



HELSINKI METROPOLIA UNIVERSITY OF APPLIED SCIENCES

Master's Degree in Industrial Management

Master's Thesis

SUPPLY CHAIN IMPROVEMENT STUDY

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Approved: 7.5.2010

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PREFACE

This thesis project was conducted during the autumn 2009 when the undersigned had received an acceptance letter from Metropolia University of Applied Sciences to become a Master's Degree Programme student in Industrial management. I have learned a lot while writing and compiling data for this thesis along with my daily work. Setting the schedule for writing the thesis, completing my daily tasks and being able to arrange some free time was not always easy. Learning about the supply chain was both interesting and demanding as there were plenty of new things that I needed to comprehend and apply for this thesis.

The company I work for, and especially my boss Minna Mabbott, provided me with the opportunity to take part in this degree programme. I wish to thank Esa Jaskari for suggesting a good subject for the Thesis, and all other people who have contributed in this thesis. With this study I hope to give some new insight to things that are happening within the organization and help people make good decisions in their daily tasks. The project team I work with was very supportive of my studies and showed flexibility when possible. My family supported me when I was in doubt and they gave me the strength and persistence to continue until graduation.

My thesis supervisor, Marja Blomqvist, played an important part during the writing process. Her extensive knowledge about the topic and her guidance drove me towards completing this thesis. The staff members in the Master's Degree Programme in Industrial Management, and the visiting lecturers during the programme inspired me to get the most out of the classes and of this thesis. Finally, I cannot stress enough how important the support and advice received from fellow students during the past year has been.

Looking back to autumn 2009, I have come a long way. The personal growth that I've experienced during the Degree Programme and all the interesting topics that I have learned about during this scholar year will help me in the future. It has been a valuable experience for me to learn more about international services business management. I will cherish what I've learned and do my best to apply it in the best possible way in my current and future roles that I will be holding.

Turku, May 2, 2010

Juha Nieminen

ABSTRACT

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| Title: Supply Chain Improvement Study | |
| Date: May 2, 2010 | Number of pages: 91 + 1 appendix |
| Degree Programme: Master's Degree in Industrial Management | |
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This thesis is about improving certain supply chain activities within the case company, either by reducing costs or by increasing value for the customers. This study deals with three different business areas and one cross-functional production operation. These examples represent the most interesting cases the Case Company is currently working on. It is essential to thoroughly understand the internal processes in order to be able to analyze the company's performance in each area. Memory Cards are a commodity business, and are thus strictly price driven. Besides understanding the physical costs of manufacturing and delivery, it would be important to bring the allocation of indirect operation costs up to the level it should be. The business of Carrying Cases is unique compared to the other businesses areas, and it is important to establish whether the current way of working is optimal. The Case Company has outsourced almost all of its activities and is purchasing ready-made products to be sold under its trademark. The processes related to the supply chain of Bluetooth Headsets are studied to find out if there is room for improvement. Most of the issues are related to optimum logistics and packaging issues. The cross-functional production operation is evaluated for the activities it incorporates, to understand if its efficiency can be improved. The service level model proposals are studied to understand if such service options are feasible to be implemented in terms of increased customer value and satisfaction.

This project is conducted as a constructive case study and it draws on related literature along with experience gained in this particular topic through study and work. The structure is based on semi-structured interviews and internal data for each business case, logistics and cross-functional operations. Based on the findings of this work recommendations are made for each case.

The results indicate that the company logistics is in good condition and that there are activities to improve performance constantly. Similarly, the memory card business area is engaged in many activities designed to reduce costs. The most critical issue seems to be the current insufficient method concerning the allocation of operation costs. The business area of Carrying Cases is profitable with the current setup, but deeper analysis is required to determine the feasibility of bringing the activities in-house. Transportation and packaging of Bluetooth Headsets are both in good condition and improvement plans are constantly evaluated. However, cost allocation for the operations is not on the level it should be. Prompt action is thus required as this naturally reflects all product cost calculations and, as a result, the company's performance.

Key words: Supply Chain, Business Area, Cost allocation

OPINNÄYTETYÖN TIIVISTELMÄ

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|---|-----------------------------------|
| Työn tekijä: Juha Nieminen | |
| Työn nimi: Tutkimus toimitusketjun parantamiseksi | |
| Päivämäärä: 2.5.2010 | Sivumäärä: 91 s. + 1 liite |
| Koulutusohjelma: Tuotantotalous (Ylempi AMK) | |
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| <p>Tässä työssä tutkitaan yrityksen toimitusketjua ja tarkastellaan mahdollisuuksia alentaa tästä aiheutuvia kustannuksia. Lisäksi etsitään ratkaisuja, jotka toisivat tuotteille ja palveluille lisäarvoa asiakkaan silmissä. Työssä tarkastellaan kolmea liiketoiminta-alueetta sekä yhtä tuotantolaitosta. Esimerkkitapaukset edustavat tuotealueita, joihin liittyviä prosesseja yrityksen on ymmärrettävä nykyistä paremmin voidakseen arvioida ja parantaa niiden tehokkuutta. Muistikorttiliiketoiminta on pääosin riippuvainen tuotteiden myyntihinnasta, ja on huomattu että kustannusten kohdistus eri tuoteryhmien välille ei ole vaatimusten tasolla. Kantolaukkuliiketoiminta on erityinen verrattuna muihin, ja sen takia on ymmärrettävä onko nykyinen tapa toimia yrityksen kannalta paras. Tuotanto ja suunnittelu ovat pääasiassa ulkoistettu, ja myytävät tuotteet ostetaan yrityksen tuotemerkillä varustettuna sopimusvalmistajilta. Bluetooth –kuulokkeiden toimitusketjuun liittyviä prosesseja tarkastellaan, jotta mahdolliset parannuskohteet pystytään määrittämään. Useimmat näistä parannuskohteista liittyvät joko logistiikkaan tai loppukoontaan. Tuotantolaitosarvioinnissa arvioidaan tuotannon prosesseja ja parannusehdotusten avulla pyritään tehostamaan sen toimintaa. Tuotannon osalta selvitetään myös, onko kannattavaa tarjota asiakkaille eritasoisia toimituspalveluja asiakastytyväisyyden lisäämiseksi.</p> <p>Työ on suoritettu rakenteellisena tapaustutkimuksena, pääasiassa haastattelujen avulla. Käytössä on lisäksi ollut yrityksen raporteja sekä muuta aineistoa tukemaan haastatteluissa keskusteltuja asioita. Tutkittaviin aiheisiin liittyvää kirjallisuutta on tutkijan oman kokemuksen lisäksi verrattu tapausten nykytilaan ja sen perusteella annettu kullekin alueelle omat parannusehdotuksensa.</p> <p>Tulokset paljastavat, että yrityksen logistiikka on toteutettu tehokkaasti, ja uusia ratkaisuja kustannusten pienentämiseksi etsitään jatkuvasti. Muistikorttien alueella on hyviä suunnitelmia kustannusten leikkaamiseksi. Suureksi yksittäiseksi ongelmaksi on havaittu kustannusten kohdistaminen eri tuoteryhmien välillä. Kantolaukkuliiketoiminta on kannattavaa nykyisellä toimintatavalla, ja tarkempia analyysejä toimintojen siirtämiseksi yhtiön toimintaympäristöön tarvitaan. Bluetooth –tuotteiden kuljetus- ja pakkausprosessit ovat kunnossa, sekä kehityssuunnitelmat olemassa. Tuotantoprosesseissa syntyviä kustannuksia ei kohdisteta tuotteiden välillä oikein. Väärin kohdistetut kustannukset vaikuttavat tuotteiden tuloslaskelmiin sekä yrityksen tulokseen. Parannustoimenpiteitä suositellaan tehtäväksi mahdollisimman pian.</p> | |
| Avainsanat: toimitusketju, liiketoiminta-alue, kustannusten kohdistaminen | |



TABLE OF CONTENTS

PREFACE

ABSTRACT

TIIVISTELMÄ

TABLE OF CONTENTS

LIST OF FIGURES AND TABLES

LIST OF ABBREVIATIONS

| | | |
|----------|---|-----------|
| 1 | INTRODUCTION | 1 |
| 2 | SUPPLY CHAIN MANAGEMENT | 4 |
| 2.1 | Design for Different Types of Supply Chains | 14 |
| 2.2 | Cost Management in Supply Chains | 26 |
| 2.3 | Summary | 38 |
| 3 | DESCRIPTION OF METHOD AND MATERIAL | 41 |
| 3.1 | Method and Process | 41 |
| 3.2 | Reliability and Validity Considerations | 43 |
| 4 | ANALYSIS AND RESULTS OF EXAMPLE BUSINESS CASES | 46 |
| 4.1 | Case of Memory Cards | 54 |
| 4.2 | Case of Carrying Cases | 58 |
| 4.3 | Case of Bluetooth Headset | 65 |
| 4.4 | Case of Final Packaging | 71 |
| 4.5 | Summary of the Business Problems | 76 |
| 5 | DISCUSSION AND CONCLUSIONS | 78 |
| 5.1 | Evaluation of Business Cases | 79 |
| 5.2 | Recommendations & Managerial Implications | 86 |
| | REFERENCES | 90 |

LIST OF FIGURES

| | |
|---|----|
| <i>Figure 1. Research design.</i> | 3 |
| <i>Figure 2. The supply chain availability fulcrum. (Aitken et al. 2005: 19)</i> | 5 |
| <i>Figure 3. Physically efficient versus market responsive supply chains. (Fisher 1997: 108)</i> | 18 |
| <i>Figure 4. Integrated framework for the development of focused demand chains. (Childerhouse et al. 2002: 677).</i> | 22 |
| <i>Figure 5. How demand/supply characteristics determine pipeline selection strategy. (Christopher et al. 2006: 283).</i> | 24 |
| <i>Figure 6. Managing product service levels. (Christopher 2005: 71-72)</i> | 25 |
| <i>Figure 7. Stages in the order-to-collection cycle. (Christopher 2005: 97).</i> | 27 |
| <i>Figure 8. The programme budget. (Christopher 2005: 101).</i> | 31 |
| <i>Figure 9. Customer profitability analysis: a basic model. (Christopher 2005: 106).</i> | 33 |
| <i>Figure 10. Cost activity types within a pipeline. (Christopher 2005: 156).</i> | 36 |
| <i>Figure 11. Should cost model phases. (Anklesaria 2008: 68).</i> | 37 |
| <i>Figure 12. Case Company supply chain.</i> | 47 |
| <i>Figure 13. Logistics routes for Sea and Rail.</i> | 51 |
| <i>Figure 14. Inbound freight cost split.</i> | 52 |
| <i>Figure 15. 16 GB microSDHC Card.</i> | 54 |
| <i>Figure 16. Carrying Case.</i> | 58 |
| <i>Figure 17. One-size blister package from Supplier A.</i> | 64 |
| <i>Figure 18. Bluetooth Headset.</i> | 65 |
| <i>Figure 19. Production site in Eastern Europe.</i> | 71 |

LIST OF TABLES

| | |
|---|----|
| <i>Table 1. Relating pipeline types to supply/demand characteristics. (Christopher et al. 2006: 283).</i> | 24 |
|---|----|



LIST OF ABBREVIATIONS

| | |
|------------------|---|
| ABC | Activity-Based Cost |
| ABCM | Activity-Based Cost Management |
| BOM | Bill-of-Materials |
| DWV ³ | <i>Duration of life-cycle, time Window for delivery, Volume, Variety and Variability</i> (Christopher and Towill 2000). |
| EDLP | Everyday Low Price |
| ERP | Enterprise Resource Planning |
| FTL | Full Truck Load |
| GM | Gross-Margin |
| ICC | Inventory Carrying Cost |
| iHub | Consignment stock warehouse |
| iMES | A MES application |
| Inbox | A sales pack including mobile device |
| Key Product | High-priority product for promotions, campaigns etc. |
| LSP | Logistics Service Provider |
| MES | Manufacturing Execution Systems |
| MID | Master (package) Identification |
| MOQ | Minimum Order Quantity |
| MRP | Manufacturing Resource Planning |
| NTPRS | Non-Terminal Profitability Reporting System |
| NRE | Non-Recurring Engineering |
| OMEPE | Original Mobile Enhancement Provider |
| ODM | Original Design Manufacturer |
| Outbox | Standalone product |
| PID | Pallet Identification |
| PRS | Profitability Reporting System |
| RFQ | Request for Quotation |
| RQ | Research Question |
| RFID | Radio Frequency Identification |
| SA | Strategy Analyst (publication) |
| SCM | Supply Chain Management |
| TCO | Total Cost of Ownership |
| VMI | Vendor Managed Inventory |

1 INTRODUCTION

The case company sells mobile enhancement products which are compatible with most mobile devices in the market. It also does final packaging for ODM products in three operations sites around the world. Company's product portfolio consists of products that can be differentiated from mobile devices and computers.

The case company is fairly profitable considering its size, but in order to perform even better, business improvement plans must exist. During the economic downturn, all processes need to be improved to eliminate hidden costs that in the worst case might lead to wrong business decisions. As there are many products in the product portfolio, the supply chain must be in the top-of-the-class condition to provide company with the competitive advantage it seeks. This is the reason why the case company has to understand where costs are generated within its supply chain. It is already recognized that some extra costs are generated in processes related to packaging and outbound delivery processes. It is important to understand how operation costs are allocated between product families which require different amount of effort during the final packaging. Packaging solutions are known to have room for improvements, and those are to be analyzed. Packaging has a direct impact on outbound delivery processes, as the more efficient the packaging is the more efficient also the outbound delivery in terms of costs per shipment. Case company offers its customers standard services while in some cases special arrangements can be made to speed up packaging and delivery. It is not understood well enough whether service classes should be renewed and different level of manufacturing and delivery services should be implemented to meet customer needs. This project focuses on three business cases in commodities such as Memory Cards, Carrying Cases and in Bluetooth Headsets. These business cases are directly linked to cross-functional operations responsible for the sales packages of products and thus included in the research scope, as well. The basics of company's logistics are introduced and evaluated in order to understand how the supply chain is constructed as a whole.

While considering all supply chain related challenges, it was recognized that reducing costs and improving case company's image in the eyes of the customers would impact the business positively. Thus, the research question is formulated as follows: "How to increase customer value or bring costs down within case company supply chain?"

As stated in Wikipedia (2010), a supply chain is a system of organizations, people, technology, activities, information and resources involved in moving a product or service

from supplier to customer. This thesis focuses mostly on evaluating the latter three attributes - i.e. activities, information and resources - within the case company's supply chain. Customer service brings value and is a series of activities designed to enhance the level of customer satisfaction – that is, the feeling that a product or service has met the customer expectation. Customer value, in the context of this thesis, refers to improved customer satisfaction towards the products and services that they receive from the example company.

The scope of the study is limited to three business cases which represent different types of business. Findings from each area can be applied for similar existing or emerging product areas within the mobile enhancement industry. The first case, Bluetooth Headset business, is considered the foundation for the case company. Typically BT headset business is very well optimized in terms of product cost, logistics, packaging and customer needs. The second case, memory card business, is profitable business for the case company especially with its high volumes. The gross margins are relatively low and efficiency plays an important role for keep the business profitable also in the future. The third case, the Carrying Cases business, is different from the earlier cases. The case company has very little activities in-house, and mainly purchases product design, manufacturing, packaging etc. from external vendors. For Carrying Cases, the scope is to evaluate whether this is the optimum way to conduct business. Finally, case company's operations are introduced and evaluated for processes that can be improved regarding the above business cases, or on a more general level.

This study is based on a constructive case study. The research question is answered by having the company internal processes investigated through interviews and internal data sources, and by drawing on related literature for this particular topic. For most parts, it is about investigating the company's supply chain and collecting information across the functional teams. For each business case, between two to five persons were interviewed for their opinions about the current state and their vision of the future. The interviewees were sent a semi-structured list of questions for preparation. This was done to avoid asking the wrong questions, and to give respondents the freedom to express their opinions as they saw was important. Some interviewees shared data with the researcher to support their opinions about the business case. By combining the expert opinions, the company data along with the current literature and the researcher's own experience, the results were analyzed and presented in the last section of this study.

Research Design

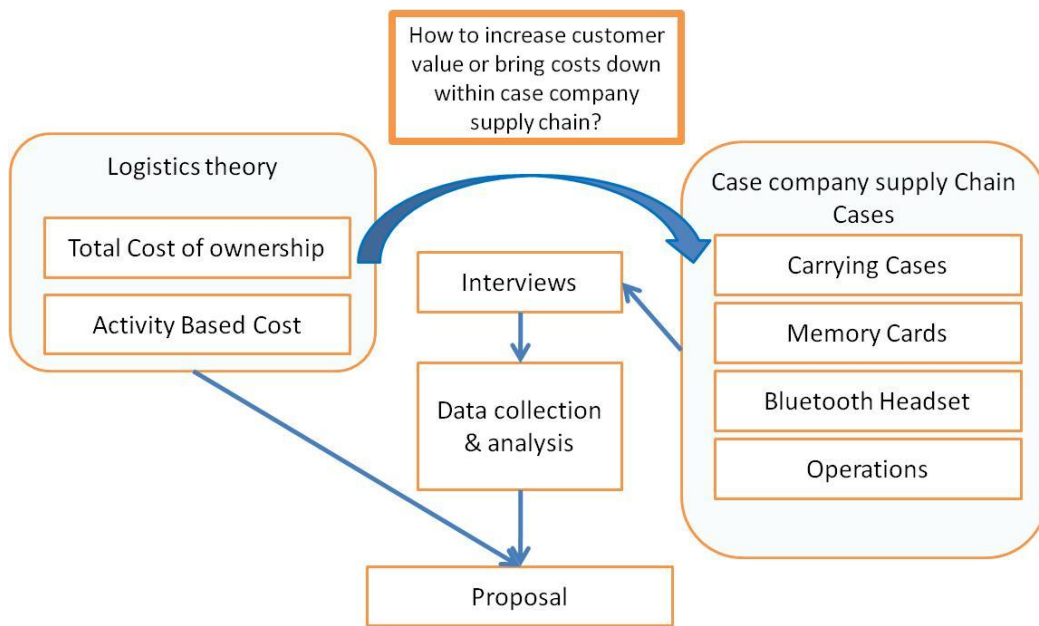


Figure 1. Research design.

Figure 1 shows the research question (RQ) about how to increase customer value or bring costs down within Case Company supply chain. Keeping in mind the RQ, material was collected about logistics and supply chains. During the interview and data collection round it became clear that different types of products require different types of pipelines within one supply chain. In order to be able to analyze these pipelines, reference literature about specialized supply chains was required. This literature, both publications and books, of supply chain requirements and structures, provided a good overview about the case company's situation. In addition to supply chain theories, the presence of supply chains in terms of cost management was studied: Total Cost of Ownership (TCO) and Activity-Based Costing (ABC) were found to be helpful for guidance on how to make a cost analysis of the case company's supply chain including three business cases and one cross-functional operations case. That literature was reflected on the outcome of interviews that were conducted with case company's specialists' in those particular business case areas. With the help of the company data analysis, it was possible to formulate recommendations that would benefit the company in the area of cost management within the supply chain and by adding value to the customer.

2 SUPPLY CHAIN MANAGEMENT

The ideology of supply chain management

Christopher defines logistics as being essentially a planning orientation and framework that seeks to create a single plan for the flow of product and information through a business (2005: 4). Supply chain management builds upon this framework and seeks to achieve linkage and co-ordination between the processes of other entities in the pipeline, i.e. suppliers and customers, and the organization itself. One goal of supply chain management is to reduce or eliminate the buffers of inventory that exist between organizations in a chain through the sharing of information on demand and current stock levels. For Christopher, the whole purpose of supply chain management and logistics is to provide customers with the level of service and quality that they require, and to do that with as low costs as possible (2005: 65). When a company is developing a market-driven logistics strategy, the aim is to achieve “service excellence” in a consistent and cost-effective way.

Requirement for supply chain management

In many markets, time has become a competitive variable. Not just time-to-market for new product introductions but time to respond in terms of being able to meet the needs of time-sensitive customers. This is true in industries where product life-cycles are short and demand is unpredictable. For some reason, lead times have typically lengthened over the past decade due to global sourcing with retailers seeking out low cost sources of supply. The risk that is incurred through lengthened lead times can be considerable. If decisions on different product qualities, such as different colors etc. have to be taken into consideration months in advance, the greater risk lies in chance of error in the forecast. Christopher et al. (2006: 280) present a rule of thumb, originally introduced by Watson (1994), about forecasting errors in consumer electronics. If the forecast has been set one month prior to demand, the error rate is \pm five per cent of the original figure. In case the forecast has been defined two or three months in advance the error increases dramatically to \pm 20 per cent and even to \pm 50 per cent.

At its simplest, the purpose of any supply chain is to balance supply and demand. Traditionally this has been achieved through forecasting ahead of demand and creating inventory against that forecast. Alternatively additional capacity might be maintained to cope if demand turned out to be greater than forecast. Either way in an ideal world demand is balanced with supply. Figure 2 (a) shows a typical balanced supply chain. If for

a reason or another, the fulcrum is moved closer to the demand box, as illustrated in Figure 2 (b), the same amount of demand can now be balanced with fewer inventories and/or less capacity. The fulcrum is the point at which company commits to source/produce/ship the product in its final form and where decision on volume and mix are made. In other words, if the point of commitment can be delayed as long as possible, then the closer company is for make-to-order i.e. mass customization, with all the consequential benefits this brings. In practice, the problem for many companies is that the fulcrum in their supply chains is more like that shown in Figure 2 (c). The fulcrum is a long way from demand i.e. the forecasting horizon is long, necessitating more inventory and capacity to balance against demand. Therefore it is clear that responding to the volatility of present-day customer demand requires the availability fulcrum to be located closer to demand, as illustrated by Aitken et al. (2005: 7) in Figure 2.

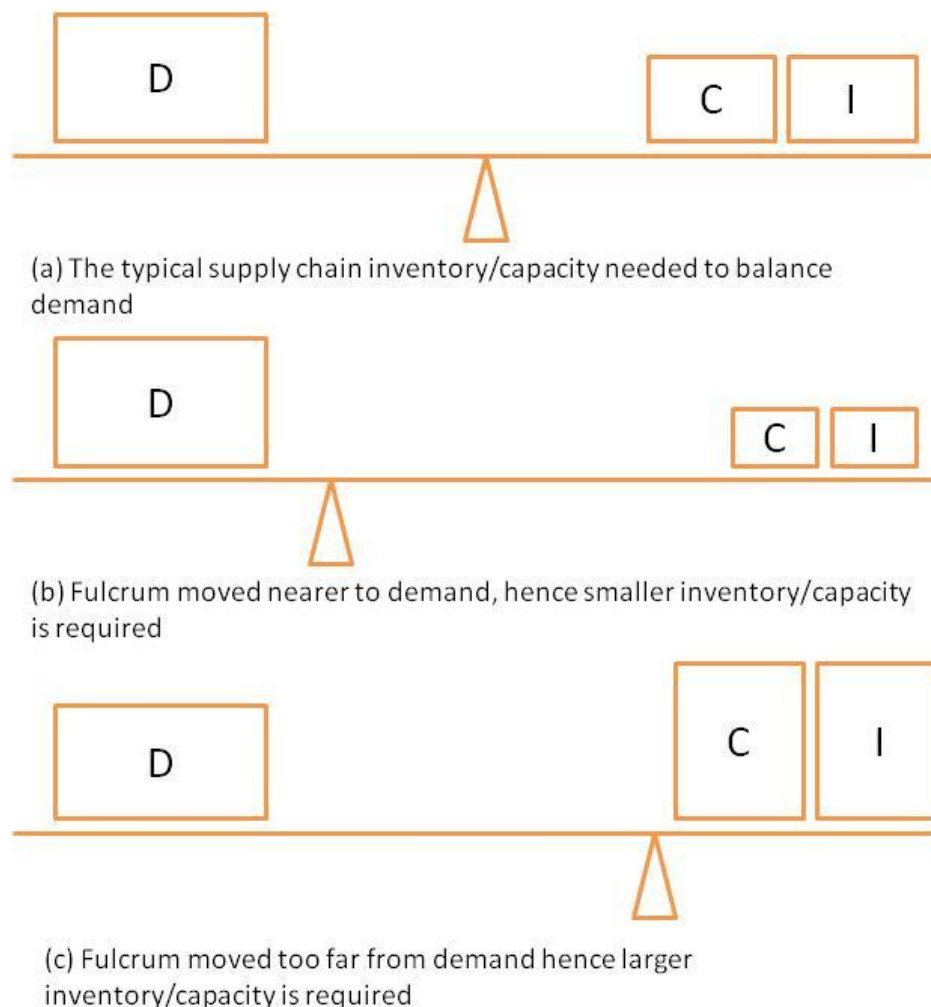


Figure 2. The supply chain availability fulcrum. (Aitken et al. 2005: 19)

Whilst it has long been recognized that a key goal in any logistics system should be to “substitute information for inventory” the real challenge is to achieve this through greater

levels of information sharing between supply chain partners. This in turn requires closer and more trusting relationships between the different entities in the supply chain.

Philosophies of supply chains

During the past years, there has been a debate between different supply chain strategy philosophies called lean and agile. The idea of lean thinking has been introduced by Womack and Jones (1996, according to Christopher et al. (2006: 281). The focus with this philosophy has been on the reduction or elimination of waste. According to Christopher (2000), it is suggested that lean concepts work well where demand is relatively stable and therefore predictable, and the level of variety is low. On the other hand, in those cases where demand is volatile and the customer needs for variety are high, another approach is required. This approach, agility, is concerned primarily with responsiveness. It is about the ability to match supply and demand in turbulent and unpredictable markets. In essence, it is about being demand-driven rather than being forecast-driven. Agility is a business-wide capability that embraces organizational structures, logistics processes and especially mindsets. A key characteristic of an agile organization is flexibility. Indeed, the origins of agility as a business concept lie in flexible manufacturing systems. 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.

To master the concept of being just capable to adjust to changes that supply chain experiences in demand and delivery lead-times, Lee (2004) introduces a concept of triple-A supply chain where those three A's stand for agility, adaptability and alignment. First, agile supply chains can react speedily to sudden changes in demand or supply. Secondly, they adapt over time as market structures and strategies evolve. Third, they align the interests of all companies in the supply network so that companies optimize the chain's performance while maximizing their own interests. Only supply chains that have these three qualities provide companies with sustainable competitive advantage, according to Lee (2004: 3). The challenge with the efficient supply chains is that despite of being high-speed and low-cost, those are unable to respond to unexpected changes in demand or supply. Many companies have centralized manufacturing and distribution facilities benefit from the economies of scale. Simultaneously, they try to minimize costs and number of deliveries by delivering only container loads of products to customers at once. When demand for particular brand, pack size, or assortment rises without warning, these companies are unable to react even if they had requested items in stock. By the time they can deliver, demand peak has been passed by resulting excess inventories in distributor's warehouse. Eventually this stock needs to be marked down resulting in discounted prices

at the stores. Mark downs do not only reduce companies' profits but also erode brand equity and anger loyal customers who bought the items at full price in the recent past, Lee (2004: 4) scrutinizes.

Great companies create supply chains that respond to sudden and unexpected changes in markets. Agility is critical, because in most industries, both demand and supply fluctuate more rapidly and widely than they used to. Most supply chains cope by playing speed against costs, but agile ones respond both quickly and cost-efficiently. Lee (2004: 6) presents six rules of thumb on how companies can build agility into a supply chain:

- Provide data on changes in supply and demand to partners continuously so they can respond quickly. First step in creating an agile supply chain is to ensure that there are no information delays between collaborative companies.
- Develop collaborative relationships with suppliers and customers so that companies work together to design or redesign processes, components, and products as well as to prepare backup plans.
- Design products so that they share common parts and processes initially and differ only at the end of the supply chain, if possible. This is commonly called as "postponement". This is often the best way to respond quickly to demand fluctuations because it allows firms to finish products only when they have clear indication on customer preferences.
- Keep small inventory of inexpensive, non-bulky components that are often the cause of bottlenecks.
- Build a dependable logistics system that can enable your company to regroup quickly in response to unexpected needs. Companies don't need to invest in logistics systems themselves to achieve this benefit; instead they can form alliances with third-party logistics providers.
- Put together a team that knows how to invoke backup plans. This requires also companies to have trained managers and prepared contingency plans available in case of a crisis.

Successful companies don't stick to the same supply networks when markets or strategies change. Instead, organizations keep adapting and renewing their supply chains so they can adjust to changing needs. Adaptation can be tough, but it is critical in developing a

supply chain that delivers a sustainable advantage. Adaptation is required also as the business environment is constantly changing, due to economical progress, political or social change, demographics trends or technological advances. Lee (2004: 7) points out that the best supply chains recognize these changes, for example structural shifts, already before they actually happen by capturing the latest data, filtering out noise and tracking key patterns. They then relocate facilities, change sources of supplies, and, if possible, outsource manufacturing. Building an adaptable supply chain requires two key components: the ability to spot trends and the capability to change supply networks. To identify future patterns, it is necessary to follow some guidelines outlined by Lee (2004: 8) as follows:

- Track economic changes, especially in developing countries. When country opens up their economies to global competition, the cost, skills, and risks of global supply chain operations change.
- Evaluate the needs of your company's ultimate consumers – not just customer on the next level of supply chain. Recognizing the real demand from the source will reduce the bullwhip effect in demand.
- New suppliers are needed all the time to complement the current ones. Smart companies work in relatively unknown parts of the world by using intermediaries to find reliable vendors.
- Product design teams must be ensured of the supply chain implications of their designs. Designers must also be familiar with the three design-for-supply principles. First one is commonality, which ensures that products share components. Second, postponement, which delays the step at which products become different and lastly standardization, which ensures that components and processes for different products are the same.

All above principles allow companies to execute engineering changes whenever they adapt supply chains.

Demand chain management

Traditionally in supply chain management the key focus and scope has been in managing the flow of materials and goods from suppliers through manufacturing and distribution chain to the consumer, describes Korhonen et al. (1998: 528). Things that are needed to be taken into consideration are MRP, capacity management, production planning and

scheduling, inventory levels, and supply allocation. In most cases the information flow from customers to the chain including suppliers is not clear. Often the information is presented in the form of periodical forecasts and internal stock orders and not by the true customer orders and market demand in real time.

The key in demand chain management is the continuous flow of the demand information from customers and end users through distribution and manufacturing to suppliers. The common goal for each participant within the chain is fulfilling customer demand with the most important controlling inputs being rolling forecasts and plans, point-of-sales data, daily orders, management decisions and performance feedback. Lee (2004: 9) has also highlighted the importance of aligning the interests of all companies within the supply chain. That is critical, as every company tries to maximize only its own interests. If any company's interests differ from those of the other organizations in the supply chain, its actions will not maximize the chain's performance. Alignment can be created in several ways, first ones being the data sharing presented above. Lee (2004: 10) agrees with what Korhonen et al. (1998: 529) present about the controlling inputs between participating companies. Next they align identities – in other words it means that companies have to have defined roles and responsibilities so that there is no scope for conflict. To back this up, companies must align incentives, so that when companies try to maximize returns they simultaneously maximize the supply chain's performance. The controlling trigger of the chain is the customer order or other replenishment signal, and the order penetration point is varying dependent on what is the optimum way to provide the required level of service in a most efficient way. The focus in demand chain is in information management. The flow of information can be described with nouns as timely, meaningful and transparent. The materials flow from the suppliers through manufacturing to customers is controlled as much as possible by daily consumption in order to guarantee the availability of goods in demand and at the same time minimize the inventories.

The main difference between supply and demand chain management is the focus and starting point of planning and controlling. In supply chain management it is in the material supply push, and in the demand chain management it is the opposite – end user pull that triggers the flow throughout the chain. The latter one can only be achieved by using timely end-user information as a pull trigger to the suppliers as a primary planning and execution source.

Korhonen et al. (1998: 529) concludes that information management is the key enabler in demand chain management. It means that with the help of technology a real time market and end user demand information can be captured at the point-of-sales in a relevant

manner. It also necessitates the ability of being able to search for alternative supply scenarios, carry out risk and profitability analysis in an almost real time manner, and prepare the needed capability and capacity to serve the foreseen customer demand when the triggering order arrives.

The problem of offshoring

Globalization has provided companies the opportunity to source products and services from low-cost countries. Despite of companies rushing to China, it has not overturned the basic fact that the longer your supply line is, the greater the risk. Vulnerabilities of such a supply line has been reduced with the help of internet-based communication and applications, with better ships and more sophisticated logistics systems, but those still exist. More and more companies are learning that a supply chain that is stretched one-third of the way around the world requires increasingly expensive management oversight. It also has additional places where unexpected delays can occur, extending an already time-consuming trip from the factory to the showroom floor. Many of the costs of such delays are appreciated by the managers dealing with logistics issues, but they often fail to take into account the loss of gross margins when you adhere to a basic business formula: Have on hand what's selling, and don't have what isn't, Stalk, G. Jr. (2006: 64) points out. Hidden expenses like this can more than offset the benefits of low Chinese manufacturing costs and ruin a China sourcing strategy. As the time to order and receive goods from China increases, so do the costs. At the very least, the supply chain glitches and bottlenecks are likely to result in profit returns that are lower than those anticipated when the decision was made to source in China, Stalk, G. Jr. (2006: 64) concludes.

A recent study identified that a significant cost penalty is incurred by both manufacturers and retailers when they run out of stock, scrutinizes Christopher (2005: 50). The study shows that over a quarter of customers facing a stock-out bought another brand and 37 per cent told that they go elsewhere to shop for that article they were looking for. Other research represents that two-thirds of shopping decisions are made at the point of purchase by seeing the product on the shelf. If the product is not available, the purchase will not be triggered. According to Christopher (2005: 51), in industrial markets things are quite similar: Just-in-time strategies with minimal inventories require even higher levels of response from the suppliers. This leads for the requirement of shorter delivery lead times and reliable delivery. Companies seek to rationalize their supplier base and to do business with fewer suppliers to guarantee the service level required. After becoming a preferred supplier, company needs to ensure that their customer service level is fully able to serve customers' requirements in a world class manner. Cost reduction is a worthy goal

as long as it is not achieved with the expense of value creation. So called low-cost strategies might lead to an effective logistics but not in efficient logistics, analyzes Christopher (2005: 52). Typically the most impressive and best offers are the ones that clearly identify a positive impact upon the customer's own value-creating processes.

The bullwhip effect

The second point in the above guideline is about the figuring out the real need of the end customer in order to reduce the bullwhip effect in demand. Lee et al. (1997: 93) explain that distorted information from one end of a supply chain to the other can lead to tremendous inefficiencies listed as follows: excessive inventory investment, poor customer service, lost revenues, misguided capacity plans, ineffective transportation and missed production schedules. In a supply chain for a typical consumer product, even when consumer sales do not seem to vary much, there is pronounced variability in the retailers' orders to the wholesalers. Order to the manufacturer and to the manufacturer's supplier spike even more. The ordering patterns share a common, recurring theme: the variability of an upstream site is always greater than those of the downstream site, a simple, yet powerful illustration of the bullwhip effect. To solve the problem of distorted information, companies need to understand what creates the bullwhip effect so they can counteract it. Innovative companies in different industries have found that they can control the bullwhip effect and improve their supply chain performance by coordinating information and planning along the supply chain. Lee et al. (1997: 95) state that the bullwhip effect is a consequence of stakeholders' rational behavior rather than irrational. Therefore it is suggested that companies that want to control the bullwhip effect need to focus on modifying the chain's infrastructure and related processes rather than decision makers' behavior. Lee et al. (1997: 95) identify four major causes of the bullwhip effect which are presented as follows:

Demand forecast updating

Companies within supply chain usually do product forecasting for its production scheduling, capacity planning, inventory control, and material requirements planning. Forecasting is often based on the order history from the company's immediate customers. When a downstream operation places an order, the upstream operation manager processes that information as a signal about future product demand. Based on this signal, the upstream manager readjusts his or her demand forecasts and, in turn, the orders placed with the suppliers of the upstream operation. The activities for updating forecasts cause big swings in demand, i.e. bullwhip effect, when moving up the supply chain and

further increased whether safety stocks are being built. One remedy to avoid bullwhip effect in demand forecasting is to provide demand data at the downstream site available throughout the supply chain. This way, each company has the same information of the demand and they can adjust it accordingly to their production. However, as there are differences in forecasting methods and buying practices, there might still be some fluctuation from downstream site to upstream site. Solutions introduced to tackle these challenges are to set up vendor-managed inventories (VMI) and to reduce the lead-times in supply chain.

Order batching

In supply chain, each company places orders with an upstream organization using some inventory monitoring or control. Customers place orders, and inventory levels are lowered but the company might not immediately place an order with its supplier. Companies often batch or accumulate demands before issuing an order. There are two forms of order batching, either its periodic ordering or push ordering. Periodic ordering amplifies variability and contributes to the bullwhip effect. Periodic ordering is based on Materials Requirement Planning (MRP) rounds, which are typically run monthly according Lee et al. (1997: 96), and companies also prefer to have Full Truck Load (FTL) instead of less-than-truck, as the differences in rates are significant. In push ordering, a company experiences regular surges in demand. The company has orders “pushed” on it from customers periodically because salespeople are regularly measured, sometimes quarterly or annually, which causes end-of-quarter or end-of-year order surges. Salespersons that need to fill sales quotas may “borrow” ahead and sign orders prematurely. If all customers’ order cycles were spread out evenly throughout the period, the bullwhip effect would be minimal. Since the order batching contributes to the bullwhip effect, companies need to devise strategies that lead to smaller batches or more frequent resupply. Some manufacturers induce their distributors to order assortments of different products, which can be in a same pallet truck load. The effect is that, for each product, the order frequency is much higher, the frequency of deliveries to the distributors remains unchanged, and the transportation efficiency is preserved. The use of third-party logistics companies also helps make small batch replenishments economical: by consolidating loads from multiple suppliers located near each other, a company can realize full truck load economies without the batches coming from the same supplier. Some costs naturally occur due to additional handling and administrative costs but the savings often outweighs the costs.

Price fluctuation

Forward buying is resulted from price fluctuation in the marketplace. Manufacturers and distributors periodically have special promotions like price discounts, quantity discounts, coupons, rebates and so on. All these promotions result in price fluctuations. Additionally, manufacturers offer trade deals to distributors and wholesalers, which are an indirect form of price discounts. When a product's price is low, customer buys in bigger quantities than needed. When the product's price returns to normal, the customer stops buying until it has consumed its inventory. As a result, the customer's buying pattern does not reflect its consumption pattern, and the variation of the buying quantities is much bigger than the variation of the consumption rate – again the bullwhip effect. When high-low pricing occurs, forward buying may well be a rational decision. If the cost of holding inventory is less than the price differential, buying in advance makes sense. In fact, the high-low pricing phenomenon has induced a stream of research on how companies should order optimally to take advantage of the low price opportunities. The simplest way to control the bullwhip effect caused by forward buying and diversions is to reduce both the frequency and the level of wholesale price discounting. In grocery industry, major manufacturers have moved to an Everyday Low Price (EDLP) or value pricing strategy. According to Lee et al. (1997: 101), this has been proven to reduce list prices to trade customers while improving the profit share through stabilized demand.

Rationing and shortage gaming

When product demand exceeds supply, a manufacturer often rations its product to customers. In one scheme, the manufacturer allocates the amount in proportion to the amount ordered. For example, if the total supply is only 50 per cent of the total demand, all customers receive similarly 50 per cent of what they order. Knowing that the manufacturer will ration when the product is in short supply, customers exaggerate their real needs when they order. Later, when demand cools, orders will suddenly disappear and cancellations pour in. This seeming overreaction by customers anticipating shortages results when organizations and individuals make sound, rational economic decisions and “game” the potential rationing. Solution for this might be that when supplier faces a shortage, instead of allocating products based on orders, it can allocate in proportion to past sales records. Customers then have no incentive to exaggerate their orders. Also, some manufacturers are beginning to enforce more strict cancellation policies to avoid exaggeration in the orders they receive.

The requirement for multiple supply chains

It is commonly accepted that “one size does not fit all” when it is about designing supply chain strategies that support a wide range of products with different characteristics, and that are sold in a diversity of markets, discusses Christopher et al. (2006: 277) based on Shewchuck’s analysis from the year 1998. First section analyzes different supply chains from different perspectives and for different use purposes.

There is a growing recognition that supply chains should be designed from the customer backwards rather than the company onwards. If such a view is accepted then the implication is that since the company will most likely be serving multiple markets or segments there will be a need to design and manage multiple pipelines to serve those different customers, Aitken et al. (2005: 3) introduce. To be successful in the challenging markets of the 21st century, organizations need to develop capabilities necessary to achieve a much higher level of customized response to the different needs of different customers. It really seems that for one to be successful in these markets companies will need not just one supply chain solution but many. The implications of this transformation are significant: designing and managing multiple pipelines will become a necessary competence in the search for competitive advantage.

Aitken et al. (2005: 4) makes distinction between supply chains and pipelines. The supply chain is defined as the network of connected and interdependent organizations that work together to enable the flow of products into markets, whereas a pipeline is defined as the specific operational mechanisms and procedures that are employed to service specific product/market contexts. Thus within a single supply chain there could be a number of unique pipelines. The pipelines being utilized are dependent on the life cycle of the product so that items are being switched and rerouted as their demand category changes. The challenge for companies is in meeting the needs of different market segments whilst managing a portfolio ranging from standard products with predictable demand to one-off customized solutions. Companies might need to introduce new and more effective costing systems to recognize differences between pipelines thus avoiding undesirable cost-averaging when fixing prices changed to individual customers. Different supply chain designs and where to use them are evaluated more closely in the next section.

2.1 Design for Different Types of Supply Chains

Today’s supply chains are designed and improved with the latest technology. At the same time companies are investing a lot of money to hire best people to work for their supply chain issues, analyzes Fisher (1997: 105). Scanners at the point-of-sale allow companies

to have direct access to customer's voice. Electronic data interchange shares that information at all stages of the supply chain and reacts to it by using flexible manufacturing, production planning, automated warehousing and rapid logistics. New software has made these possible, according to Slone et al. (2007: 122). Assorted new technologies including Radio Frequency Identification (RFID) chips and systems with advanced bar codes and machine-readable coding schemes have emerged to make Supply Chain Management (SCM) more sophisticated. On the other hand, supply chains are also really complex and require the whole organization to be involved with its activities, Slone et al. (2007: 122) remind. Supply chains are their best when they employ and inspire the cooperation of external partners. However, even though there are most sophisticated tools and new concepts in use – the performance of many supply chains has never been worse. Typically this situation has occurred due to the fact that managers lack a framework for deciding which ones are best for their particular company's situation. Fisher (1997: 106) has compiled such tool to help managers to understand the nature of the demand for their products and it helps to devise the supply chain that can best satisfy that demand.

Fisher introduces two categories based on their demand patterns for this purpose: products are either primarily functional or primarily innovative. Both categories require a distinctly different kind of a supply chain. According to Fisher (1997: 106), the root cause of the problems plaguing many supply chains is a mismatch between the type of product and the type of supply chain. Functional products include the staples that people to buy in a wide range of retail outlets, such as grocery stores and gas stations. These products tend to satisfy basic needs, which don't change much over time; they have stable, predictable demand and long life cycles. Downside with the stability of demand is that it draws competition, which leads to low profit margins. To avoid low margins, many companies introduce innovations in fashion or technology to give customers an additional reason to buy their offerings. Innovative products have high profit margins and volatile demand in contrary to functional products. As those qualities differ, both products require completely different approach on supply chain. Also Lee (2004: 7) points out, that smart companies tailor supply chains to the nature of markets for products. He continues by saying that those companies typically have more than one supply chain, which can be expensive, however they also get the best manufacturing and distribution capabilities for each offering with that cost. Though the innovation can enable companies to achieve higher profit margins, the very newness of innovative products makes demand for them unpredictable. Also, life-cycle for such products is quite short because imitators erode the competitive advantage that innovative products enjoy; companies are forced to introduce

a steady stream of newer innovations. The short life cycles and the great variety typical of these products further increase unpredictability.

To understand the difference in supply chains, one should recognize that a supply chain performs two distinct functions: a physical function and a market mediation function. A supply chain's physical function is readily apparent and includes converting raw materials into parts, components, and eventually finished goods, and transporting all of them from one point in the supply chain to the next. Less visible but equally important is market mediation, whose purpose is ensuring that the variety of products reaching the marketplace matches what consumers want to buy. Both functions incur distinct costs. Physical costs are the costs of production, transportation and inventory storage. Market mediation costs arise when supply exceeds demand and a product has to be marked down and sold at a loss or when supply falls short of demand, resulting in lost sales opportunities and dissatisfied customers, scrutinizes Fisher (1997: 107). Electronics manufacturer Sony found this to be so with its high-tech camcorders and digital cameras. In 2002, it moved production of both from China to Japan. The reason for Sony's decision was supply chain cost-related. China had proved to be an excellent location for many Sony's less innovative competitors who focused on the forecast driven, efficient production of products based on proven technologies. But for its leading edge products, Sony found that China's manufacturing base lacked critical "market mediation" capabilities, for example technological expertise, benefits of proximity and the supply chain flexibility to cope with the demands of high-margin, high-risk new product innovations, analyzes Christopher et al. (2006: 279) about Sony's decision to move production back to Japan.

The predictable demand of functional products makes market mediation easy because a nearly perfect match between supply and demand can be achieved. Companies that make such products are thus free to focus almost exclusively on minimizing physical costs – a crucial goal, given the price sensitivity of most functional products. To that end, companies usually create a schedule for assembling finished goods for at least the next month and commit themselves to abide by it. Freezing the schedule in this way allows companies to employ manufacturing-resource-planning software, which orchestrates the ordering, production, and delivery of supplies, thereby enabling the entire supply chain to minimize inventory and maximize production efficiency. In this instance, the important flow of information is the one that occurs within the chain as suppliers, manufacturers, and retailers coordinate their activities in order to meet predictable demand at the lowest cost. That approach is exactly wrong one for the innovative products. The uncertain market

reaction to innovation increases the risk of shortages or excess supplies. High profit margins and the importance of early sales in establishing market share for new products increase the cost of shortages. And short product life cycles increase the risk of obsolescence and the cost of excess supplies. Hence market mediation costs predominate for these products, and they, not physical costs, should be managers' primary focus. Most important in this environment is to read early sales numbers or other market signals and to react quickly, during the new product's short life cycle. In this instance, the crucial flow of information occurs not only within the chain but also from the marketplace to the chain. The critical decisions to be made about inventory and capacity are not about minimizing costs but about where in the chain to position inventory and available production capacity in order to hedge against uncertain demand. Fisher (1997: 108) concludes that suppliers should be chosen for their speed and flexibility, not for their low cost.

Christopher et al (2006: 279) discuss that companies which differentiate themselves through innovative products, must balance themselves between the dangers of over-optimistic forecasting versus the risks of wasted opportunities arising from the inability to supply quickly enough when a winning product is produced. These companies need to minimize the risk of obsolescence and to maximize the profits before margins fall as competitors follow with cheaper, less risky, "me-too" offers. Sony had managed the risks of innovative new product introductions through close collaboration between itself and its suppliers throughout the new product development process. The networks of suppliers had the capabilities to respond very rapidly to consumer demand should the product prove to be successful in the market. Sony recognized that its low-cost manufacturers in China lacked those essential capabilities and had to re-locate to Japan where the skills were well established and available, though with higher cost. On top of the manufacturing capabilities to meet these requirements, the customer base for the high margin innovative products are in more developed markets of the US, Western Europe and Japan. Japan also provided a better base in terms of user markets proximity than China, and this helped Sony to make a decision about relocating back to Japan.

Companies with high service levels are left with little room to improve in market mediation costs. Hence, company might target improving the physical efficiency instead. On the other hand, company that has to cope with uncertain demand and high market mediation costs in forms of losses on products that don't sell and lost sales opportunities due to the stock outs that occur when demand for particular items outstrips inventories. Although the distinctions between functional and innovative products and between physical efficiency

and responsiveness to the market seem obvious once stated, Fisher (1997: 108) has found that many companies founder this issue. Figure 3 illustrates how physically efficient supply chains have been compared to market-responsive supply chain (Fisher 1997).

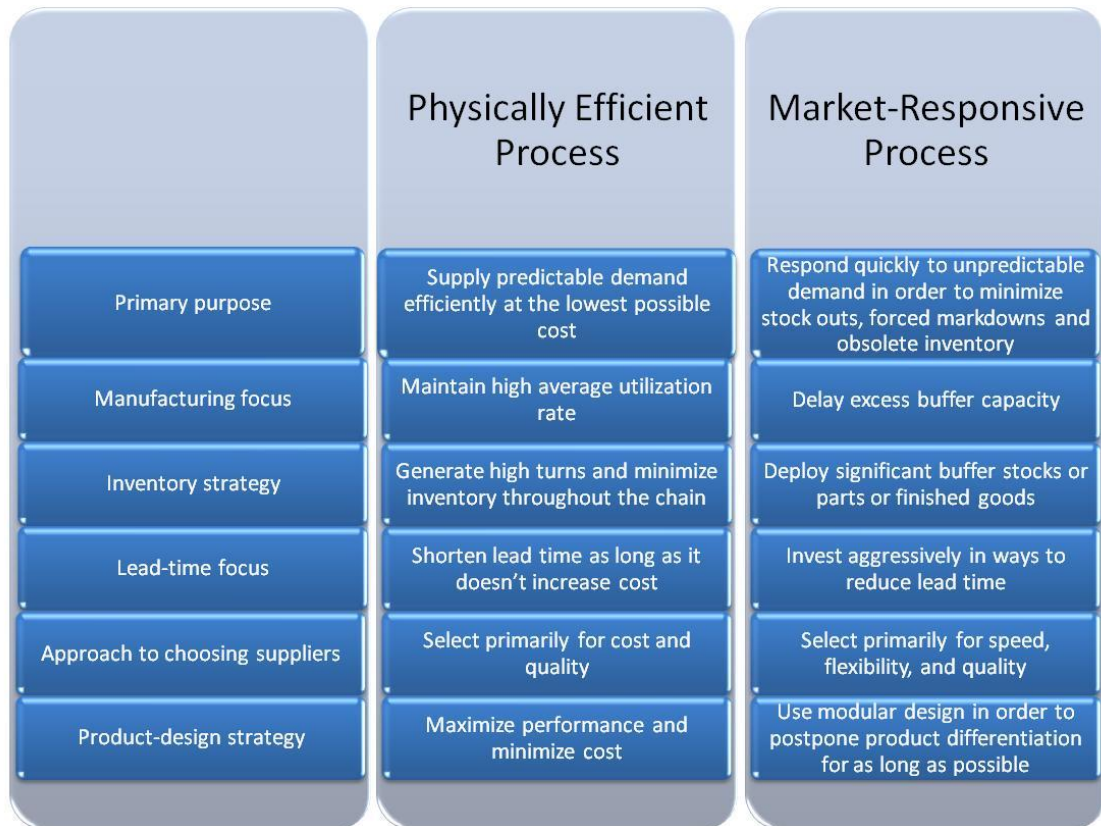


Figure 3. Physically efficient versus market responsive supply chains. (Fisher 1997: 108)

It might be that a company, through its product strategy, gravitates from the functional to the innovative sphere without realizing that anything has changed. Then its managers start to notice that service has mysteriously declined and inventories of unsold products have gone up. When this happens, they look longingly at competitors that haven't changed their product strategy and therefore have low inventories and high service. They even may steal away the vice president of logistics from one of those companies, reasoning, if we hire their logistics guy, we'll have low inventory and high service, too. The new vice president invariably designs an agenda for improvement based on his or her old environment: cut inventories, pressure marketing to be accountable for its forecasts and to freeze them well into the future to remove uncertainty, and establish a rigid just-in-time delivery schedule with suppliers. The worst thing that could happen is that he or she actually succeeds in implementing that agenda, because it is totally inappropriate for the company's now unpredictable environment discusses Fisher (1997: 109).

For companies to be sure that they are taking the right approach, they first must determine whether their products are functional or innovative. Most managers have some sort of a sense which products have predictable and which have unpredictable demand: the unpredictable products are the ones generating all the headaches. Some managers are not sure or want to have confirmation on their intuition, Fisher suggests following approach: Once it has been determined that products are either functional or innovative by the demand behavior, managers can evaluate whether their supply chain is physically efficient or responsive to the market (see the Figure 3). When the nature of their products and supply chain has been determined, managers can employ a matrix to formulate the ideal supply-chain strategy. The four cells of the matrix represent the four possible combinations of products and priorities. By using the matrix to plot the nature of the demand for each of their product families and its supply chain priorities, managers can discover whether the process the company uses for supplying products is well matched to the product type: an efficient process for functional products and a responsive process for innovative products). Companies that have either an innovative product with an efficient supply chain or a functional product with a responsive supply chain tend to be the ones with problems.

When building an integrated framework for the development of focused supply chains, Childerhouse et al. (2002: 676) suggest, that the first step is the development of a holistic demand chain strategy. This leads from highlighting of core competencies and resources, and its primary purpose is the identification of specific markets to be targeted plus the overall corporate strategy. Hence, inputs from the marketplace in the form of key order winner and order qualifier characteristics are used, together with information about the competitive situation in the form of knowledge of the strategies and tactics of the competitors. Aitken et al. (2005: 5) notice similarly, that companies need to do certain things well before they can be considered as potential suppliers; these pre-requisites are called market qualifiers. Those elements however represent only the base level of performance – In order to succeed in that market the company must out-perform the order winners, meaning the critical differentiators. In practice there will often be a relatively small number of performance criteria which constitute market qualifiers and order winners e.g. price, quality, delivery lead time and reliability. Once the overall demand chain strategy has been established, specific products and service levels are identified. Both of those are tailored to the target markets with emphasis placed on prioritization of service, quality cost or lead times, thereby emphasizing the all important trade-offs to be made in each focused demand chain. Given the specific products and their related service criteria the DWV³ (Duration of life-cycle, time window for delivery, volume, variety and variability)

classification variables proposed by Christopher and Towill (2000) are used to categorize the products into clusters with similar characteristics. The output of this step is a clear definition of the requirement for each demand channel, along with specific objectives to maximize competitiveness in each targeted market segment.

The concept of DWV³ is introduced in detail by Aitken et al (2005: 8). First attribute of stands for duration of life cycle. The likely length of the product life cycle is an important consideration in the adoption of specific supply chain strategies. Short life cycles require both rapid time-to-market as well as a short end-to-end pipeline to enable demand to be continuously replenished during the life cycle. For many products there is a recognizable pattern of sale from launch through to termination. The individual phases of the life cycle curve are introduction, growth, maturity, saturation and decline. It should be noted that today's turbulent marketplace has resulted in extreme volatility and hence uncertainty has become a characteristic of many product life cycles. Second, Time window for delivery, is more likely to be the case that agile strategies are appropriate for products that are either expected to be short-lived in the marketplace, or require to be delivered to the customer very soon after the order is placed. For example, in the first category a company needs rapid response to replenish those products (say fashion goods or mobile devices) selling well at that particular point in time. Third, volume, is where products are aimed at mass markets with a prospect of a high level of demand, conditions will often allow lean-type production and make-to-forecast strategies to be designed and implemented. Thus, the focus can be on maximizing the economies of scale. On the contrary, where volumes are likely to be smaller the benefits of flexibility, both in production and the wider supply chain, will be evident. However, it is important to recognize the impact of the Pareto distribution (the "80/20" rule). In other words at a particular point in time the top 20 per cent of the range may sell in substantial volume but the remaining 80 per cent will be much slower moving. Hence it will sometimes be appropriate to adopt lean strategies for the top 20% per cent and agile strategies for the remaining 80 per cent where it is wanted to avoid over-stock or over-produce. Fourth attribute is variety – typically the higher the level of variety demand by the marketplace, the lower will be the average volume per variant because total demand is spread across a greater number of stock keeping units, known also as SKUs. This will often mean that demand will be more variable at the SKU level. It also implies a much higher level of flexibility in manufacturing with a need for more change-over's and set-ups. With increased variety generally comes greater complexity. The challenge is to seek to achieve a higher level of commonality at the Bill of Material level but to enable late configuration or customized finishing to meet the customer demand for variety. Anklesaria (2008: 134) agrees by stating that simplification is an

obvious remedy for complexity, but one which may not always be available. Typically there are still to reduce complexity by questioning the reasons why things are the way they are. For example, marketing and sales are eager to vary offered product's appearance though it would not make any difference on the amount of sold units. However, it has a big impact on Stock Keeping Unit (SKU) level. The greater the fragmentation of the demand the harder it becomes to manage availability in that the variability of demand will tend to be higher, Anklesaria (2008: 134) scrutinizes. Finally, the concept of variability, relates to the "spikiness" of demand. It also equates to unpredictability. Where the demand cannot be forecast with any degree of accuracy, it is suggested that agility is critical. A measure of variability is the Coefficient of Variation (standard deviation divided by the mean). Where the coefficient of variation is high, then reliance on forecast-based management is to be avoided. Instead the focus must be upon lead-time reduction and the substitution of information for inventory. In other words, capturing information on demand as close to the marketplace as possible.

To continue from the framework presented by Childerhouse et al. (2002: 676), a specific demand chain types require earmarked facilities. This step is the number four of the framework described in the Figure 4 (see the next page). The facilities need to be tailored to achieve the desired objectives, for example those products that are necessitating high service levels in the form of availability may require distribution warehouses located near the marketplace. The fifth step takes the facilities requirements to a more detailed level in relation to the production layouts and control mechanisms required at each level, for example if multiple variants are offered with short lead times then postponement is applicable. Finally, the use of lean principles in the form of Kanban is applicable for reasonably stable demand, but Material requirements planning (MRP) control mechanisms are more appropriate for special or after-market products, Childerhouse et al. (2002: 676) introduce.

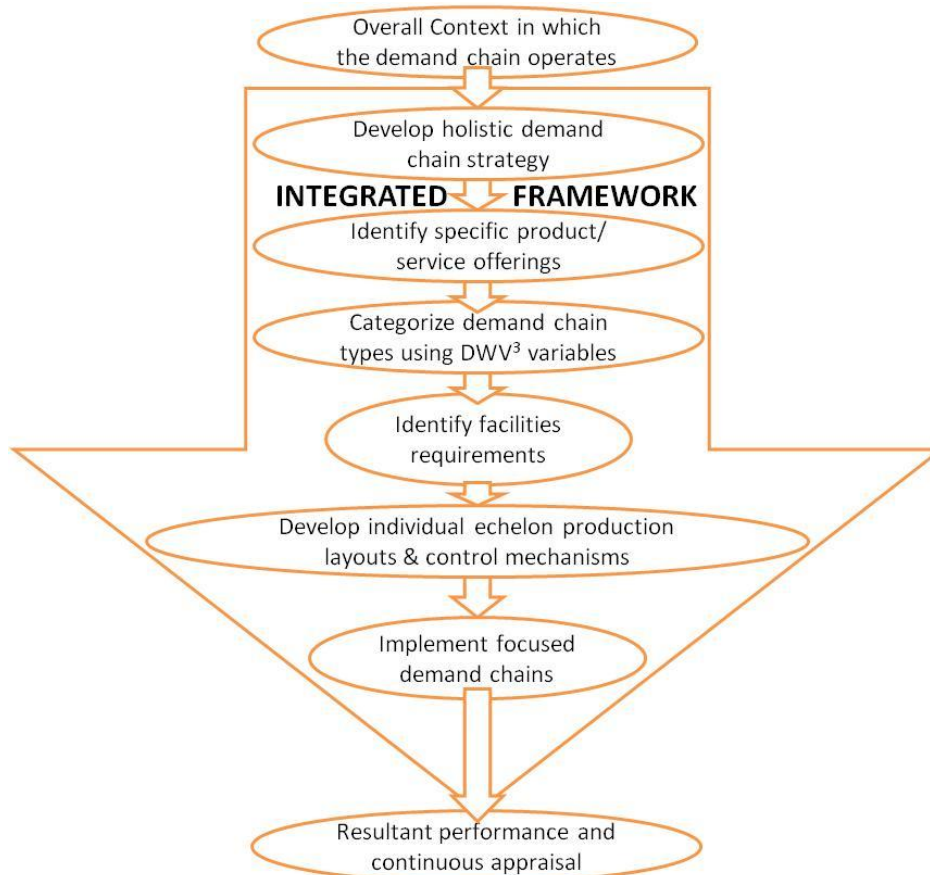


Figure 4. Integrated framework for the development of focused demand chains. (Childerhouse et al. 2002: 677).

Above figure (see Figure 4) suggest that demand chain is categorized by using the DWV³. This framework will analyze company's product portfolio and highlight the need for different pipelines to cater for the diversity of product/market profiles. Even if each of these five dimensions were at their simplest only bi-polar then this would still imply 32 (5²) pipelines. However, in reality fewer pipelines will be required through clustering products into generic families according to Aitken et al. (2005: 10).

There are two approaches for the philosophy of the supply chain strategy according to Christopher et al (2006: 281). First concept is lean, while another is agile. Lean thinking focuses on reducing or eliminating waste, meaning excess time or those activities that generate non-value adding costs, within supply chain. Agility again focuses more on responsiveness which is needed with the unpredictable and turbulent markets. Supply chain is agile when it is more of demand-driven than forecast-driven. In the real world, these two approaches can complement each other, as in many cases there is a requirement for a mix between these two strategies. Often it cannot be stated that these two strategies are competing against each other but rather it is the judicious selection and integration of selection and integration of appropriate aspects of these paradigms

appropriate to the particular supply chain strategy. In some cases, the two ideas of lean and agile can be brought together as a hybrid “leagile” solution, introduced originally by Naylor et al. (1999) according to Christopher et al. (2006: 281). One such hybrid solution is to utilize lean principles when designing supply chains for predictable standard products and agile principles for unpredictable or “special” products. It can also be used when the total demand for a product can be separated as base and surge demands. Base demand obviously is more predictable and less risky so lean principles can be applied while using agile approach to cope with surge demand.

A number of classification schemes have been proposed in the literature to guide the choice of supply chain strategy (Fisher, 1997; Christopher, 2005 and Childerhouse, 2002). Replenishment lead-times have critical impact on responsiveness to demand, and globalization typically extends those lead-times. Therefore, Christopher et al. (2006: 282) propose that lead-time must be included in any useful taxonomy. They continue by describing a simple three dimensional classification appropriate for global supply chains. First there are products that are either standard or special. Second, the demand is either stable or volatile and finally, the replenishment lead-times are either short or long. These three dimensions give eight theoretical pipeline types. In practice, not all are applicable as such by being unlikely to encounter or those are non-viable situations.

It might be over-simplified to characterize products as either “special” or “standard”, but those can be used as high-level distinction. Special product is a product with low volume with erratic demand or it is a product with short life cycle, or a product with high level of customization. Standard products are the ones with stable demand with longer life cycles without, or with limited, customization. Predictability and product type typically relates, for example standard products will be more predictable, it is possible to simplify the taxonomy into just two dimensions; predictability and replenishment lead-times. Figure 5 (see next page) shows the resulting matrix and the table 1 beneath it defines the four pipeline solutions that Christopher et al. (2006: 283) suggests.

| | | | |
|-------------------------------|-----------------------|---|--|
| Supply Characteristics | Long Lead Time | <u>LEAN</u> PLAN AND EXECUTE | <u>LEAGILE</u> POSTPONEMENT |
| | Short Lead Time | <u>LEAN</u> CONTINUOUS REPLENISHMENT | <u>AGILE</u> QUICK RESPONSE |
| | | Predictable | Unpredictable |
| | | Demand Characteristics | |

Figure 5. How demand/supply characteristics determine pipeline selection strategy. (Christopher et al. 2006: 283).

| Supply demand characteristics | Resulting pipelines |
|--|---|
| Short lead time + predictable demand | Lean continuous replenishment |
| Short lead time + unpredictable demand | Agile quick response |
| Long lead time + predictable demand | Lean, planning and execution |
| Long lead time + unpredictable demand | Leagile production/logistics postponement |

Table 1. Relating pipeline types to supply/demand characteristics. (Christopher et al. 2006: 283).

On the horizontal axis of the Figure 5 is described the demand characteristics in terms of predictability. Measures such as the coefficient of variation could be used to position products on that axis. The vertical axis reflects the replenishment lead times for the same product. It measures the time that it takes the system to react to an increase in demand if materials, etc. had to be sourced or manufactured. If this elapsed time is measured in months rather than in days then that product could be regarded as having a long re-supply lead time. The matrix suggests that there might be four possible generic supply chain strategies. In situations where the demand is predictable and replenishment lead-times are short then a “continuous replenishment” strategy may be appropriate. At the other extreme the ideal solution is to carry strategic inventory in some generic form and assemble/configure/distribute as required when actual demand is taking place. It is also known as postponement concept. When lead-times are long but demand is predictable, a “lean” type of strategy might be taken into use. In other words, it means that sourcing or making is done in advance of the demand the most efficient way. Finally, when demand is unpredictable but lead-times are short, then agile solutions will be required upon rapid

response. For each cell shown in the matrix, the chosen tactic may be influenced by whether the product is “standard” or “special”. As an example, in the postponement cell of Figure 5, for a special product it may be possible to postpone manufacturing, but for a standard product it may be better to postpone the distribution, describes Christopher et al. (2006: 284).

In addition to designing supply chain strategies, as described earlier in this section - it is as important to provide all customers with the level of service that has been agreed or negotiated. However, it must also be recognized that there will be inevitably need to be service priorities, analyzes Christopher (2005: 69). In this connections to Pareto Law, or 80/20 rule (where 20 per cent of customers bring 80 per cent of the profits), can provide the basis for developing a more cost-effective service strategy. This issue is raised up because not all customers are equally profitable nor are products equally profitable. Christopher (2005: 70) suggests that profit should be measured over sales revenue. The reason for suggesting so is that revenue and volume measures can hide a great variation in costs. In case where product profitability is measured, also appropriate service related costs need to be identified carefully as those differ between products. The problem with the conventional accounting methods is that those do not help in identifying these variable costs.

| | | | |
|------------------------------|------|-------------------------|-------------------------------|
| Volume (by SKU) | High | Seek cost reduction (1) | Provide high availability (2) |
| | Low | Review (3) | Centralized inventory (4) |
| | | Low | High |
| Profit contribution (by SKU) | | | |

Figure 6. Managing product service levels. (Christopher 2005: 71-72)

Management of product service levels represented by Christopher (2005: 71-72) by taking into account both the profit contribution and the individual product demand, as described in the Figure 6.

First, the top left corner where it is advised to seek cost reductions: Products in this category are high volume products, and are also in frequent demand. Those are low in profit contribution and the priority is to re-examine product and logistics to find out if there is any scope for enhancing profit. Secondly, moving to the right, where profitability increases while the volume per SKU stays high meaning that these products are highly demanded and they are also more profitable than products in the top left corner. With these products, a company should offer the highest level of service by holding them as close to the customer as possible and with high availability. Typically as there will be relatively few of these products, a company can afford to follow such strategy. Thirdly, the bottom left corner with a text review: Products in this category do not contribute to profits, or at least only marginally, and from sales point-of-view are slow movers. Those should be regularly appraised with a view to deletion from the catalog. Company should consider getting rid of them unless those play a strategic role in a product portfolio. Finally, the bottom right corner where centralized inventories should be built: These products are highly profitable but those only sell in a relatively slow rate. That makes them candidates for a centralized management – in other words, these materials should be kept in some central location as far back in the supply chain as possible in order to reduce total inventory investment, and by a request be shipped by express transport direct to customer. This requires the agile supply chain that has been discussed of earlier in this section.

2.2 Cost Management in Supply Chains

Total cost of ownership

Total cost of ownership (TCO) is a purchasing tool and philosophy aimed at understanding the relevant cost of buying a particular good or service from a particular supplier. TCO is described to be the present value of all costs incurred during the life of a product or a service, according to Anklesaria (2008: 89). References to TCO and related concepts, such as life cycle cost analysis, have been in the literature for some time, but its practical application has been somewhat limited, Ellram and Sifert (1998: 56) discuss. TCO is an important tool to support strategic cost management. It is a complex approach that requires the buying firm to determine which costs it considers most relevant or significant in the acquisition, possession, use, and following disposition of a good or service. In addition to the price paid for the item, TCO may include the costs incurred by purchasing for order placement, research and qualification of suppliers, transportation, receiving, inspection, rejection, storage, and disposal. Ellram and Sifert (1998: 58) conclude that lack of understanding of TCO can be very costly to the firm. Poor decisions

will likely result, hurting the firm's overall competitiveness, profitability, pricing decisions, and product mix strategies.

Many problems at the operational level in logistics management arise because all the impacts of specific decisions, both direct and indirect, are not taken into account throughout the corporate system. Too often decisions taken in one area can lead to unforeseen results in other areas. Changes in policy on minimum order value, for example, may influence customer ordering patterns and lead to additional costs. Similarly, changes in production schedules that aim to improve production efficiency may lead to fluctuations in finished stock availability and this affect customer service. The problems associated with identifying the total system impact of distribution policies are immense. By its very nature logistics cuts across traditional company organization functions with cost impacts on most of those functions. Conventional accounting systems do not usually assist in the identification of these company-wide impacts, frequently absorbing logistics-related costs in other cost elements. The cost of processing orders, for example, is an amalgam of specific costs incurred in different functional areas of the business which generally prove extremely difficult to bring together, illustrates Christopher (2005: 97) as shown in the Figure 7 (see the next page).

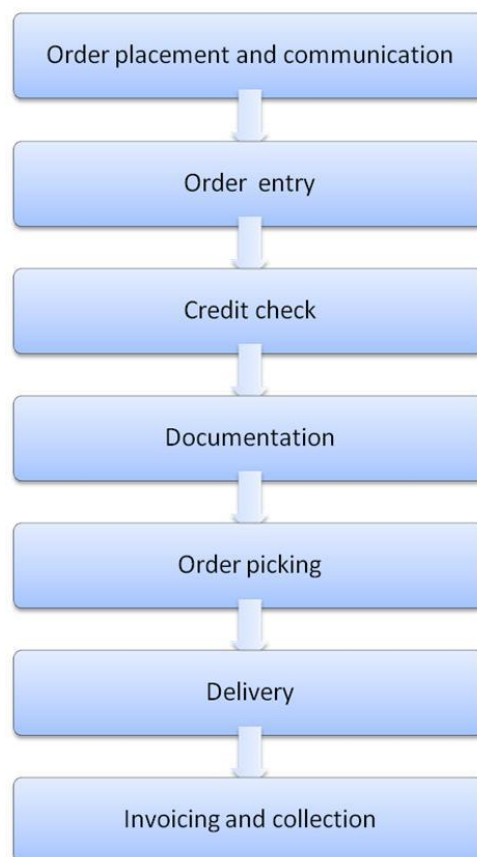


Figure 7. Stages in the order-to-collection cycle. (Christopher 2005: 97).

Inventory, for example, is one of the cross-functional sinkholes that might be overlooked when inventory carrying costs are not included to sales metrics. If obsolete inventories are not marked down and moved out of stock in time, the company will pay for the carrying costs and eventually – sometimes years after – also the cost of inevitable markdown. To avoid such needless inefficiencies, management should be involved in developing a mature S & OP (Sales & Operations Planning) process. The operations and supply chain function should be held equally accountable with the sales and marketing function for customer service and inventory, examines Sloan et al. (2007: 124).

The issue whether to outsource such logistics functions as transportation, warehousing, and order processing is a variation on the traditional “make-or-buy” decision. Make-or-buy is really a shorthand term for the crucial decision of how a firm obtains goods and services. If the company determines that the open market is the best source for a particular component or support service, the firm should buy the item or service. If the company decides that the part or function should be supplied by company employees, the firm has chosen the “make” choice, analyzes Maltz and Ellram (1997: 45). As the name implies, formal make-or-buy analysis began in a manufacturing context, where the question is whether a product’s component parts should be bought from a supplier or produced in-house. Both operations management and purchasing texts routinely treat this question as a cost minimization issue. One compares the supplier’s quote to internal costs and chooses the less expensive alternative. Perceived differences in quality, delivery reliability, responsiveness, and similar issues are sometimes quantified, but often these non-price issues are treated separately. Maltz and Ellram (1997: 45) discuss, that a number of companies have used TCO procedures to incorporate non-price considerations into the make/buy decision. They believe that TCO is an excellent starting point for analyzing logistics outsourcing issues. Logistics, especially finished goods distribution, is vitally concerned with external customers and services, rather than internal customers and products. Since logistics deals with services rather than parts, any outsourcing analysis must account for managing a third-party process from initial loading to final delivery. In contrast, component outsourcing involves inspection costs at a point in time, often at the supplier’s shipping dock or the factory’s receiving dock – or in both. Logistics’ focus on external customers entails data gathering over time on both third-party performance and customer satisfaction. Buyers managing component outsourcing receive direct feedback from a single source: the manufacturing function they supply.

It is important to understand the implications of using unit price as the sole principle in the delivery of the purchasing strategy. The primary objective of unit price focus is for the

buying organization to obtain the lowest unit price of the service or product that is being procured. The price that is negotiated with the suppliers is focused on their price, but does not look at the total cost to the buying business: this is a fundamental difference. Any pricing reductions achieved will come directly off the cost base of the business. Therefore it is often perceived to be a quick win for business hoping to reduce operational expenditure. However, there are many input variables in TCO according to Pennington, J. (2008: 24). Initial pricing addresses the initial purchase price of the product, but this is only one variable of the overall cost to the business. Other variables may be, as suggested earlier by Ellram and Sifert (1998: 56), for example service prices, cost of returns, warranty costs, emergency freight charges, additional management expenses and the cost of customer dissatisfaction. Following example describes it clearly: A logistics provider may only quote for the transportation of goods from A to B, but will later add costs of implementing the new service – set-up costs, technology/IT platforms, account resourcing – and will be less flexible in accommodating other support services – emergency shipments – for free. These costs are not always possible to capture up front, because the negotiation process is more focused on driving down the unit purchase price. Tracking measurements through quantitative data should be embedded in regular review sessions, so the TCO can clearly be seen.

TCO modeling is a tool that systematically accounts for all costs related to an investment decision. TCO models were initially developed by Gartner research in 1987 and are now widely accepted, scrutinizes Heilala et al. (2006: 3970) basing the statement on Wikipedia. To put it simple, TCO includes all costs, direct and indirect which are incurred throughout the life cycle of an asset, including acquisition and procurement, operations and maintenance, and end-of-life management. Heilala et al. (2006: 3985) continue that sometimes it might be difficult to obtain data for all mentioned cost factors, and therefore focus is on system design and the cost of operating it. Some overhead-type costs are not possible to be calculated directly, such as upper-level-management costs.

Activity-based costing

Activity-based costing (ABC) can best be described as a system that assigns the costs to products based on the causal relationships of the activities required to produce the product, describes Anklesaria (2008: 82). He quotes CAM-I, a professional standards organization for accounting, that “activity-based accounting is a collection of financial and operational performance information dealing with significant activities of the business. Activities represent repetitive tasks performed by each specialized group within a company as it executes its business objectives”. In other words, ABC seeks to allocate

overhead costs by using many “bases” instead of just direct labor, machine hours or square meters. As mentioned earlier, costs are allocated to product lines based on the activities required or consumed by a production line.

One of the basic principles of logistics costing, it has been argued, is that the system should mirror the materials flow, i.e. it should be capable of identifying the costs that result from providing customer service in a marketplace. Second principle according to Christopher (2005: 99) is that it should be capable of enabling separate cost and revenue analysis to be made by customer type and by market segment or distribution channel. This latter requirement emerges because of the dangers inherent in dealing solely with the averages, e.g. the average cost per delivery, since they can often conceal substantial variations either side of the mean. To have these principles operationalized, it requires an output orientation to costing. In other words, company must first define the desired outputs of the logistics system and then seek to identify the costs associated with providing those outputs. A useful concept here is the idea of “mission”. In the context of logistics, a mission is a set of customer service goals to be achieved by the system within a specific product or market context. Missions can be defined in terms of the market served, by which products and within what constraints of service and cost. A mission by its very nature cuts across traditional company lines. The successful achievement of defined mission goals involves inputs from a large number of functional areas and activity centers within the firm. Thus an effective logistics costing system must seek to determine the total systems cost of meeting desired logistics objectives (the output of the system) and the costs of the various inputs involved in meeting these outputs. Interest has been growing in an approach to this problem, known as “mission costing”. Figure 8 (see the next page) illustrates how three distribution missions may make a differential impact upon activity centre or functional area costs and, in so doing, provide a logical basis for costing within the company. As a cost or budgeting method, mission costing is the reverse of traditional techniques: under this scheme a functional budget is determined now by the demands of the missions it serves. Cokins (2002: 24) suggest that companies might develop more realistic, dynamic budgets based on predictive planning. It is suggested to have it done by using activity-based costing by basing company plans on fluctuating needs related to demand rather than on historical data. In Figure 8 the cost per mission is identified horizontally and from this the functional budgets may be determined by summing vertically, sums Christopher (2005: 100).

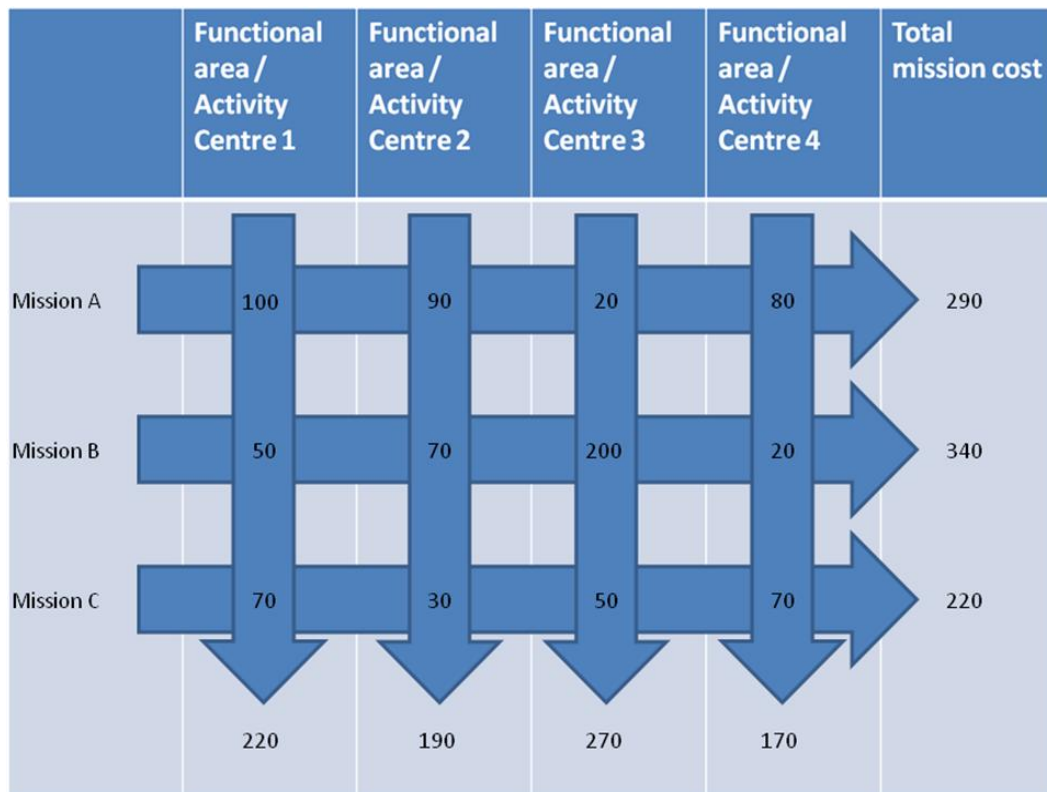


Figure 8. The programme budget. (Christopher 2005: 101).

Given the logic of mission costing is sound; following things reveal how it can be made to work in practice. Mission costing approach requires firstly that the activity centers associated with a particular distribution mission be identified, e.g. transport, warehousing, inventory, etc., and secondly that the incremental costs for each activity centre incurred as a result of undertaking that mission must be isolated. Incremental costs are used because it is important not to take into account “sunk” costs or costs that would still be incurred even if the mission were abandoned. It can be made use of the idea of “attributable costs” to operationalize the concept: Attributable cost is a cost per unit that could be avoided if a product or function were discontinued entirely without changing the supporting organization structure.

This approach becomes particularly powerful when combined with a customer revenue analysis, because even customers with low sales off-take may still be profitable in incremental costs terms if not on an average cost basis. In other words the company would be worse off if those customers were abandoned, discusses Christopher (2005: 101). Based on Sloane et al. (2007: 118), suggest that all metrics that purport to evaluate customer service assesses the company’s performance from customer’s viewpoint. It is also important the effectiveness of the metrics have been confirmed directly with several of the company’s best customers. True cost to serve, determined on activity basis, should

be part of management's metrics dashboard. Total assets employed, including both physical and working capital should be measured and analyzed in relation to supply chain performance. Furthermore, it should be verified that evidences of goals are based on benchmarks of best practices and they are shared cross-functionally within the organization.

Such insights as this can be gained by extending the mission costing concept to produce profitability analyses for customers, market segments or distribution channels. The term "customer profitability accounting" describes any attempt to relate the revenue produced by a customer, market segment or distribution channel to the cost of servicing that customer, segment or channel. The principles of customer profitability accounting will be explored in detail later in this chapter.

One of the basic questions that conventional accounting procedures have difficulty answering is; "How profitable is our customer compared to another?" Usually customer profitability is only calculated at the level of gross profit – in other words the net sales revenue generated by the customer in a period, less the cost of goods sold for the actual product mix purchased. However, there are still many other costs to take into account before the real profitability of an individual customer can be exposed. The same is true if one seeks to identify the relative profitability of different market segments or distribution channels, claims Christopher (2005: 103).

According to Christopher (2005: 103) the significance of these costs that occur as a result of servicing customers can be profound in terms of how logistics strategies should be developed. Customer profitability analysis will often reveal a proportion of customers who make a negative contribution. The reason for this is very simply that the costs of servicing a customer can vary considerably – even between two customers who may make equivalent purchases from us.

If we think of all the costs that a company incurs from when it captures an order from a customer to when it collects the payment, it will be apparent that the total figure could be quite high. It will also very likely be the case that there will be significant differences in these costs customer by customer. At the same time, different customers will order a different mix of products so the gross margin that they generate will differ. Christopher (2005: 104) suggests companies to question what costs could be avoided and what revenues would be lost if a certain customer is lost. That is the concept of avoidable costs and incremental revenue. Using this principle helps circumvent the problems that arise when fixed costs are allocated against individual customers.

Figure 9 (see below) presents a basic model that seeks to identify only those customer-related costs that are avoidable (i.e. if the customer did not exist, these costs would not be incurred). The starting point is the gross sales value of the order from which is subtracted the discounts that are given on that order to the customer. This leaves the net sales value from which must be taken the direct production costs or costs of goods sold. Indirect costs are not allocated unless they are fully attributable to that customer. The same principle applies to sales and marketing costs as attempts to allocate indirect costs, such as national advertising, can only be done on an arbitrary and usually misleading basis. The attributable distribution costs can then be assigned to a given customer's gross contribution. Finally any other customer-related costs, such as trade credit, returns, etc., are subtracted to give a net contribution to overheads and profit.

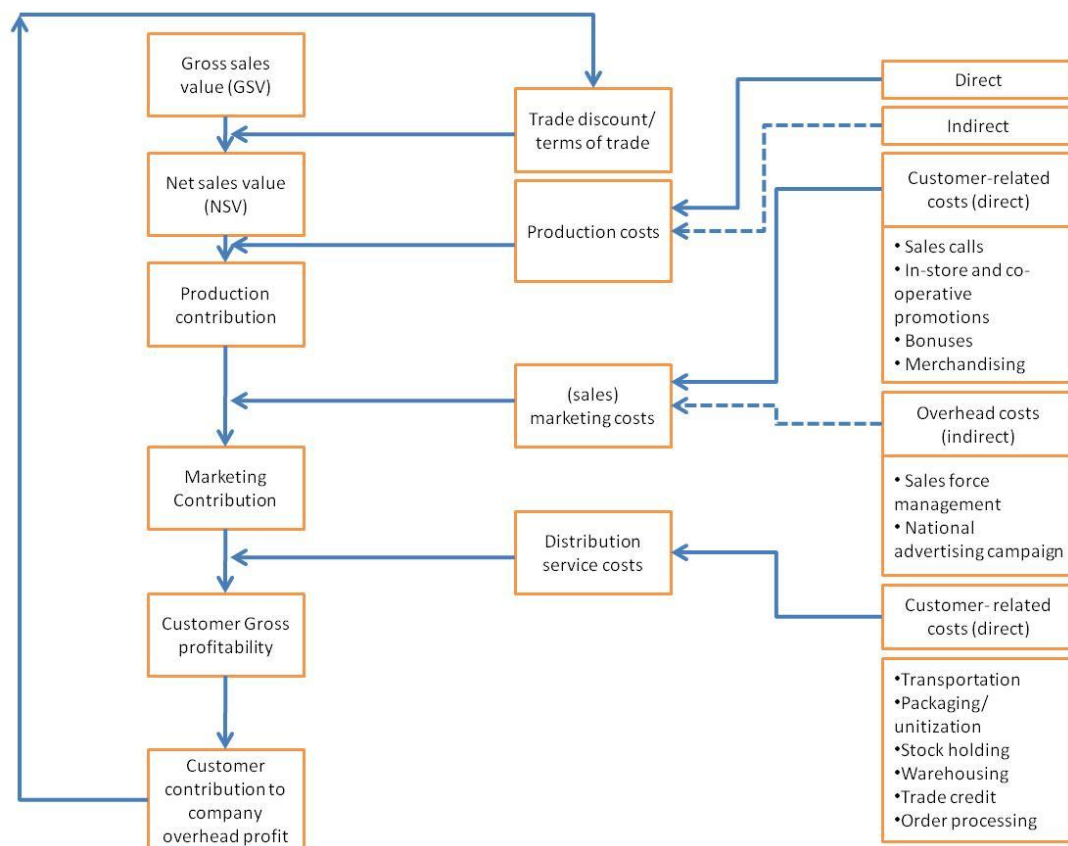


Figure 9. Customer profitability analysis: a basic model. (Christopher 2005: 106).

Christopher (2005: 111) scrutinizes the problems that currently exist in conventional cost accounting especially when it relates to logistics management. He summarizes five problems which are presented here: Firstly, there is a general ignorance of the true costs of servicing different customer types, channels and market segments. Secondly, costs are captured and aggregated at a too high level. Thirdly, full cost allocation is emphasized over the cost allocation of the smaller pieces though those are parts of the total. Fourthly,

conventional accounting systems are more function oriented than output oriented. Finally, companies understand the product cost but not the customer costs. All presented problems are caused because we seem to suffer in business from a lack of visibility of costs as they are incurred through the logistics pipeline. In general, logistics management requires means of capturing costs as products and orders flow towards the customer.

In order to tackle this problem, the basis for cost accounting needs to be changed radically away from the notion that all expenses must be allocated to individual units. Instead costs should be separated and matched to those activities that consume resources. One approach that can help to overcome this problem is called activity-based costing. ABC is that it aims to seek out the cost drivers along the logistics pipeline that cause costs by consuming resources. As an example Christopher presents cost assignment for order picking per single order. In the past, costs for a single order would probably have been the average cost of all orders. Activity-based approach might suggest that it is the number of lines on an order that consume the order picking resource and should therefore be treated as the cost driver. The benefit in using activity-based costing is that it enables each customer's unique characteristics in terms of ordering behavior and distribution requirements to be separately accounted for. After all levels of cost generating activities are identified then a clearer picture of the true cost-to-serve will be apparent. Even if activity-based cost model is strictly a cost allocation method, it uses a more logical basis for that allocation than traditional methods according to Christopher (2005: 112).

Direct costs such as materials and labor can be conveniently traced to units of products because it is easy to observe how much of the resource has been used to produce each unit. Indirect costs, usually called overhead or common costs, are shared by many products and are difficult to trace to individual units of any single product. Even the most complex costing systems are hard-pressed to assign such costs as building leases and IT to individual units in a multiproduct manufacturing facility. When they do allocate these costs, it is often done randomly; for instance, a costing system might divide total leasing costs by the percentage of total square meter required by each product, even though these products share common areas such as shipping and receiving. Variable costs vary with production at a constant rate; materials are the best example. Fixed costs like building leases and IT remain constant in total as production changes over wide ranges of activity. They can be allocated arbitrarily to units of product but these allocations should not be interpreted as marginal costs of producing additional units, which they clearly are not. Indirect costs are usually also fixed, as is the case for building leases and IT, but these terms are not synonyms, claims Bealieu and Mikulecky (2008: 18). Some costs are

indirect and variable, and some are direct and fixed. However, costs that are both indirect and fixed are the most difficult for any costing system to assign to units of product.

ABC is a complex costing system that deals with indirect and fixed costs by constructing a hierarchy of four activity levels based on these cost definitions, according to Bealieu and Mikulecky (2008: 18). The first category consists of the unit-level activities of materials and labor. A characteristic for these is that both are direct and variable costs; material and labor costs increase in proportion to increases in output and can be easily traced back to units. The second level of activities in the ABC system, known as the batch level, includes costs of activities performed on batches of units produced rather than on each unit individually. Batch level cost pools could be, for example, set-up and inspection; it is not difficult to trace costs at this level to products so they are direct. Batch costs are not variable with respect to units of production, but if batch sizes do not vary greatly, treating the cost driver rates per batch as equal and variable will not cause much error in costing. Product-sustaining activities are the third level of the hierarchy. The costs associated with these activities serve a specific product and are concurrently direct and fixed. Product sustaining cost pools might include activities such as engineering for design and change orders. The costs generated from these activities are average costs calculated over wide ranges of activity. They are not marginal costs of each additional engineering hour or change order. Finally, facility-level activities support the entire production process, as opposed to a specific product line or unit of product, and are both common and fixed. An example of facility-level activity cost could be the occupancy of a production line in terms of square meter. Even if production is stopped, the facility size and the occupancy of shop floor of that production line stay the same.

Logistics pipeline management plays an important role when logistics lead-times are being optimized. It is a process where manufacturing and procurement lead-times are linked to the needs of the marketplace. At the same time, pipeline management seeks to meet the competitive challenge of increasing the speed of response to meet to those market needs. Logistics pipeline management has following goals: To lower costs, to improve quality, to add flexibility and finally, to enable faster response times.

Reaching those goals is dependent on managing the supply chain as an entity and seeking the means to either reduce the pipeline length or by speeding up the flow through the pipeline – or both. When supply chain efficiency is being analyzed, it can be noted that many activities that take place add more cost than value. For example, moving a pallet into a warehouse, repositioning it, storing it and the moving it out in all likelihood has added no value but has added considerably to the total cost, describe Christopher (2005:

155). In other words, value-adding time is time spent doing something that creates a benefit for which the customer is prepared to pay. On the other hand, non-value-adding time is time spent on activity whose elimination would lead to no reduction of benefit to the customer. Christopher (2005: 155) proposes getting rid of all kind of non-value-adding activities even though they might exist in the current design of processes. Christopher recommends companies to flowchart their processes to understand the opportunities that exist for improvements in productivity through re-engineering of those processes. After the processes have been flowcharted, as generic example shows in Figure 10 (see below), the managers involved with those processes should be brought together to debate and agree exactly which elements of the process can truly be described as value adding. This might not be an easy task as no one likes to admit that the activity they are responsible for does not actually add any value for the customer.

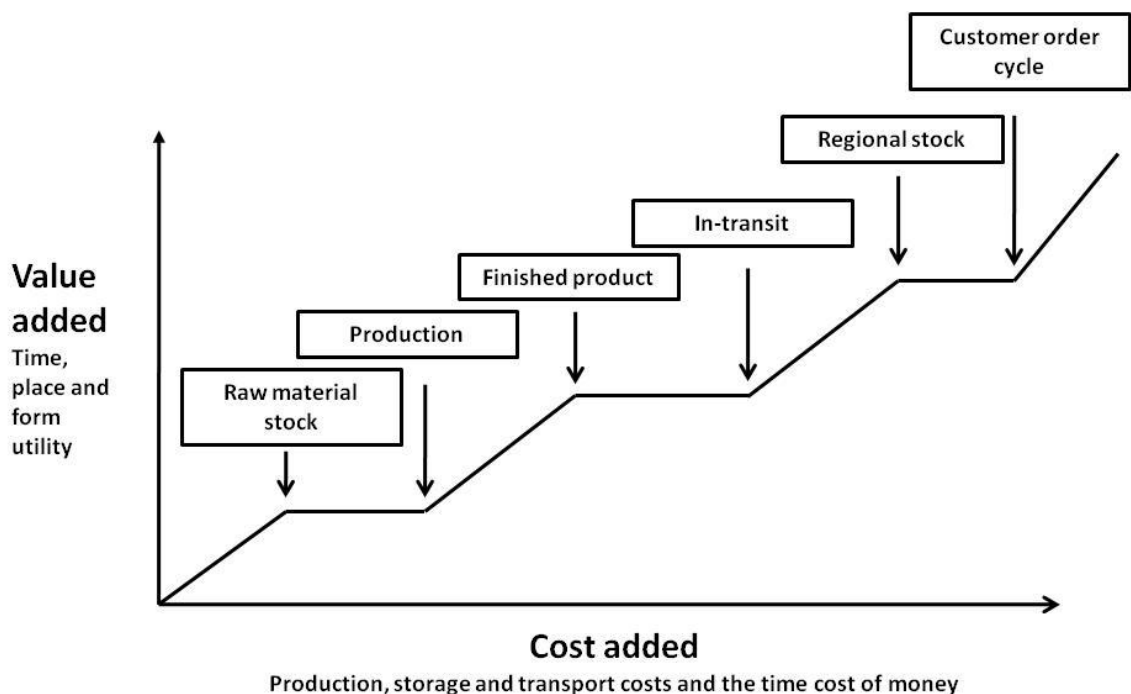


Figure 10. Cost activity types within a pipeline. (Christopher 2005: 156).

An indicator of supply chain efficiency is given by its throughput efficiency. It can be measured as:

$$(\text{Value-added time} / \text{End-to-end pipeline time}) \times 100.$$

Throughput efficiency can be as low as 10 per cent, meaning that most time spent in supply chain is non-value-adding time, claims Christopher (2005: 156).

Activity-based cost is in relation with the “Should Cost” model. It gives an understanding of supplier’s processes and how those processes affect on product’s pricing. Creation of a “Should Cost” models is one way also to understand supplier’s cost in manufacturing of a certain product. However, not all suppliers are willing to share cost data. At such times it is useful for the customer to create should cost model based on industry average and or according to their best understanding of the product or service being purchased. The level of detail in the model can vary from an industry cost profile to a detailed process-based model. Before developing a detailed model a team should think about its objective. The question is whether it is necessary to establish what the product should cost or is the team satisfied with the price but wants to better understand the breakdown of that price into its various cost elements, questions Anklesaria (2008: 67). Figure 11 (see below) illustrates the described progression in level of detail obtained from cost models.

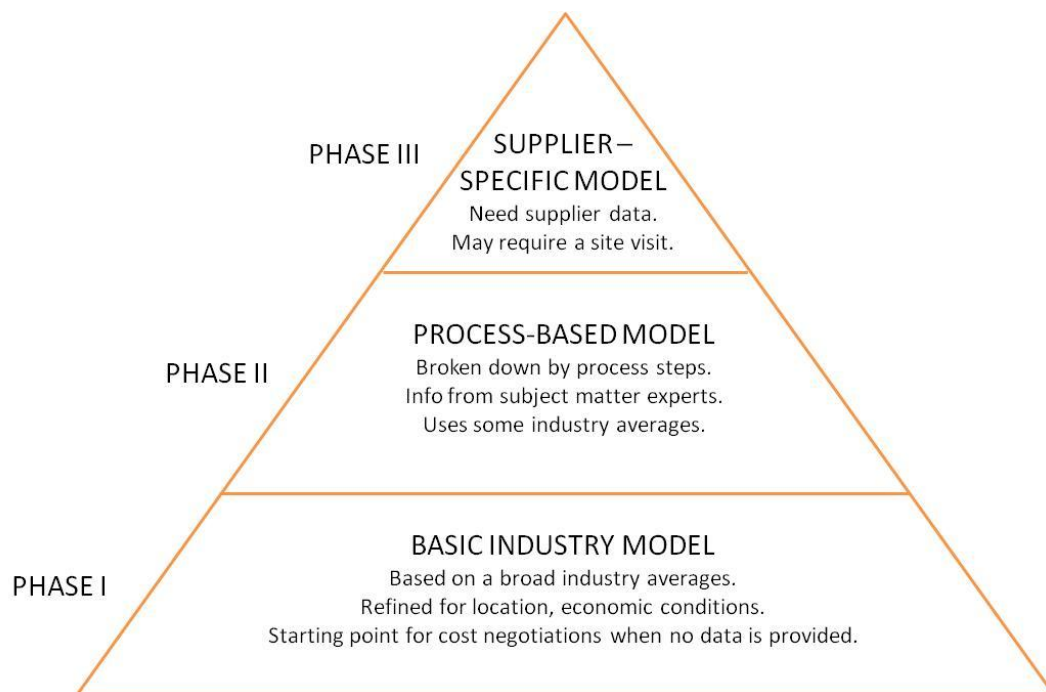


Figure 11. Should cost model phases. (Anklesaria 2008: 68).

Chenhall (2004: 19) scrutinizes Activity-based cost management (ABCM) from a human behavioral point-of-view. Activity-based cost management can provide improved information for strategic decision such as product planning and cost management, While ABCM has been increasingly adopted there is evidence that, for some organizations, promised gains have not eventuated. It appears that the main difficulties in adopting ABCM derive from implementation issues rather than the technical design of the systems. It is argued that attention to ABCM behavioral implementation enhances cognitive conflict that is then associated with successful ABCM applications, specifically the usefulness of

ABCM for product planning and cost management. Lack of attention to these factors generates affective conflict that is associated with less successful applications. Chenhall (2004: 21) suggests, based on the existing literature, that there are arguments to support the potential role of the three behavioral implementation factors in ensuring that ABCM information is useful for product planning and cost management. These three ABCM behavioral dimensions concern top management support, clarity of objectives and training. Decisions in the areas of product planning and cost management tend to be important strategically as they specify organizational direction and involve significant reengineering and cost reduction programs. Successful implementation of innovations associated with these types of strategic decisions, such as ABCM, depends on acceptance of the systems by the users. Such acceptance is enhanced if the systems are backed up by top management support. Goal theory, according to Chenhall (2004: 21), suggests that acceptance is enhanced and individuals will expend effort in trying to make systems work, if they are provided with the specific goals of the initiatives. The importance of setting the goals for ABCM is likely to be encouraged by the implementation factor of clarity of objectives. Also, it is likely that ABCM would be accepted and more readily promoted if there is nonaccounting ownership of the systems. Clarity of objectives is likely to show how ABCM aims to link operations to strategy, thereby enhancing the organizational validity of the systems. Finally, the usefulness of ABCM for product and cost management decisions will be enhanced if it is clear how ABCM can improve these types of strategic decisions. Training provides the basis to develop such understanding, Chenhall (2004: 22) sums up.

2.3 Summary

It is recognized that the purpose of supply chain management is to provide customers with the level of service and quality that they require with the lowest possible cost (Christopher 2005). In many markets, time has become a competitive variable. Not just time-to-market for the new product introductions but time to respond in terms of being able to meet the needs of time sensitive customers. There are different philosophies of supply chains as Christopher (2006) suggests. Lean supply chains fit into an environment where demand is relatively stable and the level of variety is low while agile is more responsive; it is about the ability of matching supply and demand in turbulent and unpredictable markets. It was noted by Lee (2004), that companies need to adjust their supply networks when markets or strategies change. Adaptation and renewal is required to keep up with the competition. Christopher (2005) scrutinized that cost reduction is a worthy goal, as long as it is not achieved with the expense of value creation. Low cost-strategies might lead to an

effective logistics but not in efficient logistics. Lee (1997) noticed that distorted information in the other side of the supply chain can lead to tremendous inefficiencies such as excessive inventories, misguided capacity plans, ineffective transportation, etc. It is vital that information within the supply chain is coherent and reliable.

The first section introduces the marketplace and product requirements for different supply chains based on their demand characteristics. Fisher (1997) categorizes products to be either functional or innovative. Functional products have stable, predictable demand and long life-cycle. Stable demand draws competition, which leads to low profit margins. Many companies try to avoid low margins by introducing new innovations on those products to promote their offerings. Innovative products have high profit margins and volatile demand, which sets completely different requirement on supply chain. Companies need to tailor supply chains to the nature of markets for products.

The second section analyzes supply chain ideology from another point-of-view, turning it upside down by describing the set up as demand chain. Korhonen et al. (1998) have based their article on this matter and discuss this while keeping the focus on information management as well. When discussing demand chain, it is based rather on demand “pull” by the end customer rather than demand “push” concept, which is typical for a traditional supply chain. The difference between supply chain and demand chain is that in supply chain materials are “pushed” to the market, while in demand chain the end user “pull” triggers the flow throughout the chain.

The third part of the section two takes a look at the total cost of ownership by explaining what it means and how does it benefit the company in question as it does for the customer of that particular company. The cost of purchase is different than the total cost which occurs during the life-cycle of a certain product, including maintenance and upkeep costs in addition to purchase cost. Companies need to have an understanding of the total costs to be able to control costs in the best possible way.

The last section drills deeply into a subject called activity-based cost (ABC). ABC analyzes all the activities and resources that require and cause costs. These costs are the ones that should be taken into consideration when making cost analysis for production or marketing purposes for certain products. For example, manufacturing different products typically require different amount of resources with a certain cost. This sets a requirement to understand generated costs for each product in order to meet agreed budgets and the targeted production quantity. Christopher (2005) offers “mission costing” which cuts across traditional company lines. Missions make different impact upon functional areas

costs and, in doing so, provide a logical basis for costing within a company. Mission costing is illustrated in Figure 8 (see the page 31). When analyzing supply chain efficiency, it can be noted that many activities that take place add more cost than value. Christopher (2005) proposes that companies get rid of all kind of non-value-adding activities to improve efficiency.

3 DESCRIPTION OF METHOD AND MATERIAL

This research has been structured as qualitative research that was carried out as a constructive case study focusing on three business cases and one cross-functional operations of the case company. Analyses for each case were conducted through interviewing persons working in different positions. Good use was made of unlimited access to internal documentation within the case company to deepen understanding about the cases. Interviews have been complemented with the data thus collected to be able to present each case with examples. However, due to the confidential nature of this study not all appendices could be included in the public version of this thesis work.

3.1 Method and Process

This research project is based on a constructive case study method. There are three example cases for different business areas, one example of the company's production processes and a general evaluation of logistics and supply chain management as a whole. Background information for each case was collected through interviews. For each case, there was a minimum of two persons, usually between three and four persons interviewed. The interviews were supported by company data sent afterwards to provide detail on the particular cases. Interviewees were chosen based on their expertise regarding cases. A typical interviewee had years of experience with the Case Company and most of them had also held other positions within the company to support their current roles and knowledge of the subject matter. Some interviewees had gained valuable experience also in other companies, which gives them a good perspective on how business is conducted elsewhere. It should be noted that their opinions are purely subjective as it was considered important to know what kind of experiences the persons who are dealing with these particular cases have, and these opinions may not represent the official opinion of the Case Company.

An email was sent to all people participating in the interviews. It contained a draft version of the questions that were to be discussed. The questions kept evolving prior to the interviews and a final list was then presented to the interviewees during the discussion. The semi-structured interview method gave the respondents a chance to freely express their thoughts and update the latest issues in the area they were working in. This was found to be a good approach as the questions that were prepared in advance might not have included all the questions that really should have been asked.

Some of the interviews were carried out over the phone as some persons were located in company's different sites. As the case company operates world-wide, the scheduling of some of the interviews had to be well planned because of the time difference. Most of the interviews were conducted face-to-face while rest over the phone. The location of the interviews was deemed not to have any impact on the outcome of the interviews. The interviews were typically started by explaining the researcher's role, what the purpose of the interview is and what the ultimate purpose of the entire thesis project is. The interviewees had mostly prepared well for the interviews and the questions that were provided prior to the meetings. Typically, the working environment in the case company causes people to have tight schedules and arranging interviews was somewhat challenging - also the winter holiday season was about to start, which had its own impact on interviewee availability. The draft list of the interview material included questions about the interviewees' background aiming at breaking the ice before starting the actual interview. The languages that were used were either Finnish or English. When speaking in English, the discussions tended to be more straightforward than when speaking in Finnish, the native language of both participants. Depending on the level of preparation of the person who was about to be interviewed, the discussion was either typed down from scratch to a draft level version or if the interviewee had provided information prior to the meeting that data was complemented with more detailed answers. Interviews and data were stored on the researcher's laptop and formulated answers were then sent back to the respondents for their approval. Interviewees were asked to correct their answers if they did not agree with the interpretation of the interviewer. Usually there were also some examples, presentations or other files that the interviewees promised to send for further study, and those were mainly received by return email. The duration of most of the interviews was from 30 minutes to 60 minutes. Some interviews lasted even longer, mainly because the topic at hand generated so much discussion. The questions were phrased to be on a general level to ensure comparability between different business areas. A storyline of the topics was written afterwards for better readability. The questions can be found in appendix section.

There is plenty of literature available for supply chain management, and the topics presented in these publications have been reflected against the current situation of the company's example cases. By comparing the theory and the actual status of the cases it has been possible to provide a proposal of how things are to be improved in order to reach the goals targeted in the research question. The researcher has added his own experience and thoughts to the discussions and summary section of this thesis. As with the logistics and supply chain management, there is not only one way to go forward but

instead it is important to find that best way for that particular company. This thesis work has been constructed to give suggestions for the case company based on the data that was collected through interviews and from the case company's internal data sources between autumn 2009 and spring 2010. The suggestions are of a subjective nature and a person looking at these matters from a different viewpoint might offer other suggestions.

3.2 Reliability and Validity Considerations

Every research publication needs to consider reliability and validity. Quinn (1999: 1189) examines the ways of enhancing the quality and credibility of qualitative analysis by presenting three concerns that relate to each other: First, there should be precise techniques and methods for gathering and analyzing qualitative data, including attention to validity, reliability, and triangulation. Second the credibility, competence, and perceived trustworthiness of the qualitative researcher should be verified. Thirdly, there are the philosophical beliefs of evaluation users about such paradigm-based preferences as for example objectivity versus subjectivity, truth versus perspective, and generalizations versus extrapolations. Even though this overview examines some general approaches to issues of credibility and data quality in qualitative analysis, it is important to recognize that particular philosophical underpinnings such as specific paradigms and special purposes for qualitative inquiry will typically include additional or substitute criteria for assuring and judging quality, validity, and credibility Quinn (1999: 1189) continues. Moreover, the context for these considerations has evolved. The debate between qualitative and quantitative methodologists was often strident in the early literature on evaluation methods. In the near past, the debate has softened. A consensus has gradually emerged that the important challenge is to match the methods to empirical questions and issues in a relevant manner, and not to universally support any single methodological approach for all problems.

This study deals with three business cases that represent completely different type of businesses. The first one, Bluetooth Headset business, is recognized to be typical for the company. It appears that BT headset business is very well optimized in terms of product cost, logistics, packaging and customer needs. The findings concerning Bluetooth business area can be applied to similar product areas within the industry. Many markets nowadays are in the same, mature state. Second, the Memory Cards business is a profitable business especially for its high volumes. Gross margins are relatively low and efficiency plays an important part to ensure profitability also in the future. Outside the case company, an example can be easily taken from the grocery industry: Things that are available can be sold, but things that are not, cannot be sold. One challenge is that

production cost allocation in Case Company's Operations, in Eastern Europe, does not take into consideration the differences between product types. This would be especially important for high volume, low margin products such as Memory Cards. The findings regarding product allocation will benefit all product costing calculations with an emphasis on Memory Cards and similar business cases. Third, the business area of Carrying Cases is completely different from any other. The company has very little activities in-house, and mainly purchases product design, manufacturing, packaging etc. from external vendors. For Carrying Cases, the scope is to evaluate whether this is the optimum way to conduct business. The results can be easily expanded to other commodities, either to current ones or to businesses that will emerge in the future. The setup is not unique business-wise, but it definitely has its own nuances that make this particular case special. The case company has many similar outsourced businesses, but Carrying Cases still seem to have been taken a step forward from the others. Finally, company's operations are introduced and evaluated on whether certain aspects could be improved regarding example business cases or on a general level. Bluetooth Headsets and their manufacturing provide the most common example for the scope of this thesis. The findings in this area can be compared to surrounding business environments almost as such, and the effectiveness of a supply chain as a whole becomes an important factor for creating competitive edge.

As to the second requirement by Quinn, the researcher has working experience of approximately five years in the case company. He has worked in two different positions during his career in that company, as a Material Availability Specialist, i.e. buyer, and secondly as a Project Manager in a Research and Development team with operational and logistics responsibilities. Especially the latter position is closely related to analyzing supply chains even though it is not in the scope of responsibilities. The supply chain activities are under the responsibility of a dedicated logistics team within the case company and therefore the researcher is not fully aware of all the agreements and other requirements that are related to the supply chain development process. This particular factor reduces the willingness for the researcher to bring forward his own opinions in this research, as doing so might easily backfire.

As the interviews were the main source of information for this thesis supported by data collection from the company databases, the analysis as an outcome is highly dependent on how the questions in the interview are set and how the data has been analyzed. If another person was conducting this thesis work, he or she could come up with some other result depending on which results are preferred by this person. The data is explicit in a way that Case Company is using system tools to collect it, and one part of the thesis work

was to find out whether data is being collected the way it should be. The interviews, as mentioned earlier, were purely based on subjective opinions and that was entirely intentional. On the other hand, the questions were kept on a general level and mostly based on the interviewees' own answers about the topic. The researcher did not want to lead the interviewees in any particular direction with specifically formulated questions and thus the respondents were given the freedom to express their own opinions. The interviewer collected those answers and sent them back to the respondents for examination after the interview. This ensures that the respondents' answers were collected in the way that it was meant without any influence from the researcher. The number of professionals interviewed for one area was between two and four, which is still quite a small amount.

4 ANALYSIS AND RESULTS OF EXAMPLE BUSINESS CASES

Three business cases and one cross-functional operations case are presented within scope of this thesis. The cross-functional operations case plays a crucial part in all three business cases, and also logistics related issues are closely tied around them. The business cases represented later in this section include Memory Cards, Carrying Cases, and Bluetooth Headsets. These particular business cases and the cross-functional operations were chosen as they are currently experiencing certain issues that the company needs to understand better. These issues are presented in more detail below.

The Memory Cards business is vulnerable in terms of cost allocation calculations, if not done correctly. Gross margins with Memory Cards are rather low but with bigger volumes the Case Company is doing good business with those due to effective supply chain and manufacturing operations. The focus with the Memory Cards business case is to evaluate the cost allocation in company's operations and on a general level to see whether it has the correct information available when calculating the feasibility of certain businesses, not only Memory Cards. There is a packaging change project on-going with the Memory Cards area, and the change and any results available at this point shall be evaluated.

Carrying Cases represents a business that is different from everything else: Design, manufacturing and packing are outsourced. It needs to be understood whether this is the optimum way for Case Company to operate, or should some of these processes be brought in-house. Findings from the Carrying Cases business case can be applied to other similar, future business cases, should those become reality one day.

Bluetooth Headsets deals with one of the core businesses of what the Case Company is currently doing, and is mostly recognized for such products. Company has a good understanding of how things are done and can continue doing so in the future too, but there are still some gray areas within the supply chain and manufacturing that are generating extra costs and should therefore be optimized. There are several different types of Bluetooth Headsets for different purposes with different types of designs. Different types of products have different requirements in the marketplace and thus different supply pipelines are required. Mono headsets are typically designed for call handling while different kind of stereo headsets can be designed for several purposes, including high-quality audio listening and those meant to be used in sports. Bluetooth chips are also included in several different types of products that do not directly go under Bluetooth Headsets but by connection type are related to BT headsets. For example, Case Company has co-produced a heart rate belt with a healthcare company that can be

connected to a mobile device. By enabling the belt through an application that simultaneously connects with the Global Positioning System (GPS) it can show the person's jogging route and progress in the course of time. The Bluetooth Headsets business, especially the standard products, enjoys quite a steady demand in the markets. Naturally, special promotions and shortages in a global level for some key components might disturb the availability occasionally but mainly Bluetooth Headsets belong to commodity products, especially Product A which is used as an example product in this thesis. The Bluetooth Headsets business is presented and investigated in section 4.4.

The possible results and findings of this thesis can mostly be applied on a general level to all products with final packaging carried out in company's operations. Those findings can be applied to inbound or outbound delivery methods, packing sizes, warehousing, final packing or in any processes existing between these. Some improvements might not lead to cost savings, but on the other hand those might improve the value, for example, quality, that could improve the value to the customers who are purchasing company's products. Figure 12 (see below) describes company's supply chain on a general level. It has to be remembered, as noted in the earlier sections, that different products and markets requires different types of supply chains, i.e. pipelines to be more exact.

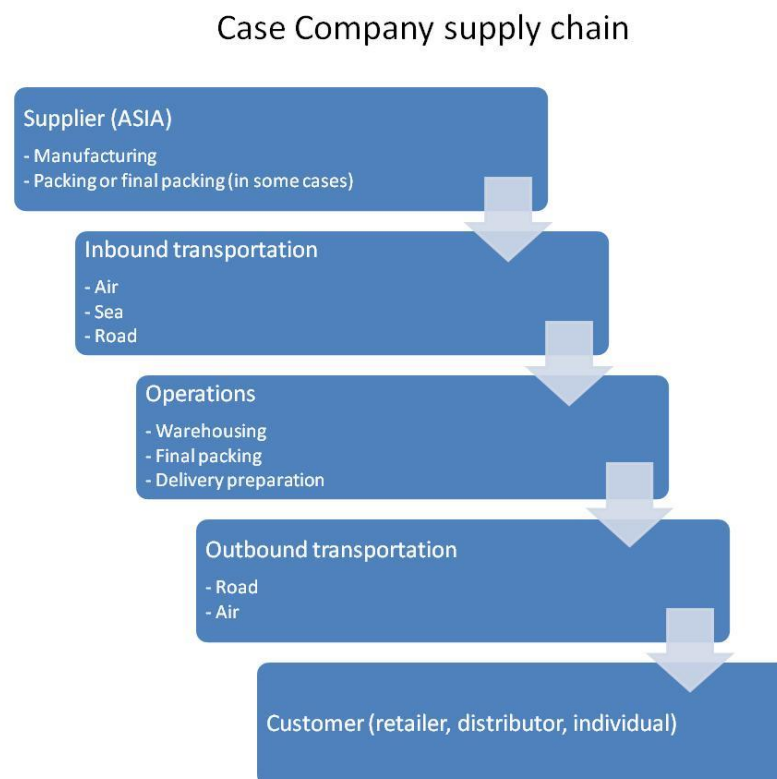


Figure 12. Case Company supply chain.

Reporting systems and cost controlling

The Case Company uses certain systems to calculate the feasibility and costs of certain business cases and business in general. There is, for instance, a system called Non-Terminal Profitability Reporting System (NTPRS) used for product feasibility calculations. The Case Company has a database in this reporting system for all products, and that database is managed by a person located in the US.

The person responsible for updating the database was also interviewed and asked about the methods for calculating the costs for different products. The report itself is consolidated from many activities that are run from the SAP R/3 ERP system. To be able to populate the actual figures, the first report is from SAP R/3 and it provides by material number the following attributes:

1. Sales quantities
2. Gross Sales
3. Royalty income
4. Adjustments to sales
5. Change in Obsolescence
6. In bound Freight
7. Customs
8. Other costs of sales
9. Actual Warranty costs
10. Warranty provision, addition
11. Warranty provision, release
12. Volume discounts
13. Sales reversal

It is typical that the materials do not have values in all of the above accounts, while *sales quantities* and *gross sales* most often have. The other report is run for the costing, with data also from SAP R3, which provides the material cost by region. That report is run three times to include the Americas, EMEA and APAC region costs. The costs are assigned to the products according to the region where they were sold. The report is being used by business controllers and sales units to analyze the figures for certain products.

The reporting system presented here was set up in the summer of 2009. Prior to that, there was no in-house production for Case Company. The system is currently in use at Europe and China. In the US, outbox packing is outsourced and reporting is therefore not

available through NTPRS. A project will be starting soon to replace the NTPRS tool and incorporate the Case Company's enhancement division reporting into the same tool that is used for reporting on terminal units (i.e. phones), currently called the Profitability Reporting System (PRS). NTPRS is only used for company's sub-unit profitability calculations. The tools are to be renewed in the future. NTPRS is not fully compliant with the PRS system currently, and it does not support combo sales at all, neither does it support enhancement area requirements as a whole. The new tool has no name yet, but a project for this is on-going. The enhancement division is a rather small business, and investments for it typically drag a bit behind when comparing to Case Company's terminal business side.

According to the person responsible for the European factory reports, the reporting has been challenging. It is a bit of a surprise to have European operations migrated to Case Company's systems even at this level. That site has two or three different cost centers from which costs are taken into account when making the calculations.

On the general level, not all products gain revenue split (in inbox or combo case), as is the case for example with wired headsets. Inbox accessories sales profits go to terminal programs for which the products are mainly developed. The sales profit for such products shows in company's result only as outbox sales, which is quite modest in comparison to inbox volumes. In wired headsets, this is to be evaluated again during the latter half of 2010. Batteries, Chargers, cables and adapters are in a similar position (all inbox content) and therefore not in scope for revenue split. Car chargers, Bluetooth Headsets and wireless headsets have been included in the revenue split agreement already before the year 2010. Car holders and speaker phones are to be included from the beginning of 2010. The Charger business unit was moved under enhancement division's umbrella during autumn 2009, which increased headcount but it did not contribute to the result largely for that particular year.

The Enhancement division's gross margin is generally higher than with the rest of the Case Company, contribution percentage is also on a good level. However, cost efficiency can always be improved. Company is lacking information on a product level profitability, but this information is available at enhancement division level.

The Case Company has five business areas: essentials, voice, data, entertainment, and car products. Under these business areas there are at least eighteen product families. Consultancy negotiations have been started during this thesis project, and these categories are bound to change.

Logistics in the Case Company

The Case Company has efficient logistics and supply chain operations. According to the literature and publications, it is viewed as a mobile phone industry benchmark company and recognized as one of the most efficient companies in the world with its supply operations. Logistics is tied with all production and plays a big role in the supply chain. However, there are things that can be improved. In order to understand better how the company operates its inbound and outbound logistics functions, two persons responsible for these areas have been interviewed. The first person is working as a Logistics Service Provider Manager, dealing with inbound logistics issues for both mobile devices and enhancements. The second interviewee is working as a Senior Outbound Logistics and Transportation Manager, responsible for outbound material flow from Case Company's European operations. Through the interviews, it can be better understood what the latest developments with the logistics area are.

Most of the suppliers are located in Asia and this created a challenge for logistics services. Optimizing costs that go with transporting parts to Europe has always been important but now even more than ever. The long distances put a lot of pressure on optimizing costs and transportation methods in order to find the best alternatives. Customers are becoming more and more demanding regarding On-time-deliveries. On company level this is a real challenge as customers are located around the globe. The challenge is how to be able to consistently deliver to customers the parts they require. Providing demand visibility towards customers and using simultaneously many logistics service providers (LSP) requires a flexible system tool. The visibility between shipment and customer receipt of the ordered goods is required from the LSPs and from the tracking tools at all times.

Currently there are three main transportation methods: Air, sea and land (trucks). Trucks are needed in any case; it does not matter whether it is a long haul flight or a cargo ship between Asia and Europe. Parts need to be delivered to and from the airport or harbor to the factory by road. There has been discussion about using train transportation in some cases, but until now it has not proved sensible. However, one of the LSPs is negotiating with the Chinese government about trans-Siberian track delivery through Russia to Europe. The challenge with this alternative is that delivery times are currently too unpredictable: the delivery times may vary by days or even weeks depending on how the local customs operates with the cargo and passengers onboard. The Case Company's sea, sea-air and rail delivery routes are introduced in Figure 13 (see the next page).

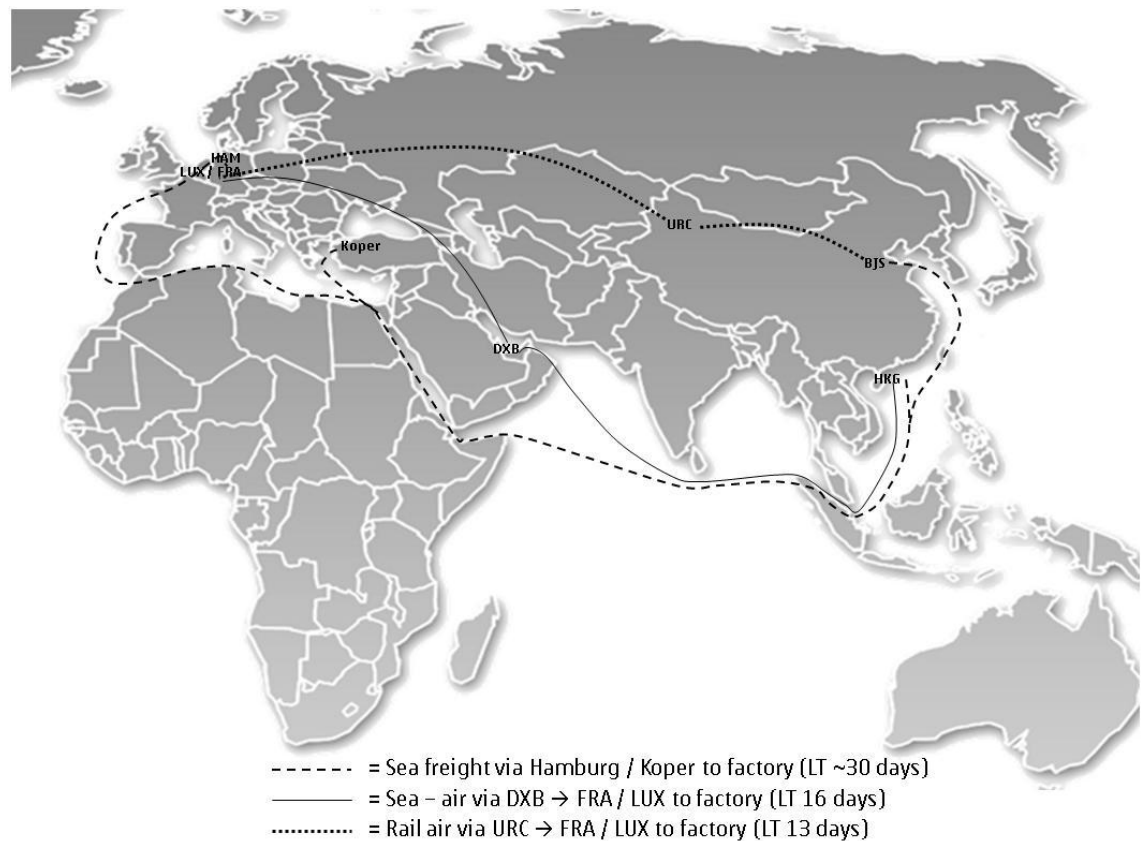


Figure 13. Logistics routes for Sea and Rail.

Damages and losses are continuous issues with logistics, as parts are transferred long distances from Asia to Europe through many destinations until they reach the factory. During transportation there are many loading and unloading points, where damages or losses might occur. In case delivery problems are foreseen, company communicates those to the customers to find the best solution for that particular situation. LSPs are responsible for most of the damages and losses, as delivering the shipments is on their responsibility. However when a delay or damage occurs, it impacts the Case Company simultaneously due to an unsatisfied customer. Action has been taken to prevent losses by using special locks and by hiring security personnel to secure shipments, but in some cases it has been shown that drivers have been involved with the thefts. A natural disaster or changes in one country's political environment issue might affect the fuel price resulting in LSPs having to increase their rates. The effect of such an event might lead to compromises in service delivery and from Case Company perspective that would harm brand image from customers' or consumers' point-of-view. The current economic downturn has caused LSPs to reduce their excess capacity in terms of equipment (air planes, cargo vessels and trucks). Now that a new boom seems evident, LSPs are not releasing these for transportation purposes but instead they try to increase the prices by reducing the available capacity to gain back lost sales. This causes a rise in the prices

and many manufacturing companies will face shortages if things are not done in a proper manner – and with correct timing.

P11 IB freight cost split by mode of transport

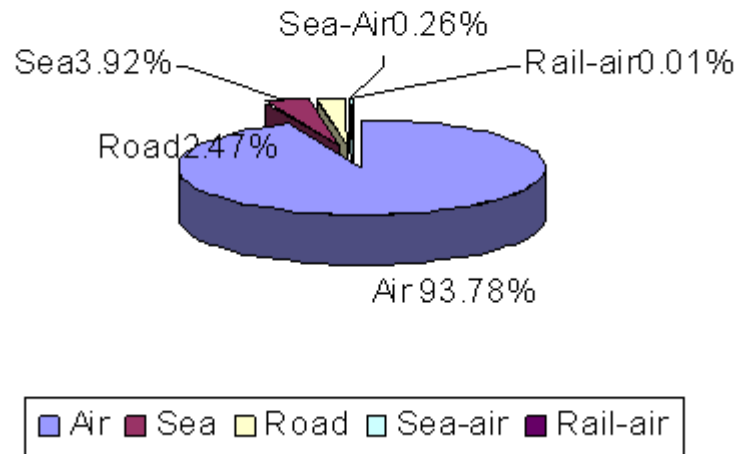


Figure 14. Inbound freight cost split.

As shown in the Figure 14 (above), shipments by air represent a huge proportion of company's logistics costs: Over 90 per cent of the costs are generated by air freight. This explains why company is pressurized to reduce the costs by reducing air shipments.

The Case Company is acquiring transportation services mainly from four LSPs: LSP A, LSP B, LSP C and LSP D. LSP C is also operating Case Company's warehouse (iHub) in India, and in Eastern Europe. The main traffic is generated from three hubs in China, as 44 per cent of all transportation is via Hong Kong airport and 16 per cent from both Beijing and Shanghai.

Company has the option to have parts transported via air, sea or by land. Air freight is naturally the fastest option for deliveries from Asia to Europe, but it also is the most expensive. However, batteries or products including batteries do not really have another option as they are very sensitive to transportation by sea due to challenging conditions: Heat, humidity and salinity in the container might rise too high for these products and the quality will suffer. Road transportation is needed to support air and sea freight, but is used mostly for short distance deliveries. Typically the cost for air freight is some Euros per kilogram. This varies somewhat on a monthly basis, as some airports (Hong Kong) are more expensive than others and the level of expedited shipments also affects the average transportation prices. The transportation costs are negotiated with airlines for each route separately. Cost calculation method is split in two different approaches, deliveries over

167 kg and the ones below that: The shipment cost for above 167 kg is determined by the actual weight times agreed price. For shipments below 167 kg, the transportation price is calculated by the shipment's volume times 167 kg times agreed price. For sea transportation, the costs are generated on container level: There is an option between 20 or 40-foot versions which can take in 22 or 44 pallets respectively. The logistics costs per product are calculated using the information that is available for the case company's products in terms of volume and weight. As products' attributes differ from each other to a great extent, the cost of delivery is some Euros per kilogram. The delivery frequency by sea freight is once a week and delivery time to Europe is between 33 and 35 days, depending on the destination harbor. The third option is road transportation – meaning trucks. Logistics service providers offer two service options with this delivery method: A Full Truck Load, FTL, or “less than truck” options. A Full truck is obviously more cost-efficient than the latter. This is understandable considering the amount of work it generates towards LSPs in comparison to FTL, such as cargo collection and distribution. For FTL, the delivery costs per kilogram are lower than with smaller quantities, meaning less than truck load.

The delivery methods that currently are being used with the logistics service providers are described above, but the service levels are still to be introduced. There are mainly two options to choose from: Standard delivery or expedited (Flash) delivery. These options apply only with air and road deliveries, as sea deliveries cannot be expedited due to the nature of the transportation method. Typically an expedited delivery takes between three to four days within Europe by road, and by air around three days. A rule of thumb is that expedited deliveries by air should be avoided within Europe, as shipments will not arrive much earlier than by truck but the costs are considerably high in comparison. The reason for such small difference in delivery time can be explained through all manual work that air freight has to go through during the transportation. The parts need to be moved back and forth between air pallets and road pallets and it causes delivery lead-time to increase. In addition, LSPs have set strict cut-off times for both bookings and deliveries to the airport warehouses which significantly reduce the possibility to use expedited air freight within Europe. Truck freight is loaded only once, at the shipping point, before off-loaded at the destination. In an expedited delivery, truck will be occupied by two drivers in order to be able to continue after first driver has reached the hourly limits for his shift. For long-haul flights flash service is usable and reduces delivery time significantly compared to standard service.

Neither LSPs nor the Case Company has a rule for minimum delivery quantity in inbound logistics, but typically less than 1 kg deliveries are not delivered via air. With sea freight it is not feasible to deliver less than five to seven pallets, which is the break-even point (depending on the material which is being transported) – otherwise air freight would cost less or the same, considering the total costs including Inventory carrying costs (ICC) etc. that has an impact, especially when delivery time increases. Most of the air freight from Asia to Europe, around 95 per cent, is routed via Frankfurt. Shipments will be shipped to their final destinations by truck. Sea freight destinations at Europe are Koper in Slovenia and Hamburg in Germany. Shipments that are delivered to Eastern Europe will be delivered to Koper, and shipments with destination in Northern Europe are delivered via Hamburg and from there onwards by truck to Finland.

4.1 Case of Memory Cards



*Figure 15. 16 GB
microSDHC Card.*

Company (Internet pages) promotes Memory Cards (see Figure 15) as follows: “This microSDHC card provides 16 GB of removable memory for your favourite music, photos, games, applications, data, and more.” Memory Cards add value to the customers by allowing them to use their mobile device more efficiently with more data storing capacity. Many applications and photographing require plenty of storage space within a mobile device either a camera, and these Memory Cards provide

exactly that to the customers.

Memory Cards are commodity materials which are currently included in every mobile device sales pack that the Case Company sells. Memory Cards are also sold separately but the large volumes which require agile supply chain come from the requirements of mobile device production. The Case Company controls the purchasing and material flow for these parts separately from the mobile devices business unit(s).

When setting the scope for this thesis, it was decided that it is important to find out the current status for Memory Cards and the outlook of the business as a whole. It was seen equally important to gain insight into how costs are allocated in Company’s operations, meaning the activities related to packaging before products are being shipped to customers. In order to have expert opinions about these matters, interviews were carried out with two persons working with the Memory Cards area, one person being a product manager and another working with business development for Memory Cards.

Business description

A general overview of the Memory Cards business is that the Case Company currently adds little or no value at all for actual Memory Cards that it purchases from Memory Card manufacturers. To put it simple, company packages these products and forwards them to customers by doing it with as low cost as possible to be able to keep up with the competition. As company's added value with the operations in this commodity business is rather small, packaging costs and delivery optimization needs to be on a top-of-the-class level.

Memory Cards are becoming more and more commodity products as the manufacturing methods and the overall skill of manufacturing such products is increasing. The competition is getting tougher and tougher, and for customers it means that they do not really care about the brand anymore – they care about the availability and the price, while the quality of the product also has an impact on the purchase decision. Considering these aspects, it is really important to understand how the costs of the business are generated and how to efficiently reduce these to maintain profitability and remain ahead of competition.

In the past, the Case Company used to sell fifty thousand pieces of Memory Cards a month compared to the current over one million pieces per month. Logistics costs per unit were reduced with higher volumes, but on the other hand margins had to be lowered to reach those volumes. Memory Cards provide a good business with high volumes, as economies of scale help to improve the profitability. The margin target is a bit higher than the current business result shows. Understanding costs is really important due to low product price and relatively low revenue percentage. An erroneous calculation base for operating and logistics costs might drive company to make wrong business decisions.

Business problem

The Case Company is facing a challenging problem, especially with Memory Cards, as the reporting tool it uses for cost allocation does not recognize the differences between products on the operations side. For example, all direct and indirect costs generated on the operations side are split evenly between all products although Memory Cards packing activities differ a lot from other products, such as Bluetooth Headsets. This clearly is not the correct way to do it, as Memory Cards require little resources in comparison to, e.g. headphones, that are packed separately into a leather case including several adapters, wires, manuals and so forth. The company needs to recognize that different products require a different approach to costs. The differences between the packing methods for

the example business cases are examined in more detail in the discussions section of this thesis work.

The Memory Cards business is highly dependent on availability. The company has experienced temporary problems as demand might exceed availability occasionally. Fortunately, there have not been any continuous availability problems lately, and typically shortage cycles run only between two or three years. The Memory Cards suppliers are always looking for the best deals and shortages might occur after a hiccup in their supply chain. Customers who are willing to pay the most will get the products first.

The case company competes with the original suppliers producing Memory Cards through synergies that give competitive edge: the company has efficient supply chain solutions and also Memory Cards business benefits from the scale of economies it offers. Memory Cards cost a certain price for original manufacturers too, and on top of that they add some margin which their customers, including case company, have to pay. From there on, it is all about what the company can do to deliver and pack these products as efficiently as possible: The Company can compete by having as low Operational Excellence (OPEX) costs as possible. Currently its fixed costs are lower than the competitors. The target for case company is to be only few per cent more expensive than the best competitors, and by the means that were presented earlier, it should be possible. The next steps to reduce costs are to be done with packing, examined in more detail later in this section.

Operations, logistics and sourcing

The good thing with the product is, from the logistics point-of-view, that the size of a memory card is relatively small. If delivered bulk, several hundreds if not thousands of products can be fitted in a one delivery carton box. Such shipments are common to inbound deliveries to case company's Operations prior to final packaging. As Memory Cards are still currently included to mobile device sales packs, those are delivered in a similar way to dedicated mobile terminal side factories. This way the delivery costs per unit can be kept low, but it should be remembered that the gross margin is also really thin for these products.

Memory Cards are delivered from Asia by air to company warehouses around the world. In another plant in Eastern Europe where Memory Cards are packed together with mobile terminals, suppliers have a consignment warehouse which in case company's terms is called the iHub. The warehouse operates on Vendor Managed Inventory (VMI) basis and the units are owned by their suppliers until that very moment when order for delivery to

operations side has been released. A similar concept is under discussion for East Europe Operations too, and will possibly to be set up during this year.

The case company purchases Memory Cards from original manufacturers, some of those being direct competitors, and inserts the product in to inbox (i.e. sales package). At the moment, Memory Cards are being purchased only from supplier E, but the supplier base is heavily dependent on price and this is why other suppliers are constantly monitored for their prices. Other suppliers are supplier F, supplier G, supplier H, supplier I and supplier J. Our direct competitors control what they sell out and what they keep in their own sales channels, typically this is with the new high-end products in this field of business. Company is currently negotiating with one supplier about the high capacity, 32 Gigabyte, memory card to be purchased and sold under its brand.

Memory Card manufacturers have different strategic approaches to conducting their business. Supplier I, for example, has its own delivery channel down to the distribution and retail level – the similar way as supplier G and supplier H. Supplier E and supplier F are focusing only on producing Memory Cards, and other supply chain functions downstream from their position are operated by external companies within their supply chains. The Company operates in the delivery channel, including the packaging of Memory Cards. This is why the case company needs to be competitive with the pricing in comparison to supplier I, supplier G and supplier H at the marketplace.

Typical order sizes from company's customers are between 2000 and 3000 pieces for one and two gigabytes Memory Cards, the ones with higher capacity are usually sold in smaller lots. The case company's customers do not seem to have any special requirements for Memory Cards regarding deliveries or packaging. Typical requirements, especially from customers located in the U.K., are about strict slot times for deliveries, if any. And in such cases, the requirements are customer specific, not necessarily having to do with Memory Cards.

Memory Cards are packed to carton packages for each delivery to the customers. First, when products arrive to factories, they are packed in bulk to a master carton. Memory Cards are removed from the carton packages and moved to the operations lines to be packed in sales packages. After the products have been packed, they are fitted in to a master carton that currently accommodates 100 pieces of Memory Cards. Inside the master carton there are separated smaller packages, so called "five-packs". As the name indicates, each of those can hold five pieces and 20 of these are fitted in a master carton. There are plans to optimize these packages in a certain way: In the first phase of the

renewal process the size of the master cartons are to be reduced to accommodate only four pieces of these five-packs. The second phase is making the actual Memory Cards sales packs slimmer so that more of those can be fitted in to these “five-packs”. After the optimization, these inner cartons will hold between 12 to 15 pieces of Memory Cards sales packs in each. This way, the new smaller master carton can include from 48 to 60 pieces of products to be sold. Other activities are considering the cost saving in the sales packs. At the moment, the sales packs include adapters but an evaluation whether those should be removed or not is underway. The impact of adapter cost is high especially with the high volume, low capacity Memory Cards. Most of the Memory Cards are being packed in Europe, around 95 per cent of the total volumes. As the volumes are centralized to Europe, it means that in the Americas and in China the packaging with low volumes per product is more expensive. There are plans to introduce a global packing design to reduce such location-dependent costs.

Expectations for the future

There have been discussions whether to include applications or other data (music, applications and maps) to Memory Cards to add more value for customers. Company’s service offering portfolio is including such services, and it might be a good idea to include those to the mobile terminal sales packs as well. Customers could benefit from the additional services they would have access to from the beginning and they could purchase additional features for those applications from company’s web-based shop. This creates additional requirements for customer service, but also for the logistics chain.

4.2 Case of Carrying Cases



Figure 16. Carrying Case.

The promotion at company’s internet site for Carrying Cases promote the product (see Figure 16) as follows: “The durable Carrying Case offers quality protection for your mobile device and easier access for you. Ideal for active use, this high-quality leather case comes in cognac and features a convenient Belt loop, so your phone is always handy”.

The company has branded several Carrying Cases and styling accessories for mobile devices and for similar products during the years, and sees this business to be very supportive for mobile terminal products. The product portfolio contains a vast collection of articles including Carrying Cases, silicone covers, stylus pens, sleeves, jewellery and straps. The current way for the company to

design products, prepare materials and to manufacture products is through outsourcing. It has been considered to save costs compared to if things were done in-house.

Business description

The first thing is to understand why Carrying Cases are sold, and what benefits it brings to the company and for the customers purchasing these products. It is obvious that it is a good business and it can be run with relatively low amount of resources in-house. The decision to begin with the Carrying Cases business and other related products came from a former Head of the case company and it gained support within the management team. These products clearly compliment the product portfolio as those bring significant additional value to the customer owning or purchasing a mobile device manufactured by the case company. Carrying Cases and silicone covers protect phones by preventing scratches etc making them last longer in use.

Interviews were conducted with three persons within the organization, working with Carrying Cases' suppliers, product development, and marketing. These persons are working as Purchasing Manager, Product Manager and as a Material Availability Specialist. The latter position can be recognized as a buyer elsewhere in the industry. The Purchasing Manager for Carrying Cases told that when she first started working with this commodity, the case company did not sell any carrying cases. External vendors licensed its trademark with an "official accessory" tag for Carrying Cases and then paid a certain percentage per month of their sales.

The case company needs to do business with Carrying Cases efficiently, as in all commodities. The competition is tough and there are many players involved. The Carrying Cases business case is really interesting as it seems to be related to clothing and fashion industry. Fashion trends come and go, and reacting to new styles and fashion needs to be immediate. In the future personalization will become even more important and it is vital that case company is in the frontline in this competition and is able to predict the requirements from marketplace as they are born. It was told that such trends and new possible solutions are constantly monitored and signals are being picked from various places at all times. From supply chain perspective, short life cycles and ever-changing market requirements for products require a flexible and reactive approach to be able to serve the market for what they require.

There are products that do not belong to Carrying Cases' core business anymore, for example cloths meant for cleaning the display of a product. Those are often bundled with terminal sales packs but are controlled by the terminal program's sourcing people and are

not in the scope for outbox accessories as such. These products can be modified if a standard version is not appropriate for that particular use. Inbox demand of Carrying Cases has reduced significantly since the purchasing manager joined the team. However, it might be that demand increases in the future as protective cases made of silicone are to be included into company's portfolio with an increasing number of products. One terminal program with big volumes has already made a deal to include a silicon case for their inbox.

Business problem

Last year case company delivered hundreds of thousands pieces of products, including both bulk and ready-packed products. Bulk deliveries are done only on make-to-order basis, meaning that the case company does not have stock available without an order. Product lead-time is typically some weeks from order placement. The actual production for Carrying Cases and similar accessories is mainly done as handicraft, which is peculiar in this type of a business. Hard tooling (manufacturing equipment) is not typically involved with the production, as with other products. Molding machines and such are needed only for silicon covers and Carrying Cases with a cradle, i.e. a hard plastic frame, which holds the mobile phone in place.

Current net sales are Millions of Euros per year, and the target is to double it in the future. The revenue level for Carrying Cases is tens of per cents of the sales price and therefore it is seen as really profitable commodity for the case company. The gross margin level will stay remarkable, although the Average Selling Price (ASP) will become lower in the future. New low priced products, such as silicone cases, will gain more volume share in the product portfolio than what is expected for traditional products. A big portion of the revenue is received from dedicated Carrying Cases, i.e. a product that has been designed for a certain terminal product. The plan is to increase headcount in the carrying case accessory team and also to increase the size of the business. Currently there is only one product manager working in the Carrying Cases business area and another will join during the spring of 2010. It is expected that this will help the Carrying Cases business area to reach their business targets.

Phone roadmap information has been developed and planned by Total Product Offering (TPO) manager in cooperation with product managers. In a situation where a new product development is being started, a Request for Quotation (RFQ) round is arranged with suppliers. Suppliers selected for RFQ round are to send case company their design proposals and an estimated cost for those. Final supplier selection is based on the offer

and on subjective experience on the supplier. Suppliers are mainly doing the design work, but in some programs a case company's designer does a framework for the accessory which is then collaborated with supplier designers. Suppliers are conducting product testing in their facilities and sending out the reports to the company for evaluation, as it does not have this capability. In the past, there used to be only one dedicated Carrying Case product designed for one key product. In the future there will be more options to choose from, for example silicone covers, functional covers and pouches with different colors, shapes or painted with a personalized logo. For new product variants case company typically requires a minimum order size which varies between 10000 pieces and 50000 pieces before production is started, though order size is always decided case by case.

Nowadays case company is selling products under its own trademark but the production has been outsourced. There are two main suppliers which are being used at the moment: Supplier A and supplier B. Both of these suppliers have been developing, producing and packaging carrying cases, functional cases and pouches for both inbox and outbox purposes for several years. There are plans to introduce a third supplier in the near future, but at the moment it is not public information.

Supplier A is a South European company that has their headquarters in Istanbul and their production facilities are located in Southern Europe, China and India. Supplier A is a known producer for accessory items to other brands such as Vertu, Prada, Blackberry, Canon and Leica. It is a traditional leather producer company established in 1990. Apparently the sales for Leica's top model camera increased about 35% when a leather case made by supplier A was added to the camera sales pack. Supplier A's performance on customer service level and response to case company's enquiries was a bit conflicting as one respondent felt that supplier A's performance in both has deteriorated and continued by saying that the cooperation between the case company and supplier A is monitored constantly. However, this is also company's standard way to evaluate suppliers and partners. This concern has been communicated to supplier A, but significant improvement has not been noticed so far. On the other hand, another respondent commented that supplier A provides good customer service and good quality products with low level of claims. Deliveries arrive to the warehouses on time and with requested quantities.

Supplier B is a Scandinavian based company which has its production facility in China. Supplier B produces trendy products such as accessories and premium packaging to add value for their customer's offerings. Supplier B is well aware of case company's processes

and work procedures. They are more aware of the design language and can support carrying case business well, this is supported with their involvement in product creation for the case company with the terminal side too – it helps that they are familiar with the new device models for which pouches, bags or silicone cases are being designed. From case company's point-of-view, it makes daily tasks easier for them, but on the other hand it means that they perhaps possess a bit too much information about case company's products and product creation processes. Supplier B is very aggressive with their marketing activities. Their CEO used to work for the case company so they know its processes and the way of working well. Supplier B is aware of their strong position as case company's supplier and they use that information well to drive the business. Despite the previously presented possible downsides, Supplier B is a good supplier with good design capability. As a result, they are also getting more and more business. However, lately there have been some delays with samples, despite the promised schedule. Ramp-up volumes might not be accurate even though planned ahead, and this causes some uncertainty for case company before a new product is launched. Product development with supplier B is said to be easy: samples and design proposals are done quickly, while with the other supplier, Supplier A, it takes more time.

Supplier B is gaining more and more business due to their ability to produce silicone cases for the case company's products while Supplier A is not. Therefore there is only one supplier, Supplier B, producing those at the moment for case company's purposes. As the interest in the marketplace towards silicone case business is increasing, the case company cannot rely only on one supplier in terms of risk management and achieving competitive product pricing. Therefore, a new supplier is to be introduced, to compete with same area of competences as Supplier B. This as yet unannounced supplier is a designer and manufacturer for complementary products of other world-class brands such as e.g. Apple. Silicon cases are currently offered for 22 mobile phone models in three to five different colors. The total sales volume of few Million pieces is planned for year 2010 (outbox). Bundle cases with device terminals are also possible, and will be increased also during this year. The packaging cost for Supplier B manufacturing silicon covers is currently really high. The purchasing price for packed silicone covers are less than a Euro each, and from that total product cost major part is for finished product and the rest for packaging costs. Supplier B has come up with a suggestion for a new package solution for silicon covers, which would reduce packaging cost significantly. The planned change applies to all outbox packages being sold at the moment.

MOQ for raw materials (fabrics etc.) is quite high with Supplier A which often leads to liability negotiations after production has been ramped down. Similarly, the liability terms are more demanding than with the competitor, Supplier B, and therefore a lot of negotiation and data analysis is needed before things are solved.

Supplier A faced a significant demand drop between the end of year 2008 and early 2009. A major reason was that case company's product development needed cost savings and typically inbox accessories are the first ones to be removed from the sales pack in order to lower BOM costs. In this case more than one terminal program removed the planned accessories from its sales pack.

Product cost-wise, Supplier A used to be more expensive than Supplier B. However, it seems that the gap is getting closer between these two suppliers. The case company is targeting to have a complete transparency in supply chain costs, thus gross margin targets for both inbox and for outbox products. Activities for opening price calculations were required, and Supplier A reacted by challenging case company for determining up their GM percentage, as they relied on a tradition that each company can set their own target operating levels. However, case company requires open book models, and those are in use with both suppliers after all. Supplier B understood this concept from the beginning and implementation succeeded without any hesitation.

There have been challenges in the past with order placement and internal communication: in December (2009), local vendors in South East Europe contacted Supplier A for product ordering, despite of the fact that every single order for products with company's tag should go via case company's systems to production planning at Supplier A. This was something that was investigated within the case company and the outcome was that the sales office in that country advised the local retailers to contact the manufacturer directly because they were not familiar with the ordering process for that particular business unit. The case company's systems do not support direct deliveries or direct ordering from company's suppliers to local distributors at the moment.

The interviews revealed that it has never been studied if the company should employ a person to design carrying cases, even though it has been discussed from time to time. As the current cost structure is on a good level, there has not been too much interest in studying what it would cost for the company to have designated design team for Carrying Cases. It is not clear whether the case company could cut costs and improve its GM if things were organized in a different way. By looking at the current good gross margin, a rough estimation is that there is not too much place for improvement. However, there are

always things that can be done better, and continuous improvement is really important for any company that wants to keep up with the competition. Non-recurring Engineering (NRE) costs with current suppliers are around 1500 Euros per product which is not high if compared to other commodities of products. Tooling costs are quite low, only few hundred Euros, for Carrying Cases while some products including cradles cost a bit more. The Case Company makes dozens of new products per year in the Carrying Case business area. The product is manufactured and sold as long as the terminal program is. The decision for ramp-down is done quite easily if demand starts dropping. On the other hand, products may live up to 5 years if the design remains popular and the product maintains its popularity in the marketplace.

Supplier A's blister package is more expensive than a similar product from Supplier B. The packaging design is following the company specification, but suppliers choose their own suppliers from whom they purchase the raw materials and components needed. Supplier A produces packaging blisters by themselves offering currently only one-sized blister. Figure 17 (see below) illustrates the unsuitable approach for different use-cases and makes the company pay for transporting "air". This has been identified as an important improvement area in the Operations side as well, and action is being taken.



Figure 17. One-size blister package from Supplier A.

As illustrated in Figure 17, extra delivery costs are originated from packaging stage: the more there is space within the sales package, the fewer products can be delivered in one standard size delivery carton.

Operations, logistics and sourcing

Activities to adjust the blister size for optimized delivery packaging and transportation are on-going. The finished products are delivered from suppliers to company iHubs, where they are warehoused and delivered to customers when an order is placed. Bulk materials are only routed via company's hubs to customers as production lot size is determined during the ordering process. Bulk products are not stored in the warehouse at all.

Customer order size is typically quite small, within the range of 30 to 200 pieces. There is no rule of MOQ for customers though a minimum of 30 pieces is suggested when they are placing an order. However, the system does not prevent customers to enter smaller orders and on the other hand, if a strict MOQ is required it could mean losing some sales when customers are not willing to order the full amount. Naturally, if it was possible to forward products in the same package as products are received, it would reduce handling and packing costs. This sets a challenge for designing a cost-efficient way to deliver parts to customers, no matter what the quantity. MOQ sizes are quite easy to optimize, but other quantities require that delivery cartons etc. exist in many sizes depending on the delivered quantity. The cost per delivery is dependent on weight and volume, and the more excess space there is within a single package the more case company is paying per unit. Most of the customers have their shipments picked up once a week, and requests for express deliveries are uncommon.

4.3 Case of Bluetooth Headset

The Bluetooth Headset offers comfort and long-lasting power for convenient on-the-go communication. You can manage your calls directly from the headset by pairing it with your compatible mobile phone via a wireless Bluetooth connection. Start enjoying comfortable wireless communication with the pleasant ergonomic design and adjustable ear hook. Have the conversation going for longer with up to 10 hours of talk time - here is described how case company's internet pages advertise this successful Bluetooth device (see Figure 18).



Figure 18. Bluetooth Headset.

This particular Bluetooth Headset is one of the most common wireless mono headsets that the case company is currently selling. Its benefits are the small size, long operating time and low price. These features have made it popular, and popularity means requirements for an effective supply chain to keep customers happy with availability. Similarly as with Memory Cards, the availability plays an important part when customer

enters the store and wishes to buy a product. If the first option is not available, he or she shall choose other model or brand to have one to go right away.

The case company is a mobile device manufacturer and Bluetooth Headsets complement and enhance the communication experience. A typical use case for Bluetooth Headset is driving a car, which requires hands-free use of the mobile device. Bluetooth Headsets, especially the mono version, are designed to fulfill this requirement.

Business description

The current situation is that logistics and packaging needs to be improved and optimized to fight the increasing costs of logistics and supply chain overall. There are still restrictions for using sea freight. Thus products including batteries and parts are being transported by air, which is an expensive way to move parts across the globe. In case sea freight could be used, it would reduce costs in terms of transportation, but delivery times would then be over a month. Long lead-time again requires either investment in terms of inventory, as the case company does not typically receive customer confirmations for orders weeks prior to delivery date. Customers require high availability and at the same time orders come in with a short notice and might be cancelled only days before the actual delivery to them. Company's supply chain needs to be optimized to be able to react to these uncertainties and to do that with the lowest possible cost. From the customer point-of-view availability plays an important part – if a product is not available at the moment they request it, they will choose something else. This is because there are plenty of similar products with almost the same features and functions in the marketplace from which to choose. The product itself needs to be of good quality, but in the range of Product A and its competitors, the price is the only factor that can be influenced by enhancing the supply chain.

As with Carrying Cases and Memory Cards, interviews were conducted with persons who are closely working with the related area – Bluetooth Headsets in this case. The first person who was interviewed is working as a Supplier Integration Manager. She is working with both Devices unit as well as with the enhancement division in the case company. She has observed that enhancement division's suppliers and business area overall was very unclear compared to mobile devices, and not all had a clear idea of what the purpose of enhancement division is. According to her, it is not fully appreciated as seen a bit apart from the devices side and with different kind of products. The second person who was interviewed is working as Manager in product marketing. The discussion dealt mostly with product features and the Bluetooth area's outlook. As it is considered important to have

detailed information about Bluetooth devices packaging activities and their opinions about the sales packages, Planning and logistics manager of European Operations were interviewed while other persons contributed also to the subject. Those persons were selected for interviews in order to have opinions about the business context from different perspectives.

The business for Bluetooth Headsets is quite profitable, as the gross-margin for them is tens of per cents of product cost. Bluetooth Headsets can be separated in different products ranges that represent their particular target markets. Those product ranges are High-tier, Mid-tier and value-tier.

Businesswise, the year 2008 was record-high, but lately results have suffered from the economic downturn. Year 2009 again was a challenging one, as demand dropped from year 2008 significantly. According to Strategy Analyst (SA) publication, the results of year 2008 can be reached again in 2014. SA continues by claiming that unit prices are going down, and the increase in business can happen only with higher volumes.

It is typical to create variants for products that sell well, to make their life-cycle longer and to make the product more personal for its owner. However, there is only a black version available for Product A, but it seems that it has been an appropriate approach towards consumers with this particular headset. Speaking of other Bluetooth Headsets, the case company's Product B, which is quite similar to Product A, has variants in different colors. Other products with color variants are for example Product C, where its white version included into the sales pack of successful mobile devices. A dark version of that particular headset is selling well in outbox, meaning separate sales packs. Other Mono Bluetooth products that have been planned with color variants, either in their own sales packs or to be bundled with devices, are Product D and the upcoming Product E. A product, in which the researcher has also been involved, is music oriented stereo Bluetooth Headset Product C. It has received great success at the marketplace and is currently available in two colors, white and dark. There are plans to bring out more color variants and to bundle it with several devices in the future.

The decision whether to create a product variant or not, is highly depending on the target volumes that are planned for it. In case a variant is to be made, a MOQ is set for each different variant; otherwise those will not be developed. With higher volumes, usually more tooling will be needed at the supplier and the feasibility of the variant needs to be justified in terms of cost and profit. There have been cases where marketing department has promoted certain color variants to be developed, but those have not been approved by

internal customers. Most of the variants are requested by terminal programs and they have requested special colors for their campaigns etc. instead.

Business problem

Supplier C is the only current supplier for Product A. They are quite an easy supplier to work with, but on the other hand there are some challenges. They have a wide-ranged product portfolio and many different research & development teams collaborating with the case company counterparts. Daily work between the case company and Supplier C is working out quite well, even though there are differences between the teams on the both sides. Some teams collaborate better than the others. In the past, there have been unclear issues with some business cases with Supplier C, for example there was an unclear Value-added Tax (VAT) return from operations that was closed. After an investigation, it was noted that Supplier C did not have the excuse for such a payment, at least in the scale they requested. Supplier C has shown willingness to invest in their communication tools (e.g. Rosetta-net) to meet the requirements in order to conduct business more efficiently. However, customer service personnel require constant reminders of the case company requirements and are lacking the ability to learn things quickly. These continuous reminders about a standard way of working are sometimes frustrating from the customer point-of-view, as Supplier C has been working with such processes for many years already.

There is a need for improvement that Supplier C improves their communication with the third-party logistics service providers. Currently, Supplier C is not proactive enough to meet the LSP deadlines, which are to be followed in order to have shipments delivered on agreed time. Communication is not accurate enough or the information about planned shipment does not reach the LSP early enough. The delivery schedule can be affected if not done properly and in a timely manner.

Operations, logistics and sourcing

During the interviews, it was noted that "Product A" Bluetooth Headsets are packed in China, Europe and Korea. Typically these sites are not involved with the case company operations, but this product has been included in the sales packs of mobile terminals. The Case Company terminology calls such combination of products as "bundling". There is a trend that more and more accessories made by enhancement division are also included in the case company's device terminal sales packs. China operations pack both English and Chinese versions for both inbox and outbox, i.e. sales packs, while European operations packs outbox products for English variants only.

Products that are packed in a sales pack require packaging materials from several other suppliers in addition to the actual sellable device. Such packaging materials, prints, user guides etc. are mainly from vendors located in Europe. Key components, i.e. the sellable devices are received from ODM suppliers typically located in Asia. All of these components build up as a sales pack, respectively as terminal devices sales packs are constructed. Some customers buy headsets in bulk and pack in their own sales packages. The Case Company has several Original Mobile Enhancement Provider (OMEP) customers. Discussion for inserting operator logo in the product has been on-going in the past, but such deals have not been sealed (with both Operator A and Operator B). Operator A requested a headset without company logo, but this could not be accepted.

Bluetooth Headset business versus normal wired headsets business is different in terms of delivery: Wired headsets can be transported in containers by Sea freight, while Bluetooth Headsets includes batteries and therefore have to be transported by air. The Case Company's quality department has not given its approval for delivery of products containing battery via sea. This decision has been based on transportation tests that have proven the challenging environmental conditions in terms of humidity, salinity and temperature. All these environmental attributes may affect product quality.

Air shipments are routed via Hong Kong, with standard freight – unless there is a special case. In case there is a domestic shipment within China, for example, it is delivered by truck. LSPs, have been arranged a RFQ round and in case of Supplier C, LSP B is responsible for deliveries to the US and in China, and LSP A for the rest of the world.

The finished products of Product A are delivered to case company's operations in a master carton that holds 200 pieces in each and in one pallet there can be eight master cartons in four layers. For a single full delivery these attributes sum up to 6400 pieces of products.

Supplier C is taking part in case company's Vendor Managed Inventory (VMI) program. Warehouses operating on VMI mode are called "iHubs" in company terminology. Supplier C delivers parts to iHubs, which are typically located right next to case company's factories. The only exception is the US where final production (i.e. packaging) has been outsourced to a local vendor. Suppliers are responsible for insuring shipments during the delivery however case company bears the delivery cost with a few exceptions.

The supplier base for Product A currently only includes Supplier C, however there are plans to introduce a new supplier, supplier D as second source supplier for a variant of

this particular product (Product A). Supplier C has had some delivery problems with the product.

East European factory's Materials Manager and another person ran a project for packaging and delivery renewal regarding not only logistics, but also warehousing – the target was to reduce the size of SKUs. Supplier C has confirmed in autumn 2008 that they will take this method in use in their production. Changes have been applied for new products and deliveries. This change was carried out on a global level for all sites, iHubs and for all shipments. Standardization in this area has been a significant improvement. Supplier C has applied these requirements well in this area. The sales packs have an impact on logistics costs: the size, the shape, the weight, materials and delivery method both to and from the packaging factory. Packing is based on customer order requirements. According to the information on hand, there are no special requirements at the moment from company's customers.

Expectations for the future

Current products are not made convenient enough for all people. As for future products, they need to be street credible, meaning products that have a cool design and are easy to use. The Bluetooth mono headsets are quite “techy”, and cannot be used in all situations as, for example, during driving if not all connections and arrangements are set up prior the journey. This is to be improved in the future according to the person from product marketing. User experience plays a vitally important part when a product is introduced to a customer and when trying to promote the ultimate features for that particular product. The importance of user experience is greatly highlighted in both terminal devices and mobile enhancement product development. Audio quality has not been improved for a long time, so it is in the scope for future product development plans. Also, as Bluetooth products are used in situations where hands-free is highlighted, the optional ways to control and use gadgets with your voice and other gestures becomes more important than ever. Discussions have been conducted for creating solutions for simplified charging, as users tend to forget to charge the battery of their Bluetooth Headset on use basis, which means the product might run out of power and cannot be used as planned. This is an important usability related case and some user-friendly solution should be developed sooner rather than later.

4.4 Case of Final Packaging



Figure 19. Production site in Eastern Europe.

This section will introduce the current situation for final packing of accessories in Eastern Europe (see Figure 19 above). There are three similar sites in the world focusing on different markets. The other sites for the case company accessory final packing are in China and in the US. This study focuses mostly on Europe, as it is the site which is the most closely related to R&D activities from where the example business cases presented in this study are.

During the planning phase for the Thesis, it was discussed that the case company does not have clear knowledge about the value adding features that company might be able to offer for its customers. In other words, it would be beneficial to know whether customers are willing to pay more for express delivery for their order instead of having those according to normal delivery process and with standard lead-time. Typically customers want their products within days after their confirmation but the lead-time for a non-forecasted order might be as long as 16 weeks. The Case Company really has to put a lot of effort to predicting the demand and have demand forecasting systems in place with fairly accurate data. This is a real challenge, as even the confirmed orders might be cancelled on the very last minute before production should take place. Operations works with certain flexibility, but as a part of the supply chain, they are dependent on other parts within the supply chain to meet that level of overall flexibility.

The operating costs and how those are generated is playing an important role in this thesis. There is a danger of misinterpretation of costs that comes out from the ERP system, if those are not calculated carefully for each product separately. In the worst case, business decisions might be made based on incorrect information.

Operations description

The following describes the current situation regarding operations cost calculation. Product costs are calculated based on Bill of Materials (BOM) costs and activity type prices occurring during the final packaging: Those are direct labor, freight, consumables, scrap and FPO (Factory overhead with a certain multiplier). Allocation to sales pack is done equally based on planned volume (evenly for all product families) and hand time (for direct labor, one minute is considered as hand time for all products). Until now there are measured only two products in a blister sales pack: Chargers (direct current, DC) and wired headset. For carton sales pack it has been measured only for one product, the Bluetooth Headset. The target is to have all products timed during the second half of 2010. Based on time measurements done for the above mentioned products the packaging cost per unit is relatively low per piece for wired headset in a blister and a bit more expensive for Bluetooth Headset packed in a sales carton. This is an average calculation and does not recognize different products with different activities, so it does not take into account different types of packaging which, for example, is required when comparing the actual cost for packaging memory cards or Bluetooth Headsets.

The Case Company's Operations is following lean thinking which basically is about minimizing stock, build-to-order, minimizing failures, minimizing scrap etc. There is a scorecard system for production volume follow-up, activities to align up and downs in demand with the headcount flexibility by using external labor with three-month contracts. Operations costs are to be optimized by checking the demand levels constantly. Wherever there is a waste (time, resources, materials etc.), the reason for it is analyzed and a solution for reducing it is to be implemented. Product cost calculation methods with different product mixes will be improved in the future to support better decision making. Lately, the European operations have been busy with ramping up different products. The Case Company activities were implemented to European operations during the second half of 2009, earlier all final packing was done by an external company, quite close to the new factory.

A base product (i.e. Bluetooth Headset) can be packed either in sales carton package or into a blister package. The costs that incur with package materials for both options are on the same level. It needs to be taken into account that this cost is product specific and it may vary. Blisters are typically standard sizes but sales cartons may vary a lot depending on the product it is planned to be packed with.

The warehouse, the iHub, as it is called in the company environment, is operated by an external company, LSP C – the same company that is used as logistics service provider (see section 2). The iHub costs are dependent on the amount of codes in stock, and on the number of pickings. Stock keeping units (SKU) determine the amount of different items that are stored in the warehouse. At the same time when products tend to have more variation than ever before, it sets a challenge to do it efficiently. The iHub operations costs per SKU between May and December in 2009 were around the same level as the packaging costs.

There are two different ways of packing products for delivery: products that are packed in carton sales packs will be further placed in to master cartons before loading on a pallet if delivery size requires so, otherwise master cartons are sent to customers via chosen LSP. Products in blister sales packs are be packed into delivery cartons and then to master cartons before loading on a pallet similarly before being dispatched for delivery. The case company is continuously looking for solutions that reduce delivery costs and currently the biggest activity is on-going with blister packages that currently cause problems especially with Carrying Cases. The vendor for the Carrying Cases produces and packs the product in a sales carton according to customer requirements. However the blister pack that they are using is always the same size, even if the product size would differ. This causes some smaller products to be packed in a huge blister package and those consume valuable space in a delivery carton as less products can be packed together. Delivery cost per item increases clearly, and alternative package is being developed by the supplier. An example of this is presented in section 4.2 regarding Carrying Cases. The Case Company will introduce a new design for sales packs in 2011 and packaging build have been arranged already in European operations. The first impression with the new sales packs and blisters is that those can reduce overall packing time and affect operations cost by shortening the overall packing time.

There is a MOQ defined for all enhancement products and it is typically based on value and packing size per master carton. There is a database with company's sales roadmap for all relevant variances that are reviewed on a weekly basis.

An important thing is to understand whether customers are willing to pay more for express delivery over normal delivery. Currently, such special delivery requests are rarely requested and during the past year there have been only few cases where customer has requested this type of action from the company. Also, if considering the possibility to offer such service to the customer – following thoughts were received from a sales development manager for the Case Company: Operators might not be interested in this

proposal, as they do not expect any increase in services prices in case of extra service. In fact, they are already benefiting from such a service as they are in most cases ordering products via distributors. As customers are doing so, they see benefit in:

- No minimum order quantities
- Decentralized deliveries
- Deliveries in 24 hours
- Retail shelving and other marketing services included
- Better payment terms

Basically the services the Case Company offers do not matter, when dealing with operators. It is all about price, and the Case Company is often reduced to be a commodity player as a supplier. Operators are mostly working in ODM mode, meaning that they buy large quantities with low price and label it under their own brand or trademark. The Case Company is also a competitor, when an operator has its own branded products next to those made by the Case Company.

Obviously operator customers are not the target group for special supply chain services, but there might be others – such as the distributors who supply operator customers as explained above. Distributors are more and more acting as a logistic platform towards their customers with different kinds of service offerings: stock level & stock rotation follow-up, capabilities to make planographic printings in store, assuring fast delivery, etc. to mention a few of their current activities. Where in the past the money was made by just taking margin on the products and selling them to retail, nowadays the profit is made with those extra services. The margin taken on a product as such is very small and is not profitable anymore alone. Distributors are selling their logistic services and charging separately for that. Customers are paying for this separately but it cannot be seen as something where the Case Company could go in between: The service provided by distributors goes much further than the Case Company could ever offer, and with a very low cost. For distributor's customers, it is the full package that counts. For example, they might pay extra for fast replenishment services, but in the mean time they might have additional services in terms of distributors representatives come to the shop floor and will make sure all products (cross brands, cross product groups) are nicely placed and promoted in the store.

Above condition drove the services offering study towards distributors. Distributors need to purchase parts from the Case Company and the out-of-stock situation for them is out of the question. It has to be kept in mind that Case Company's competitors might already provide this service free of charge. Some of them do not have minimum order quantities,

for example: regarding mobile phone accessories, the Case Company is the only one having that requirement for certain products. Distributors are mainly able to order even single pieces of products directly to their warehouse, if needed. The minimum order requirement issue was questioned, as previously the researcher was under the impression that there was no such requirement. However, it seems that the information was not fully correct: For example, in Benelux countries at least five pieces of products are kept as MOQ. It was highlighted that these requirements vary depending on the country and market in question. Some distributors order materials in bulk, mainly for their own packaging and labeling purposes. In such cases, deliveries have pre-defined MOQ per product.

Development areas

The Case Company always aims to improve internal and external processes and in case of Operations there is no exception. An on-going improvement project on final packaging is the iMES (see below) implementation project, including also the so called "Ready Packs" which will also be included in the project scope. This will help to gain information on enhancement products location, PID/MID (see below), stock quantity from shipping and automatic transmission of starting delivery status to the client. Other activities are related to manufacturing and purchasing environment. Currently company is purchasing printed materials such as stickers and labels from a vendor in Northern Europe, though a local vendor nearby could be used with cheaper prices and with less money spent on logistics. An environmental aspect can also be brought to this matter when materials are delivered from a closer location. For warehousing matters it was told that there is an external warehouse nearby the factory whose operating costs are cheaper than in the iHub. However, this might not be an option for the Case Company, as it needs to be sure that the warehouse operation environment is meeting all the requirements set. Those requirements are based on products' quality in terms of temperature, humidity and business-wise for security etc. Without proven compliance with such requirements, it could mean that products are defected for one reason or another, or be stolen. Such unfortunate activities can have an impact on profitability in the long run.

MES is a Manufacturing Execution Systems (including company's internal applications such as PDMS, MPWS, PDRS, CSS, EMS, PTSD2, iMES, gMES and PMT) are systems that produce and trace mobile devices, sales packages and other packing structures. They also control, execute, monitor and verify the execution. After delivery of finished stock these tools also communicate the content of delivery to customers and various other internal instances, mainly databases.

MID is an abbreviation for Master packages physical box, containing collection of consumer packages or mobile devices that are bound together as a logical handling unit. Common master package size is 5, 10 or 20; but in some special cases it can have over 200 sales packages. Master is formed in MES systems by associating selected serial numbers with master ID (identification). A special case is when a master carton contains mobile devices: then it is called a bulk master. Another special case is when master contains another master unit. In this case they are called inner master and outer master. All levels i.e. inner, outer, bulk need to have label markings to define content and origin. Typically master contains only one type of a product, but in case master package contains several different products it is called mixed master.

PID is an abbreviation for Pallet ID (identification). Pallet is the physical frame where goods are stacked for shipping or storage. Pallet can contain consumer packages, bulk masters, masters, accessories, any unfinished materials etc. It can also be any combination of the above. Pallet containing bulk masters or masters is usually modeled in systems and has a Pallet ID. If a pallet contains several different products and if it is modeled in systems, it is called a mixed pallet.

4.5 Summary of the Business Problems

It is recognized that the Memory Cards business is price-sensitive, and understanding how costs are generated is vitally important. When this is understood, cost reduction activities can be developed and deployed. There are activities on-going currently with the packaging method optimization, which also seeks to reduce generated costs per unit. Memory Cards consume less time in final packaging than other products; however the calculation method is based on a fixed time consumed for each product.

Carrying Cases experience growth with the silicone covers, which requires an introduction of a new supplier to be able to minimize the risk of using only one supplier, and to help in pricing negotiations. The products have many variants in different colors, shapes and with personalized features. It is also recognized that system tools do not support direct deliveries or ordering from suppliers to distributors and retailers. It has not been studied if activities related to product development and production would bring cost efficiencies if carried out in-house. Currently almost all activities are outsourced to external manufacturers. Carrying Cases come in many shapes and sizes, but the packages currently not. Action to improve packaging design is on-going.

Bluetooth Headsets have quite high and steady volumes, but due to the batteries they include these products need to be delivered overseas by air freight. There are many

variants for these products, and many of those are bundled with terminal devices. The availability is vitally important for these products. One problem is that these products are not as easy to use as they should be. There are plans, however, to improve the usability of Bluetooth products in the future.

Each business case has the following things in common: the ordering process does not require MOQ from customer orders though it is recommended. Customers may enter any size of order to the system. Cost allocation affects each product, but the effect is biggest for those with lowest margins, e.g. Memory Cards. Service level offering towards customers of the Case Company is not seen viable, as distributors already offer similar services with better terms. The operations could benefit from near-shoring. Currently, for example, packaging materials are delivered long distances despite the fact that there are suppliers located close to the operations.

5 DISCUSSION AND CONCLUSIONS

This section discusses the results and analysis of the interview and data collection round. Typically there are actions on-going with issues that the case company is aware of. Progress shall be evaluated together with the issues that emerged during this project.

A great deal of learning about the Case Company's internal processes was required in order to be able to recognize and point out the critical processes that generated costs and to which Case Company had not paid enough attention. The purpose of the thesis project was not to find problems by the means of finding them, as in the best case the processes and ERPs would cover all concerns and only some minor recommendations might be given. However, it seems that there are certain issues that require management attention to improve the general business conditions such as cost allocation tools and measurement systems in Case Company's Operations. Second, for outbound deliveries it was claimed that there is no requirement for a special service class, but it was left unclear whether company's customers even know that such a service could be provided to them at certain price. Third, optimizing the packaging on sales pack and delivery level is required. Action is being taken and improvements can already be seen for the business area of Carrying Cases and Memory Cards.

This study can be used as introduction material for new employees, or to give an overview on how the company has been performing in certain areas in the past. It is good to remember which factors and actions have brought about the desired results. These kind of important lessons were learned in the meetings after each project and this information is kept with the case company.

Organization

The interviews round revealed that gross margins are followed for each product, but these might not tell the whole truth: Product mixes and customer profit analysis needs to be conducted to understand which customer activities are profitable and which are not. In the past, each business area was responsible for its own portfolio and its own business. While collecting data for this study, a new Vice President was nominated for the enhancement division. The first message was that the product portfolio is to be sharpened in each area, and that the new VP will focus closely on business cases for each new product to make them as realistic as possible. A new, planned, organizational structure will include Volume / Value thinking, which is already in place in the Devices unit. It is a natural shift for the enhancement division towards supporting Devices unit through "solutions" better than it

has done in the past. The organization of the enhancement division will change, and it will have an impact on the results that were collected in between September 2009 and March 2010. If this constructive case study were repeated within one year, it would most definitely show changed mind-sets of people still working in the organization. However, despite the fact that the organization is restructured, it would be interesting to compare the situation today and one year from now. It would really measure whether this kind of a change leads to a more efficient organization, and whether the change was managed well.

Method

This thesis project was structured as a constructive case-study, and data was collected through interviews and from company applications. The interviews were not based on exact questions, but were semi-structured instead. This left some room for interpretation, even though the answers were to be dealt with in as neutral a way as possible. This affects the repeatability of this thesis and the results would therefore differ from the ones presented here. Also, as mentioned before, the on-going changes with the Case Company inevitably affect the repeatability and the results presented. In order to have the most applicable results available after the company reorganization, this study needs to be conducted again. As organizations tend to change quite often, it means that a study similar to this one should be arranged from time to time – depending on the organization's life-cycle. Using the Case Company as an example, a repeatable study focusing on ways of working is to be conducted between one or two years due to the company's aggressive approach on organizational efficiency.

5.1 Evaluation of Business Cases

A common requirement for all business cases (see section 4.5) is that they require a specific supply chain setup to meet the requirements of the marketplace. Different types of supply chains are presented in the literature review and summary sections (see section 2) of this study.

General findings

If the demand is stable and predictable, a lean (see section 2) approach for supply chain could be appropriate. The focus of a lean supply chain is to reduce or eliminate waste, meaning non-value-adding activities and other costs. "Lead" method could be applied with most of the example cases as all those tend to have a reliable "base" demand. Naturally there are sudden surges in demand, and these situations call for a different approach. The

concept of an “agile” supply chain is about being responsive to unexpected demand: This requires all parts of the supply chain to be able to respond quickly when demand appears. There are also hybrid solutions of the above two philosophies, called “leagile” in the literature. This seems the most suitable philosophy for the case company’s requirements in the example cases.

A cost activity type –model is introduced (see Figure 10) in page 37, which reveals non-value-adding time in the supply chain. Once the company truly understands value-adding processes, the discussion about getting rid of non-value-adding processes can begin. All process owners should be present in a meeting to discuss the issue and agree on action steps to improve efficiency.

The ABC cost allocation model is introduced in section 2.4. The case company is using cost allocation between product families at the moment, but it is not as accurate as it should be. Inaccurate cost allocation affects product profitability calculations by distorting them and this can result in bad business decisions. Memory Cards seemed to be the most sensitive product in this respect, while other products were influenced, as well. Thus, it is vitally important that appropriate systems to help cost allocation and product mix business case evaluation are put in place as soon as possible.

Logistics in the case company

This study shows that the Case Company has efficient supply chain and logistics processes. Most improvement ideas for logistics are related to outbound deliveries, as the incoming materials flow is well optimized on a general level. However, there is one big concern for the case company in terms of inbound freight costs: Air freight is generating over 95 per cent of total costs (see Figure 14), and no immediate solution to reduce the costs is in sight. For outbound deliveries, the case company could develop different service levels for their offerings, including logistics services with different lead-times depending on the chosen option. Obviously, developing specialized service levels would require each part of the supply chain to support one another in order to be able deliver the service promised to the customer.

Inbound logistics seems to operate effectively but a more precise selection of logistics route and transportation methods might improve the efficiency level even further. Outbound deliveries suffer from inconsistent order quantities which cannot be fitted to delivery and master cartons optimally. The latter causes transportation costs to increase per product. It has been suggested that MOQ is applied for outbound deliveries to avoid high delivery costs, as It already does so for some products and countries. On the other

hand, MOQ might have an impact on customer ordering behavior: some customers might reduce their orders or order in bigger batches less frequently. However, keeping in mind what Christopher said about the Pareto Law (The “80/20” rule), the company needs to be aware of the costs that are generated when servicing a customer and then analyze if that particular customer is profitable or not.

Memory Cards

With Memory Cards, most improvement activities are related to reducing packaging costs. The Case Company’s input for Memory Cards is mainly in final packaging, so the possibility to reduce overall costs is in the sales package BOM, overheads and in operations costs. The Memory Cards business operates purely based on price, as products from one vendor to another are similar. Brand loyalty has little or no impact when a purchase decision is made. The memory card team has a clear vision of how to proceed and continuously improve the business. A packaging change project is on-going and it will be interesting to see how it will affect costs. As presented in the analysis section (see section 4.1) for business cases, cost allocation is crucial for Memory Cards. The memory card business GM is modest, so cost allocation calculation can have a significant impact on the result - if not done properly. There are new tools to be implemented for the case company to help calculate profitability for certain products. The memory cards business case is clearly in urgent need for it.

Carrying Cases

A strong profit margin shows that the business is profitable and that there is no immediate requirement to bring the design and packaging activities “in-house”. However, a calculation based purely on the cost structure for the two suppliers and what the Case Company has for its own operations, implies that the generated costs would be less if packaging was carried out in-house. Whilst this may be true, that setting up a complete in-house driven business for Carrying Cases would, however, require a huge amount of resources and capital. Sunk costs for setting up proper production facilities, design team, supply chains, vendors, etc. would be really high. Interestingly, it would be good to see where the break-even point is in terms of capital and products with current product mix.

For most orders, the deliveries from suppliers are only circulated through the case company’s warehouse, as suppliers are doing everything from design to final packaging of the product. In case an order is for bulk products, those are sent to the case company and forwarded onwards to the case company’s customers by using the same package. It would be much better if the supplier could deliver the parts directly to the Case

Company's customer as that extra round is simply not adding any value to the customer. It was pointed out that the financial systems are not capable of dealing with such business – but the requirement for it exists already now. Normal sales packs are warehoused to wait for an order. The case company's warehouses operate on a Days-of-Supply (DOS) basis and stock requirement is based on anticipated demand for each stock item. There is no MOQ requirement in use with Carrying Cases. However, customers have been instructed that the lowest number of products to be ordered for a single delivery would be 30 pieces. The system still does not prevent smaller batches from being ordered. MOQ sizes can be fitted optimally to delivery cartons, while other sizes cannot, and extra costs with deliveries are generated due to wasted space in the delivery carton. It is clear that the packaging for Carrying Cases can be improved. ODM suppliers do not have many different sizes of sales packages (see Figure 17), and those are not in line with Case Company's attempts to optimize delivery packaging and costs. The logistics service providers charge the same amount for the volume whether the delivery carton includes one or ten products – i.e. the cost is almost the same for the company.

Carrying Cases is a growing business and there are ambitious plans to improve this business area's result. There are plans to introduce a new supplier to the business, as silicone covers are gaining more interest on the market. It is reasonable to avoid risks by having more than one company supplying the parts. If the first supplier fails to deliver for any reason, a second supplier is available to reduce the business impact. In order to support this new supplier, also the Carrying Cases team must grow. A decision has been made that another product manager will join the team during spring 2010.

Low-cost Bluetooth Headset

According to this study, the Bluetooth Headset was the most cost-efficient one in terms of transportation mode. The transportation methods are presented more thoroughly in business case description (see section 4.3). Bluetooth Headsets are currently delivered via air to Europe and to Americas. Sea freight is not an option, as Bluetooth Headsets contain a battery that is sensitive for moisture and salt. However, there are other plans and tests on-going to find a viable alternative, and it can already be seen that deliveries will be carried out using this method sometime in the future. This is bound to reduce delivery costs significantly, but at the same time forecasting will become more difficult. As pointed out earlier (see section 2), the longer the period of forecast the bigger the error in actual demand. The purpose was to evaluate which transportation method is the most appropriate one for Bluetooth Headsets, although the answer is not that simple. The transportation to be used depends on the situation – for an order received well before time

of demand, sea freight is feasible, but air freight is the only option for sudden demand. The requirements for different types of pipeline solutions are introduced in detail in the literature review (see section 2.1). The option for rail delivery is also evaluated, but this method seems to have too many uncertainties at this point. However, if reliable delivery times and product quality can be guaranteed, this option sounds as feasible as sea freight. The Case Company is well aware of the transportation options and there is a dedicated, professional team working on them. In that respect, things are in good shape with the inbound deliveries for Bluetooth Headsets. The incoming packaging method is optimized and constantly followed. The Case Company and vendors both evaluate how to have optimum quantity delivered in a single pallet while maintaining product quality. This area seems to be working well and will continue to do so in the future.

From the costs point-of-view, one aim was to find out whether it makes any difference if Bluetooth Headset products are placed in a carton sales pack or in a blister box. This issue was raised as a topic in the interviews, but no clear answers were obtained. The costs for both options were known, but they did not have a big effect on product cost. A personal preference leans more toward the carton sales pack. However, to validate such a statement a more thorough study would be needed. Typically, customers tend to appreciate sales packages that reflect high value and give a feeling of quality. Blister packages made of plastic can seem somewhat “cheap”. This study shows that there was no significant difference in cost between carton and blister sales pack.

The final packaging costs for Bluetooth Headsets arise from several activities: Direct labor, freight, consumables, scrap and FPO (presented in detail in page 73). The packaging cost with the current calculation method for Bluetooth Headset is some Euro Cents per unit, when carton sales pack is used.

Eastern Europe Operations

The newest manufacturing operations for the case company were set up in the early 2008. The Case Company introduced Eastern European Operations during the summer of 2009 and not all reporting systems seem to be in place yet – this is true at least according to the interviews conducted among the people working with that particular Operations. Currently there is a reporting tool called Non-Terminal Profitability Reporting System (NTPRS). This reporting system will help to allocate costs per each product’s actual costs that occur during the final packaging in Case Company’s Operations. However, as discussed earlier in this paper, the current reporting system is not accurate enough to support all business areas requirements, for example Memory Cards. There are plans to

implement a new reporting tool, yet untitled, which will also be used in other operation sites after implementation. The US Operations have been outsourced and thus will not be in scope for the new reporting tool. During the thesis project it was not discussed which reporting system is used with the Americas production and whether that system is compliant with the Case Company reporting systems. The results presented in this thesis could be improved by adding and comparing that information, if a similar study is conducted at some point.

One goal of this thesis project was to find out whether the case company's customers are willing to pay for different service levels (e.g. express). The persons interviewed for this topic felt it was not very important, or they tended to see challenges with it as the current distributor-retailer setup already offers similar solutions. In order to understand the need for such offering from the customers' point-of-view, a more detailed study should be carried out. It would be a shame if the case company declined an idea of customer requirements without studying it. Implementing such services could increase customer value and improve customer satisfaction with the case company. If implemented, all parties influenced by such a decision (sales, planning, logistics, operations, and suppliers) must commit to a service level promise. Critical processes should be identified, action plans should be created and work procedures should be agreed on. The weakest link in this collaboration will determine the success or failure of such a service.

Another goal of this study was to evaluate the differences in incoming material packaging requirements between the case company's operations in three continents. Unfortunately this was not possible due to the tight schedule for completing the project, and also due to the lack of direct contact points with factory personnel. Also, it turned out to be challenging to reach people working at operations and receive answers for questions. It might be that the purpose of this study was not altogether clear for them and perhaps the respondents did not feel motivated enough to participate in this particular research.

Overview of the findings

This study indicates that air freight is currently generating over 95 per cent of total transportation costs for the case company. For outbound deliveries, there are discussions whether service level offerings should be implemented to serve the different purposes customers may have. Express deliveries would have higher costs, but delivery time from order point would be shorter. Obviously, developing specialized service levels would require a solid commitment from all parts of the supply chain to support each other in order to be able to deliver customers the service that was promised.

One question is whether the case company should apply MOQ for all outbound deliveries to avoid high delivery costs which are caused by inefficient delivery packaging. This already applies to some countries. It has to be kept in mind that MOQ might have an impact on customer ordering behavior: some customers might reduce their orders or order in bigger batches less frequently. However, as discussed earlier about the Pareto Law (The “80/20” rule), the company needs to be aware of the costs that are generated when servicing a customer and then analyze if that particular customer is profitable or not. Obviously, customers who are generating more costs than profit should not be served at all.

Correct allocation of operations costs between product families is particularly important for Memory Cards. The Memory Cards business GM is modest, so cost allocation calculation can have a big impact on the result - if not done properly. This business is profitable, and with its high volumes its contribution to the case company’s result is significant. There are new tools to be implemented for the case company to help calculate profitability for certain products, even though the schedule has not been revealed yet.

The adequate profit margin for the business area of Carrying Cases shows that this business is also profitable. There is no immediate need to bring design and packaging activities in-house the case company. A calculation based purely on cost structure for the two suppliers and what the Case Company currently has for its own operations, implies that the costs would be lower if packaging was carried out in-house. It is also clear that there is room for improvement with outbound deliveries: the cost could be reduced if suppliers delivered the parts directly to the case company’s customers and not re-routed via regional warehouse as is currently the case. This arrangement simply adds no value to the customer, rather it generates extra costs. Finally, ODM suppliers do not have many different sizes of sales packages (see Figure 17) and this is not in line with company’s attempts to optimize delivery packaging and costs. New packaging is currently being designed, so the situation will improve in the future.

Currently sea freight is not possible for Bluetooth Headsets deliveries. BT products contain a battery that is sensitive for normal sea conditions containing moisture and salt. However, there are other plans and tests on-going to find a viable alternative, and it can already be seen that deliveries will be carried out using this method sometime in the future. This will definitely cut costs, but it needs to be made sure at the same time that cost saving does not reduce business opportunities in terms of out-of-stock. The study shows that there was no significant difference in BOM cost between blister and carton sales packs. However, the end-user might appreciate carton sales over blister packs.

One goal for this Thesis project was to find out whether case company's customers are willing to pay for different service levels (e.g. express). The persons interviewed for this topic did not consider this important, or they pointed out several arguments that did not support such an offering. On the other hand, it would be a shame if the case company did not offer something that would be valued by the customers. In order to understand the need for such an offering from the customers' point-of-view, a more detailed study should be undertaken.

5.2 Recommendations & Managerial Implications

The supply chain management plays a more important role in achieving competitive advantage than ever before and while globalization reduces operating costs, other logistics challenges have increased. Customers are more demanding, require better customer service and are more time-sensitive than they used to be. This all sets a requirement not only for a functional supply chain, but to one where costs are minimized without having that with the expense of value creation towards both, the company and the customer. The design for all processes within the supply chain needs to be easily modified, so that it can be adapted to the changing requirement from the market place. Lee (2004) introduces a concept of triple-A supply chain where those three A's stand for agility, adaptability and alignment. First, agile supply chains can react speedily to sudden changes in demand or supply. Secondly, they adapt over time as market structures and strategies evolve. Third, they align the interests of all companies in the supply network so that companies optimize the chain's performance while maximizing their own interests. As pointed out by Lee (2004) only supply chains that have these three qualities provide companies with sustainable competitive advantage.

In this study, supply chain management was evaluated for three business areas and one cross-functional production operation. There are quite many findings and recommendations, but none of them are business critical as such. The message promoted in this thesis work is that supply pipelines need to be designed according to each product's requirements from the market and that all waste should be removed from supply chain processes without reducing business opportunities. This means that not all costs can be evaluated separately but rather by looking at the big picture to understand what the total cost structure of delivering products or services to a customer is. The Most effective supply chains might not be able to deliver to the customer what they want, as the costs have been minimized and flexibility to respond to special requirements is thus missing. An effective supply chain rarely gives more competitive advantage than an efficient supply chain.

Recommendations and managerial implications

A new version for production reporting and cost allocation system tools needs to be set up as soon as possible. With the current set up, operations cost generated in final packaging produce erroneous cost estimations. Standard costs which typically occur during final packaging processes are used for different product families even though the required activities between these products vary a great deal.

Different product families require different supply chains, or supply pipelines to be more exact. It is recommended that products, or product families, are analyzed for their demand characteristics from the market place. In case the demand for a certain product or product family is steady and therefore predictable and the level of variety is low, as for Memory Cards, supply chain activities can be aligned according to the concept of lean supply chain. The lean supply chain aims to reduce or eliminate all waste – let it be excess time or material costs. If the demand is volatile and customer requirement for variety is high, as for high-end Bluetooth Headsets, agile approach is more suitable. The philosophy of agile supply chain focuses on responsiveness. In this method, logistics costs may be higher, but then the cost for inventory is lower. However, as the case company's products typically tend to have a "base" demand with sudden demand peaks occurring occasionally, a hybrid approach is recommended - such a concept is called "leagile". It suggests a lean approach for the above "base" demand, and agile approach for any sudden increases in demand.

The improvement plan for the operations is recommended to be carried out by mapping each supply chain process and by evaluating if that particular process is a value-adding activity for a product or service being produced. Non-value-adding activities are the ones that should be eliminated as soon as possible. Currently it is clear that at least products related to Carrying Cases are circulating through regional warehouse even though it only generates costs.

Customer profitability and Minimum order quantity are matters that should be studied more thoroughly. Currently, based on the information that was available, customers can order any product they like, in any quantity they like. Such freedom weakens operations and logistics profitability; packages are standard sizes and deviations from those generate extra logistics costs. This might even lead to a situation that serving such a customer might generate more costs than profit – meaning that the company is actually making a loss by serving such customer. Thus, customer profitability analysis is highly

recommendable at certain intervals. The business conditions should be adjusted for each customer in such a way that conducting business does not generate negative income.

Proposals can be given to fix the issues evaluated in section 5.1. To improve cost-efficiency with inbound deliveries, the sea freight option is proposed to be deployed as soon as possible. A project focusing on studying service levels would give insight on customer preferences regarding different service offerings. Direct information from the case company's customers is required in this matter, and decisions should be made based on that information.

The carrying case business environment requires deeper study to understand the real costs of alternative operating modes. Changing the entire way of working would be a huge investment, but there is clear evidence that bringing final packaging to the case company's operations would cut BOM costs clearly. Improvement activities, which are already on-going, are related to carrying case's blister packaging from ODM partners. One size does not fit all products, as extra volume in sales package reduces the quantity of products which can be packed in a single shipment to customer. Fewer products per shipment mean higher transportation costs per unit.

Suggestions for further development

Supply chain management can be developed in the case company by following the guidelines of the corresponding literature. In this study, activity-based costing and mission costing are presented in detail, and it is obvious that these concepts can be further improved in the case company. There are processes in logistics and operations, which seem to prevent the development of the business by setting boundaries for certain activities. It seems that logistics requirements will continue to shift more towards end-user "pull" rather than supply "push" and companies need to prepare for that. All inflexibilities need to be removed and to enable agility in the supply chain while deploying leanness for those pipelines where possible. Product variation will increase, and it directs more focus on postponement strategy for product manufacturing. The later in the supply chain the product variation can be done, the less there will be excess or obsolete inventories generating costs. At the moment, the case company is not focusing on late variation / postponement in product creation, thus it should be taken into account in the future to make supply chains more efficient. It would also help to reduce costs in terms of obsolete stock after production has been ramped down.

Evaluation of the recommendations

The recommendations and proposals made in this study are based on the analysis of the current state of the business cases discussed here. They have also been influenced by relevant professional literature and the experience gained during this project. These descriptions are not the absolute truth about the described matters, and might be expressed differently if another person gave the recommendations. The recommendations are for starting a discussion about the topics introduced in this study, and for each case a thorough investigation is required before a change process is implemented.

Limitations

The results for this thesis are limited directly to the case company. However, the on-going organizational change affects the results so that the results are not directly applicable to the new organization and the work procedures. However, the supply chain itself is not undergoing any changes because of the organizational change, and therefore everything that has been presented and discussed concerning supply chain management and related topics are directly applicable within the industry. Recommendations are based on the particular cases within the case company.

The literature was selected mainly based on the presented example cases but certain author's publications were preferred over others. However, the literature chosen reflects a wide variety of insight and offers a comprehensive view of supply chain management.

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Interviews

General questions

- Interviewee's background (with the material / commodity)?
- General status for (Bluetooth, Memory Cards, Carrying Cases, Operations and logistics) business. Please comment on issues around the topic.
- Why do we sell (Bluetooth headsets, Memory Cards, Carrying Cases) these products? Why do those add value to our services/products?
- Which Supplier(s) there are for the Case Company (for Bluetooth, Memory Cards and Carrying Cases)?
- What is the gross Margin (percentage) and profitability overall for (Bluetooth, Memory Cards, Carrying Cases) business?
- How is the global availability for products?
- How many pieces are packed in one master carton?
- How (Bluetooth, Memory Cards, Carrying Cases) products are delivered to the Case Company? Which route and delivery method/service level used?
- Are there any improvement plans for logistics? Are there any known delivery issues at the moment or problems with suppliers?
- If the Case Company offered different delivery options for a certain products, would customers pay more for "express manufacturing" and special delivery services (regarding final packing and outbound deliveries mainly)?
- Any other issues that comes into your mind about the (Bluetooth, Memory Cards, Carrying Cases) business / commodity?

Bluetooth headsets

- Do we have color variants for Bluetooth headsets? How much do different variants contribute to total sales?
- How do our customers want the product? How they like it to be delivered /served to them? Is there any special requirements?
- What is the weekly demand (average)?
- Are there any current/planned bundle cases to increase customer value?

Carrying Cases

- Per the information I have, product design and material preparation are outsourced to save costs? Have you noticed cost savings occurring compared if we had in-house talent? Any ideas how to cut costs in carrying case area?
- Typical order size from our customer? MOQ in use? Delivery preferences (daily or weekly deliveries)? Does incoming MOQ and outgoing (deliveries) MOQ ever meet? Would it be beneficial to promote these order sizes to reduce handling costs?
- How do our customers like to receive their products? Any requirements about special packing decorations or similar? How do our sales packs look like (cartons or blisters)?

Memory Cards

- Are all memory cards meant for Inbox products or do we sell those as separate accessories as well?

Logistics

- Which LSPs are being used for both inbound and outbound deliveries?
- How inbound freight costs are calculated? (By weight or by volume?)
- How outbound freight cost is calculated? (By weight or by volume?)
- Is that optimal way to calculate delivery costs for the Case Company (Weight vs. volume)?

- What different service levels do we offer for our customers (Standard, express etc.)? What is the cost difference between these options?
- What is the minimum shipping qty and with what delivery method? What is the average cost per delivered unit?
- Which delivery methods are used with the Case Company (Air, Sea or Road)? In which routes what method is being deployed?
- Average cost of delivery for one full pallet? With what delivery method?
- Is there any data analysis for the Case Company's logistics costs available for further study?

Operations

- How are the costs generated? How are costs allocated per one unit's production (evenly for all or some other factors considered)?
- What are the packaging costs per unit?
- Which packing method is most cost efficient? Blister or a box?
- How much does one sales carton cost?
- How are sales packs sent to distributors, retailers etc.? A sales carton is packed into master cartons which then are packed to delivery cartons? Do you see any improvement ideas how to reduce "air" inside our packages?
- What is the MOQ that the Case Company applies in outbound deliveries for its customers?
- Would customers pay more for "express" delivery vs. normal delivery?
- How much iHub operations cost per SKU in one year?
- Improvement projects planned or on-going? In which functions it will affect and how?