value-added customer service, proactive quality, collaborative communications and interactions with customers. Here the customer closeness may be seen as the responsive strategies.

Supply chain operational capabilities should be used to support business strategies and help achieve the competitive capabilities of the firm. Morash (2001) discusses that supply chain capabilities are the building blocks for supply chain strategy and a source of competitive capability for firm success.

A firm must develop strategic capabilities for managing the supply chain based on overall corporate capabilities, and based on these high level capabilities, a set of detailed operating capabilities can be developed for each process within the supply chain (Lummus et al. 1998). Therefore, a better understanding of the shape of the interactive relationship between corporate competitive capability and SC operational capability is needed. Watts et al. (1995) emphasize that the SCM function should play an important role in shaping the competitive capability of the firm in its marketplace. Accordingly, SCM decisions should be strategic and must be aligned with a firm's business strategy and capability. With an overall cost leadership strategy requiring tight cost control, one can also expect the supply chain function to emphasize cost minimization. A cost minimization focus related to supply chain lead us efficient supply chains. Meanwhile, if the corporate competitive strategy is centred on providing customers with high quality products, the supply chain strategy and operational capabilities must also focus on quality.

The association of corporate competitive capability with proper SC operational capability can significantly influence performance improvement. Kim (2006) empirically found out that when corporate competitive capability is associated with appropriate SC operational capability, it will have a significant influence on performance improvement.

In order to link business strategy with supply chain strategies determining the competitive capabilities, it is necessary to examine order winners and qualifiers for a specific customer segment. Then establishing an appropriate supply chain and operations process and infrastructure to support the competitiveness of the firm with respect to the market characteristics shall be executed.

The major competitive dimensions that form the competitive position of a company demonstrated in the table (adapted from Frohlich and Dixon, 2001).

Table 4.4: Competitive capabilities.

Competitive Capabilities	**Definition**
Low Price	The capability to compete on price.
Design Flexibility	The capability to make rapid design changes and/or introduce new products quickly.
Volume Flexibility	The capability to respond to swings in volume.
Broad Line	The capability to deliver a broad product line.
Conformance	The capability to offer consistent quality.
Performance	The capability to provide high performance products.
Speed	The capability to deliver products quickly.
Dependability	The capability to deliver on time (as promised).
After-sales Service	The capability to provide after sale service.
Advertising	The capability to advertise and promote the product.
Broad Distribution	The capability to distribute the product broadly.

The attributes of demand such as wide product variety, high demand variability etc. will ask for a specific capability to be accomplished by the firm. Thus, by understanding the order winners and qualifiers of the marketplace, the proper competitive capability should be strengthened within the supply chain.

5. DETERMINATION OF SUPPLY CHAIN STRATEGY

Supply chain strategies determine the capability of a manufacturing system and specify how it will operate to meet supply chain objectives. It is supposed to be the foundation for manufacturing firms to meet the overall business objectives and gain competitiveness in the supply chain.

Managing supply chain (SC) is a complicated task. Technologies are easily to be cloned and business models can be imitated by rivals. Supply chain management indeed emerged as fundamental in order to remain competitive in a context where most activities are outsourced and the interaction of multiple actors is critical to ensure the delivery of products to the customer (Caniato et al., 2008).

The need to focus on supply chain strategy and align it towards the competitive capabilities of the considered product/market, i.e. those features in terms of product or service design that allow a firm to succeed into a specific market segment (customers select the firm's product and not the competitors' ones because of those specific features) has been noted in the literature (Caniato et al., 2008). Product features in terms of competitive capabilities indeed influence supply chain configuration and management choices (Brun et al., 2008) and should be taken into account in order to capture end users' needs and maximize the value in their perspective (Al-Mudimigh et al., 2004).

The operations strategy framework in terms of competitive priorities, structure and infrastructure can be extended to the SC (Harland et al., 1999). In particular, in order to compete in today's highly competitive marketplace, SC strategy should aim at matching product characteristics and customer requirements (Aitken et al., 2003; Li and O'Brien, 2001; Mason-Jones et al., 2000). Simply engaging the customers with the particular supply chain configuration most appropriate to their buying behaviour (or mindset) at that time is essential.

In order to align supply chain strategies with business strategies, combining defined manufacturing strategies with other supply chain operations can contribute to give a conceptual framework encompassing main supply chain decisions. A market orientation towards a certain set of competitive capabilities (which also indicate the business strategy) such as price, quality, flexibility, service and delivery can be useful for managers to make appropriate supply chain decisions. Differences within customers demand in different market segments can determine different competitive priorities for a single market/product.

Those competitive capabilities can be interpreted as the aspects of demand which is explained in the previous chapter, in other words, the criteria chosen in this thesis as determinants of a beneficial supply chain strategy proposal. For instance, when the demand variation is low and the demand volume is high, while forecast uncertainty is low, then achieving a low price capability in supply chain is necessary for efficiency.

Table 5.1: Aspects of demand and primarily affected competitive capabilities.

Aspects of Demand (Criteria)	**Primarily Affected Competitive Capability**
Forecast Uncertainty	Delivery Dependability Design Flexibility
Demand Volume	Low Price Flexibility
Product Variety	Volume Flexibility Broad Line Design Flexibility
Time Window for Delivery	Delivery Dependability Delivery Speed
Demand Variability	Volume Flexibility Low Price

The link between business and supply chain strategies can be achieved by the right combinations of capabilities supporting the objectives of the business strategy.

There are many types of supply chains and each of them designed to perform different tasks well. A company must understand what its supply chain is designed to do well. In case there is a mismatch between what the supply chain does particularly well and the desired customer needs, the company will either need to restructure the supply chain to support the business strategy or change its strategy.

Certain supply chain capabilities especially distinguish and support particular supply chain processes. A successful supply chain strategy should strength the necessary capabilities in order to meet the target customers' needs, hence; value drivers (e. i. inventory, transportation, facilities, and information) that impact the responsiveness and efficiency of a supply chain should be structured with the purpose of establishing those capabilities within the chain. The competitiveness of a firm could be described in terms of its ability to win orders on the market, in other words, its competitive capabilities.

The idea of aligning the firm's operations with market place requirements has not usually been extended to the wider supply chain. It is logical that sourcing strategy, operations strategy and route-to-market need to be appropriate to specific product/market condition. The selection of suppliers, the location of facilities and the choice of distribution channels should all be driven by the goal of enabling the marketing objectives of the organisation to be achieved. The right supply chain decisions should be made which will enable the defined business and marketing strategy to be enacted.

In this thesis, it is aimed to detail the specific supply chain tools and techniques, as well as decisions which are required to service each supply chain process distinguished according to customer needs. A conceptual framework is built for supply chains in order to meet marketplace requirements.

The steps to follow in order to propose an appropriate supply chain strategy were selected as;

- Identify existing (or planned) offerings by categorising the product portfolio via using the selected criteria
- Identify requirements within the supply chain structure for each category
- Propose supply chain strategies for each regarding facilities, inventory, transportation and information value drivers as well as supply chain tools and techniques

In order to see the foregoing current (or expected) situation, the existing (or planned) product portfolio can be categorised and supply chains designed to maximise competitiveness in each category.

For this purpose, from all the variables proposed in the literature, five criteria are selected in this study (The list of the sources was given in the background section of the thesis). These are; forecast uncertainty, demand volume, product variety, time window for delivery (delivery lead-time) and demand variability.

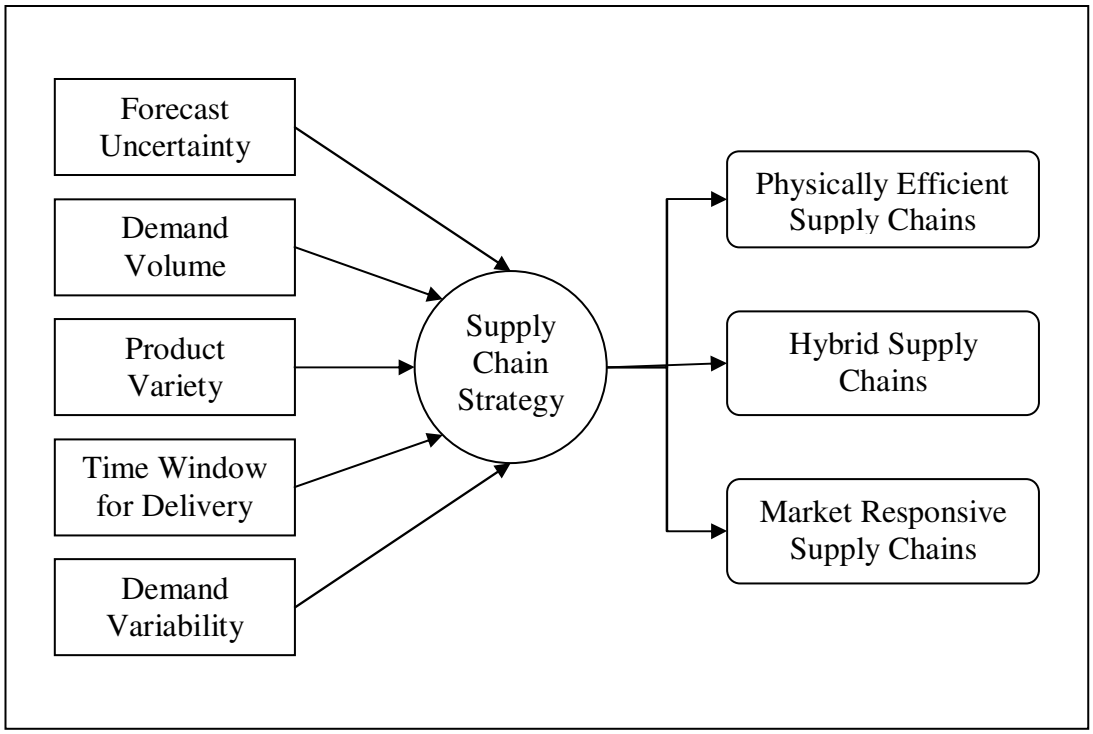

Figure 5.1 : Categorising the product portfolio and supply chain.

The sequence of the five criteria can be shifted and sorted according to the each particular company (Childerhouse et al., 2002). Because in many situations, all the variables might not be utilized for classification by companies due to their product portfolio.

The important thing to pay attention here is to achieve the distinguishing among the products of a company so as to maximise the competitiveness in the marketplace through establishing the right supply chain strategy in each category.

From the collections made from literature, it is realised that forecast uncertainty (or product life cycle duration or contribution margins) has a determining effect on product classifications. What is determined from the empirical studies of many authors is that differences in forecast uncertainty, product life cycle duration and contribution margin indicate very different needs for supply chains; either efficiency- or responsiveness-focus (Wong et al., 2006; Childerhouse et al., 2002; Christopher and Towill, 2002; Li and O'Brien, 2001; Chase et al., 2001; Pagh and Cooper, 1998).

Hence, one of those variables is selected so as to be the first criterion in the framework. It is "forecast uncertainty" so do the forecast errors occur, (Fisher, 1997) because the factors causing it include "unexpected customer trends" (Wong et al., 2006) which is a good significance of product life cycle stage, "competition" (Gattorna and Walters, 1996) which makes the effect of competitive situation included in this study and "supply chain uncertainty" which is very important in supply chain strategy determination (Lee, 2002 and Chopra and Meindl, 2004).

As the second criterion in the framework, "demand volume", which refers to annual volume of demand, is selected. Because it has a great impact on appropriate manufacturing process selection, as well as on other supply chain operations. Additionally, high volume generally implies opportunity for "low cost capability" as a business competitive capability through adopting the economies of scale, whilst low volume requires focusing on availability.

"Product variety", which implies the quantitity of product variants in one category, is chosen as the third criterion because it signifies the need for "flexibility capabilities" and "service capabilities" as business competitive capabilities and it influences the extent to which postponement can be achieved.

"Time window for delivery", which refers to the delivery lead-time, is determined as the forth criterion due to the fact that it reflects the customer requirements in terms of "delivery capabilities" as business competitive capabilities, as well as responsiveness need. It shows also the extent to which production and supply chain operations can be postponed (or speculated otherwise).

Finally, "demand variation", which implies relates to spikiness of demand and unpredictability, is chosen because it influences the inventory policies and production strategies. Unpredictability increases the risk of obsolescence and lost sales and can be addressed via information enrichment (Mason-Jones and Towill, 1997), consultative forecasting (Fisher, 1997) and lead time reduction. It can be measured by the coefficient of variant (c.o.v.) of demand. It stresses "volume flexibility capability" as a business competitive capability.

5.1 The Conceptual Framework

The conceptual framework for manufacturing firms which may guide them while devising/revising their supply chain strategies is built. The fundamental approach of the framework is the necessity of the alignment between the business and supply chain strategies through the chosen aspects of demand as the principal strategic dimensions by which supply systems can be analysed and classified. Accordingly, it is essential to build the supply chain based on the competitive objectives of the firm (order winning criteria in market place). Finally, the techniques and tools related to supply chain management, as well as decisions and approaches are proposed.

In the framework, the clustering of products for a manufacturing firm can be made and the corresponding strategy can be followed for each clustered category of products with respect to the five selected criteria for this framework.

The framework is separated into two and demonstrated as figure 5.2 and figure 5.3. Afterwards, the summary of criteria combinations are given for each strategy as table 5.2 and 5.3 in two parts.

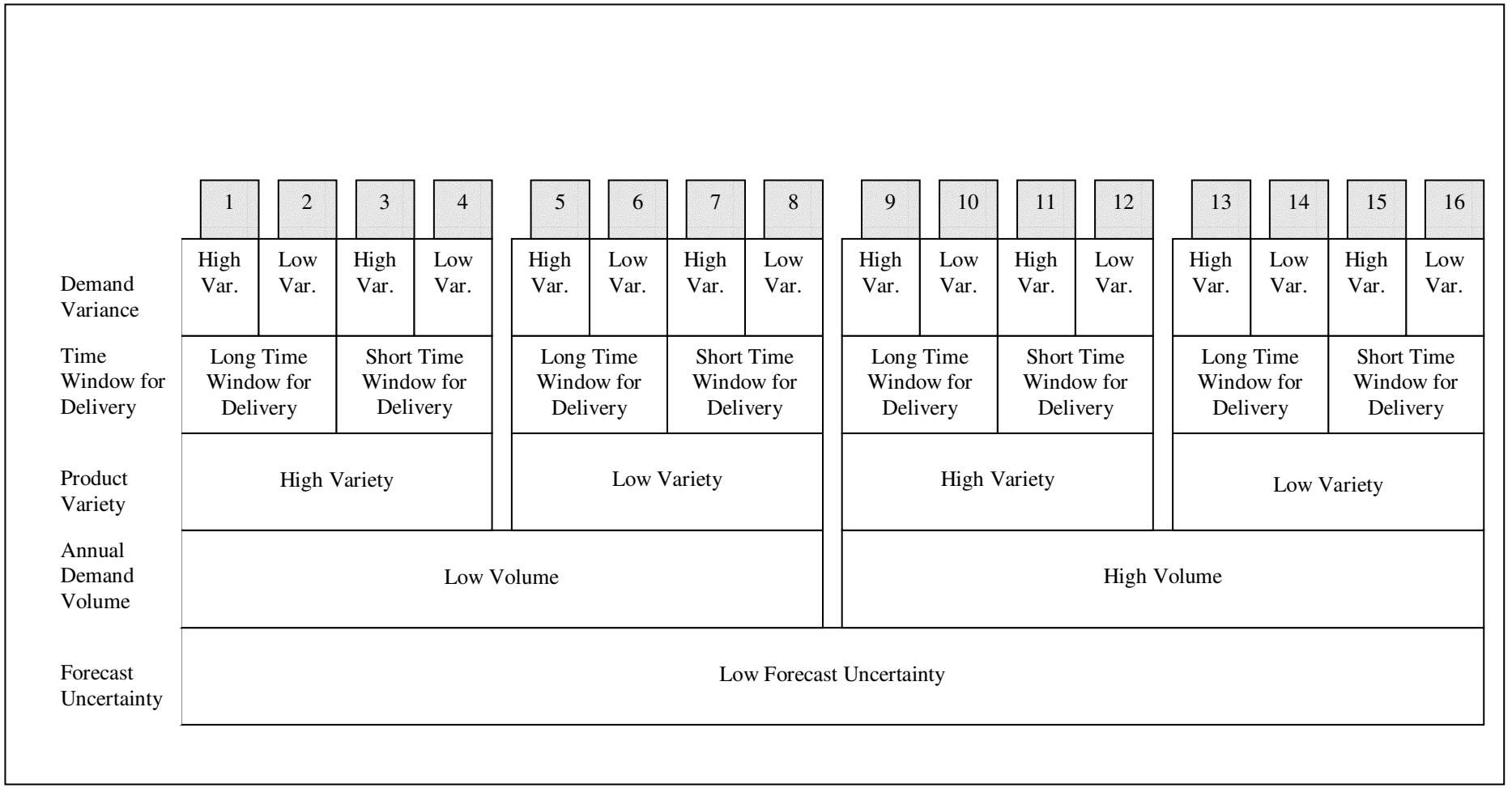

Figure 5.2 : The conceptual framework – Part I.

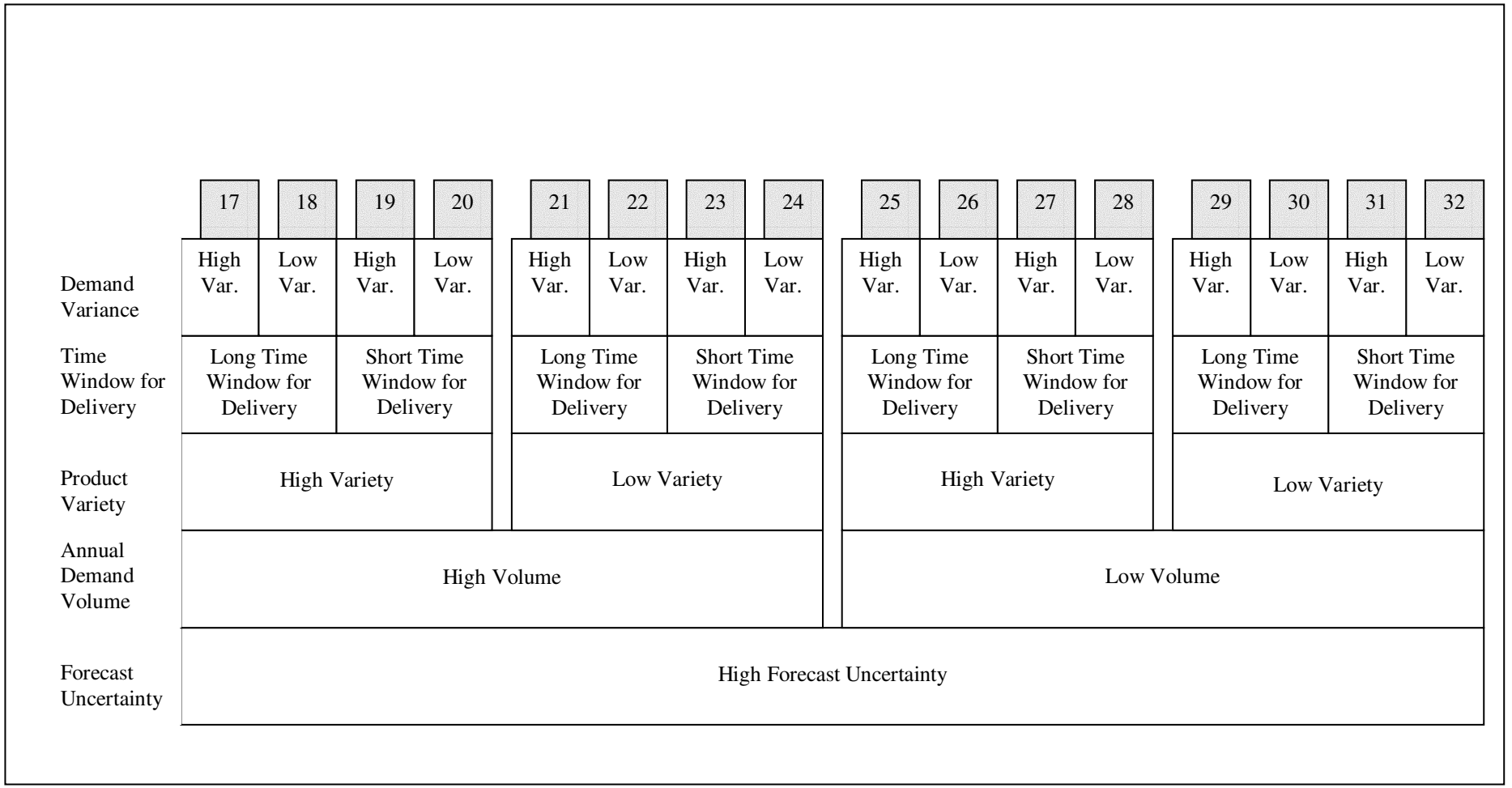

Figure 5.3 : The conceptual framework – Part II.

All combinations of those criteria can not be necessary for the products of a particular firm. Hence; for each firm, just a few strategies of the proposed ones can probably be used. Some of the combinations are not possible in the real world. The most encountered situations are explained as the first in the interpretations section.

All theocratic combinations of selected criteria are summarized in Table 5.1 and Table 5.2. According to those characteristic combinations of demand and supply chain, some appropriate supply chain practice advices are given in the further sections. However, some combinations are not common in real life, are not possible as well. For those, some basic recommendations are made as common sense.

Table 5.2: Summary of all strategies regarding the selected criteria (I).

Aspects of Demand	Strategy 1	Strategy 2	Strategy 3	Strategy 4	Strategy 5	Strategy 6	Strategy 7	Strategy 8
Fore. Un.	Low	Low	Low	Low	Low	Low	Low	Low
Volume	Low	Low	Low	Low	Low	Low	Low	Low
Variety	High	High	High	High	Low	Low	Low	Low
TW for D	Long	Long	Short	Short	Long	Long	Short	Short
Variability	High	Low	High	Low	High	Low	High	Low

Aspects of Demand	Strategy 9	Strategy 10	Strategy 11	Strategy 12	Strategy 13	Strategy 14	Strategy 15	Strategy 16
Fore. Un.	Low	Low	Low	Low	Low	Low	Low	Low
Volume	High	High	High	High	High	High	High	High
Variety	High	High	High	High	Low	Low	Low	Low
TW for D	Long	Long	Short	Short	Long	Long	Short	Short
Variability	High	Low	High	Low	High	Low	High	Low

Table 5.3: Summary of all strategies regarding the selected criteria (II).

Aspects of Demand	Strategy 17	Strategy 18	Strategy 19	Strategy 20	Strategy 21	Strategy 22	Strategy 23	Strategy 24
Fore. Un.	High	High	High	High	High	High	High	High
Volume	High	High	High	High	High	High	High	High
Variety	High	High	High	High	Low	Low	Low	Low
TW for D	Long	Long	Short	Short	Long	Long	Short	Short
Variability	High	Low	High	Low	High	Low	High	Low

Aspects of Demand	Strategy 25	Strategy 26	Strategy 27	Strategy 28	Strategy 29	Strategy 30	Strategy 31	Strategy 32
Fore. Un.	High	High	High	High	High	High	High	High
Volume	Low	Low	Low	Low	Low	Low	Low	Low
Variety	High	High	High	High	Low	Low	Low	Low
TW for D	Long	Long	Short	Short	Long	Long	Short	Short
Variability	High	Low	High	Low	High	Low	High	Low

5.2 Strategies and Interpretations

The strategies no: 14, 11, 16 and 27 are defined as the perfect match for some specific supply chain processes.

- lean: plan and execute
- lean: continuous replenishment
- postponement
- agile: quick response

Table 5.4 and table 5.5 summarize the strategies which are most encountered in the real world and their idealized solutions.

Table 5.4 : The summary of the most encountered strategies (I).

	Strategy 14	Strategy 16
Approach	Lean: Plan and Execute	Time-based (replenishment)
Focus	Efficiency	Relationship Improvement Loyalty
Production	MTS, assembly lines	MTS, assembly lines
Capacity	Dedicated	Dedicated
Facilities	Centralised	Centralised
Inventory	DC for early orders, centralisation, SKU	Cross-docking from central DC, VMI
Transportation	Cheap transportation modes, economies of scale	Faster transportation modes, economies of scale
Information	Demand management, sales and operations planning Production Scheduling, Strategic Network Optimization, TMS, WMS, ERP & other IT systems	Demand management, sales and operations planning Joint replenishment and synchronized planning CRM, WMS, TMS, POS data shared by all vendors, RFID
Supplier Selection Criteria	low cost, quality conformance	low cost, delivery speed and delivery dependability
Supplier Relationship	Arm's-length and trading relationships of buyer-seller	Strategic Partnerships Long-term Information sharing
Winning Criteria	Low Cost Quality Conformance	Low Cost Delivery Dependability
Business Strategy	Low Cost	Low Cost

Table 5.5 : The summary of the most encountered strategies (II).

	Strategy 11	Strategy 27
Approach	Lean till DP, Agile after DP (Postponement)	Agile: Quick Response
Focus	Responsiveness	Agility
Production / Process	Modular process/Re-sequencing Standardisation long LT (MTS, assembly lines) & customisation of features with short LT (ATO batch production)	Make-to-order (MTO) and job shop of specialists Short end-to-end pipelines
Capacity	Dedicated till DP, flexible after DP	Flexible capacity
Facilities	Decentralised after DP and proximity	Decentralised, proximity
Inventory	Safety stock (strategic) for volatile demand in DP	Safety stock of generic items for volatile demand
Transportation	Consolidation till DP	Fast transportation modes, merge-in-transit (direct delivery)
Information	Advanced planning & scheduling Demand management, sales and operations planning Strategic Network Optimization WMS, TMS	Electronic data interchange or point-of-sales (EDI/POS) Market research Market exchanges
Supplier Sel. Criteria	Flexibility, Delivery speed, Delivery reliability	Speed, Delivery flexibility
Supplier Relationship	Specific and special suppliers, collaborative Supplier hubs, outsourcing	Early design collaboration, Sychonised operations High integration. Risk and resource sharing
Winning Criteria	Volume flexibility, Broad product line capability Delivery capabilities, Cost awareness exists	New product introduction Delivery speed
Business Strategy	Differentiation	Focus differentiation

The other strategies are defined and made proposals regarding supply chain structure and decisions. However, they need to be improved and shifted to the perfect matching strategies by additional strategies (if it is possible).

Strategy 14: Perfect match for lean: plan and execute:

- Low forecast uncertainty indicates low risk, a stable supply process and tend to be mature low risk product because of low demand variability. This probably signifies the need for efficiency-focus.
- Demand variability is low which implies that a forecast-driven approach can be adopted since the demand is predictable.
- According to product/process theory, this is probably a process-oriented organisation which implies possibly being at the maturity stage of the product life cycle. Low forecast uncertainty supports this idea.
- Since the key to winning criterion in the marketplace for the high volume products is generally determined to be cost, a lean approach can be followed.
- Assets that do not create added value from the customer's perspective have to be eliminated or prevented with respect to lean approach which requires inventory reduction and process improvement strongly.
- Low variability calls for a make-to-stock (MTS) production since the demand volume is high. Additionally the stable demand make it possible for firms to follow a more standardized process (supporting economies of scale and efficient solutions) such as "assembly line" which will provide the opportunity of generating with low costs and of supplying adequate products for the target customers.
- For an efficiency acquiring, a dedicated capacity will be beneficial. ERP/MRP systems can be adopted due to the fact that firms can drive their entire shop floor operations by simply loading in a forecast through those.
- Facilities should be in smaller numbers of bigger facilities in accordance with economies of scale. Thus, a centralized locating of facilities can be preferred so as to exploit efficiency. Distribution centres (DC) for inventory keeping of early-orders.
- A central IT system can be used to manage the global inventories, and then overall stock levels can be reduced through an information system that can provide complete visibility of the supply pipeline in real time.
- Logistics can be outsourced by service providers for efficiency.

- Because time window for delivery is long, an offshore supply or outsourcing may be preferred which might provide lower costs, according as the extent of this duration. However, especially for global supply chains, taxes, quotas, worker availability and skills, cost and quality are also very important determinants as well for this decision.
- Suppliers should be chosen and qualified in terms of low cost, quality conformance and delivery dependability. Arm's-length and trading relationships of buyer-seller can be proposed.
- Those characteristics ask for the "price capabilities" as the competitive capabilities, as well as the "quality capabilities" making product reliability probably important for the supplier selection with low price. Those practices support the "overall leadership business strategy".

Strategy 16: Perfect Match for Time-based: Continuous Replenishment:

- Low forecast uncertainty indicates low risk, a stable supply process and probably a standard (commodity-like) product category. This probably signifies the need for efficiency-focus. Focusing on customer retention and loyalty since the product is a commodity-like and the time window for delivery is short.
- Very low demand variation and short time window for delivery signify that a time-based approach can be adopted.
- According to product/process theory, this is probably a process-oriented organization which implies possibly being at the maturity stage of the product life cycle. Low forecast uncertainty supports this idea.
- With a time-based (replenishment) approach, emphasis should be on balancing the interests of both operations and customers (loyalty).
- The stable demand make it possible for firms to follow a more standardized manufacturing process (supporting economies of scale and efficient solutions) such as "assembly line" which will provide the opportunity of generating with low costs and of supplying adequate products for the target customers. For an efficiency acquiring, a dedicated capacity could be beneficial.

- Short time window for delivery and predictable demand make replenishment possible, hence; replenishment from finished good inventory (MTS) can be adopted.
- Due to the fact that the time window for delivery is short and demand volume is high, rate-based planning and execution (RBPE) tools can be used for more efficient and productive capacity, inventory and resource utilization since the demand is predictable as well.
- Because short time window for delivery is essential, a JIT/Kanban approach in distribution can be utilized and cross-docking from distribution centres (DC) can be adopted while stocking is centralized. Third party service providers can manage transhipment centres which are often close to the company's manufacturing or assembly facility. Fast modes of transportation can be utilised.
- Suppliers should be chosen and qualified in terms of low cost, quality conformance, delivery speed and delivery dependability, long-term relationships are beneficial.
- Joint replenishment and synchronized planning programs with suppliers are very vital to prevent from bullwhip effect. Information integration can be achieved through the Internet.
- IT should be used for monitoring and controlling the day-to-day operations, and expected to facilitate operational efficiency (operational support systems), supporting function of information sharing and communication to link with customers and suppliers (strategic decision support systems), and providing basis for decision making.
- CRP and VMI environments by using point-of-sale data can be used which are supported by specialized information systems that efficiently manage the transfer of information between customer/buyer and the supplier/vendor (e.g., EDI) works for reducing lead times as well by effective integration providing reliable and rapid information exchange at each node. (SRM, ECR, CPFR are possible as well)

- Those characteristics ask for the "price capabilities" (because of the opportunity for economies of scale in manufacturing) as the competitive capabilities, as well as the "delivery capabilities" (because the speed and supplier reliability requirements). Those practices support the "overall leadership business strategy".

Strategy 11: Perfect Match for Mass Customisation (Postponement):

- High volume, high variety and high demand variability combination indicates an innovative/fashionable product with a stable supply chain base since the forecast uncertainty is low (most probably between 20-40%). Time window for delivery is short as well.
- Probably the product is in the growth stage of life cycle, hence; supply base is stable, and patterns are existed. Market is demanding and relatively unpredictable.
- High demand variability and high variety signify that this supply chain should be customer-driven. Hence; effectiveness comes before efficiency. Order winning criterion is availability (responsiveness) while there is cost awareness due to the product life cycle stage.
- High product variety and short time window for delivery make postponement applicable, as well as; SCP, APS and network models.
- Mass customisation may be adopted if the process and the product structure are modular and final assembly can be delayed until as late as possible so that it can be planned once a customer order is received. New product design should be handled for ease of assembly and test.
- Otherwise process re-sequencing may be appropriate and carrying out the value-adding activities at the last step before delivery to the end-customer. Thus, standardisation of features with long lead times and customisation of features with short lead times can be proposed. Process design should be revised for a better sequence.

- Lean approaches till decoupling point (DP), then agile approaches till delivery might be adopted for such a product category. Hence; MTS of generic forms in which steady flow is achieved till DP, then assembly-to-order (ATO) and batch production (or low-volume assembly lines) in order to provide maximum levels of customer service. Thus, economies of scale and scope are usable.
- The co-ordination of production and logistics activities and by the management of inventories and information flow.
- Third-party distribution and logistics companies that specialize in providing an inbound consolidation service can be utilized till DP, then in order to achieve agility, decentralized facilities for so as to be more responsive can be done (buffer inventory for to be ready for customer volatile demands).
- According to the extent of the acceptable delivery lead time, a different level of postponement can be deployed, as well as fast transportation modes.
- Specific and special suppliers are necessary. Supplier selection should be according to flexibility, speed as well as reliability.
- Supply integration should be done to ensure reliable and stable supplies of components and subassemblies. Supplier hub to reduce the supply risks of their manufacturing lines can be tried.
- "IS for comprehensiveness" strategy enabling comprehensive decisions and quick responses through knowledge of other organizations would fit. Accordingly, market information, inter-organizational systems and strategic decision support systems are more beneficial. Operational support systems can be adopted in medium level due to the price awareness.
- "Volume flexibility" and "broad product line capability" (because of high product variety), "delivery capabilities" (because of short time window for delivery) and relatively "cost capabilities" (because of the opportunity for economies of scale due to the high volume) are required for such a situation as competitive capabilities. Focusing on many core competences required so as to satisfy customers, hence; the business strategy can be "differentiation business strategy".

Strategy 27: Perfect Match for Agile: Quick Response:

- High forecast uncertainty with demand variation indicate high competition, high supply uncertainty (evolving supply base) and changing customer trends, hence; highly fashionable or highly innovative product.
- According to product/process theory, this is probably a product-oriented organisation which implies possibly being at the introduction stage of the product life cycle. High forecast uncertainty supports this idea. New product introduction capability should be established and high level of R&D might be necessary.
- High variety, low volume, short time window for delivery and high demand variability probably require agility approach in production and distribution.
- No standard processes can provide the required agility, thus, low system requirements might be sufficient. Event management applications and usage of local initiatives on time might be helpful. Make-to-order (MTO) and a job shop can be adopted in production.
- Set-up and pipe-line time reduction are very important.
- Due to the very high unpredictability of demand and supply, hedging against and through collaboration with other companies and/or suppliers might be useful. Early design collaboration can be adopted; resources can be deployed to share the risk.
- "New product introduction capability" and "delivery speed capability" (because of highly innovative product characteristics) are very important. Price sensitivity is low, high value-added features with a premium price. Hence, those can support a "focus business strategy".

Strategy 13: Perfect Match for Promotions of Functional Products:

- High volume and high demand variability combination probably signify a promotional driven product. Low forecast uncertainty points out that lead-times are known and this is probably a functional product.
- Finished-good inventory on hand for maximum order quantity projections only. For those, MTS production in assembly lines since volume is high and variety is low.

- For projected quantities of order, finished-good inventory can be held. For the exceeding orders, longer lead-times should be announced to the customers. Because the production should be done as MTO.
- Out-of-stock is the primarily threat in this situation, forecasting of potential selling should be measured carefully and a buffer inventory for protection against sold-outs can be adopted.
- For facilities, if buffer stock is held for emergency orders, then it can be held in a DC close to the marketplace and faster transportation modes can be utilized. Otherwise, for MTS inventory of projected orders can de distributed from a Central DC, whilst source inventory should be held for MTO.
- "Price capabilities" (because of the opportunity for economies of scale in manufacturing and distribution) and "delivery reliability capability" are important for such a supply chain. Those support the "low price business strategy".

Strategy 1:

- Low volume and high demand variability require MTO production with push material flow. MTO production is justified with long time window for delivery acceptance in the market.
- Low forecast uncertainty indicates that MRP can be adopted as control mechanism, thus, forecasting ability should be held by giving importance.
- Low volume and high variety signify for batch production, a customisation based production.

Strategy 2:

- Low volume and low demand variability require MTO production with push material flow. MTO production is justified with long time window for delivery acceptance in the market.
- Low forecast uncertainty indicates that MRP can be adopted as control mechanism, thus, forecasting ability should be held by giving importance.
- Low volume and high variety signify for batch production.

Strategy 3:

- Low volume and high demand variability require MTO production with push material flow.
- Low forecast uncertainty indicates forecasting ability should be held by giving importance.
- Distribution warehouses located close to the marketplace as well as fast transportation modes so as to meet the short time window for delivery.
- Low volume and high variety signify for batch production.

Strategy 4:

- Low volume and low demand variability require MTO production with push material flow.
- Low forecast uncertainty indicates forecasting ability should be held by giving importance.
- Distribution warehouses located close to the marketplace as well as fast transportation modes so as to meet the short time window for delivery.
- Low volume and high variety signify for batch production.

Strategy 5:

- Low volume and high demand variability require MTO production with push material flow. MTO production is justified with long time window for delivery acceptance in the market.
- Low forecast uncertainty indicates that MRP can be adopted as control mechanism, thus, forecasting ability should be held by giving importance.
- Low volume and low variety signify that this product is one of a kind, thus, project process flow can be adopted.
- High demand variability with low forecast uncertainty imply that probably this is a seasonal product which is slow moving since the volume is low. Thus, high cycle inventory keeping might be necessary.

Strategy 6:

- Low volume and low demand variability require MTO production with push material flow. MTO production is justified with long time window for delivery acceptance in the market.
- Low forecast uncertainty indicates that MRP can be adopted as control mechanism, thus, forecasting ability should be held by giving importance.
- Low volume and low variety signify that this product is one of a kind, thus, project process flow can be adopted.

Strategy 7:

- Low volume and high demand variability require MTO production with push material flow.
- Low forecast uncertainty indicates forecasting ability should be held by giving importance.
- Distribution warehouses located close to the marketplace as well as fast transportation modes so as to meet the short time window for delivery.
- Low volume and low variety signify that this product is one of a kind, thus, project process flow can be adopted.

Strategy 8:

- Low volume and low demand variability require MTO production with push material flow.
- Low forecast uncertainty indicates forecasting ability should be held by giving importance.
- Distribution warehouses located close to the marketplace as well as fast transportation modes so as to meet the short time window for delivery.
- Low volume and low variety signify that this product is one of a kind, thus, project process flow can be adopted.

Strategy 9:

- High volume, high variety and high demand variability combination indicates an innovative/fashionable product with a stable supply chain base since the forecast uncertainty is low (most probably between 20-40%).
- Probably the product is in the growth stage of life cycle, hence; supply base is stable, and patterns are existed. Market is demanding and relatively unpredictable.
- High demand variability and high variety signify that this supply chain should be customer-driven. Hence; effectiveness comes before efficiency. Order winning criterion is availability (responsiveness) while there is cost awareness due to the product life cycle stage.
- High product variety makes postponement applicable, as well as; SCP, APS and network models, and long time window for delivery affects the DP's location and timing.
- Mass customisation may be adopted if the process and the product structure are modular and final assembly can be delayed until as late as possible so that it can be planned once a customer order is received. New product design should be handled for ease of assembly and test.
- Otherwise process re-sequencing may be appropriate and carrying out the value-adding activities at the last step before delivery to the end-customer. Thus, standardisation of features with long lead times and customisation of features with short lead times can be proposed. Process design should be revised for a better sequence.
- Lean approaches till decoupling point (DP), then agile approaches till delivery might be adopted for such a product category. Hence; MTS of generic forms in which steady flow is achieved till DP, then assembly-to-order (ATO) and batch production (or low-volume assembly lines) in order to provide maximum levels of customer service. Thus, economies of scale and scope are usable.
- The co-ordination of production and logistics activities and by the management of inventories and information flow.

- Third-party distribution and logistics companies that specialize in providing an inbound consolidation service can be utilized till DP, then in order to achieve agility, decentralized facilities for so as to be more responsive can be done (buffer inventory for to be ready for customer volatile demands).
- Specific and special suppliers are necessary. Supplier selection should be according to flexibility, speed as well as reliability.
- Supply integration should be done to ensure reliable and stable supplies of components and subassemblies. Supplier hub to reduce the supply risks of their manufacturing lines can be tried.
- "IS for comprehensiveness" strategy enabling comprehensive decisions and quick responses through knowledge of other organizations would fit. Accordingly, market information, inter-organizational systems and strategic decision support systems are more beneficial. Operational support systems can be adopted in medium level due to the price awareness.
- "Volume flexibility" and "broad product line capability" (because of high product variety), "delivery capabilities" (because of short time window for delivery) and relatively "cost capabilities" (because of the opportunity for economies of scale due to the high volume) are required for such a situation as competitive capabilities. Focusing on many core competences required so as to satisfy customers, hence; the business strategy can be "differentiation business strategy".

Strategy 10:

- Since forecast uncertainty and demand variability are low, it signifies that this is probably a functional product with a stable supply base.
- For a high volume/high variety combination in a predictable environment, the most suitable approach to adopt can be re-categorising the product portfolio in order to lower the product variety. Then, for each category, building separate supply chain process and strategy.
- A high volume/low variety combination in a predictable environment with long time window for delivery can be supported by Strategy 14.

Strategy 12:

- Since forecast uncertainty and demand variability are low, it signifies that this is probably a functional product with a stable supply base.
- Normally high variety and short time window for delivery make postponement an ideal solution. However, in a predictable environment, gain from postponement would be very little.
- For a high volume/high variety combination in a predictable environment, the most suitable approach to adopt can be re-categorising the product portfolio in order to lower the product variety. Then, for each category, building separate supply chain process and strategy.
- A high volume/low variety combination in a predictable environment with short time window for delivery can be supported by Strategy 16.

Strategy 15:

- High volume and high demand variability combination probably signify a promotional driven product. Low forecast uncertainty points out that lead-times are known and this is probably a functional product.
- Finished-good inventory on hand for maximum order quantity projections only. For those, MTS production in assembly lines since volume is high.
- For projected quantities of order, finished-good inventory can be held. For the exceeding orders, longer lead-times should be announced to the customers. Because the production should be done as MTO.
- Out-of-stock is the primarily threat in this situation, forecasting of potential selling should be measured carefully.
- Buffer inventory can be adopted since the time window for delivery is short and safety stock may be a solution for hedging against stock-outs.
- For facilities, buffer stock can be held in a DC close to the marketplace and fast transportation modes can be utilized. Otherwise, for MTS inventory of projected orders can de distributed from a decentralized DCs which are close to the customers, whilst source inventory can be held for MTO.

- "Price capabilities" (because of the opportunity for economies of scale in manufacturing and distribution due to high volume) and "delivery reliability capability" are important for such a supply chain. Those support the "low price business strategy".

Strategy 17:

- High forecast uncertainty with demand variation indicate high competition, high supply uncertainty (evolving supply base) and changing customer trends, hence; highly fashionable or highly innovative product.
- According to product/process theory, this is probably a product-oriented organization which implies possibly being at the introduction stage of the product life cycle. High forecast uncertainty supports this idea. New product introduction capability should be established and high level of R&D might be necessary.
- High variety and high demand variability probably require agility approach in production and distribution.
- However, in order to sustain required agility which is very high, product re-categorisation can be done so as to lower the volume and then maybe to take advantage of economies of scope.
- No standard processes can provide the required agility, thus, low system requirements might be sufficient. Event management applications and usage of local initiatives on time might be helpful. Make-to-order (MTO) and a job shop or batch production (after lowering the volume) can be adopted in production.
- Due to the very high unpredictability of demand and supply, hedging against and through collaboration with other companies and/or suppliers might be useful. Early design collaboration can be adopted; resources can be deployed to share the risk.

Strategy 18:

- High forecast uncertainty and predictable demand signal that this is a seasonal product (probably functional) with an unreliable supplier base, maybe due to the source characteristics.

- However, in order to achieve economies of scale, product re-categorisation can be done so as to lower the variety for each category since the volume is love and demand is relatively predictable and to build separate assembly lines for each.
- High volume and low demand variability might bring MTO production with push material flow. MTO production can be justified since time window for delivery is long.
- MTS is another option due to the fact that the demand variability is low and volume is high. Because of high forecast uncertainty, inventory pool approach might be helpful via market exchanges that are available on the Internet. This can also extend the reach of a typical buyer to suppliers from a global market so as to expand the supply base.
- When the component is of low value, then it might be worthwhile to stockpile the components so that the order fulfilment process will not be disrupted due to part shortages. The product characteristics should not be forgotten if these seasonal products are decaying fast.
- Inventory pooling can be adopted by similar companies so as to hedge against the risk. Then having real time information on inventory and demand might allow the most cost-effective transhipment of goods from one site (with excess inventory) to another site (in need).

Strategy 19:

- High forecast uncertainty with demand variation indicate high competition, high supply uncertainty (evolving supply base) and changing customer trends, hence; highly fashionable or highly innovative product.
- According to product/process theory, this is probably a product-oriented organization which implies possibly being at the introduction stage of the product life cycle. High forecast uncertainty supports this idea. New product introduction capability should be established and high level of R&D might be necessary.
- High variety, short time window for delivery and high demand variability probably require agility approach in production and distribution.

- However, in order to sustain required agility which is very high, product re-categorisation can be done so as to lower the volume and then maybe to take advantage of economies of scope. Then Strategy 27 can be followed.

Strategy 20:

- High forecast uncertainty and predictable demand signal that this is a seasonal product (probably functional) with an unreliable supplier base, maybe due to the source characteristics.
- However, in order to achieve economies of scale, product re-categorisation can be done so as to lower the variety for each category since the volume is love and demand is relatively predictable and to build separate assembly lines for each.
- High volume and low demand variability might bring MTO production with push material flow. MTO production can be justified with faster transportation modes in case time window for delivery is short enough. But this might be too expensive since the product is functional with low margins.
- MTS is another option due to the fact that the demand variability is low and volume is high. Because of high forecast uncertainty, inventory pool approach might be helpful via market exchanges who are available on the Internet. This can also extend the reach of a typical buyer to suppliers from a global market so as to expand the supply base.
- When the component is of low value, then it might be worthwhile to stockpile the components so that the order fulfilment process will not be disrupted due to part shortages. The product characteristics should not be forgotten if these seasonal products are decaying fast.
- Inventory pooling can be adopted by similar companies so as to hedge against the risk. Then having real time information on inventory and demand might allow the most cost-effective transhipment of goods from one site (with excess inventory) to another site (in need).

Strategy 21:

- High forecast uncertainty with demand variation indicate high competition, high supply uncertainty (evolving supply base) and changing customer trends, hence; highly fashionable or highly innovative product.
- According to product/process theory, this is probably a product-oriented organization which implies possibly being at the introduction stage of the product life cycle. High forecast uncertainty supports this idea. New product introduction capability should be established and high level of R&D might be necessary.
- It is probably necessary to have short end-to-end pipelines to enable demand to be continuously replenished during the life cycle.
- High forecast uncertainty and high demand variability probably require agility approach in production and distribution in order to meet unpredictable demand.
- However, in order to sustain required agility which is very high, product re-categorisation can be done so as to lower the volume and then maybe to take advantage of economies of scope.
- High variety requires continuous appraisal of the proportional breakdown between variants must be conducted during the product life cycle because those variants popular at the introductory stage may be less popular in the decline stage.
- No standard processes can provide the required agility, thus, low system requirements might be sufficient. Event management applications and usage of local initiatives on time might be helpful. Make-to-order (MTO) and a job shop or batch production (after lowering the volume) can be adopted in production.
- Due to the very high unpredictability of demand and supply, hedging against and through collaboration with other companies and/or suppliers might be useful. Early design collaboration can be adopted; resources can be deployed to share the risk.

Strategy 22:

- High forecast uncertainty and predictable demand signal that this is a seasonal product (probably functional) with an unreliable supplier base, maybe due to the source characteristics.
- High volume and low demand variability might bring MTO production with push material flow. MTO production can be justified since time window for delivery is long.
- MTS is another option due to the fact that the demand variability is low and volume is high. Because of high forecast uncertainty, inventory pool approach might be helpful via market exchanges who are available on the Internet. This can also extend the reach of a typical buyer to suppliers from a global market so as to expand the supply base.
- Low variety/high volume is appropriate for assembly line.
- When the component is of low value, then it might be worthwhile to stockpile the components so that the order fulfilment process will not be disrupted due to part shortages. The product characteristics should not be forgotten if these seasonal products are decaying fast.
- Inventory pooling can be adopted by similar companies so as to hedge against the risk. Then having real time information on inventory and demand might allow the most cost-effective transhipment of goods from one site (with excess inventory) to another site (in need).

Strategy 23:

- High forecast uncertainty with demand variation indicate high competition, high supply uncertainty (evolving supply base) and changing customer trends, hence; highly fashionable or highly innovative product.
- According to product/process theory, this is probably a product-oriented organization which implies possibly being at the introduction stage of the product life cycle. High forecast uncertainty supports this idea. New product introduction capability should be established and high level of R&D might be necessary.

- Short time window for delivery and high demand variability and forecast uncertainty probably require agility approach in production and distribution.
- However, in order to sustain required agility which is very high, product re-categorisation can be done so as to lower the volume and then maybe to take advantage of economies of scope.
- No standard processes can provide the required agility, thus, low system requirements might be sufficient. Event management applications and usage of local initiatives on time might be helpful. Make-to-order (MTO) and a job shop can be adopted in production.
- Due to the very high unpredictability of demand and supply, hedging against and through collaboration with other companies and/or suppliers might be useful. Early design collaboration can be adopted; resources can be deployed to share the risk.
- "New product introduction capability" and "delivery speed capability" (because of highly innovative product characteristics) are very important. Price sensitivity is low, high value-added features with a premium price. Hence, those can support a "focus business strategy".

Strategy 24:

- High forecast uncertainty and predictable demand signal that this is a seasonal product (probably functional) with an unreliable supplier base, maybe due to the source characteristics.
- High volume and low demand variability might bring MTO production with push material flow. MTO production can be justified with faster transportation modes in case time window for delivery is short enough. But this might be too expensive since the product is functional with low margins.
- MTS is another option due to the fact that the demand variability is low and volume is high. Because of high forecast uncertainty, inventory pool approach might be helpful via market exchanges that are available on the Internet. This can also extend the reach of a typical buyer to suppliers from a global market so as to expand the supply base.
- Low variety/high volume is appropriate for assembly line.

- When the component is of low value, then it might be worthwhile to stockpile the components so that the order fulfilment process will not be disrupted due to part shortages. The product characteristics should not be forgotten if these seasonal products are decaying fast.
- Inventory pooling can be adopted by similar companies so as to hedge against the risk. Then having real time information on inventory and demand might allow the most cost-effective transhipment of goods from one site (with excess inventory) to another site (in need).

Strategy 25:

- High forecast uncertainty with demand variation indicate high competition, high supply uncertainty (evolving supply base) and changing customer trends, hence; highly fashionable or highly innovative product.
- According to product/process theory, this is probably a product-oriented organization which implies possibly being at the introduction stage of the product life cycle. High forecast uncertainty supports this idea. New product introduction capability should be established and high level of R&D might be necessary.
- High variety, low volume, and high demand variability probably require agility approach in production. Because the time window for delivery is long, then offshore facilities or regional facilities with slower (and cheaper) transportation modes can be preferred.
- A MTO production can be held with acceptable lead times, demand driven and customisation for high variety promise.
- Probably it is in the introduction stage of product life cycle. Accordingly, "new product introduction capability" should be adopted. The capability of design is probably crucial.

Strategy 26:

- High forecast uncertainty and predictable demand signal that this is a seasonal product (probably functional) with an unreliable supplier base, maybe due to the source characteristics.

- Low volume and low demand variability require MTO production with push material flow. MTO production is justified with long time window for delivery acceptance in the market.
- High variety/low volume is appropriate for batch production.
- When the component is of low value, then it might be worthwhile to stockpile the components so that the order fulfilment process will not be disrupted due to part shortages.
- The Internet, via market exchanges, can extend the reach of a typical buyer to suppliers from a global market so as to expand the supply base.
- Inventory pooling can be adopted with similar companies so as to hedge against the risk. Then having real time information on inventory and demand might allow the most cost-effective transhipment of goods from one site (with excess inventory) to another site (in need).
- Long time window for delivery may let the facilities being located offshore for a lower cost. However, the product characteristics should not be forgotten if these seasonal products are decaying fast.

Strategy 28:

- High forecast uncertainty and predictable demand signal that this is a seasonal product (probably functional) with an unreliable supplier base, maybe due to the source characteristics.
- Low volume and low demand variability might bring MTO production with push material flow. MTO production can be justified with faster transportation modes in case time window for delivery is short enough. But this might be too expensive since the product is functional with low margins.
- MTS is another option due to the fact that the demand variability is low. Because of high forecast uncertainty, inventory pool approach might be helpful via market exchanges that are available on the Internet. This can also extend the reach of a typical buyer to suppliers from a global market so as to expand the supply base.
- High variety/low volume is appropriate for batch production.

- When the component is of low value, then it might be worthwhile to stockpile the components so that the order fulfilment process will not be disrupted due to part shortages. The product characteristics should not be forgotten if these seasonal products are decaying fast.
- Inventory pooling can be adopted by similar companies so as to hedge against the risk. Then having real time information on inventory and demand might allow the most cost-effective transhipment of goods from one site (with excess inventory) to another site (in need).

Strategy 29:

- High forecast uncertainty with demand variation indicate high competition, high supply uncertainty (evolving supply base) and changing customer trends, hence; highly fashionable or highly innovative product.
- According to product/process theory, this is probably a product-oriented organization which implies possibly being at the introduction stage of the product life cycle. High forecast uncertainty supports this idea. New product introduction capability should be established and high level of R&D might be necessary.
- Low variety/low volume is appropriate for job shop or batch production.
- High forecast uncertainty and demand variability probably require agility approach in production. Because the time window for delivery is long, then offshore facilities or regional facilities with slower (and cheaper) transportation modes can be preferred.
- A MTO production can be held with acceptable lead times, demand driven. Since the variety is low, probably specialization on some specific products is point at issue. If this very special product can not be translated into sustainability through frequent innovations, then the order winning might not be achieved any more. Accordingly, “new product introduction capability” should be adopted.
- Probably it is in the introduction stage of product life cycle due to the forecast uncertainty and demand variation. The capability of design is probably crucial.

- Because the customer group seems like very focused, the business strategy might be a “focus business strategy”.

Strategy 30:

- High forecast uncertainty and predictable demand signal that this is a seasonal product (probably functional) with an unreliable supplier base, maybe due to the source characteristics.
- Low volume and low demand variability require MTO production with push material flow. MTO production is justified with long time window for delivery acceptance in the market.
- Low variety/low volume is appropriate for job shop or batch production.
- When the component is of low value, then it might be worthwhile to stockpile the components so that the order fulfilment process will not be disrupted due to part shortages.
- The Internet, via market exchanges, can extend the reach of a typical buyer to suppliers from a global market so as to expand the supply base.
- Inventory pooling can be adopted with similar companies so as to hedge against the risk. Then having real time information on inventory and demand might allow the most cost-effective transhipment of goods from one site (with excess inventory) to another site (in need).
- Long time window for delivery may let the facilities being located offshore for a lower cost. However, the product characteristics should not be forgotten if these seasonal products are decaying fast.

Strategy 31:

- High forecast uncertainty with demand variation indicate high competition, high supply uncertainty (evolving supply base) and changing customer trends, hence; highly fashionable or highly innovative product.

- According to product/process theory, this is probably a product-oriented organization which implies possibly being at the introduction stage of the product life cycle. High forecast uncertainty supports this idea. New product introduction capability should be established and high level of R&D might be necessary.
- Because the time window for delivery is short, then it is better to be located close to the market place. Then an MTO production can be held with acceptable lead times since the volume is low, demand driven process. So, supplier selection might be held in regional area with respect to its design capabilities. Accordingly, low price sensitivity is possible.
- Otherwise, a MTS production can be held with the high risk of obsolescence, safety stock for unpredictable orders. However, this is very risky.
- Since the variety is low, probably specialization on some specific products is point at issue. If this very special product can not be translated into sustainability through frequent innovations, then the order winning might not be achieved any more. Accordingly, "new product introduction capability" should be adopted.
- Probably it is in the introduction stage of product life cycle due to the forecast uncertainty and demand variation. The capability of design is probably crucial.
- Because the customer group seems like very focused, the business strategy might be a "focus business strategy".

Strategy 32:

- High forecast uncertainty and predictable demand signal that this is a seasonal product (probably functional) with an unreliable supplier base, maybe due to the source characteristics.
- Low volume and low demand variability might bring MTO production with push material flow. MTO production can be justified with faster transportation modes in case time window for delivery is short enough. But this might be too expensive since the product is functional with low margins.

- MTS is another option due to the fact that the demand variability is low. Because of high forecast uncertainty, inventory pool approach might be helpful via market exchanges that are available on the Internet. This can also extend the reach of a typical buyer to suppliers from a global market so as to expand the supply base.
- Low variety/low volume is appropriate for job shop or batch production.
- When the component is of low value, then it might be worthwhile to stockpile the components so that the order fulfilment process will not be disrupted due to part shortages. The product characteristics should not be forgotten if these seasonal products are decaying fast.
- Inventory pooling can be adopted by similar companies so as to hedge against the risk. Then having real time information on inventory and demand might allow the most cost-effective transhipment of goods from one site (with excess inventory) to another site (in need).

5.3 Discussions and Recommendations

The strategies no: 14, 11, 16 and 27 are defined as the perfect match for some specific supply chain processes. Because they provide all conditions required to be defined as lean: plan and execute, lean: continuous replenishment, postponement, agile: quick response.

The other strategies are defined and made proposals regarding supply chain structure and decisions. However, they need to be improved and shifted to the perfect matching strategies by additional strategies (if it is possible).

References according to the publication year are:

Caniato et al., 2008; Rayner, 2008; Schnetzler et al., 2007; Wong et al., 2006; Christopher et al., 2004; Stonebraker and Afifi, 2004; Aitken et al., 2003; Vitasek et al., 2003; Childerhouse at al., 2002; Lee, 2002; Chase et al., 2001; Gattorna and Walters, 1996; Sweeney, 1991.

As recommendations for future studies;

- Application at a manufacturing company can be executed.
- The “non-matching strategies” can be examined for a better performance in supply chains.
- Additionally, demand and supply uncertainty reduction strategies can be identified.
- More detailed proposals can be made.
- Different aspects of demand can be adopted.
- Marketing and new product introduction strategies can be included into the study.
- Influences of competition can be investigated more intensively.

6. CONCLUSIONS

In order to achieve productivity, quality and speed, many management tools and techniques were brought front and they have taken the place of strategy, stated in the literature by many academicians. Hence, many companies have not been able to translate the remarkable gains of operational improvement into sustainable profitability. Consequently, supply chain performances are not satisfying enough without a particular strategy depending on characteristics of marketplace and customer needs. For sure achieving the superior performance is the primary goal of any company. However, in order to match supply and demand thus, to succeed a high performance, both operational effectiveness and strategy are needed.

Operational effectiveness refers to perform similar activities better than rivals do.But the essence of strategy is in the activities; choosing to perform activities differently or to perform different activities than competitors. Otherwise, a strategy can not be more than a marketing slogan that will not stand against competition.

Strategy can be described as the creation of a unique and valuable position, involving a different set of activities. “One does not fit all” and there is no “one ideal position”.Additionally, trying to satisfy everyone will lead not to satisfy anyone at all. It is not possible to produce all varieties, meet all needs and access all customers by using the same set of activities. Thus, companies should discover and be the first to meet the needs of their customers. This can be achieved via establishing a competitive advantage.

Competitive advantage is a position a firm occupies against its competitors. When a firm sustains profits that exceed the average for its industry, the firm is said to possess a competitive advantage over its rivals. The goal of much of business strategy is to achieve a sustainable competitive advantage. Competitive advantage is created by using resources and capabilities to achieve either a lower cost structure or a differentiated product. A firm positions itself in its industry through its choice of low cost or differentiation.

A firm's resources and capabilities together form its distinctive competencies. Competencies refer to core capabilities which are the skills that differentiate the manufacturing or service from its competitions. These enable innovation, efficiency, quality, and customer responsiveness, all of which can be leveraged to create a cost advantage or a differentiation advantage. In the end, it leads the value creation which satisfies the firm's customers' desires.

Traditional supply chain thinking has been efficiency-oriented which refers to a cost reduction and productivity sort of thinking. On the other hand, value chain thinking represents an effectiveness-oriented approach. In case, a supply chain could link with business strategy which aims to answer the question: "how should we compete in a given business?" value chain thinking may be achieved.

Furthermore, many companies are achieving significant competitive advantage by the way they configure and manage their supply chain operations. Thus, supply chain should be structured to meet the needs of different products and customer groups, which requires linking supply chain and operations with business strategy.

In order to execute a business strategy, all these functions play a role and each must develop its own strategy which refers to what each function will try to do particularly well. Consistency and support between supply chain strategy, business strategy, and other functional strategies, in other words achieving the strategic fit is very vital. Functional objectives should be derived from business (competitive) objectives, and then functional policies should be developed to address these objectives. This requires matching customer priorities with functional capabilities. Thus, for a given business strategy, a company should devise or revise its supply chain strategy.

Strategic fit implies that business strategy and supply chain strategy have the same goal. It means that consistency between customer priorities that the business (competitive) strategy aims to satisfy and the supply chain capabilities that specified by the supply chain strategy. The approach to matching the supply chain to the market is becoming increasingly important and the latest researches indicate that supply chain strategy impacts competitive performance of a company.

In developing and discussing the conceptual model of supply system structure, management and performance, the four variables of inventory, information, facilities and transportation can be seen both independently and jointly to have influence. Each has relevance within individual enterprises and between them. Opportunities exist for overall pipeline time reduction, for operational improvements leading to greater efficiency and for customer service improvements leading to greater effectiveness by configuring those with respect to the priorities of a supply chain strategy. For sure for a better performance of supply chains, it is needed to study, analyse and improve information exchange over the interfaces, linked to parallel study of the options relating to inventory, transportation, facilities, information and technology.

The idea of aligning the firm's operations with market place requirements has not been extended to the wider supply chain. It is logical that sourcing strategy, operations strategy and route-to-market need to be appropriate to specific product/market condition. Accordingly, in this thesis, it is aimed to detail the specific supply chain tools and techniques, as well as decisions which are required to service each supply chain process distinguished according to customer needs. A conceptual framework is built for supply chains in order to meet marketplace requirements in alignment with business strategies.

The strategy proposals given based on the aspects of demand and supply may be a beneficial guidance for managers while devising/revising the right supply chain strategy. However, the choices regarding and supply chain strategies must be continually reviewed and sometimes changed as the company's products and competitors evolve and mature.

REFERENCES

Aitken, J., Childerhouse, P., Towill, D.R., 2003. The impact of product life cycle on SC strategy: *International Journal of Production Economics.* **85,** pp. 127-140.

Al-Mudimigh, A. S., Zairi, M., Ahmed, A. M. M., 2004. Extending the concept of supply chain: the effective management of value chains: *International Journal of Production Economics*, **87**, pp. 309-320.

Ayers, J., 1999. Supply Chain Strategies: *Information Systems Management*, Vol. **16**, no. 2, pp. 72-79.

Buzzell, R., and Gale, B., 1987. *The PIMS principles: Linking strategy to performance,* Free Press, New York.

Bowersox, D.J., and Daugherty, P.J., 1995. Logistics paradigm: The impact of information technology: *Journal of Business Logistics*, Vol. **16**, no. 1, pp. 65-80.

Brun, A., Caniato, F., Caridi, M., Castelli, C., Miragliotta, G., Ronchi, S., Sianesi, A., Spina, G., 2008. Logistics and supply chain management in luxury fashion retail: Empirical investigation of Italian firms: *International Journal of Production Economics*, **114** (2), pp. 554-570.

Cagliano, R., Caniato, F., and Spina, G., 2004. Agile and traditional supply: How do they impact manufacturing performance?: *Journal of Purchasing & Supply Management*, **10**, pp. 151–164.

Canever, M. D; van Trijp, H., and van der Lans, I., 2007. Benefit-feature segmentation: a tool for the design of supply chain strategy: *Marketing Intelligence & Planning*, Vol. **25**, no: 5, pp. 511-533.

Caniato, F., Caridi, M., Castelli, C. M., Golini, R., 2008. A contingency approach for supply chain strategy in the Italian luxury industry: Do consolidated models fit?: *International Journal of Production Economics*, http://dx.doi.org/10.1016/j.ijpe.2008.07.027.

Chase, R. B., Aquilano N. J., and Jacobs F. R., 2001. *Operations management for competitive advantage*, McGraw-Hill/Irwin.

Childerhouse, P., Towill, D., 2000. Engineering supply chains to match customer requirements: *Logistics Information Management.* **13** (6), 337-345.

Childerhouse, P., Aitken, J., Towill, D.R., 2002. Analysis and design of focused demand chains: *Journal of Operations Management,* **20**, pp. 675-689.

Chopra S., and Meindl P., 2004. *Supply chain management: strategy, planning and operation*, Second Edition, Prentice Hall.

Christopher, M., and Towill, D.R., 2001. An integrated model for the design of agile supply chains: *International Journal of Physical Distribution & Logistics Management*, MCB University Press, 0960-0035**,** Vol**. 31**, no. 4, pp. 235-246.

Christopher, M., and Towill, D. R., 2002. Developing market specific supply chain strategies: *The International Journal of Logistics Management*, Vol. **13**, no. 1, pp. 1-14.

Christopher, M., Peck, H., and Towill, D. R., 2004. A taxonomy for selecting global supply chain strategies: *International Journal of Logistics Management*, Vol. **17**, no. 3, pp. 277-287.

Fisher, M., 1997. What is the right supply chain for your product?: *Harvard Business Review*, March/April, pp. 105–116.

Frohlich, M. T., and Dixon J. R., 2001. A taxonomy of manufacturing strategies revisited: *Journal of Operations Management*, **19**, pp. 541–558.

Gattorna, J. L., and Walters, D. W., 1996. *Managing the supply chain – A strategic perspective*, Palgrave.

Gattorna, J. L., 2008. The triple-A supply chain revisited: *Supply Chain Asia*, November/December, pp. 38-41.

Giunipero, L., and Brand, R., 1996: Purchasing's role in supply chain management: *International Journal of Logistics Management*, Vol. **7**, no. 1, pp. 29-38.

Gunasekaran, A., Patel, C., McGaughey, R. E., 2004. A framework for supply chain performance measurement: *International Journal of Production Economics,* **87,** pp. 333-347.

Harland, C. M., 1996. Supply chain management: relationships, chains and networks: *British Journal of Management*, Vol. **7**, no. 1, pp. 63-80.

Harland, C. M., Lamming, R. C., Cousins, P. D., 1999. Developing the concept of supply strategy. *International Journal of Operations and Production Management,* **19,** pp. 650-673.

Hayes, R. H., and S. C. Wheelwright, 1979. Link manufacturing process and product life cycles: *Harvard Business Review*, **January-February**, pp.133-140.

Hemilä J., Jansson K., and Happonen, A., 2007. Vendor managed inventory models in Sweden: *Industrial Benchmarking Experiences from Autumn 2006*, The Technical Research Centre of Finland Working Papers 1459-7683.

http://www.vtt.fi/inf/pdf/workingpapers/2007/W70.pdf accessed at 15.12.2008.

Hill, T., 2005. *Operations management*, Houndmills, Basingstoke, Hampshire; New York, N.Y.: Palgrave Macmillan

Hörte, S. Å., and Ylinenpää H., 1997. The firm's and its customers' views on order-winning criteria: *International Journal of Operations & Production Management*, Vol. **17**, no. 10, pp. 1006-1019.

Kaipia, R., and Holmström, J., 2007. Selecting the right planning approach for a product: *Supply Chain Management: An International Journal*, Vol. **12**, no. 1, pp. 3-13.

Ketchen, D. J. Jr., and Giunipero, L. C., 2004. The intersection of strategic management and supply chain management: *Industrial Marketing Management*, **33**, pp. 51– 56.

Kim, S. W., 2006. The effect of supply chain integration on the alignment between corporate competitive capability and supply chain operational capability: *International Journal of Operations & Production Management,* Vol. **26**, no. 10, pp. 1084-1107.

Kim, S. W., 2007. Organizational structures and the performance of supply chain management: *International Journal of Production Economics*, **106**, pp. 323–345.

Lamming, R., Johnsen, T., Zheng, J., and Harland, C., 2000. An initial classification of supply networks: *International Journal of Operations and Production Management,* **20**, no. 6, pp. 675-691.

Lampel, J., and Mintzberg, H., 1996. Customizing customization: *Sloan Management Review,* Vol. **38**, no. 1, pp. 21-30.

Lee, H. L., 2002. Aligning supply chain strategies with product uncertainties: *California Management Review*, Vol. **44**, no. 3, p. 105-119.

Lee, H. L., 2004. The triple-A supply chain: *Harvard Business Review*: October, pp. 102–112.

Li, D., and O'Brien, C., 2001. A quantitative analysis of relationships between product types and supply chain strategies: *International Journal of Production Economics*, Vol. **73**, no. 1, pp. 29-39.

Lummus, R. R., Vokurka, R. J., and Alber, K. L., 1998. Strategic supply chain planning: *Production & Inventory Management Journal*, Vol. **39**, no. 3, pp. 49-58.

Mason-Jones, R., Naylor, J. B., and Towill D. R., 2000. Lean, agile or leagile? matching your supply chain to the marketplace: *International Journal of Production Research*, Vol. **38**, no. 17, pp. 4061-4070.

Miller, J. G., and Roth, A.V., 1994. A taxonomy of manufacturing strategies: *Management Science*, Vol. **40**, no. 3, pp. 285-303.

Morash, E. A., 2001. Supply chain strategies, capabilities and performance: *International Journal of Operations & Production Management*, Vol. **41**, no 1, pp 37-53.

Naylor, J. B., Naim, M. M., Berry, D., 1999. Leagility: Interfacing the lean and agile manufacturing paradigms in the total supply chain: *International Journal of Production Economics*, **62**, pp. 107–118.

O'Brien, K., 2003: Value-chain report – Vendor-managed inventory in low-volume environments available: *Industry Week,*

http://www.industryweek.com/Column/ASP/printerfriendly.asp?ColumnId =946 accessed at 10.12.2008

Pagh, J. D., Cooper, M. L., 1998. Supply chain postponement and speculation strategy: how to choose the right strategy: *Journal of Business Logistics,* **19**, no. 2, pp.13–33.

Performance Benchmark Group, 2002. Supply chain planning benchmarking study, *presented at the Supply Chain Council's Supply Chain World Conference*, April 2003.

Porter, M. E., 1985. *Competitive advantage*, The Free Press, New York.

Porter, M. E., 1996. What is strategy: *Harvard Business Review*, Vol. **74**, no. 6, pp. 61-78.

Rayner, B., 2008. Product engineering - Bold changes ahead: *Manufacturing Business Technology*, ISSN 15543404, SWETS ID 29399335, pp. 32-35.

Reeder, G., and Rowell, T., 2001. Integration of supply chain with demand planning – Tropicana's journey: *The Journal of Business Forecasting Methods & Systems*, Vol. **20**, no. 3, pp. 3-8.

Ross, D. F., 1998. *Competing through supply chain management – Creating market-winning strategies through supply chain partnerships*, ISBN 0-412-13721-6, Kluwer Academic Publishers.

Schnetzler, M. J., Sennheiser, A., Schonsleben, P., 2007. A decomposition-based approach for the development of a supply chain strategy: *International Journal of Production Economics*. **105**, pp. 21-42.

Sen, W., Pokharel S., and Yu L. W., 2004. Supply chain positioning strategy integration, evaluation, simulation, and optimization: *Computers & Industrial Engineering,* **46**, pp. 781-792.

Simchi-Levi, D., Kaminsky, P., and Simchi-Levi, E., 2003. Designing and managing supply chain: *Concepts, Strategies, and Case Studies, Second Edition*, Irwin/McGraw-Hill, New York, NY.

Snieška, V., and Drakšaitė, A., 2008. Advanced cost saving strategies of supply chain management in global market. *Economics & Management*, http://web.ebscohost.com.ezproxy.liberty.edu:2048/bsi/pdf?vid=11&hid=114&sid=5bf2bd37-1cb9-4e9a-b2149d45c03e2ccf%40sessionmgr104 accessed at 10.12.2008

Stonebraker, P. W., Afifi, R., 2004. Towards a contingency theory of supply chains: *Management Decisions*. **42** (9), pp.1131-1144.

Storey, J., Emberson, C., and Reade, D., 2005. The barriers to customer responsive supply chain management: *International Journal of Operations & Production Management*, Vol. **25**, No. 3, pp. 242-260.

Suri, R., 1999. *Quick response manufacturing: A company-wide approach to reducing lead times*, Productivity Press, Portland, OR

Sweeney, M. T., 1991. Towards a unified theory of strategic manufacturing management: *International Journal of Operations & Production Management*, Vol. **11**, no.8, pp.6-22.

Tan, K. C., 2001. A Framework of supply chain management literature: *European Journal of Purchasing and Supply Management*, Vol. **7**, no. 1, pp. 39-48.

Towill, D. R., and Christopher, M., 2001. The supply chain conundrum - to be Lean or agile or to be lean and agile: *Proceedings of the International Logistics Symposium*, Salzburg, pp. 3-12.

Url-1 http://www.QuickMBA.com/strategy/porter.shtml, accessed at 15.11.2008.

Url-2 http://www.QuickMBA.com/strategy/porter.shtml, accessed at 14.11.2008.

Url-3 http://en.wikipedia.org/wiki/Porter_generic_strategies, accessed at 13.11.2008.

Url-4 http://en.wikipedia.org/wiki/Competitive_advantage, accessed at 14.11.2008.

Url-5 http://www.ifm.eng.cam.ac.uk/dstools/paradigm/valuch.html, accessed at 11.12.2008.

Url-6 http://www.cscmp.org, accessed at 24.12.2008.

Url-7 http://www.supply-chain.org, accessed at 03.11.2008.

Vitasek, K. L., Manrodt, K. B., Kelly, M., 2003: Solving the supply–demand mismatch: *Supply Chain Management Review*, September/October.

Wang, J. V., Huang, C. C., Chen, Y. J., 2007. The impact of alignment between supply chain strategy and is strategy on scm performance: The 2007 Conference of the International Decision Sciences Institute (DSI), conducted in association with *the 12th Asia-Pacific DSI Conference*, July 11-15, Bangkok, Thailand.

Webster, M., 2002. Supply system structure, management and performance: A conceptual model: *International Journal of Management Reviews*, Vol. **4**, Issue 4, pp. 353-369.

Wong, C. Y., Arlbjørn, J. S., and Johansen, J., 2005. Supply chain management practices in toy supply chains: *Supply Chain Management: An International Journal*, Vol. **10**, no. 5, pp. 367-378.

Wong, C. Y., Arlbjørn, J. S., Hvolby, H., and Johansen, J., 2006. Assessing responsiveness of a volatile and seasonal supply chain: A case study: *International Journal of Production Economics*, Vol. **104**, Issue 2, pp. 709-721.

Van Hoek R. I, Vos B., and Commandeur H. R., 1999. Restructuring European supply chains by implementing postponement strategies: *Long Range Planning*, Vol. **32**, no. 5, pp. 505-518.

Yang, B. and Burns, N. D., 2003. Implications of postponement for the supply chain: *International Journal of Production Research*, Vol. **41**, no. 9, pp. 2075-2090.

Yang, B., Burns, N. D., and Backhouse, C. J., 2004. Postponement: A review and an integrated framework: *International Journal of Operations & Production Management,* Vol. **24,** no. 5, pp. 468-487.

CURRICULUM VITAE

Candidate's full name:	Begüm Ellialtıoğlu
Place and date of birth:	Şişli 15/08/1983
Permanent Address:	Çınar M. Başakçı S. No:22/4 Küçükyalı İSTANBUL
Universities and Colleges attended:	İstanbul Technical University (2005 – 2009)
	Paris X Nanterre University (2007 – 2008)
	Yıldız Technical University (2001 – 2005)
	Köy Hizmetleri Anatolian High School (1994 – 2001)