ISCTE Business School
Instituto Universitário de Lisboa

SUPPLY CHAIN ADAPTABILITY IN THE MOBILE PHONES INDUSTRY

MAURICIO BERWANGER FRANCO DE SÁ

Master's thesis submitted in partial fulfillment of the requirements for the degree of Master in Business Administration

Supervisor: Professor João Menezes

Associate Professor at ISCTE Business School, Business Administration

Lisbon

September 2010

ISCTE Business School
Instituto Universitário de Lisboa

SUPPLY CHAIN ADAPTABILITY IN THE MOBILE PHONES INDUSTRY

Mauricio Berwanger Franco de Sá

ACKNOWLEDGEMENTS

This work is dedicated to my beloved wife Camila who supported me day and night and to my loved Son Matheus that is the light of my daily inspiration, without you this work would be meaningless to me.

My parents Luiz and Quinha are the reason why I could reach this far in life as they always invested all their love, time, dedication and resources in my education and this is the biggest gift I will ever inherited from them, thank you! My sister Marisa and my brother Ricado and families: I love you and you will always be my safe harbor!

Throughout the construction of my academic life some people were instrumental and this goes in first place to my supervising Professor Dr. Joao Menezes who was always patient enough and in our meetings in the lovely "Lisboa" to guide me correctly through the roads of the academia, thank you for taking the time to assist me with great insights, maybe similarly to what is called in supply chain collaboration. I cannot forget here the remaining professors of the faculty of INDEG/ISCTE for sharing their wise knowledge. A special thanks also to Mariana Rodrigues for her support and patience with all administrative issues of our Program. Special thanks also goes to the FGV Team for their great support, especially to Professors Marcus Vinicius, Carla Winter and to the always kind Georgina Oliveira.

For supporting this academic effort from an institutional point of view I cannot forget to remember Marciel Perez, Roland Schimpf and Heiko Engelke who believed was worth investing in my development, thanks for your trust!

Life is made of friendships and relationships and thus I cannot forget to thank Luca Dellacroce for his insights as great friend, an experienced PhD and also member of Project Switch, Thomas Göbel simply for his amateur Shrink abilities and patience to listen and incentivize me to finish this work and also to Aecio Flavio for sharing his experience and be a loyal wingman throughout the years, including those at ISCTE, we did it! Mauro Vieira deserves a big thank you for revising my often times incorrect and colloquial English. Also "dankeschön" to Thomas Nehmer and Roland Anderer for their quality insights on statistical methodologies. The Project Switch members cannot be forgotten and there special thanks goes to Ulisse Sarmiento for his partnership in this undertaken and to Joachim Assman in the name of the Steering Group for supporting the project.

RESUMO

Propósito: A presente investigação participa da discussão da adaptabilidade no estudo da Gestão da Cadeia de Abastecimento e relacionamentos colaborativos entre fornecedores e clientes quer externos ou internos no contexto da indústria de telefones celulares.

Metodologia de investigação: Após a revisão da literatura relevante sobre as consequências do acoplamento rígido e ágil na cadeia de abastecimento elaborou-se a seguinte pergunta de investigação: como adaptar a procura na rede de abastecimento de forma a permitir utilizar os recursos disponíveis e maximizar a disponibilidade de produto nos diferentes canais de produção da indústria de telefones celulares? Recorreu-se ao método do Estudo de Caso com carácter exploratório para conduzir o presente estudo.

Resultados obtidos: O estudo evidenciou com base em observações dum caso empresarial que é possível aos gestores fazerem modificações no sentido de criar adaptabilidade e desacoplar os sistemas trazendo-os de uma característica de rigidez a uma condição de flexibilidade.

Limitações: A investigação em questão limitou-se a observar num unico caso os acontecimentos em questão sob a óptica qualitativa baseada na experiência do pesquisador. A utilização de um maior número de evidencias poderia contribuir para evidenciar melhor as questões intrínsecas do caso. A impossibilidade do pesquisador de revelar todos os dados empresariais por motivos de confidencialidade causou algum impacto na exemplificação do pretendido.

Implicações praticas: Os resultados podem contribuir para que os gestores na área de Cadeia de Abastecimento possam encontrar referências para resolver problemas similares em suas respectivas áreas ou tão somente provocar a discussão interna dos temas abordados

PALAVRAS-CHAVE: 1 Gestão da cadeia de suprimentos; 2 Adaptabilidade; 3 Telemóveis; 4 Estudo de caso

JEL: M11

ABSTRACT

Purpose – The present research participates in discussions in the adaptability on the study of Supply Chain Management and Buyer-Supplier collaborative internal or external relationships in the context of the mobile phones Industry

Design/methodology/approach – After the review of the relevant literature on tight and loose coupling in Supply Chain Management, the following research questions was raised: "How to adapt the demand supply network in order to utilize the resources available and maximize product availability in different channels of the mobile phones industry?" As research methodology, it was utilized the current Thesis the Single exploratory Case Study, with explanatory characteristics

Findings – The study has generated evidences that is possible for managers to modify and adapted the supply chain processes in order to bring them from a tight to a loose coupling characteristic.

Research limitations/implications – The research was limited in observing the events in a single case under the qualitative aspect based in the experiences of the researcher. The utilization of a higher number of evidences could certainly have contributed in creating further insights about the case. Elements of data confidentiality and the lack of possibility of the researcher to reveal some aspects involved in the case also contributed to limit the description of certain examples of the case, which could not be made to the full extent.

Practical implications – The results encourage managers to use to find references to solve similar problems in their respective areas and also can foster internal discussions on the topics referred in this study

KEYWORDS: 1 Supply Chain; 2 Adaptability; 3 Mobile phones, 4 Case Study

JEL: M11

TABLE OF CONTENTS

TABLE OF FIGURES

LIST OF TABLES

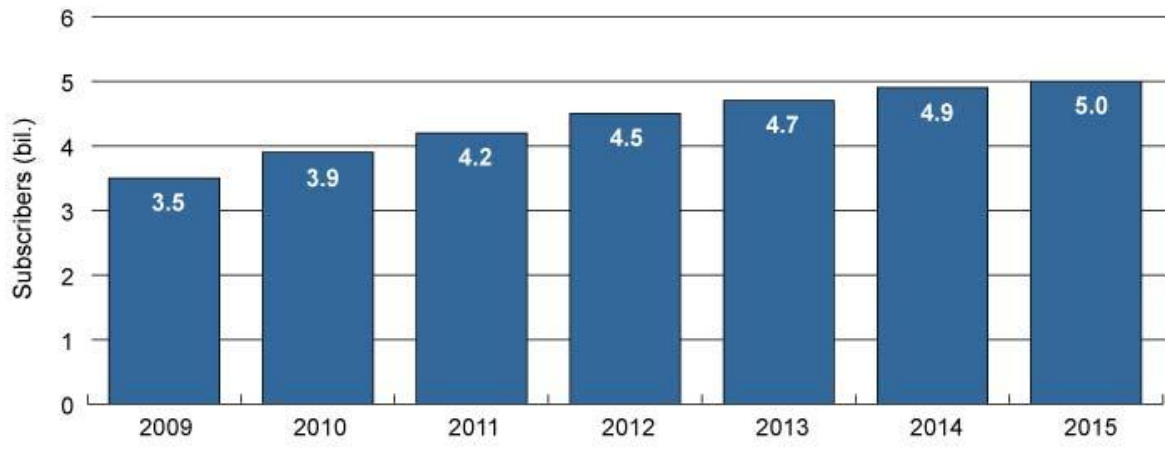
1) INTRODUCTION

This chapter brings an overview on the background of this Thesis and outlines the cornerstones of the industry where the research is inserted. Afterwards it also presents and briefly discusses the research problem and questions in order to outline also the objectives. It presents a framework of the thesis and the scope of the research which will enable a structured view of the work.

1.1) BACKGROUND

In recent years, the evolution of technology in all fronts of human life has been remarkable but specifically in mobile phones it can be best described as stated by **Neuvo (2004)** as "unbelievable". Mobile phones are a part of modern life and according to the forecasts, they shall continue to grow exponentially as fig. 1 shows below

Figure 1 - Mobile subscribers forecast



Note: Figures refer to year-end.
Source: Informa Telecoms & Media

To create competitive advantage, companies operating in this domain must continuously invest in diversifying their portfolio of products together with offering consumers with a wide array of services and applications being commonly called "Ecosystem". This consists of a conjunction of offerings that enables consumers to experience several services on their devices, such as music downloading, gaming, business and travel applications that allow one to see from weather forecasts to corporate emails.

In order to cope with this very demanding market companies must ensure that their Design, R&D and Procurement processes are synchronized to allow fast time-to-market and need to ensure the devices will be "up-to-date" when they are launched. Khan et al. (2008) state that it is important to recognize that the *"supply chain begins on the drawing board"* and therefore understand the significance of the design function/process in the supply chain.

In today's world, supply chain has to act as an enabler of such fast development cycles, otherwise there is no point in speeding resources in developing hardware or software elements if the product or technology in question cannot be manufactured or components cannot be sourced to the scale the market demands.

As suppliers are becoming more and more vertically integrated the challenge of reducing development cycles by using concepts such as ESI (Early Supplier Involvement), a process where the nominated suppliers participate in the design of a complex product or component from the very early stages, helping to reduce development times, costs and improve quality according to McIvor & Humphreys(2004) and nowadays is implemented as part of normal R&D work in the industry under study here.

Competition in mobile phones market has made innovation also a driver to stay alive, however, the good ideas and concepts must find their way to quick implementations, which means, hardware and software both need to find ways to support this need ideas at the right cost, otherwise, there is no business case behind and investments cannot be secured.

It is also proper to differentiate the fragmentation on the feature set and also price point in which the mobile phones is positioned is enormous, hence making companies to organize themselves into different business units, namely tackling separately these different aspects of the business.

This Thesis participates on the discussion of a case study situated the context of the mobile phones industry with focus on an R&D unit which develops handsets for the global markets. The research focus on the adaptability agility of the supply chain and how to adapt it in order to overcome disruptions. In brief it also tackles issues related to the interdependency between hardware and software and how to couple and decouple elements of the supply chain to become more agile. It examines the supply chain aspects of a large mobile phones Company.

In order to contextualize this case there is a need to elaborate on certain organizational and operational issues, such as: structure, processes involved, management systems and as well the issues identified as bottlenecks of the case, such as, communication, data management and alignment issues in several organizational levels.

1.2) CONSIDERATIONS ON ORGANIZATIONAL STRUCTURE, MARKET CONDITIONS, STRATEGY AND FINANCIAL INDICATORS

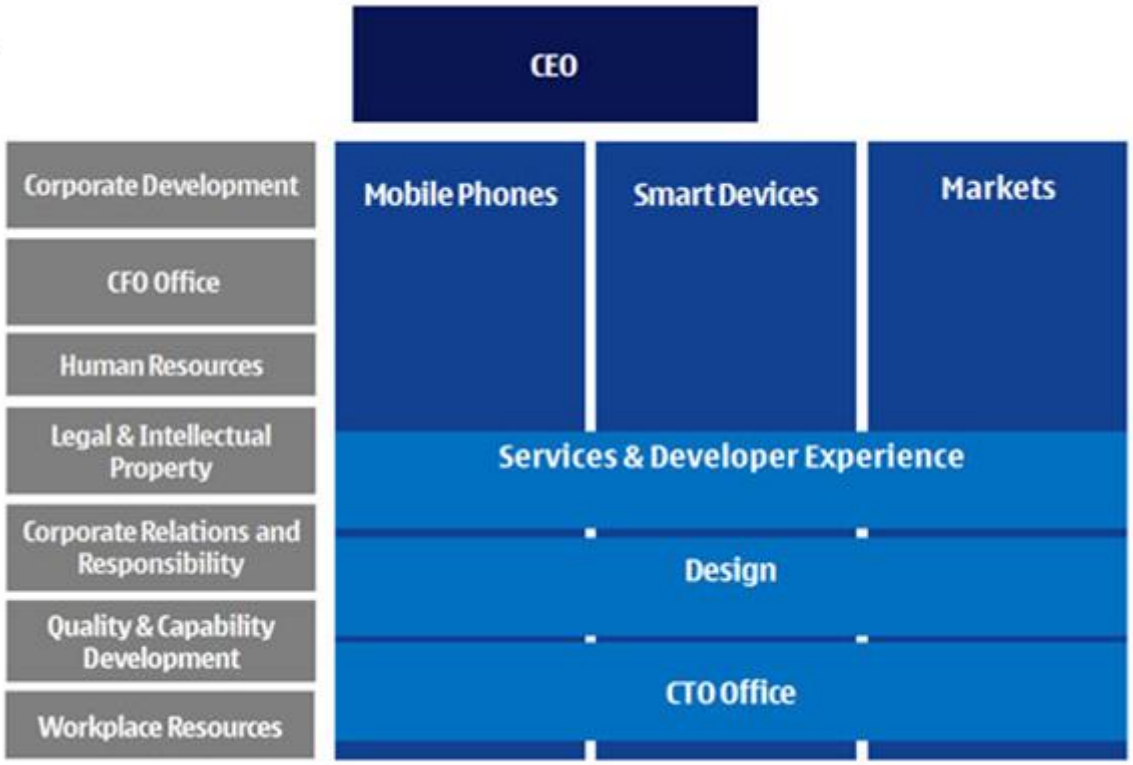
The company which is objective of this study is one the world's leading handset manufacturing currently operates in all kinds of segments across this industry and has been on the pioneers in the voice era. Setting the boundaries for what was one of the world's largest and fastest technological revolutions its products and services are widely known to customers in all five continents. Considered to be one the world's most recognized brands it also holds a very solid background as one the strongest supply chain management organizations.

Its sales and operations scale have a global footprint and so is the need to also source materials of all kinds in a massive scale in order to meet the demand. As the supply chain is very complex in this industry, the capability of securing the ability to deliver product can also become a competitive advantage for producers of devices.

As the market trends and technology moves extremely fast, there is also a need to orchestrate the supply chain to be as flexible and adaptable as possible as the risk of obsolescence is real and likely to hit the financial results very hardly.

The company adopted recently a new cross-functional organizational structure, which is illustrated by the fig. 2 below:

Figure 2 - Organizational structure



It is proper to state that the vertical structures on the list of the fig.2 are the heart of the company, meaning embedded into these so called Business entities , are all relevant functions of Research & Development, Manufacturing Operations, Sales and other main activities.

A brief description of the main aspects of these business units is below:

- **Mobile phones** is the business entity that is responsible for all development activities for handsets which are targeted and recognized as a device bringing a modern and affordable mobile experience to people around the world;

- **Smart Devices** is business unit which focuses on smartphones, and additionally on exploring next-generation opportunities in devices, platforms and user experiences to support the industry position and longer-term financial performance;

- **Markets** business unit heads the "traditional" functions related to DSNM – Demand Supply Network Management and is responsible for sales, marketing, communications, consumer insights, sourcing, manufacturing, logistics, quality and IT;

The horizontal business units provide support services to the main business units and also address corporate wide functions that are either strategic or statutory and their detailed role and responsibility is general, thus, not relevant to be described in this study.

This structure is in place since April 2011 and it's also proper to quote the company's declared strategic intent: "to build great mobile products".

The Company also defines its job as "to enable billions of people everywhere to get more of life's opportunities through mobile."

In recent months, the business scenario has been very challenging with loss of market share and thus decline in sales and profit. As a counter strike measure attempting to regain the leadership in the market a series of strategic changes has been initiated and among which, we emphasize on the following:

- Plans for a broad strategic partnership with a leading American Software Company to jointly build a new winning mobile ecosystem.
- A renewed approach to capture volume and value growth to connect "the next billion" to the Internet in developing growth markets
- Focused investments in next-generation disruptive technologies
- A new leadership team and organizational structure with a clear focus on speed, results and accountability

These recent strategic changes mentioned above represent a tremendous shift in the overall plans and operating model of the company, who traditionally over the years have taken a different approach. One major example is for instance its operating system strategy. Across all its products, the focus on software development has always been on rather internally managed platforms and therefore the cooperation with the leading American Software Company will represent a completely new way of working, where the main software assets in its devices are coming from another partner. The intention declared by the

two companies that made the announcement was to create a mobile ecosystem[1] in on order to compete with the two main players in this domain of smartphones: Apple with its iPhone and iTunes and Google with Android Marketplace ecosystems. Together these two companies have changed the industry completely, breaking the status-quo and bringing new domain on value offering for the consumers.

Zander (2010) brings the following overview about the importance of an Ecosystem in the industry currently.

"Ecosystems – The new World Order

The increasing interdependency between the key stakeholders on the market, already important under the previous era, changes the boundaries of how we define a company and a product proposition. Today a company must manage and balance the interests from standardization bodies, partners, open source communities as well as 3rd party developers, which all together contribute to create value to ones product offering. Devices and services go together and the actual value adds is in the joint offering and not the components standalone, it is clear that mobile devices go PC style and the device value itself will vanish without services attached."

On these new domains, the company under study here has suffered a great deal of market share loss as its Smart Devices offering has proven less competitive and appealing in the eyes of the consumers.

In the Ecosystem world, having good quality of Software pre-loaded in the device no longer guarantees a successful product; it is rather a sanitary requirement which brings no competitive advantage.

In the new era of wireless device industry, being able to attract 3rd party application developers and provide them with tools and systems to develop, upload and market their applications is key to be able to create value offering that the consumers are looking for.

[1] Mobile ecosystem as described consists on the offering by vendors of handsets a diversity of applications and content such as music, games and other that can usually be purchased over their own on-line application stores, such as the iTunes service from Apple.

For Zander (2010), the competitive advantage derives from four key drivers which have evolved over the years and can be grouped under the concept of eras, which are summarized on Table 1

Table 1 - Eras for the wireless device industry

	1990 – 2000	2000-2005	2005 - 2010
	THE VOICE ERA	THE ENTERTAIN ME ERA	THE CONNECT ME ERA
Key features and applications	Voice and SMS Battery, size and radio performance	Mp3-player, FM-radio, games, downloadable ringtones, digital camera, color screen, Bluetooth, WAP, 3G, multimode	Mobile Broadband for laptop, full Internet browser in mobile, downloadable applications, touch screen, podcasts, watch video
Value chain	Vertically integrated (all in house) device and Networks	Starting to unbundle, Increasing complexity and cost to develop pushes towards specialization New entrants without vertical integration and thus need for chipset suppliers Increasing usage of ODMs	Unbundling continues but integration varies depending on device segment Vertical integration of device and services (iTunes + iPhone, Android + marketplace etc.) Reintegration of parts of the value chain (ST+EMP)
New technology	2G (GSM, CDMA IS-95, TDMA, DAMPS), 350nm, 250nm, BGA package	2,5G (GPRS), 2,75G (EDGE), 3G (WCDMA, CDMA 1x), 130nm, 90nm, Bluetooth, WAP, Java	HSDPA, HSUPA, HSPA+, 65nm, 45nm, open source software, WLAN, Assisted GPS, SiP
Important players	Telecom companies, e.g. Ericsson, Nokia, Motorola, Siemens	Consumer electronics companies, e.g. Samsung, LG, Sharp as well as Nokia, SonyEricsson, and Motorola	IT/PC industry companies, e.g. Apple, Google, HTC, Acer, Facebook, RIM, Microsoft as well as Nokia
Value creation (when & where)	Value creation pre-loaded on the device	Value creation pre-loaded on the device	Value created at point of sales &during in-life usage

Source: Adapted from Zander, Martin (2010) "Technical and economical trends in wireless applications," ESSCIRC, 2010 Proceedings of the ESSCIRC, pp.37-44.

According to Zander (2010), main aspects to consider in this scope are:

- ***"Value chain structure*** *– Balance between vertical and horizontal integration shifts depending on need for specialization and complementary assets as well as opportunities for grasping new values with unique vertical propositions.*
- ***New technology opportunities*** *– The increasing complexity and the convergence with other areas have constantly opened up for new players as well as changed the scope for the existing.*

- ***New entrants adding new capabilities*** *– New opportunities arise as the wireless device industry evolves in combination with convergence with other industries, which opens up for new entrants with different set of capabilities shifting the basis for competitive advantage.*
- ***The when and where for value creation*** *– Value creation started as preloaded to the device but has now shifted towards making the phone just an entry point for value creation."*

The value domain of this industry is impressive and across time the efforts of the players have concentrated in investments around increasing the capability of the devices to also capture service monetization and not only be restricted to selling of the hardware piece.

In order to contextualize the company's profile, which is relevant to give the proper scale of operation and business environment, the table 2 brings the latest financial results as published in the 2010 annual report summarized by one of the statements which illustrates elements of sales figures, bringing insights towards the Profit & Loss scale.

Table 2 - Consolidated Income Statements, IFRS

Financial year ended December 31	Notes	2010 EURm	2009 EURm	2008 EURm
Net sales		**42 446**	40 984	50 710
Cost of sales		**–29 629**	–27 720	–33 337
Gross profit		**12 817**	13 264	17 373
Research and development expenses		**–5 863**	–5 909	–5 968
Selling and marketing expenses		**–3 877**	–3 933	–4 380
Administrative and general expenses		**–1 115**	–1 145	–1 284
Impairment of goodwill	8	**—**	–908	—
Other income	7	**476**	338	420
Other expenses	7, 8	**–368**	–510	–1 195
Operating profit	2–10, 24	**2 070**	1 197	4 966
Share of results of associated companies	15, 31	**1**	30	6
Financial income and expenses	8, 11	**–285**	–265	–2
Profit before tax		**1 786**	962	4 970
Tax	12	**–443**	–702	–1 081
Profit		**1 343**	260	3 889
Profit attributable to equity holders of the parent		**1 850**	891	3 988
Loss attributable to non-controlling interests		**–507**	–631	–99
		1 343	260	3 889

This information is important to give the reader a dimension of the operation presented hereby in this study. The numbers also reflect the decline in sales that was referred earlier and also permit to conclude the size of the operation here in question. The importance of realizing those insights will help further to understand the supply chain related challenges in this operation, enabling an immediate correlation to those of a multinational corporation which operates in a very complex value domain.

1.3) RESEARCH PROBLEM

This case study is based on a real business issue that has been identified as a bottleneck in the operations of a large-scale European Mobile Phones company and the main focus of the work and question which intends to be discussed by this work is supply chain adaptation.

The case consists of an issue which would affect severely the profitability of one the company's business units and its correlation with the supply chain adaptability and other key concepts.

In order to prepare for a good understanding the main aspects of the case several aspects and characteristics of the supply chain model of the company need to be described and analyzed in order to provide the basis to underline how the operations take place and how the issue in discussion has taken place.

These aspects are important as they need to be studied and explained in order to make a sensible overview of the problem.

1.4) RESEARCH QUESTION AND OBJECTIVES

The main issue that motivated this research was the observed on an interesting interdependency between components of hardware nature and elements of software approval and deployment process. The tight coupling of systems in value chain and some peculiar

internal challenges led to a scenario where an imminent risk of supply chain disruption became very evident and required some extent of intervention to be tackled.

The following research question can be formulated to explain the main challenge of the present work:

"How to adapt the demand supply network in order to utilize the resources available and maximize product availability in different channels of the mobile phones industry?"

In order to address the answers to the above question, the present work aims to fulfill the following objectives:

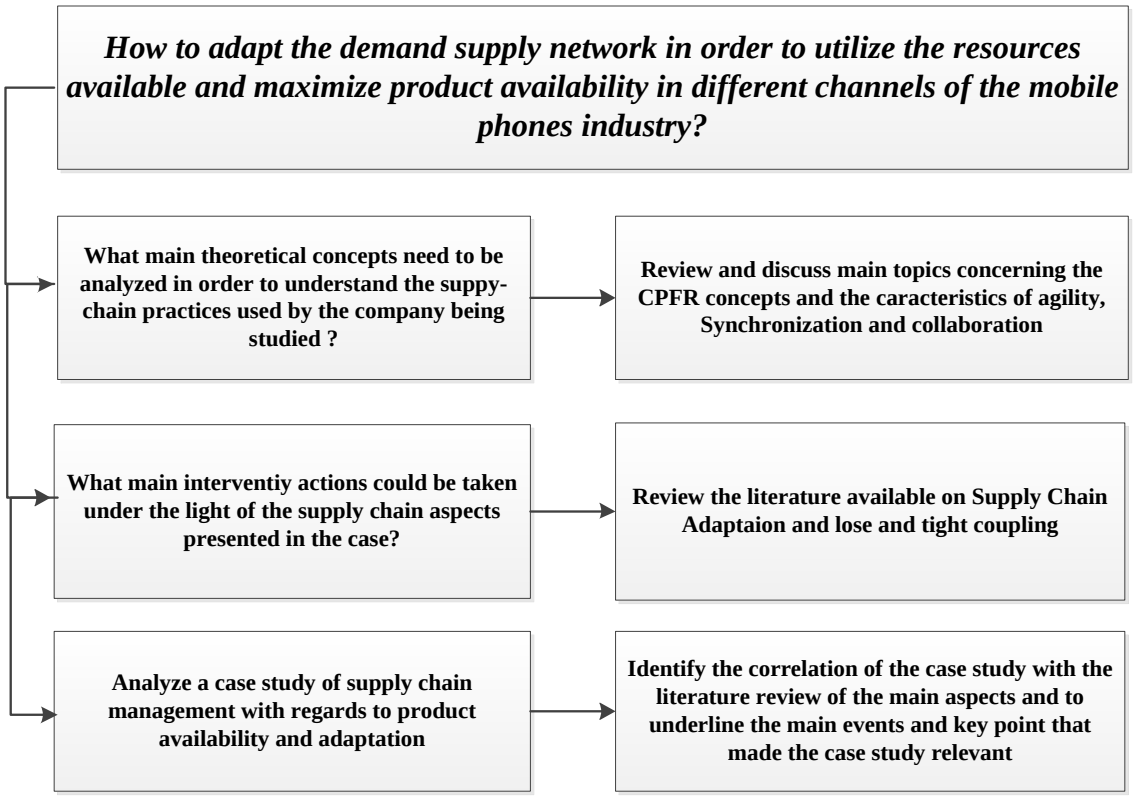
a) Provide an overview of the main aspects on the literature that are relevant to contextualize the issue, which are:
   - Agility in supply chain
   - Synchronization of supply chain
   - Collaboration in supply chain management
   - Customization in supply chain management

b) Understand what theoretical underpinnings can be used from the main supply chain concepts to solve the case, with focus on:
   - Adaptation, coupling and decoupling on supply chain

c) Analyze the case study and find the correlations between theory and the case aspects.
   - Provide the researchers view on the main aspects of the case that can be solved by applying the techniques presented in the literature review

The table 3 brings a comprehensive overview of the case objectives and its main goals on a schematic way.

Table 3 - Research Question diagram



1.5) THESIS FRAMEWORK

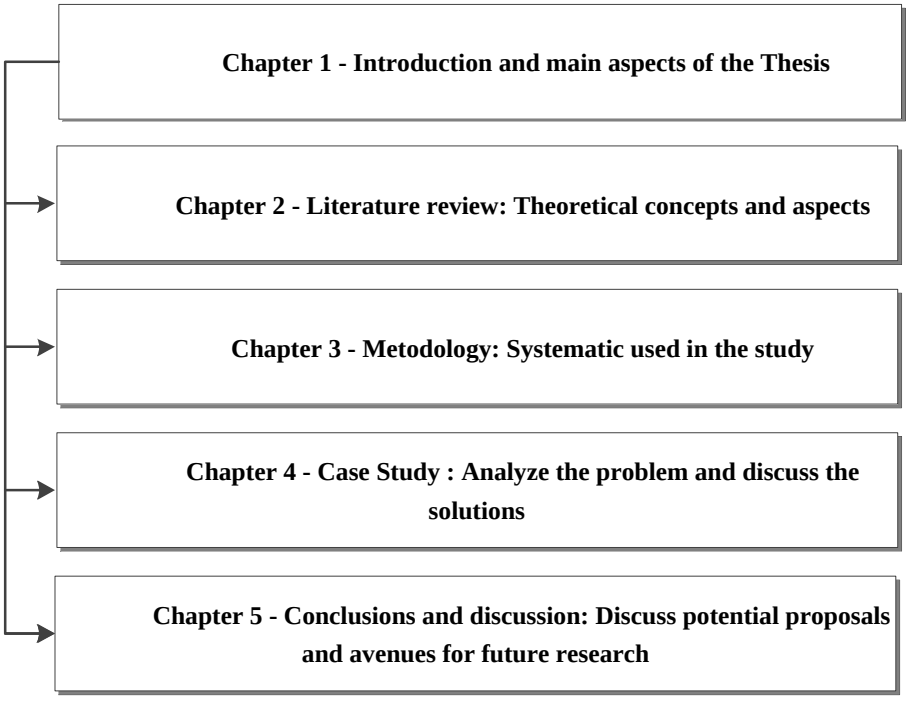
The Thesis consists of the following chapters:

1) **Introduction and main aspects**: The nature of this chapter serves as the background to contextualize about the industry studied and to outline what is the main problematic behind the events that lead to this research.
2) **Literature review:** The purpose of the chapter is to review and outline main theoretical underpinnings that recent literature has fundamentally discussed. The focus has been in providing a general understanding of ideas, models and concepts that previous researchers have perceived with their work.
3) **Methodology:** Equally as important as having a good and solid theoretical framework, the quality of a good research is intrinsically connected to having the right methodology, a good understanding of it and the right definition of how to apply it in correlation to the subject of study. This chapter is devoted to bring clarity over this essential aspect of this Thesis.

4) **Case study**: The main ambition of the chapter is to report the case study describing exactly the elements of research and most importantly their impact and influence on the subject study. All go this allied to the challenge of describing a very complex industry environment and it specific characteristics
5) **Conclusion and discussions**: No research can be considered effective if it cannot lead to conclusions that are relevant to the topic under study. The aim of the chapter is to discuss the aspects founded by the research, its limitations and perspectives that can subject of further study

Table 4 brings a comprehensive overview of the how the Thesis is organized and what can be expected of each chapter.

Table 4 - Structure of the Thesis



The intention is to participate on the discussion concerning what are the tactical things can be done in an operational level as well as analyzing and proposing structural and procedural aspects that could be improved over time.

The study has no intention to create a theory but rather to raise awareness over important aspects of the supply chain that need to be adapted to overcome business critical impacts.

1.6) SCOPE OF THE RESEARCH

The scope of this research is to look into the aspects of adaptation in the supply chain and co-relate them to the case studied and to propose to researchers and practitioners an understanding of the concerned topics. Considering the limitations of the study not all issues are dealt with deepness but rather considered as avenue for further research.

1.7) METHODOLOGY

The methodology selected for this Thesis was the case study. The motivation of the researcher to choose such method is the fact that allows the exploration and understanding of complex issues as proposed by Zainal (2007). The type of case study selected was a single case study and the reason is the events took place in a relatively recent past and the occurrence was the motivation for the start of the studies.

According to Johansson (2003) The case study should have a "case" which is the object of study. The "case" should:

- be a complex functioning unit,
- be investigated in its natural context with a multitude of methods, and
- be contemporary.

The method also was identified as appropriated as satisfies the characteristics described in the literature which states that explanatory cases study would be used if you were seeking to answer a question that sought to explain the presumed causal links in real-life interventions that are too complex for the survey or experimental strategies. In evaluation language, the explanations would link program implementation with program effects (Yin, 2003).

2) LITERATURE REVIEW AND THEORETICAL FRAMEWORK

The purpose of this chapter is to review the theoretical concepts and models that outlined the basis for the research and the case study. This should enable the creation of a conceptual framework to understand the issues and eventually support the discussion potential solutions to the study.

2.1) AGILITY IN SUPPLY CHAIN

Nowadays, cycles of technological development are becoming shorter and shorter, supply chain needs to be agile and companies have to look beyond the cost, quality and time triad. Christopher (2000) defines Agility as a business-wide capability that embraces organizational structures, information systems, logistics processes, and, in particular, mindsets. In order to reach that capability it is also relevant for the companies to plan roadmap of components that bring some kind of differentiation (either cost, quality or performance improvements) for creating the basis to a sustainable and agile supply chain. According to Mason-Jones et al. (2000) agility means using market knowledge and virtual corporation to exploit profitable opportunities in a volatile marketplace.

Several other authors have explored the concept of agility in light of the supply chain, another idea is that Agility is an ability to produce a broad range of low-cost, high quality products with short lead times in varying lot sizes, built to individual customer specification (Fliedner & Vokurka, 1997). Y.Y Yusuf et al. (2004) argue that until recently, supply chains were understood mainly in terms of long-term upstream collaboration with suppliers. An equal amount of emphasis is now paid to downstream collaboration with customers and lateral collaboration with competitors as a means of integrating the total value creation process. The importance of the downstream is substantial in the mobile phones industry as it has to be combined with the customization concept, which will be explored in another chapter.

According to Aitken et al. (2002) Agility is an ability to have visibility of demand, flexible and quick response and synchronized operations. This is particularly difficult in industries with high degree of uncertainty such as the one currently under study. Another

proposed discussion is that agility of a supply chain is a measure of how well the relationships involved in the processes mentioned above enhance four pivotal objectives of agile manufacturing (Hoek et al., 2001). These objectives are customer enrichment ahead of competitors, achieving mass customization at the cost of mass production, mastering change and uncertainty through routinely adaptable structures, and leveraging the impact of people across enterprises through information technology (Y. Y Yusuf et al., 2004)

In mobile phones Industry, the role of supply chain agility is enormous due to the fact that cycles of component development require extensive amount of R&D work in hardware but also a lot in the embedded software that often require long programing.

However, often in closed architectures of software as defined by Garlan (2000) "*developed and operated under control of individual institutions. The constituent components may be acquired from external sources, but when incorporated in a system they come under control of the system designer. Architectures for such systems are either completely static- allowing no run time restructuring - or permit only a limited form of run time variation*". It is sometimes extremely difficult to match roadmaps of hardware and software development together as they complexity involved in the matter is very high.

Alongside with challenges listed above, portfolio planning play a key role in penetrating as many markets and price points as possible and the development model in the need to serve as many products as possible. In other words, development is done so that one component or so called "engine" (group of electronics that function as heart of the phone) platform has to suit as many product programs as possible, meaning that if one needs to change anything in that specific "platform", one will most likely affect several products, this becomes a challenge as the software has to server several products. According to Neuvo (2004) the engine consists of three main chips: one for RF, one for baseband, and one for mixed-signal and energy management.

Another very challenging factor has to be added to this equation in this specific industry is related to customer approvals and certification by all regulatory and governmental control agencies which also plays a key role in enabling the needed agility

According to Christopher (2000**)** there are four key characteristics for agile supply chain:

1) **Market Sensitiveness**

   An agile supply chain is always market sensitive with capability of reading and responding to real demand. Focus should be on process of understanding actual customer requirements with direct link methods and not to be based too much on market forecast information. In the agile supply chains actual execution process is always more demand-driven than forecast-driven

2) **Virtual**

   Extensive demand and supply information sharing between members of the chain, namely buyers and suppliers, helps to foster a virtual supply chain where physical inventories are maximally replaced with information sharing. The effective use of Collaborative planning through automated transaction systems, e.g. VMI e-business solutions, between supply chain participants is required for creating agility into the value chain.

3) **Process Integration**

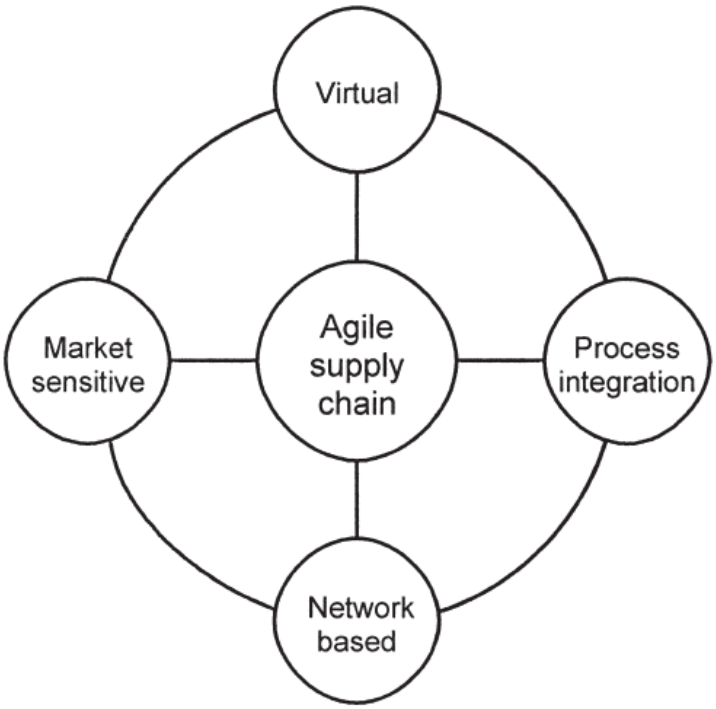
   Fundamental aspect to promote an agile supply chain is deep process integration between the members of the chain. Comprehensive demand information sharing also enables true collaborative environment, joint R&D and common systems between buyers and suppliers.

4) **Network based**

   Agile supply chain has a strong network based type, where partners share targets commonly. The supply chain partners develop networks with committed and close relationships with final customers.

On the fig. 3 we can see the illustration of the Agile Supply chain characteristics.

Figure 3 - Characteristics of Agile Supply Chain



Source: Harrison, A., Christopher, M. and van Hoek, R. (1999), ``Creating the agile supply chain", School of Management Working Paper, Cranfield University, Cranfield.

The four dimensions can work together if there is a clear customer focus between the partners. In this regard, Christopher (2000) refers that "*We are now entering the era of "network competition," where the prizes will go to those organizations who can better structure, coordinate, and manage the relationships with their partners in a network committed to better, closer, and more agile relationships with their final customers. It can be argued that in today's challenging global markets, the route to sustainable advantage lies in being able to leverage the respective strengths and competencies of network partners to achieve greater responsiveness to market needs."*

Having an agile supply chain is a quintessential competitive advantage condition to survive in this industry and in times where complexity trends are rather more towards increasing than decreasing, agility can represent survival.

2.2) SYNCHRONIZATION OF SUPPLY CHAIN

Uncertainty is the key word that defines the biggest challenges faced by companies operating in an environment where technological cycles of innovation are extremely fast and customers are always seeking for the latest "hype". Uncertainty propagates through the supply chain and leads to inefficient processing and non-value adding activities (Agarwal et al., 2007)

According to Lee (2003) "*demand uncertainty is linked to the predictability of the demand for the Product. Functional products are ones that have long product life cycles and therefore stable demand, while innovative products are products that have short life cycles with high innovation and fashion contents – and which, as a result, have highly unpredictable demand"*

On the following table we can visualize the main aspects of the demand characteristics:

Table 5 - Demand Characteristics

Functional	Innovative
Low demand uncertainties	High demand uncertainties
More predictable demand	Difficult to forecast
Stable demand	Variable demand
Long product life	Short selling season
Low inventory cost	high inventory cost
Low profit margins	High profit margins
Low product variety	High product variety
Higher volume per SKU	Low volumes per SKU
Low stockout cost	High stockout cost
Low obsolescence	High obsolescence

Source: Lee, H.L.;(2003) "Aligning supply chain strategies with product uncertainties," Engineering Management Review, IEEE, vol.31, no.2, pp.26

Supply chain is always linked with an uncertain external environment by customer demand from one-side and raw material suppliers from other side (Prater et al., 2001).

Demand is one dimension of the business and traditionally has represented the biggest challenges to predict across all the industries.

In other hand one cannot underestimate the fact that the Supply side of the business also present uncertainties which Lee (2003) classifies as:

- ***"Stable Supply:*** *is one where the manufacturing process and the underlying technology are mature and the supply base is well established*

- ***Evolving Supply****: is where the manufacturing process and the underlying technology are still under early development and are rapidly changing, and as result the supply base may be limited in both size and experience"*

The essential differences between these two types of supply can be seen better when we compare their characteristics below:

Table 6 - Supply Characteristics

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

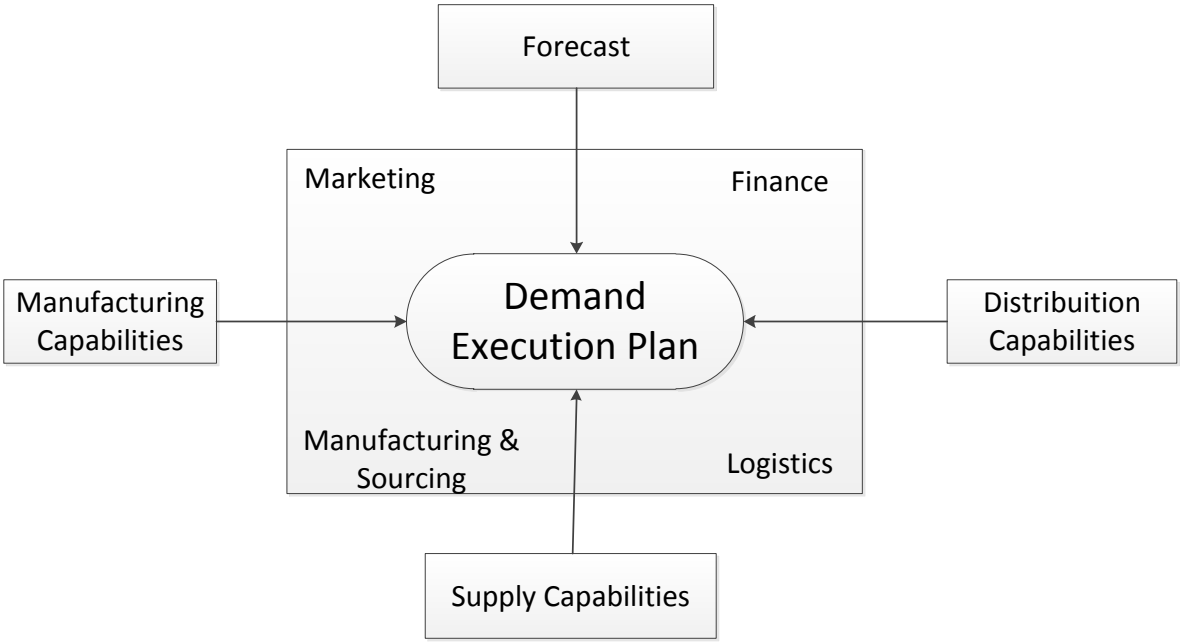
Source: Source: Lee, H.L.;(2003) "Aligning supply chain strategies with product uncertainties," Engineering Management Review, IEEE, vol.31, no.2, pp.26

So even a bigger effort remains in synchronizing these two uncertain aspects of the supply chain. Lambert (2006) proposes that synchronization requires coordination marketing, manufacturing and sourcing, logistics and finance. Still according to him "*when executed at operational level, this synchronization process includes examining the forecasted customer*

demand and determining the requirements back through the supply chain. It requires not only understanding of the level demand, but also the velocity at which product is required at each touch point of the supply chain. The output of this execution will be a single execution plan that will balance the needs and costs of the manufacturing, logistics, sales and the suppliers to meet anticipated demands".

Still he proposes the following schema to underline the optimized model to manage the synchronization of the demand supply network

Figure 4 - Synchronizing the supply chain



Source: Adapted from Lambert, Douglas M. (2006) "Supply Chain Management, Processes, Partnerships, Performance," 2nd edition,pp.67 SCMI

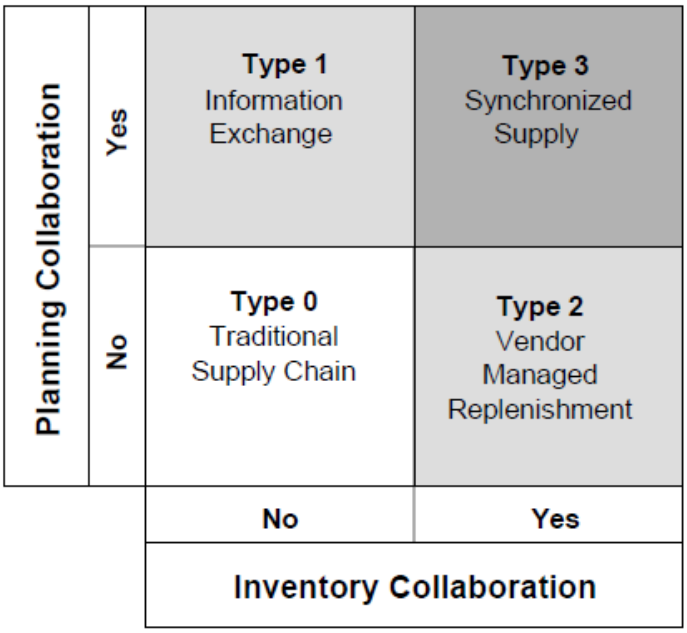
According to Holweg et al. (2005) "*Synchronized supply eliminates one decision point and merges the replenishment decision with the production and materials planning of the supplier. Here, the supplier takes charge of the customer's inventory replenishment on the operational level, and uses this visibility in planning his own supply operations".*

In this sense it is proper to state that Synchronization is fundamental to create value in the supply chain it's often not implemented to the full extent, or certain levels of

synchronization are not always achieved due to multiple factors such as legal barriers and other negotiable and financial aspects of partnerships.

There are also differentiated the levels of synchronization as discussed by Holweg et al. (2005) they represent differences in ordering and replenishment policies may be subtle, but the consequences for the dynamics of the supply chain can be drastic, which makes it ever more important to be specific. According to them, there are four levels which can be distinguished by the differences in inventory control and the planning. See fig. 5 below for a detailed overview

Figure 5 - Basic supply chain configuration



Source: Adapted from Holweg, Matthias, Disney, Stephen, Holmström, Jan, Småros, Johanna (2005) Supply Chain Collaboration: Making Sense of the Strategy Continuum, European Management Journal, Volume 23, Issue 2, pp.172.

The typical collaboration modes in supply chains involve demand-side collaboration, supply side collaboration and overall synchronization **(**Yonghui & Rajesh, 2004)

Collaboration is thus recognized as a significant process that holds the value creation opportunity which can drive effective supply chain management (Bauknight, 2000; Anderson and Lee, 1999).

Tolone (2000) has supported the role of real time and asynchronous collaboration technology for allowing manufacturers to increase their supply chain agility.

Table 7 -Benefits of supply chain collaboration and synchronization

Benefits typically achieved through supply chain collaboration:	Additional benefits, typically not achieved without supply chain synchronization
1. Collaborative forecasting enables better customer service levels, or a reduction in inventory (but generally not both. In fact, in many cases these are traded off against each other, or service levels are traded between customers).	**1. Elimination of the bullwhip effect by linking the inventory and replenishment decisions. This still is a technical challenge, but modeling with real demand shows how collaboration can filter out the bullwhip effect (Småros et al., 2003).**
2. Reduce the rationing game by giving the supplier responsibility for replenishment. However, if there is a general shortage this collaboration can quickly break down. For example, when demand for a product is rising dramatically, such as for mobile phones or PDA's in the 1990's, vendor managed replenishment arrangements are easily abused to secure a larger share of supply. A distributor triggers an early replenishment by transferring inventory to other stocking locations, which the supplier then would misinterpret as consumption, and replenish.	**2. A reduction of inventory levels by up to 50% without compromising customer service levels (Disney and Towill, 2003), and better utilization of production capacity as the extended visibility of the supply chain provides a certain additional flexibility to prioritize or delay customer replenishment without compromising service levels, thereby reducing the need for capacity buffers (Waller et al.1999).**

Source: Adapted from Holweg, Matthias, Disney, Stephen, Holmström, Jan, Småros, Johanna (2005) Supply Chain Collaboration: Making Sense of the Strategy Continuum, European Management Journal, Volume 23, Issue 2, pp. 176

As mentioned in the table above, better utilization of production capacity as extended visibility of the supply chain is necessary. Highest level of synchronization allows perhaps elimination of additional production buffers and could contribute to further inventory optimization.

Highest degrees of synchronization can be achieved by combination of planning and inventory collaboration and thus the need for integrating also on Sales and Operations planning (S&OP) planning aspects.

Perhaps one of the biggest challenge managers encounter is the management of data complexity in their respective IT systems, according to Agarwal et al. (2007) The market sensitiveness of a supply chain is affected by level of collaboration among its trading partners, and its ability of using IT tools.

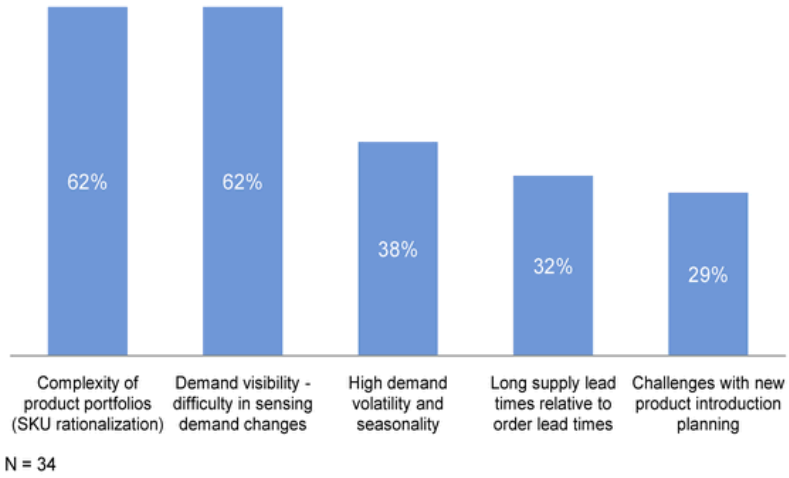
Also, behavioral aspects such as trust and communication are quintessential to succeed in collaboration projects, as stated by (Agarwal & Shankar, 2002) *"improves trust among trading partners, which motivates them to share business information and to work on the same data".*

2.3) COLLABORATION ASPECTS IN SUPPLY CHAIN MANAGEMENT

In response to the challenges listed by the complexity of the relationship between the so called Demand Supply Network, several concepts have been developed. Supply chain collaboration means two or more autonomous firms working jointly to plan and execute supply chain operations (Simatupang and Sridharan, 2002).

In a recent study done by Gartner group, demand visibility is attributed as 62% of top issues affecting inventory performance, see fig. 6. Still according to the study: "*Demand visibility is a major challenge for industrial companies. Product portfolio complexity and challenges with new product launch require cross-functional collaboration, which supply chain cannot control but can attempt to influence. Demand volatility is an externality and on the increase, requiring demand-shaping tactics developed collaboratively with the commercial organization."*

Figure 6 - Top Three Issues Affecting Inventory Performance



Source: Lord, P. (2011) Insights on Inventory Management: Challenges and Best Practices for Industrial and High-Tech Companies, a report by Gartner Group.

One important concept under collaboration is the idea of collaborative advantage and according to Vangen and Huxham, (2003). It relates to the desired synergistic outcome of collaborative activity that could not have been achieved by any firm acting alone. Collaborative advantage is also called joint competitive advantage (Jap, 2001)

According to Mei and Qingyu (2011) there are various ways to define supply chain collaboration, however they mainly fall into two categories depending upon their focus, which are process focus and relationship focus. As cited in Mei and Qingyu(2011) *"Supply chain collaboration has been viewed as a business process whereby two or more supply chain partners work together toward common goals (Mentzer et al., 2001; Stank et al., 2001; Manthou et al., 2004; Sheu et al., 2006),"* There is an aspect of forming long-term partnerships in supply chain collaboration where supply chain members work together and share information, resources, and risk to accomplish mutual objectives **(**Bowersox et al., 2003; Golicic et al., 2003).

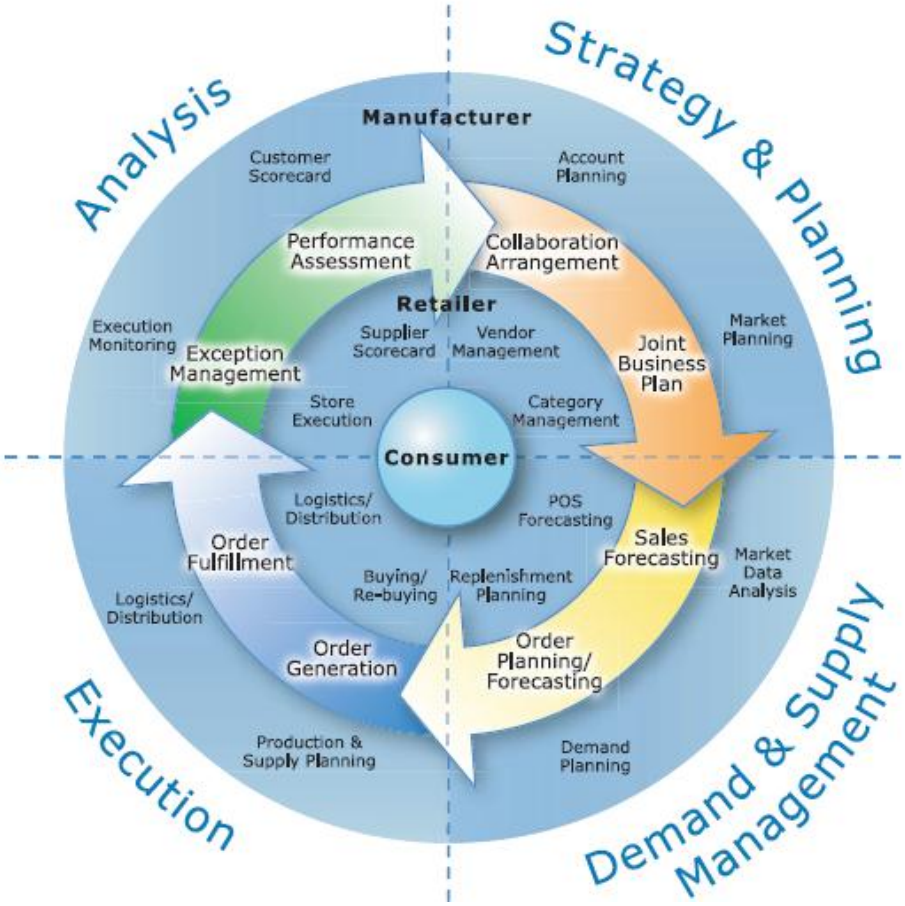
On the process front several efforts have been developed in recent years to overcome this and minimize the impact of the inventory costs. Since the Company in this study has widely adapted the Collaborative Planning Forecasting and Replenishment - CPFR, we will concentrate in illustrating this aspect.

According to Skjøtt-Larsen et al. (2007) the VICS Voluntary Interindustry Commerce Standards introduced the CPFR concept and described it as "*collection of new business practices that leverage the internet and electronic data interchange in order to radically reduce inventories and expenses while improving customer service"*

According to Hollweg et al.(2005) the forecast decision point is eliminated and the replenishment decision is merged with the planning of the supplier, thus both parties are eliminating redundancies from the chain and have access to the direct requirements of their partner.

Looking at the four dimensions on Fig. 7, Analysis, Strategy & Planning, Demand & Supply Management and Execution, one can conclude this is quite a challenging process.

Figure 7 - An overview of the CPFR Model



Source: VICS(2004) Collaborative Planning, Forecasting and Replenishment(CPFR): An Overview, https://committees.vics.org/committees/cpfr/CPFR_Overview_US-A4.pdf

On relationship level, openness in sharing the company's information is unprecedented; therefore, trust among the partners is also a very important factor. Mei and Qingyu (2011**)** describe what they call Collaborative communication which is defined as the contact and message transmission process among supply chain partners in terms of frequency, direction, mode, and influence strategy. Open, frequent, balanced, two-way, multilevel communication is generally an indication of close inter-organizational relationships (Goffin et al., 2006; Tuten and Urban, 2001)

In large, the CPFR has been suggested by researchers as a remedy for coping with the bullwhip effect. According to Lee (1997) the bullwhip effect occurs when the demand order variability in the supply chain are amplified as they moved up the supply chain. Distorted information from one end of a supply chain to the other can lead to tremendous inefficiencies.

In return, high inventory levels and poor customer service rates are typical symptoms of the bullwhip effect according to Metters (1997) and Chopra & Meindl (2001)

Execution phase of a CPFR strategy requires massive investment and intense integration of IT and ERP systems which has proven to be time consuming and perhaps one of the most costly parts of implementing this model. Several aspects have to be noted when it comes to data security infra-structure and management and development of extranet portals can be rather slow and resource consuming.

In the Demand & Supply Management still a lot of the traditional challenges of the model still remain, which is as stated on Fig. 6 is the "difficulty in sensing demand changes". One of the interesting aspects of this model is that it also allows quicker reaction to demand balancing due to the "real time" sharing of the data and thus allowing all the partners in the Demand Supply Network to balance the inventories faster than the traditional approach

Another important partnership program under Supply Collaboration is the VMI-Vendor Managed Inventory, a concept where the supplier manages the inventory and replenishments of stock are made only when the demand really happens.

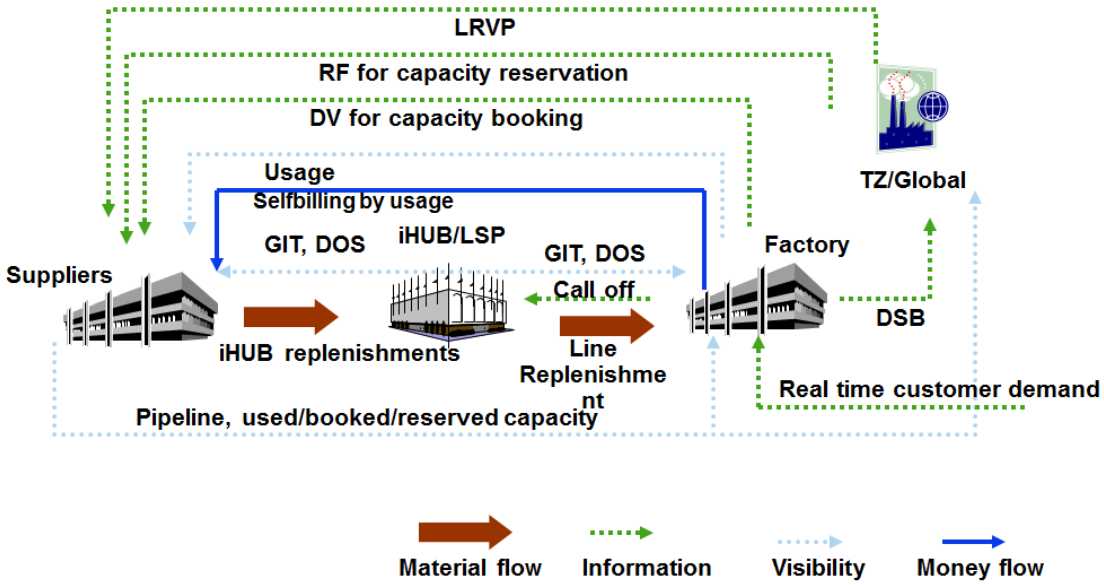
According to Chopra and Meindl (2000) VMI is a continuous replenishment program where the supplier is given the responsibility for all decisions regarding the replenishment of the customer's inventory. Also known as continuous replenishment or supplier-managed inventory, is one of the most widely discussed partnering initiatives for encouraging collaboration and information sharing among trading partners according to Angulo et al., (2004).

Kazim (2008) defines it as "*a supply chain initiative where the vendor decides on the appropriate inventory levels of each of the products and the appropriate inventory policies to maintain those levels. According to him, the retailer provides the vendor with access to its real-time inventory level. In this partnership program, the retailer may set certain service level and/or self-space requirements, which are then taken into consideration by the vendor*".

It brings a competitive advantage for manufacturers as it reduces the cost of inventory ownership and it should bring higher levels of product availability and for suppliers, it brings better utilization of manufacturing capacity as well as better synchronization of replenishment planning according to Waller et al., (1999)

The Company under study here has created a conceptual model to illustrate the implementation of the VMI concept, which can be found on following schema:

Figure 8 - iHUB (inbound hub) model - an applied VMI concept



Legend:

- LRVP – Long Range Volume Plan ;
- RF – Rolling forecast;
- DV – Demand Visibility;
- GIT – Goods In Transit;
- DOS - Days Of Supply;
- DSB - Demand Supply Balancing ;
- LSP – Logistics Service Provider
- iHUB- Inbound hub (bounded warehouse)
- LSP – Logistics Service Provider
- TZ – Time zone (regional organizations)

This business model has been applied with a relative successful rate since 2002 in most of the manufacturing network. There are adaptations according to legislation as in each country of operation the legal framework differs and thus requirements are also different.

From a systems point of view is proper to stated that this concept has been incorporated directly into the company's ERP and therefore providing a total visibility of inventories across all the manufacturing network, including both "company owned inventory" as well as "supplier owned inventory", which enables fast decision-making in balancing exercises.

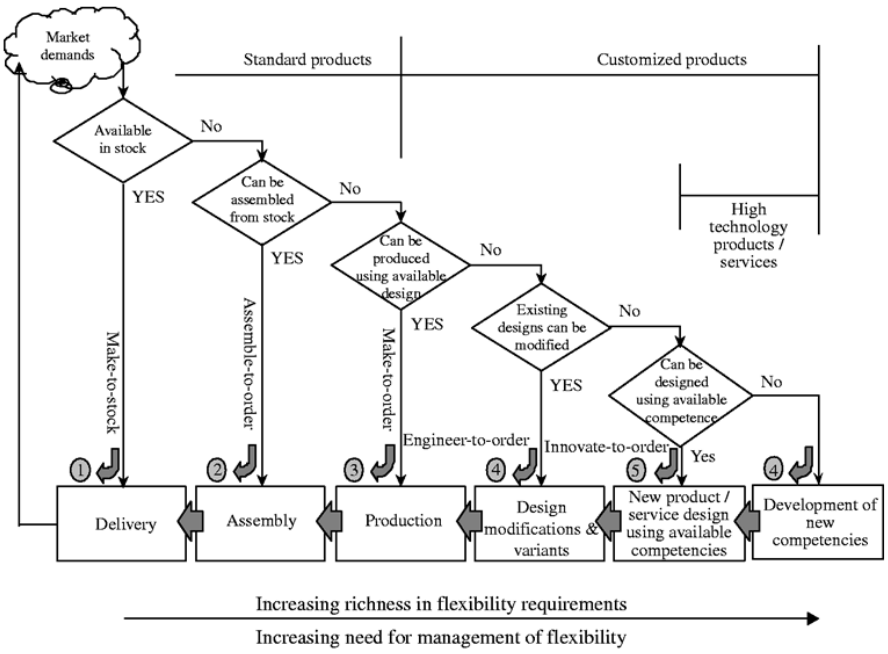
2.4) CUSTOMIZATION OR POSTPONEMENT STRATEGIES

As part of the strategies to tackle the uncertainty and to reduce costs in the supply chain management and also improve the demand planning process (as we discussed in item 2.2 often) nowadays companies adopt in their Manufacturing and Sales & Operation Planning models the concept of postponement.

Van Hoek (2001) defines postponement as: "*an organizational concept whereby some of the activities in the supply chain are not performed until customer orders are received. Companies can then finalize the output in accordance with customer preferences and even customize their products. Meanwhile, they can avoid building up inventories of finished goods in anticipation of future orders. Moreover, transportation between warehouses and factories can be avoided by shipping products directly to the customer rather than keeping them in stock"*

Wadhwa and Rao (2000) suggests that "*Postponement strategies can offer significant benefits if the knowledge of existing supply chain and manufacturing processes is used to innovate new integrated process redesigns"* figure 9 brings the concept in a visual form:

Figure 9 - Postponement Strategy Overview



Source : S. Wadhwa, K.S. Bhoon, F.T.S. Chan, (2006) "Postponement strategies through business process redesign in automotive manufacturing: Knowledge innovation", Industrial Management & Data Systems, Vol. 106 Iss: 3, pp.312

Hsuan Mikkola & SkjØtt-Larsen (2004) discuss that "t*he logic behind postponement is that risk and uncertainty costs are tied to the differentiation of goods (i.e. form, place and time) that occurs during manufacturing and logistics operations".*

Obviously the concept of postponement and customization in the case study hereof are tight together. On the mobile phones industry customization can occur in different ways, either by hardware or accessories differentiators (e.g.: different covers or decoration elements) or by components of customization done on the software (operator specific variants of software).

Hsuan Mikkola & SkjØtt-Larsen *(ibid)* offer an interesting example:

"An example of manufacturing postponement is the mobile phone industry, where the final assembly of mobile phones often is carried out by a third-party logistics (TPL) provider, who has an inventory of mobile phones, manuals, SIM cards and peripherals. When the TPL provider receives the specific customer order, the components are assembled and shipped directly to the customer within a narrow time window."

Obviously the concept of postponement and customization in the case study hereof are tight together. On the mobile phones industry customization can occur in different ways, either by hardware or accessories differentiators (e.g.: different covers or decoration elements) or by components of customization done on the software (operator specific variants of software).

As it is the key element of interaction with the user thus biggest source of experience for them, software customization is seen internally as a key strength and it is part of the cornerstone of the core strategy on customer offerings. The basis for the offering comes from the need that people have in consuming local content, being it language, applications, features, entertainment (music, video streaming, etc,)

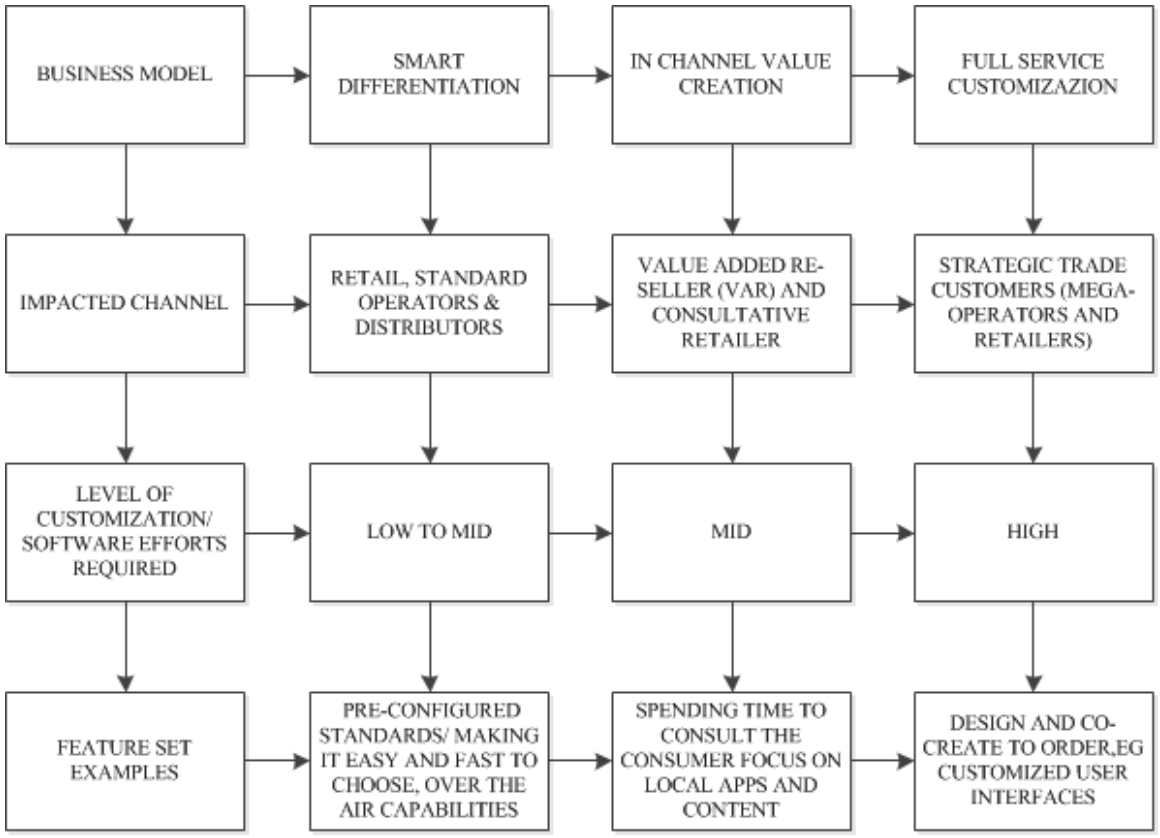
The strategy in this area is defined by four elements of customer "promise":

- **Co-create:** defined by both internal and customer teams doing co-development of customization
- **Channel differentiation**: three different levels of customization differentiation (see table 8)

- **Local relevancy:** content has to have local characteristics and features
- **Continuous engagement:** software is a living element, thus needs continuous improvement and support.

In order to be executable, the strategy has to be broken down into several layers according to table 8 below

Table 8 - Customization strategies overview



This customization aspect present challenges as it creates additional steps in the manufacturing process and increases the level of variable material as well (literature material and other customer specific items) but it is key in competing in this very challenging market environment.

2.5) ADAPTATION, COUPLING AND DECOUPLING ON SUPPLY CHAIN

The concepts of collaboration and synchronization could only function together to a certain degree provided that cycles of adaptation happen between the interactions.

As defined by Brennan and Turnbull (1999) Adaptation between Buyer-Seller are "*behavioral or structural modifications, at the individual group or corporate level, carried out by one organization which are initially designed to meet needs of one other organization"*

Still according to Brennan et al. (2003) is embedded in interactions between actors in business markets and they are linked to a relationship. In the context of supply chain, this adaptation is vital to provide the needed environment to cooperate in light of the concepts listed here previously work, so in other words, it's needed to cope with collaboration as the companies involved in the collaboration from time-to-time adjust their processes.

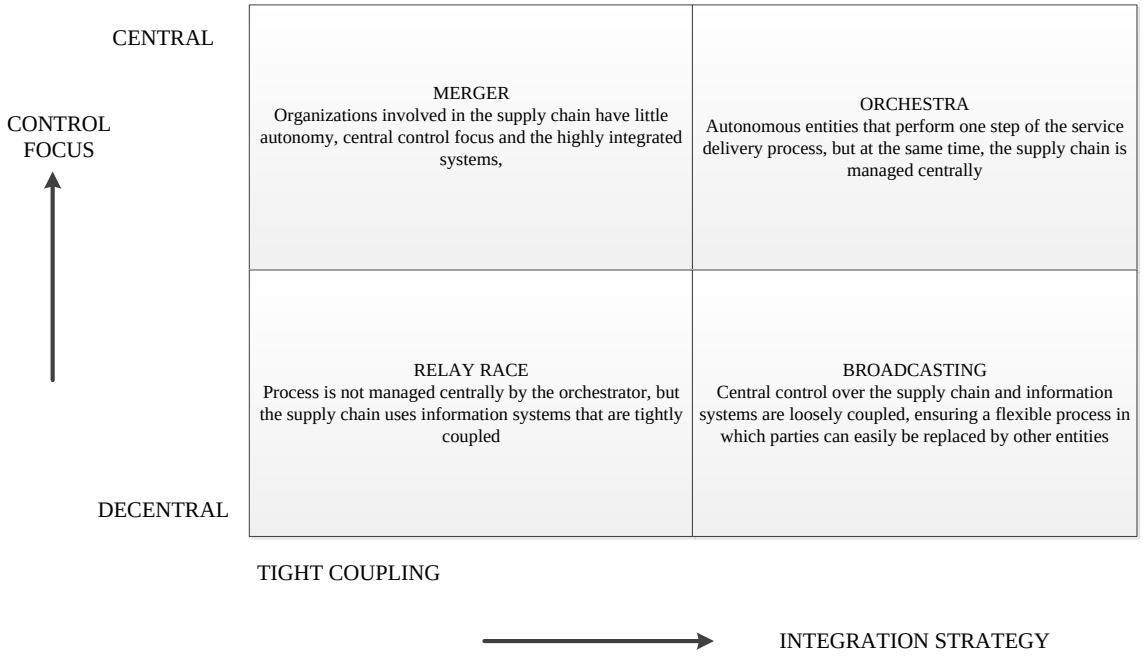
According to Menezes (2011) "*The process of receiving and providing value through interactions is space and time specific within a particular relationship through a continuing cycle of episodes and is likely to involve adaptation/adaptability aspects of the activities and resources of both actors and to the actors themselves*"

An important part of the adaptation processes is the concept of coupling and decoupling, which suggests that organizations can be coupled or decoupled according to the their level of interaction. As cited in Menezes *(ibid)* loose coupling *"is due to causal indeterminacy and fragmentation of both the external and internal environment. It combines concepts of connection and autonomy recurrent between organizations and their environments in a way that coupling at coupling is concerned with stability hindering the interaction with external forces, while looseness produces flexibility for opening these forces outside of it (Orton & Weick, 1990)"*

Loose coupling expresses the ability to handle flexibility and stability simultaneously but in different parts of the system (Christensen, 2008) As opposed to loose coupling, the tight coupling concept is characterized by strong dependencies between elements of a system (Perrow, 1984). Loose and tight coupling cannot be dissociated in a complex organization and are complementary dimensions in the process of organizational adaptation and learning (Lynn, 2005). The main idea behind the concepts is that by companies should be able to adjust the level of coupling according to the complexity and the need of the organization.

Fleur van Veenstra et al. (2009) proposes that the loose and tight coupling are related to supply chain strategy and make a parallel proposal that there are four levels of our integration on the supply chain, this model can be seen on table 9 below:

Table 9 - Loose vs. Tight coupling on strategic perspective



Source: Fleur van Veenstra, A, Janssen, M. and Klievink, B.(2009) Strategies for Orchestrating and Managing Supply Chains in Public Service Networks. Electronic Journal of e-Government Volume 7 Issue 4, pp427.

The metaphor with strategy and systems can be understood but on organizational level the issue becomes more complex to translate. Christensen (2008) discusses that today's organizations encounter a larger challenges as they not only have to respond with rapid changes on the surface (in their contact points with the environment), but the focal points in the organization have to be informed of the environmental changes so that more central changes to meet the challenge can be made in time, before the organization's image and messages become obsolete. As an example, certain organizational areas are more open to the shifts in the need to tighten or loosen the coupling, rather than others. Marketing department for example can be more open than Manufacturing to the need to adapt to changes.

Supply chain in itself has to be able to adapt and to respond the environmental challenges outlined by contingencies; otherwise, it will be part of the problem whereas it should be working to be part of the solution.

3) METHODOLOGY OF THE RESEARCH

3.1) CASE METHOD

The case study method was selected to conduct this research, thus making it a qualitative approach. The grounds for such selection are that the research is intended to be an interpretative approach of the studied phenomena. Baxter and Jack (2008) affirms that it facilitates the research that facilitates exploration of a phenomenon within its context using a variety of data sources and ensures that the issue is not explored through one lens, but rather a variety of lenses which allows for multiple facets of the phenomenon to be revealed and understood.

According to Yin (2003) the case method should be selected when:

(a) The focus of the study is to answer "how" and "why" questions;

(b) One cannot manipulate the behavior of those involved in the study;

(c) One wants to cover contextual conditions because of the belief that they are relevant to the phenomenon under study; or

(d) The boundaries are not clear between the phenomenon and context.

So if one refers to the research question once again it's clear that criteria (a) is fulfilled once we have a "How" question and contextual conditionals are completely relevant to the case study and the correlation with literature review.

3.2) SINGLE EXPLANATORY CASE

There are several approached considered in the literature for selection of case methodology and its selection is as important as deciding the method to take As the source of information in the case study is the observer itself, it's also appropriated to select what Yin (2003) defines as an exploratory case:

"This type of case study would be used if you were seeking to answer a question that sought to explain the presumed causal links in real-life interventions that are too complex for the survey or experimental strategies. In evaluation language, the explanations would link program implementation with program effects"

Tellis (1997) also mentions that there are six sources of evidence for data collection in the case study protocol and that not all need be used in every case study:

- Documentation;
- Archival records;
- Interviews;
- Direct observation;
- Participant observation;
- Physical artifacts;

We have used partially the non-structured interviews, direct observation and participant's observation as main sources of evidence in this case.

3.3) ASSESSING THE QUALITY OF INTERPRETIVE RESEARCH

Traditionally, knowledge has been produced from quantitative or qualitative approaches within the positivistic research tradition (Sandberg, 2005).

Observation is an important aspect of the method as Qualitative research is a situated activity that locates the observer in the world (Denzin & Lincoln, 2000).

According to Sandberg (2005) the advocates of interpretive approaches claim that those methodological procedures and claims for objective knowledge have significant theoretical limitations for advancing our understanding of human and organizational phenomena (Alvesson & Sköldberg, 1999; Denzin & Lincoln, 1994, Lincoln & Denzin, 2003; Prasad & Prasad, 2002; Sandberg, 2001).

Based on this, the idea of rejection that there is objective knowledge and that work should be positioned in the experienced world.

To approach the quality of interpretive approach, Hudson and Ozanne (1988) present two main criterions: natural settings and thick description. The natural setting proposes that the researcher must adapt to the environment of research to understand the cultural meanings

and processes that influence the causal events. Thick description refers to detailed description of the phenomenon, which is evaluated based on its comprehensiveness.

Table 10 - Positivist vs. Interpretative approach

Assumptions	Positivist	Interpretive
Ontological		
Nature of reality	Objective, tangible Single Fragmentable Divisible	Socially constructed Multiple Holistic Contextual
Nature of social beings	Deterministic Reactive	Voluntaristic Proactive
Axiological		
Overriding goal	"Explanation" via subsumption under general laws, prediction	"Understanding" based on Verstehen
Epistemological		
Knowledge generated	Nomothetic Time-free Context-independent	Idiographic Time-bound Context-dependent
View of causality	Real causes exist	Multiple, simultaneous shaping
Research relationship	Dualism, separation Privileged point of observation	Interactive, cooperative No privileged point of observation

Source: Hudson, L. A. and J. L. Ozanne (1988), "Alternative Ways of Seeking Knowledge in Consumer Research", The Journal of Consumer Research, Vol. 14 No. 3, pp. 509.

In this thesis the case study is reported in respect to the criterion of thick description but also in natural setting as the researcher has taken active role in adapting to the environment. Both procedural and situational aspects are attempted to be described in the report that had an influence on the decision-making, actions conducted and their results.

Baxter and Jack (2008) suggest that "*as data are collected and analyzed, researchers may also wish to integrate a process of member checking, where the researchers' interpretations of the data are shared with the participants, and the participants have the opportunity to discuss and clarify the interpretation, and contribute new or additional perspectives on the issue under study"*

So in concluding this chapter is proper to emphasize that the nature of this Thesis falls under the interpretative category as its ontological assumptions are contextual and holistic, its axiological assumptions are based on "understanding" (how) and its epistemological assumptions are from knowledge point of view context-dependent, from view of causality perspective multiple and from research relationship interactive.

4) CASE STUDY

4.1) CASE SELECTION

As the complexity in the mobile phones architecture continues to evolve in search of more features, hardware components and software become more and more dependent.In essence the subject of the study here is the disruption of the supply chain due to conflicts between component availability and the company's ability to fulfill the demand.

The scenario is complex but a rich subject of research and one which has many facets and lead to many investigation paths. In order to provide a better contextualization of the events, this case study will be divided into two phases which we will briefly explain here:

- **PHASE I – DEALING WITH IMMINENT SUPPLY DISRUPTION RISKS: ADAPTING THE SUPPLY CHAIN THROUGH TIGHT OR LOOSE COUPLING**

  A narrative of important and relevant events that took place in an effort to adapt the supply chain in order to meet customer expectations and maximize monetary loss due to supply disruption
- **PHASE II – IMPROVING SUPPLY CHAIN AGILITY IN PRODUCT MAINTENANCE, A BRIEF REPORT ON PROJECT SWITCH**

  Summarized report of the main findings of an internal Project conducted in the organization under this study, which was called Project Switch (Software Interdependent Component Changes). The narration of this element of the study is relevant as it brings substantial insights upon the subjects studied and also underlines avenues for further research opportunities.

4.2) CASE QUESTIONS AND OBJECTIVES

The case was conducted with following premises in mind:

How to adapt the demand supply network in order to utilize the resources available and maximize product availability in different channels of the mobile phones industry?

As a specific objective for this chapter, according to what was outlined under item 1.4) of the Introduction, its intent is to: c) Analyze the case study and find the correlations

between theory and the case aspects: provide the researchers view on the main aspects of the case that can be solved by applying the techniques presented in the literature review

4.3) CASE REPORT

BACKGROUND

The issue to be reported affect mainly the Mobile phones business unit (please refer to figure 2) and it's relationships to other vertical areas specially the so called Markets organization.

The case study took place under the leadership of the German PCC (Product Creation Center) unit, one the company's Research and Development (R&D) centers.

As a Mobile Phones site, the German PCC has the main proposition is develop products classified as Rich Feature Phones-RFP that aims to address mainly the developing BRIC[2] markets targeting the sub 100€ space, with offerings of products on following categories:

- **Smartphone[3]:** high-end mobile phone, combining features of a PDA and mobile phone, offering a wide range of services and applications as well as a superior hardware performance (higher memory capability for example);

- **Feature phone:** more sophisticated mobile phone with advance technologies (touchscreen functionality) and providing some degree of services and applications.

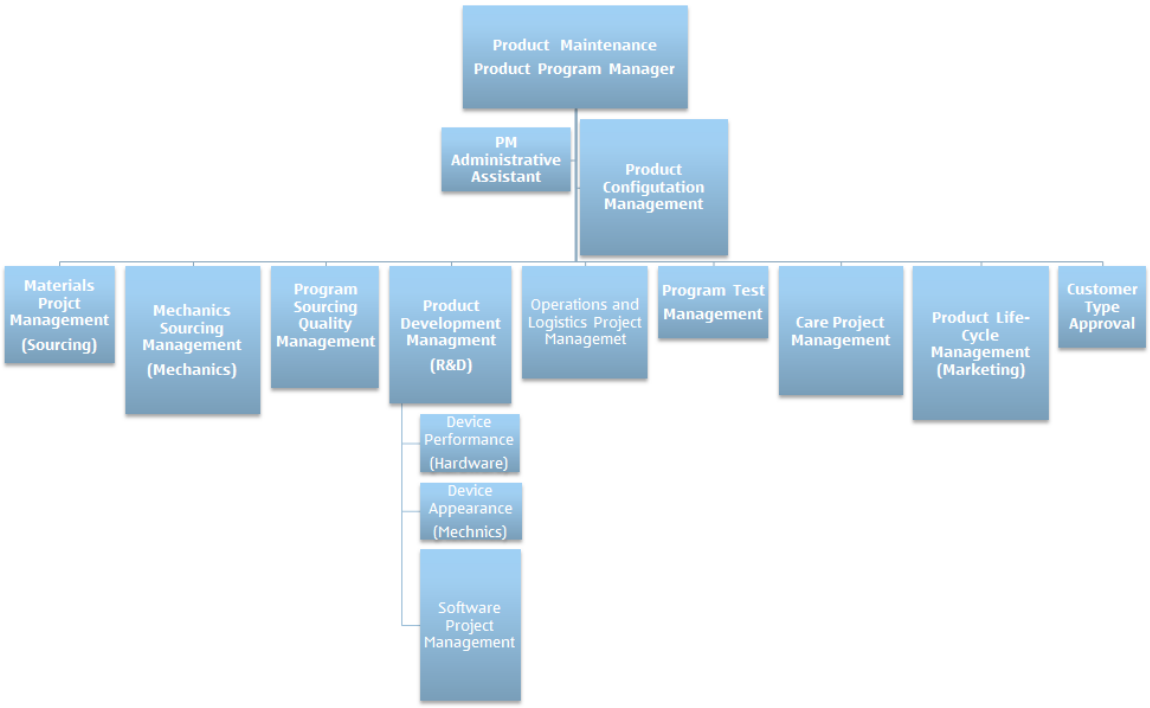
- **Entry:** basic segment that used to be characterized mainly by voice but that lately have also aggregated features such as camera, music players and data connectivity (Browser).

Using the approach of cross-functional teams, the main entity responsible for product development and the correlated activities in the Product Maintenance phase (as opposed to the others phases such as Product Concepting and Product Development phase) is the so

[2] The BRIC countries as Brazil, Russia, India and China are frequently referred (Biggemann & Fam, 2010)
[3] The term is used on the mobile phones context, so it's also proper to note that he company also has another business unit called "Smart Devices" which aims to address the high-end segment of Smartphones

called Product Program Team, commonly called internally only as “The Program”. See fig. 10 below for an example of Product Program Organization

Figure 10 - Product Program Organization Model



There are three main strategic intents that the area must fulfill according to its mission:

Keep the sales running

- Quick solving of product quality problems
- Product renewal/ refreshment (new applications, color updates, facelift, languages, new total product offering elements, etc.)

Keep the factories running

- Solving of process/ component/ product related problems in production
- Ensuring availability of components
- MFR (Manufacturing Failure Rate) improvement in factories

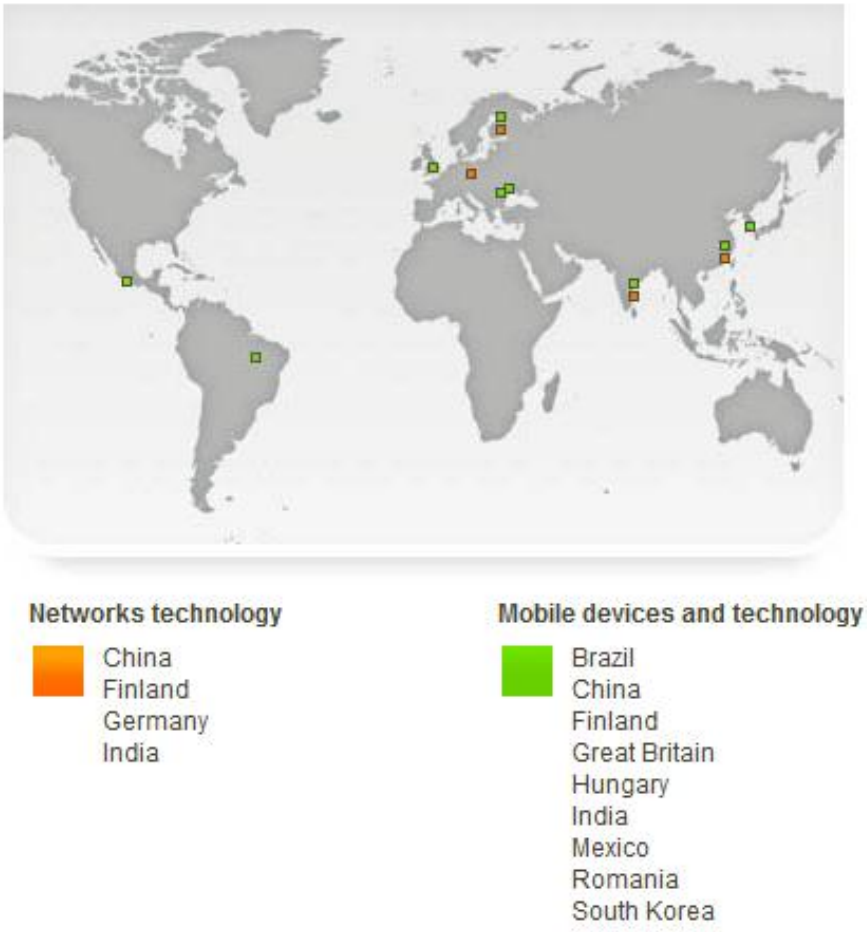
Keep the business case healthy

- Components (design) and manufacturing process cost reduction
- Minimizing of service and warranty costs by continuous quality improvement (BFR – Batch Failure Rate and FFR – Field Failure Rate)

So as part of the "keep the sales running" mission, is proper to state that this area administers and must react on all component-related shortages and insure that the flow of raw material from suppliers to all its manufacturing facilities is effective and has no disruptions.

Factory network of the so called mobile phones (Devices) operations are located in several factories across the globe, please see Figure 11 for an overview.

Figure 11 - Manufacturing Network



1

PHASE I – DEALING WITH IMMINENT DISRUPTION RISKS

On what concerns the supply base, even though it has a global footprint, it's proper to observe that an Asian concentration is very high, following the trend of the high technology industry. Several of its assembly houses are located in China and other "low-cost" countries in the region. On the other hand, Semiconductor operations and a lot of raw materials sourcing are coming from Japan and it's characterized by having extremely long lead-times which can take up to 18 weeks from ordering entry point to delivery of packaged component

The operation functions on the basis of CPFR which is applied in the full extent, so both in processes and relationship levels. The concept consists of a series of integrated processes recognized as worldwide benchmark in the industry. They go from a sophisticated extranet portal where partners can view each other's main relevant data for supply chain collaboration, such as inventory levels, demands, goods in transit etc. to a sophisticated management of physical goods using i-Hubs (inbound VMI warehousing hubs) which operates under automated self-billing process.

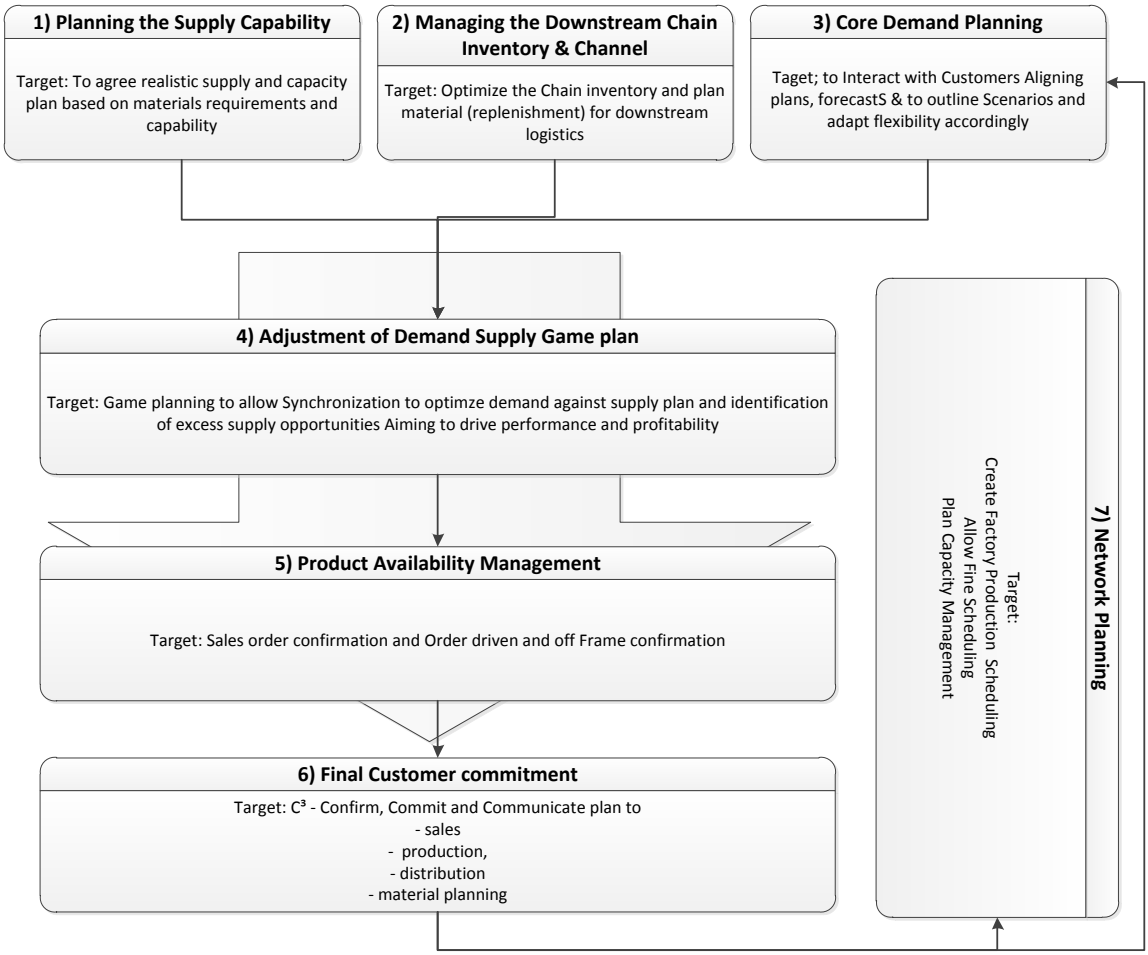
The iteration happens mainly in two cycles of synchronization: The so called short-term based, where the focus is on the current plus next 13 weeks of demand: and on the so called Mid-term phase which is the one covering from the 14^{th} week towards the next 12 months window of demand.

Apart from that, overall long term capacity planning is followed carefully by all relevant sourcing entities, which are than looking into sharing long-term forecasting trends, supplier portfolio and selection, pricing and other commercial and contractual aspects of the supplier relationship management

During one of the cycles of the Sales and Operation (S&OP as described in table 11) planning in spring of 2010, the management of the German PCC received an alert about a potential disruption on the supply chain which was bound to take place on the second half of 2010 and would severely impact sales over the next two quarters at least.

As the alert was received during the phase of planning the Supply Capability (table 11 - Item 1) the management still had the possibility of not adjusting the Demand Supply game plan (table 11 - Item 4) so that the opportunity could still be pursued.

Table 11 - Sales & Operations (S&OP) Planning process overview

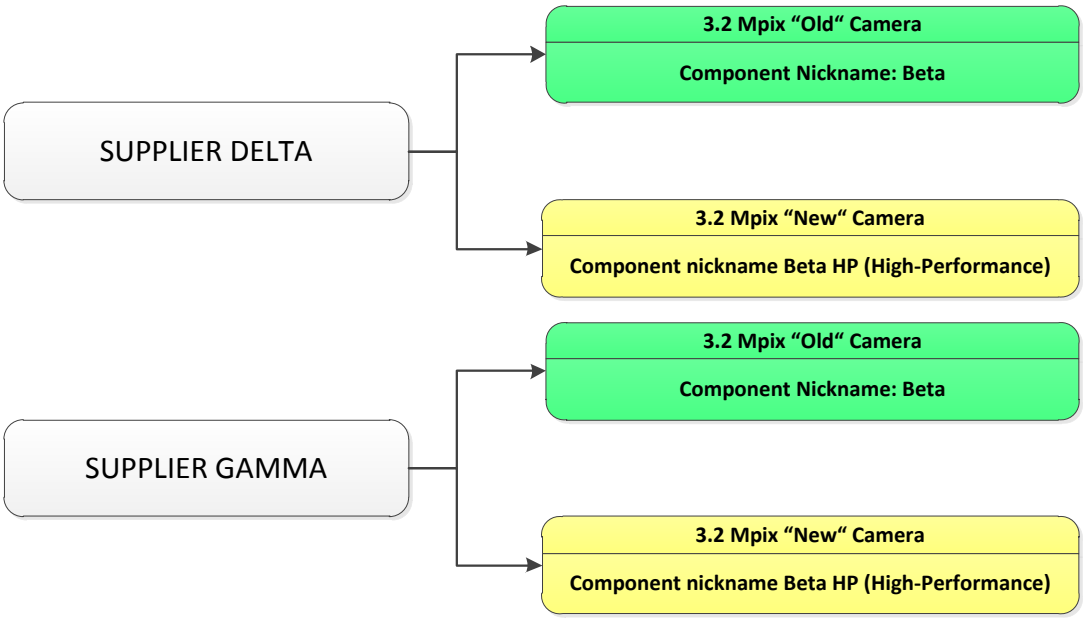


The warning came from the imaging components division under Global Sourcing advising that the supplier's response to the supply demand shared-plan for the 3.2 Mega-pixel camera modules was not meeting the demands. The modules had two different vendors that here will be called for effect of this case study: Supplier Delta and Supplier Gama. Table 12 brings an overview of how was the setup.

The Supplier setup has been the same for both modules and obviously the driver for having two different models was the ambition to achieve a better technological performance and with that obtain enough economy of scale to reach the desired and expected cost

reduction factor, which in this case was beneficial for both parties of the chain, making this a classical win-win situation.

Table 12 - Suppliers and variants of the camera module



The companies have being working together in adapting their portfolio and thus they had under the similar spectrum of specification two production technologies running in parallel which for effect of this study will be called simply as "Beta"(old) and "Beta HP"(new) Camera

The development of the camera module Beta HP has been introduced as cost challenger and thus there were some fundamental differences in the Silicon (semiconductor) which made the whole production substantially cheaper, which was regarded internally as the "next generation" of the component.

Table 13 - The main characteristics of each camera module

Supplier	Module	Capacity	Costs	Margins	Yields	Supplier Willingness to invest in capacity increase	Ability to meet specification and quality requirements
Gamma	Beta	Constrained	Higher	Lower	Lower	Low	Fair
Gamma	Beta HP	Available	Lower	Higher	Hiher	High	High
Delta	Beta	Constrained	Higher	Lower	Lower	Low	Fair
Delta	Beta HP	Available	Lower	Higher	Hiher	High	High

PORTFOLIO IMPACTS

In short one can describe that the company uses a modular approach to the construction of product structures, meaning, one module (for example) a camera component can be shared across multiple products and this was exactly what happened in the case.

Once the management received the alert from global sourcing organization the first concern was to verify in which products was the camera Beta used. It has been identified that 3 products used the mentioned module which here we will call under this study here Products Alpha, Delta and Kappa.

These 3 products were responsible for more than 80% of second half forecasted sales for the Business unit (German PCC), which raised this topic to the highest priority within the Department.

It had become pretty obvious that the case impact would be extraordinarily big and would require a massive team effort to tackle the problems and necessary actions to be taken in order to overcome the situation. In order to bring it to the context in this case, we adapted the internal figures released during the case which can be seen on following table:

Table 14 – Financial impact - Potential loss of sales risk

Product	Volumes (2H) 2010	Constrained volume *	Potential P&L Impact MEUR**
Alpha	2,900,000	870,000	44
Delta	1,000,000	300,000	15
Kappa	1,000,000	300,000	15
Total	4,900,000	1,470,000	74

* Constrained due to material shortage risks
** 50€ Average sales price per mobile phone unit was considered as a calculation example

Needless to say that the conclusion was that urgent action was required. A cross-functional crisis team was quickly assembled and designated members of the task-force immediately commenced investigations of counterfeiting actions needed to overcome such severe business impact risk. The cross functional team had one single mission: to minimize the business impact.

The team was formed by several areas: Sourcing, Product Marketing, R&D (Hardware, Mechanics and Software), Product Validation and Operations (DSNM) among others. The idea was that this task-force team would have overall responsibility and would have autonomy to supersede the normal SOP (standard operating procedures) in order to solve the case, in other words, the team would be empowered to solve the problem.

Once the team got together it concluded that there was one way out: using the new version of the camera, namely the Beta HP version as there was excessive capacity on this module please refer to Table 13 for the characteristics. A check list was made and all the areas had the opportunity to check with their specialists and identify bottlenecks.

After this action took place, a compilation of these requirements led to two streams of investigations on a macro level:

- **Hardware**: verification stream responsible for checking all the hardware requirements, such as component assembly compatibility (footprint, dimensions, specifications) as well as all the R&D verification requirements (sample testing, trial runs, MFR – Manufacturing Failure Rates check and others). Also all regulatory aspects needed to be validate (product type approval and regulatory certification) ;

- **Software**: Stream that should look into difference between the components and understand from the lower layers of software development if driver software was compatible and if not, there was also an extra step needed which was to verify if the support for the camera would be included in a future release and so when it would be available in the roadmap: This was proven to be the biggest challenge

UNDERSTANDING HARDWARE SOFTWARE INTERDEPENDENCIES

Once the status of the hardware investigation was consolidated it was proven that hardware would not be a bottle neck as components were developed in time and samples have been made available for the needed verifications on product integration level.

Also it was identified that requirements were in place in the planning of software release, so availability of software drivers was not a problem. The problem was that the software version which supported the mentioned component was only planned in future releases

Table 15 – Overview of Software vs. Hardware Interdependencies

Product	Software version	Release	Hardware supported	Market Status	Next planned SW release	Release	Hardware supported
Alpha	SW Version PR1	06.50	Gamma	100% in all SU's	PR2	07.10	Gamma HP
Delta	SW Version PR2	07.94	Gamma	100% in all SU's	PR3	09.10	Gamma HP
Kappa	SW Version PR1	06.80	Gamma	100% in all SU's	PR2	07.10	Gamma HP

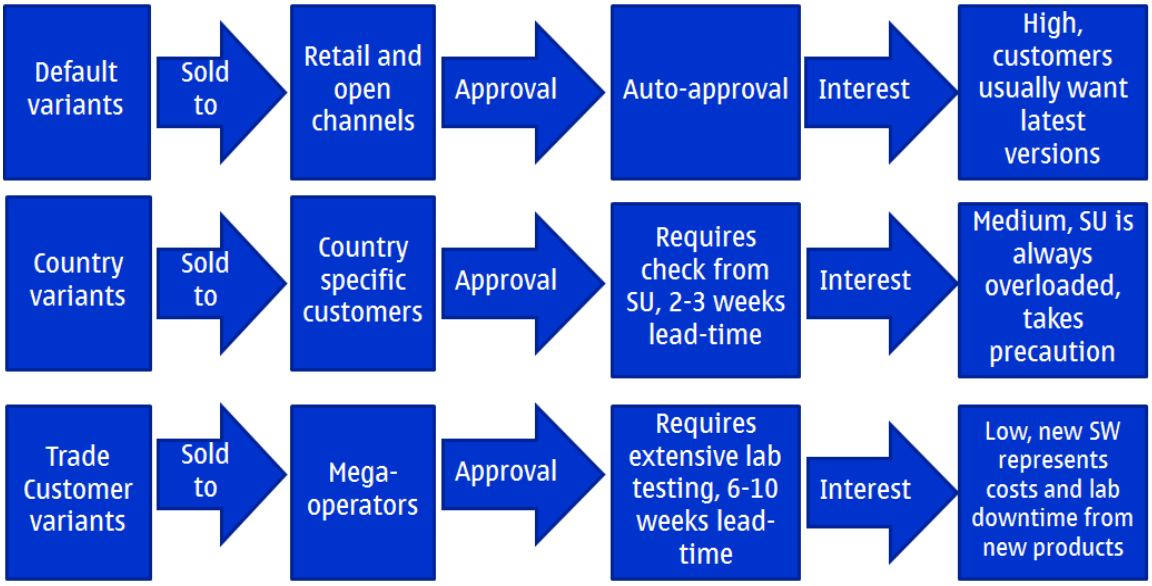
However, having stated that, the team was confronted with a big question mark, how to launch and get software approval from the sales units and customers quickly enough to allow the needed turnaround to avoid the loss of sales?

Traditionally the process of releasing Software was slow and demanded a lot of effort from the Programs to be deployed as it was very fragmented and there was not much focus on getting newer software versions approved.

There was also the communication layers involved in the process and this has proven to be a very time-consuming and ineffective activity. The layers of approval can be broken down into 3 main sections: Default variants; Country Variants and Customer Variants

The essential difference between these three variants and the business aspects embedded in each type of variant can be seen on figure 12

Figure 12 - Software approval challenges on variant level



As customization in the mobile phones industry is a quite intensive process and the need to fulfill customer requirements in that area is crucial, the team has realized that the focus should really be in so called “Trade Customer variants”.

Previous experience showed that customers are not willing to engage quickly on releases of new software due to several reasons such as:

- **Value Creation:** Approval of software doesn’t bring any “major” value to customers: This is intriguing statement and very intensively discussed in the task force. What this means is that actually apart from a more reliable and perhaps some improved features and quality, there is no real perceived value from trade customers (Operators)
- **Costs**: There is a cost associated to approving a new software: Lab time costs money and resources and it is also constrained by new product introduction

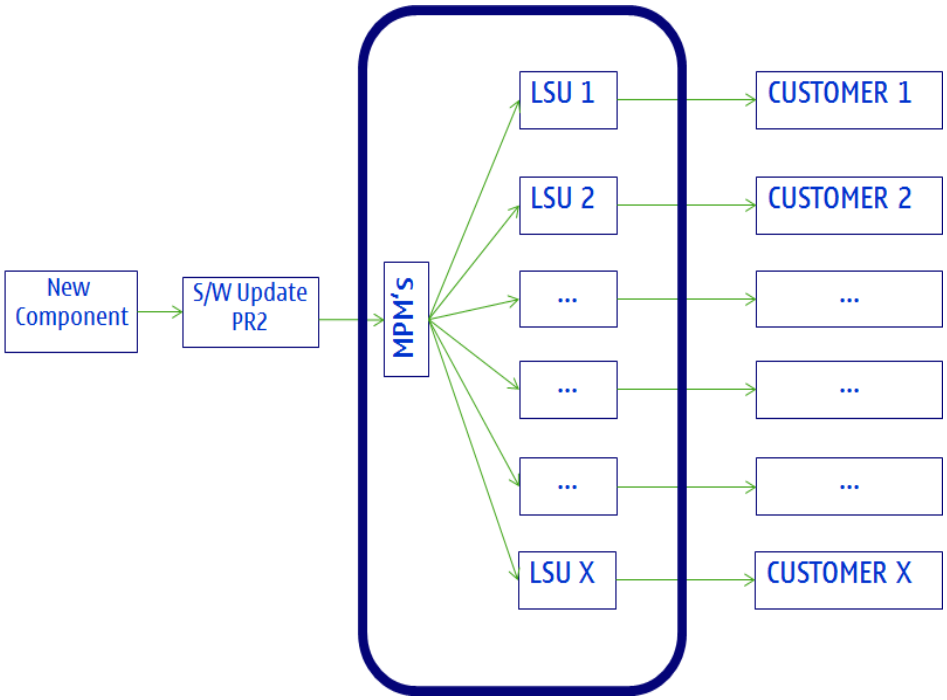
requirements and operators will rather give their testing slots out to test a new model rather than an “old model” which is already being sold in the market

- **Incentive/Benefit**: There is no incentive scheme to award operators with a rebate or with any kind of price discounts in case they approve new Software.

Seen from a commercial perspective it was definitely an area where we there was lot of improvement needed.

Another challenge that was also identified was actually that the so called Markets Product Managers (MPM) had a very fluid way of working, so there also a lack of communication between them and the Local Sales Units (LSU), see Figure 13.

Figure 13 - The communication flow problem



Main issue occurring was in the network communication, so information flow was proven to have flaws and it was identified that there was an issue with systematic IT tools used in the process.

There was a myriad of tools in use, but their architecture was so that the link was missing and each one had a different purposed.

So the task force team was confronted with basic question, how to adapt the supply chain situation to these circumstances?

TOWARDS ADAPTING THE SUPPLY CHAIN

One of the counter-measures identified sounded feasible but would require a degree of adaptability which was not used in the past and of course was not risk free.

According to Agarwal et al. (2007), one of the characteristics of the truly agile supply chain is a component of high degree of Process integration or process interconnectivity between the network members. Once the process integration didn't work properly an intervention was required to overcome the synchronization aspect.

It was obvious that the problem required a break-down into smaller buckets and the next natural step was to look into the downstream chain of the logistics or in other words, how the sales would happen under these circumstances of clear rupture of the established CPFR model

After several discussions conducted with the main stakeholders, it was possible to establish a prioritization grid for determining which sales units could eventually approve the new software faster, enabling the suppliers Delta and Gamma to balance their shipments demanded for camera Beta and Beta HP and minimize the gap. Table 16 brings an example of how estimations were done.

Once the prioritization grid was completed it would enable a possibility of looking into a partial implementation based on variant level data. This meant we looked into each variant (sales packages) from each of the factories and manually compiled them and analyzed one-by-one.

Just the process of collection of the necessary data was already one very time-consuming exercise. As the network of factories producing the products Alpha, Delta and Kappa was enough to generate several thousand lines of data that needed to be combined together. Systems were not setup to handle such cases thus all the data analysis had to be done manually

Once analysis was completed one could compile a list of approved "variants" in the system and estimate how much of the total supply could be direct to those which have approved the higher software version, which gave full flexibility.

Table 16 - Volume estimation based on approval expectation from Sales Unit

Plan Identifier:	20100917C			
Plan	CONFIRMED SALES PLAN			
Item Category	PACKING			

Sales Cluster	Descripton	2010 - Nov	2010 - Dec	2011 - Jan
Eurasia	Alpha	71,244	51,379	41,363
	Delta	226,070	204,510	90,000
	Kappa	111,416	78,552	56,009
Eurasia Total		408,730	334,441	187,372
Esimated SW Approval rate in Q4	95%	388,294	317,719	178,003
Greater China, Japan and Korea	Alpha	159,448	158,675	201,000
	Delta	23,808	37,338	31,000
	Kappa	138,654	158,177	280,422
Greater China, Japan and Korea Total		321,910	354,190	512,422
Esimated SW Approval rate in Q4	80%	257,528	283,352	409,938
Middle East and Africa	Alpha	132,512	132,655	138,300
	Delta	150,112	141,199	118,180
	Kappa	145,143	134,706	84,280
Middle East and Africa Total		427,767	408,560	340,760
Esimated SW Approval rate in Q4	95%	406,379	388,132	323,722
South East Asia Pacific	Alpha	34,331	33,072	23,649
	Delta	21,097	19,946	17,250
	Kappa	39,632	30,276	36,480
South East Asia Pacific Total		95,060	83,294	77,879
Esimated SW Approval rate in Q4	80%	76,048	66,635	62,303

Sub-total estimated by Sales Unit	1,128,248	1,055,838	973,966
Program's "confidence" factor	50%	80%	100%
Total esimated volume to use Beta HP	564,124.08	844,670.52	973,966.20

Risk order quantity (Nov, Dec/2010 + Jan/11 Volumes)		2,382,760.80
Beta HP Gamma price		USD 3.00
Exchange rate		1 EUR = 1.2675
Price in EUR	€	2.37
Risk order value in KEUR	€	5,639.67

Under the CPFR framework that the company operates the IT systems could not be configured accordingly as the MRP system could not be changed since the components was not 100% approved, this would also bring legal implications with all regulatory agencies.

So the solution found was to go for a instrumental change of process, which we will refer to as the "risk ordering process". Under this concept, the Program would initiate a

special internal order, which due to the high monetary value according to the SOP would have to be approved by an EVP (Executive Vice-President) level, the first level of management, reporting immediately to the Company CEO.

Once the approval was obtained, the Global purchasing organization could initiate a "Hard Purchase Order – PO" and submit that to the suppliers for starting material preparation.

With this part covered in the process the next step was to continue to work with factories from network in order to implement the new component into production. With this solution in place there was no disruption on the supply chain and the lost sales avoidance was significant, see table 14.

In the end of the day the conclusion from the management team was that problem has been partially solved by supply chain adaptation and loosening of the coupling between the elements of the system with a high level of risk of obsolescence stock and potential high loss in sales, but at that point it became clear for the management that we had a much more serious process issue that had to be addressed: the seed for Project Switch was planted.

PHASE II – IMPROVING SUPPLY CHAIN AGILITY IN PRODUCT MAINTENANCE, A BRIEF REPORT ON PROJECT SWITCH

ORGANIZING A STRUCTURED APPROACH

At the point in time where some of the short-term issues have been solved, it became obvious to the ones involved in the effort to safeguard sales that a severe process issue had been identified. Even though there were many aspects to be look into management decided that the project aim was to be a rather small team looking into aspects that could be realistic to improve in short-term.

Traditionally projects which involve huge undertakings and very ambitious goals in the company environment, specially affecting IT systems trend to take a long execution time and often are held back due to resources and budget constrain issues. This is the grounds for selecting a more straight-forward approach with a rather small but focused cross functional project team.

Also the multi-disciplinary aspect of the issue required also involvement of other business units which were outside of the R&D scope, so the team would also need a solid support from senior management level to obtain the needed accreditation to negotiate resources from other relevant areas to be committed to join the initiative.

In parallel to that, as in every big organization with several operating units, there is always a myriad of internal projects ongoing, so there was the concern that the Project team would have also to have a permanent representation from the area called Sourcing Operational Development, so in other words an area that works mainly with processes and improvement projects that are affecting the way the company operates and does business.

The so called Product Management area was also at the core of the issues which was supposed to be addressed by the project team as it concerns the way R&D interacts with other

main functional areas which are focused on customer relationship such as sales units, variant creation teams and other relevant interfaces to the trade customers.

Regardless of the importance and involvement area, naturally the Business unit Sourcing or so called Program Sourcing organization had always been seating at the driver seat of the issue and thus naturally was the area that had the biggest interest for the project to take place, for two main reasons: First in order to assure that the material availability, meaning that there was not going to be components missing at the end of the day due to lack of software approval; Secondly to make sure that we could benefit from cost reduction components by enabling that they get implemented in the future and are not held back due to software dependencies. So it was defined that the Project Manager of the initiative had to come from this area.

Also another important aspect that needs to be understood and mentioned in this case report is that the internal organizational structure and operating environment are already complex in due to a variety of reasons which we will briefly outline:

- **Very organic and matrix organizational structure**: One too many units and multiple layers and overlapping responsibilities between areas with different focus and different management and motivations;
- **Misalignment of internal shared and interlocked goals:** incentives are given on unit area and lacking a holistic view, so people are driven to their own goals, making cooperation to work on a common agenda a difficult task;
- **Change fatigue:** several recent (and constant re-organizations) have led to an internal working environment that people were suffering from tiredness about changes, making difficult for a new effort which was planning to bring change to be introduced
- **Lack of ownership and accountability:** Due to the constant change a corporate culture that has been often times too lenient towards failure and low performance, an establishment of a “relaxed” culture has dominated several organizations and the procrastination and delegation culture have taken place
- **General demotivation with the company’s performance**: In recent past the company has lost severely market share and competitiveness and this often times caused frustration, demotivation and general anxiety about the future

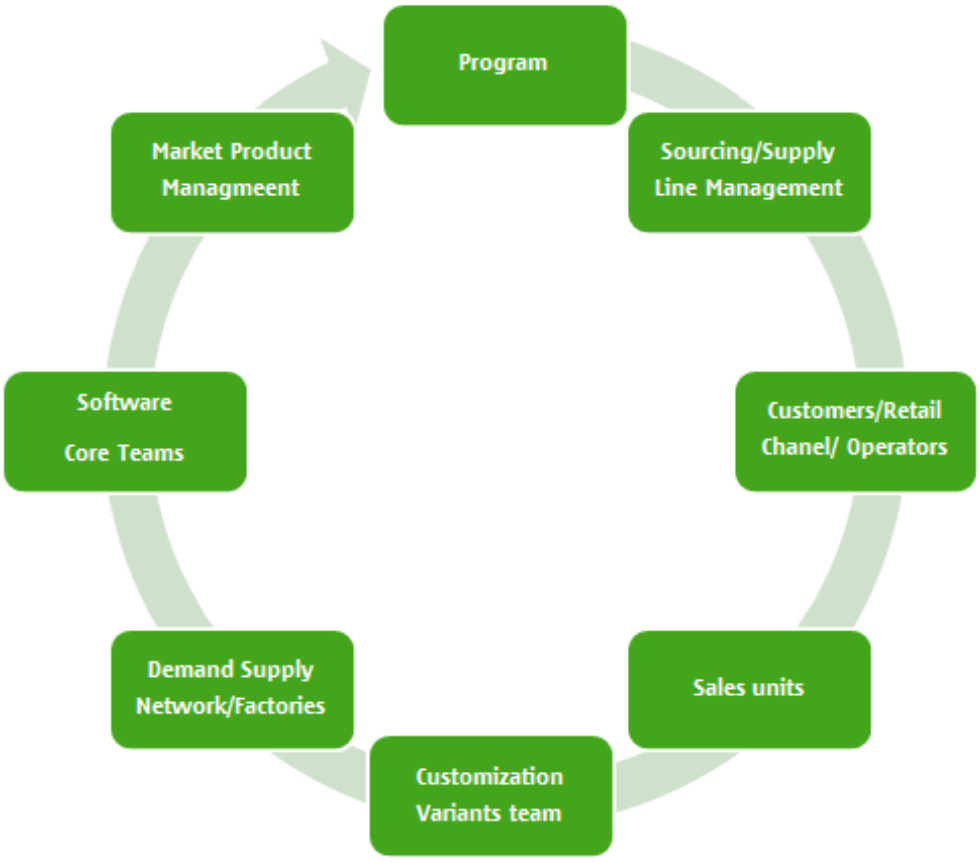
steps which aligned with announcements of re-structuring and layoffs have made the whole scenario to engage people a challenging effort.

So in order to cope with all the challenges the need to staff the team correctly was essential for the project's success.

Also as the scope of the project, which we will detail in the next section was under definition, the assembly of a team that could wide enough to cover all the aspects of the project was seen as crucial.

After several iteration rounds to design the best and most objective team, the proposal for the steering group of project switch was comprehended of the areas listed below in fig.14:

Figure 14 - Areas impacted by Project Switch



DEFINING THE SCOPE, AN IMPORTANT AND CHALLENGING STEP

As happens in every project definition work, the scope is usually a very sensitive area and one which requires the project manager and all members to think very thoroughly what is really the essence of the definition of the project scope. In case of Project switch it was not different, however, as the project involved a complex issue which had several ramifications inside an already complex organizational structure, defining the right scope was seen as crucial step to engage people on the effort.

Simplicity was also internally seen as a key factor when it comes to define project scopes and working definitions, in other words, been able to declare on a simple way what is the project challenges and goals in order to allow people to understand by taking one glimpse at the description is essential to draw attention to it.

After several sessions and reviews with the core project team, the vision was summarized as described here:

- **Challenge:** To implement in production components that are dependent on latest software versions (Poor visibility, customer approval information and link to variant creation process)
- **Project main goal:** To get End-to-End (E2E) visibility on maintenance software releases approval process and translate into enabler for faster **SWITCHES** to newer, better and cheaper components.

One of the findings of the project team when defining scope is that it is equally important to declare also what is NOT the project intention, in other words a statement about what are the things that the project will not tackle at all. This is important to simplify and to send people the right message about what is intended to be discussed and addressed by the project, it becomes an important element in the process of "selling" the idea about the project internally and highlighting the attention to the right issues.

So the project declaration on what are the Do's and Don'ts which brings the limitation of the scope is listed herewith:

The project scope DO'S:

- Maintenance Software releases
- Hardware (Component) support on each software release
- Approval of the Software releases
- Link between software approval and supply planning
- Find quick win's and fixes, being that only a simply database or an MS excel macro that enables programs to plan better the component changes based on software approval status
- Look into Roles & Responsibilities and if possible redefining who does what in order to reach a more clear accountability.
- Seek training opportunities for existing tools and IT system landscape
- Make a quick implementation and create a network of people interested in cooperate to improve this situation

The Project scope DON'TS

- Discuss why software releases are always late in their schedule, so discussions that concerned the core of software coding process and could not be changed at all was seen as worthless.
- Working directly with customers: Avoid bringing the message to the outside audience that we cannot coordinate our efforts correctly.
- Creating requirements for IT to develop a solution that might be optimal, but it might require 3-5 years to be implemented and consume millions of Euros in IT investment

After the definition of the scope, the next step would be to work on developing the project schedule and setting up internal sessions to officially kick-off the project and obtain managerial approval from the so called project Steering Group, which was made of a group of selection senior level managers with autonomy to approve budgetary requirements for conducting the project as well as give guidance towards procedural aspects of implementing the improvements that could be proposed by the project team.

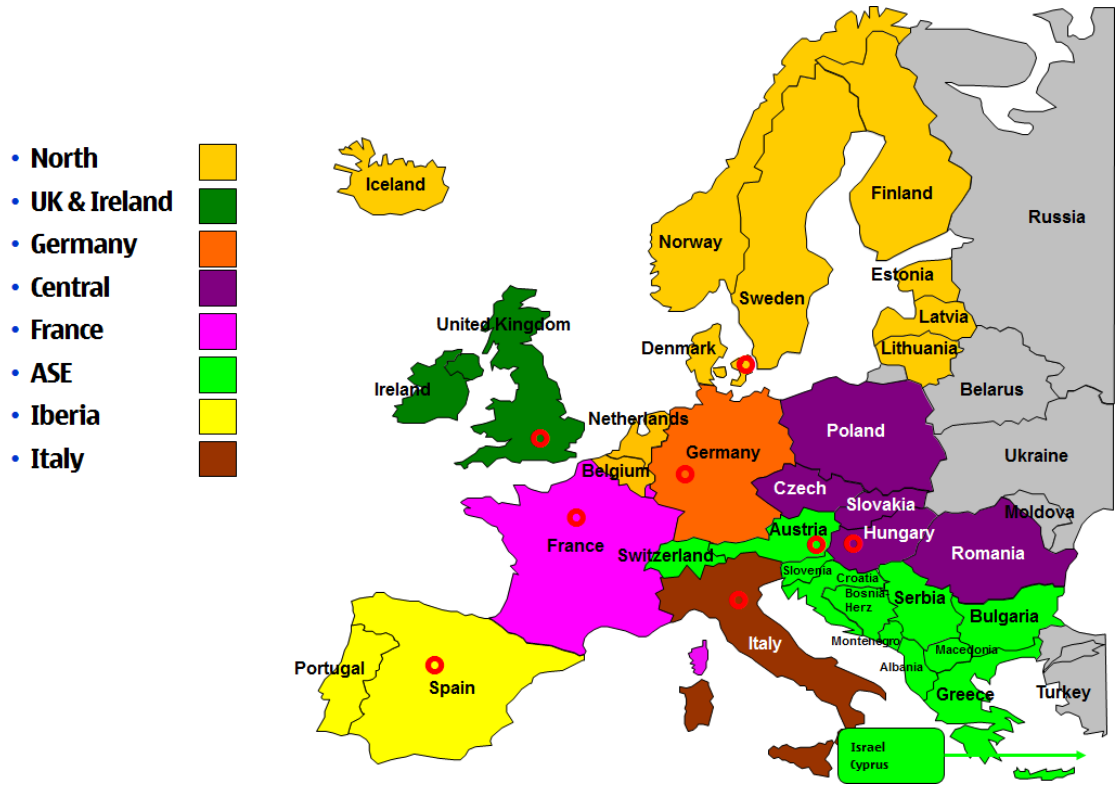
TOWARDS IMPROVEMENTS: INSIGHTS FROM WORKSHOPS & CONFERENCES

It has been made clear to the Steering group that the only way such an effort could work would be if the project team would be able to meet face-to-face on difference instances. Obviously judging by the size of the organization and its geographical footprint, this undertakes relative efforts in coordinating workshops and conferences to gather all the members of the team together to debate the key topics.

For starters the virtual collaboration plays a key role in the organization of these events, so through a series of on-line meetings and video conferences the team has gathered and discussed on how to move forward with preparing a common agenda.

The first face-to-face workshop took place in Europe where parties meet to discuss the challenges seeing through the lens of sales interfaces. So the discussion was basically to understand how the Trade Customer software approval process in specifically European sales units took place. Fig.15 brings and overview of what was the scope of European Sales Unit:

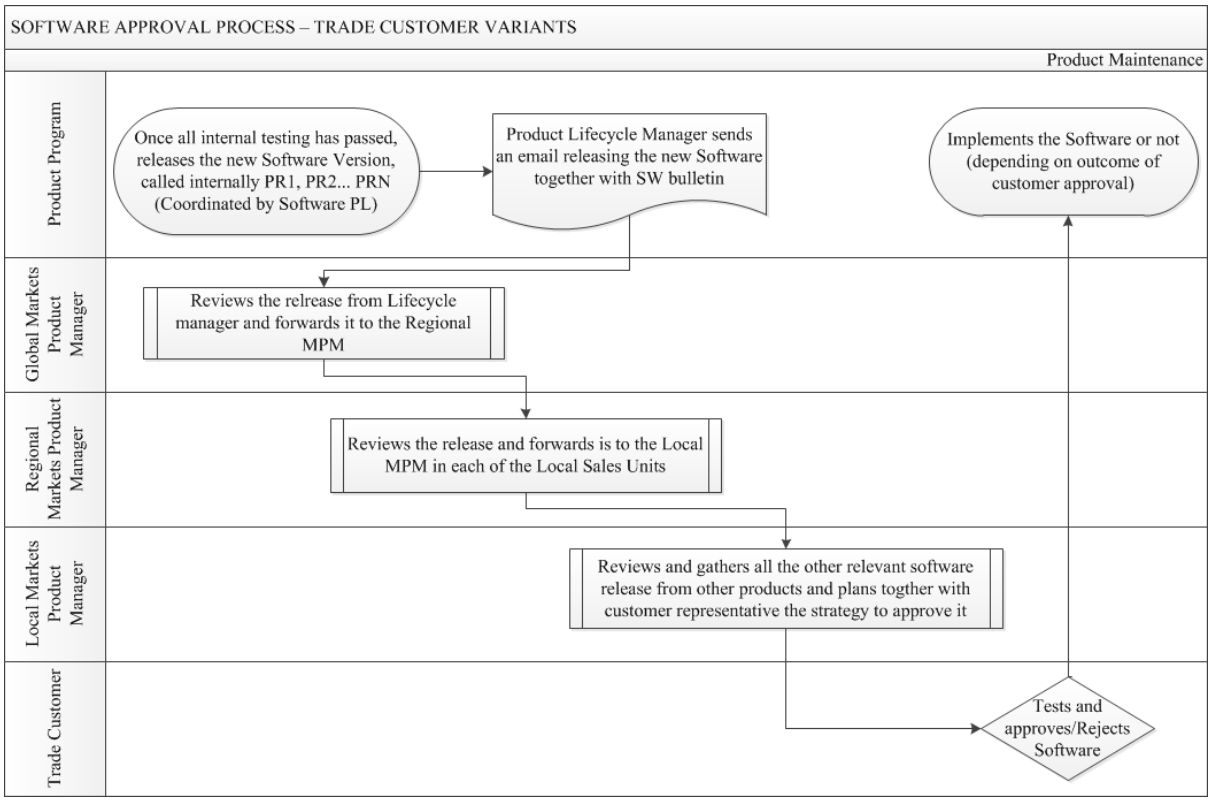
Figure 15 - Europe SU: 41 countries, 8 LSUs



Simply by looking at the geographical pictures, several insights have surfaces specially concerning the challenge inherent to the simple follow-up and communication of the software releases of several products across only this one sales unit, it was definitely a huge undertaken that the team was confronted.

As next outcome of this workshop, better clarity arose for the so called Trade customer approval process, which was the bottleneck of the operation. On table 17 we can find a chart describing the findings discussed during this workshop

Table 17 - Trade customer SW approval process overview



This process is supported by several tools, however none of them is centralized and carries all the information that is necessary to enable program to understand status of the variant.

After analyzing the process above it is clear that the fragmentation of the communication process is bound to fail. Too many parties are involved and the

decentralization makes it simply too complex to manage. It can work when there is no need to speed it up or no other contingency foreseen in any of the value chain steps.

The second major face-to-face activity on the agenda of Project Switch team was a group cross-functional conference held in Beijing, People's Republic of China. The event was organized in a two-day session with a much more wider scope so this time including participation from representatives of several business units, including delegates from the factory network, variants teams and Asian local product managers from the China and other representative Sales unit.

The agenda of the first day was targeted at building the background and to align the understanding of all participants on the project and also as information and process sharing day. Basically all relevant areas have made detailed presentations on the processes being reviewed by the project team. Very interesting facts have been verified and shared across the team and compiled on the second day, as this was reserved for group work activities.

The teams have been split into smaller groups and given specific topics to analyze and propose actions and changes in the process. The major findings from the event are summarized into two main areas described here:

- The need to create a detailed mapping of the communication chain involved in the Software approval process, which was an action assigned to the Product Management group. The action is still ongoing as the current organization is undergoing a re-organization process. This would enable the creation of a map of accountable individuals and functions and the two main activities would be try to simplify the process and to create also a workflow tool that would enable on-line view of approvals.
- The other very important finding from the project was a discovery that one of the factories has a local data base, developed by their resources which congregates partially the solution which is needed for the

Project Switch is still running on the organization and the actions listed above are ongoing, thus we cannot conclude further than saying they shall definitely lead to the right path and bring some improvements to the process.

5) CONCLUSIONS AND DISCUSSIONS

5.1) DISCUSSIONS

This study proposes to evaluate the supply chain adaptation in order to ensure that the supply chain will it be agile enough to meet the customers' expectations and to add value to the network.

The primary objective was to understand the characteristics that model a world-class supply chain and to review the literature available to outline the main theoretical framework and fundamental aspects and to build a consistent framework that would enable to analyze the case study based on all the theory on the area.

i) WORLD CLASS SUPPLY CHAIN FRAMEWORK UNDERPINNINGS AND CORRELATIONS BETWEEN AGILITY, SYNCHRONIZATION, COLLABORATION AND CUSTOMIZATION AND THE BUSINESS MODEL ANALYZED:

Throughout the literature review the intent of providing elements to create the background and build a conceptual model which allow understanding of what are the best practices that make a company world-class supply chain were embedded. By looking at the concepts of agility once can perceive that a winning supply chain must be flexible and provide a quick response to changes and other restricted imposed by the environment. Those characteristics were the cornerstones that lead the solution of problem under the case.

On the other hand it was also important to build the understanding of the researcher to analyze what are the key elements under a synchronized supply chain such as the characteristics of the innovative demand and its high level of uncertainty and the evolving supply and also to understand and co-relate the levels of collaboration, meaning either planning or inventory collaboration. Those concepts were instrumental in understanding the inherent aspects of the case on what concerned the Phase I where there was a need to analyze the company's way of working and its main collaboration frontiers to understand how to intervene and mitigate the disruption risks.

As customization plays a big role especially towards mobile consumers and it is intimately interconnected with software development and what brings value to the consumer, it was needed to understand it and specially how it would impact further on the hardware vs. software dependencies.

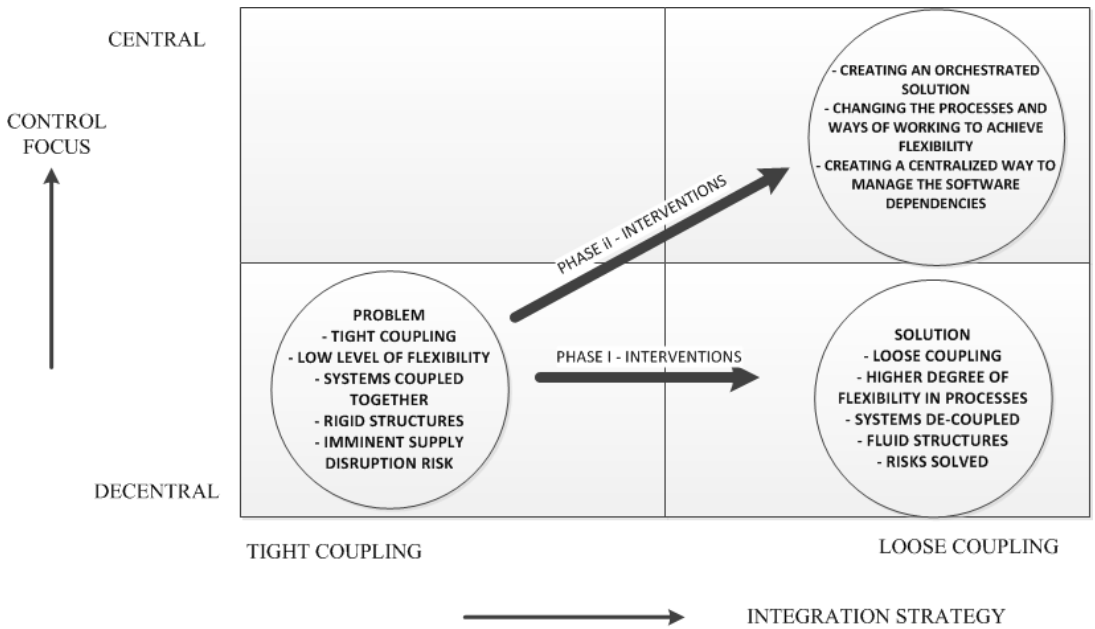
ii) **ADAPTATION LOOSE AND TIGHT COUPLING AS KEY STRATEGY TO CHANGE AND MITIGATE RISKS ON SUPPLY CHAIN MANAGEMENT**

The concepts of adaptation and how it affects interactions and it is embedded in relationships between actors in business markets explains how certain parts of the organization need to be adapted in order to continue function. Allied to the idea of tight and loose coupling and the characteristics of handling flexibility and stability inside organizations helped to paint he background to allow better understanding of the interventions taken by the management to solve the case and reach a favorable scenario.

The understanding that supply chain managers can influence their systems through adaptation is clear when we verify that loose coupling combines concepts of connection and autonomy recurrent between organizations and their environments in a way that coupling at coupling is concerned with stability hindering the interaction with external forces, while looseness produces flexibility for opening these forces outside of it.

By changing the internal procedures a movement from a tight coupling towards a loose coupling can be evidenced by the way the data under the case was managed in each phase as we can see in table 18.

Table 18 - Links between case and theory



iii) "HOW TO ADAPT THE DEMAND SUPPLY NETWORK IN ORDER TO UTILIZE THE RESOURCES AVAILABLE AND MAXIMIZE PRODUCT AVAILABILITY IN DIFFERENT CHANNELS OF THE MOBILE PHONES INDUSTRY?"

This can be achieved by applying adaptation principles on loosening the coupling in systems. This can be done by several means and ways and we could see evidence here that acting on processes and adapting the systems is the first step for it.

Complex supply chain architectures often underestimate the coupling aspects present in the relationship between all parties of the chain, being them internal or external forces. A lot of focus is often put in research on aspects related to the external collaboration, however, as the case study shows evidence, frequently there are also severe internal issues that can cause challenges.

Adaptation is a prerogative that needs to be in the hands of the management and also has to be embedded in complex supply chains in order to allow flexibility to happen.

The organization under study here was adapted due to a high risk of failure to fulfill its mission which proves that it is essential for companies to learn from the mistakes and evolve. Higher degrees of collaboration will always require adjustments that need to occur from time-to-time to ensure that the "machinery" around making all this transactions is not simply hiding inefficiencies at an operational level.

Justifications have to be replaced by common sense and a strong will to influence the control of the organizations' future under the risk that competitive advantage could not be achieved otherwise.

In adapting companies need to open avenues even for breaking down processes into smaller buckets of fragmented levels and understand there that even a modification on small scale which can look at first sight insignificant can represent great opportunities to start a change process that can become bigger. We refer here to the case where the adaptation was focused on influencing trade customer variants. If the project was overlooked due to a belief that the impact would be small, a comprehensive positive impact on the P&L could have been made a negative one.

5.2) CONCLUSION AND MANAGERIAL IMPLICATIONS

Supply chain keeps evolving with the years and definitely it is a topic which will continue very high on the agenda of companies, especially in the mobile phones industry, were it plays a vital role in ensuring capability of meeting a fast and always changing market.

One can consider that the study conducted in this thesis has been able to reach its objectives as there was a clear bridge between the literature review framework and the results we discussed in the case report, which brings evidence that management science, has no role if not the practice in the corporate world and vice-versa.

The landscape and complexity that the integration of components in the scale that the industry requires is simply tremendous and thus issues such as the one we discussed in this Thesis arise in all fronts of the business.

Managers can encounter here certain references that could allow an application of the case approach, based on the background of consolidated thinkers in supply chain management that help them to take a similar approach to solve their own issues.

The elements of structure on how the study was defined appeared to also serve as an example for managers that intend to take a similar approach to look into supply chain cases. More specifically to the case, the fact that interdependencies between hardware and software can occur in other companies on the same industry, but also in other industries of consumer goods that require extensive embedded software can also benefit other practitioners that need to study similar topic

5.3) LIMITATIONS AND FURTHER RESEARCH AVENUES

"When you aim for perfection, you discover it's a moving target."

George Fisher

The spirit of the researcher is one that aims high and in that perspective the work is never good enough. There are always considerations to be made concerning optimizing the study and the work can always evolve. However, academia only works with structured processes and deadlines. On the other hand those involved in the mobile phones industry know the dynamic market and the tremendous workload involved in coordinating supply chain in this area. So one can say that one of the major limitations of this Thesis is the

contingencies created by time constrains. Specifically to what concerns the outcome of Project Switch, it would have been an excellent opportunity to further enhance the case report with the results from this effort, however, as stated, the timelines between the project conclusion and the deadline to submit this study unfortunately did not meet.

Elements of confidentially and the nature of the problem investigated also brought limitations, clearly one that the company's name is not cited on the Thesis, aspect which does not impose a credibility issue to the study, but certainly would bring more light to some of the topics on the case report if the name of the organization being studied could be mentioned.

The case method and the qualitative approach also bring the researchers point of view and are an excellent fit to the way this study was conducted but certainly as an avenue for further researchers one can suggest that this issue can be tackled under the eyes of quantitative studies, which could be for example:

- Continuation of the Switch project, extrapolating the study elements to other relationships of the chain, bringing a comprehensive overview of the inefficiencies hidden under operational model
- A Corporate *Six Sigma* project bringing light to the case by applying this methodology and looking into solving the holistic case by this approach
- Another Master or PhD Dissertation that could look into specific problems on the supply chain industry using also quantitative methodologies with statistical correlations between the myriad of data available in this area. Richness of research topics is certainly one not to waste.

Choosing the road less traveled can make all the difference at the end and this is also what companies need to do to innovate and adapt their supply chain capability in order to always find new and more efficient ways of making an old practice of exchanging goods between merchants a source of competitive advantage.

6) REFERENCES

Agarwal, A., & R. Shankar, (2002), Modeling integration and responsiveness on a supply chain performance: A system dynamics approach. *International Journal System Dynamics and Policy-Making*, XIV(1 & 2), 61−83.

Agarwal, A., R. Shankar, M.K.Tiwari (2007), Modeling agility of supply chain, *Industrial Marketing Management*, Volume 36, Issue 4, 443-457

Aitken, J., M. Christopher, and D.Towill, (2002), Understanding, implementing and exploiting agility and leanness. *International Journal of Logistics: Research and Applications*, 5(1), 59−74.

Alvesson, M., & K. Sköldberg, (1999), *Toward reflexive methodology*. London: Sage.

Anderson, D.L., Lee, H.L.,(1999), Synchronized supply chains: the new frontier, http://mthink.com/content/synchronized-supply-chains-new-frontier

Angulo, A., H. Nachtmann, , M.A. Waller, (2004), Supply chain information sharing in a vendor managed inventory partnership. *Journal of Business Logistics* 25 (1), 101–120.

Bauknight, D.N., (2000), The supply chains future in the e-economy and why many may never see it. *Supply Chain Management Review*, 28–35.

Baxter, P., & S. Jack, S. (2008), Qualitative case study methodology: Study design and implementation for novice researchers. *The Qualitative Report*, 13(4), 544-559.

Biggemann, Sergio, K.-S., Fam,(2011), Business marketing in BRIC countries, *Industrial Marketing Management*, Volume 40, Issue 1, January, 5-7

Bowersox, D.J., D.J Closs,., T.P. Stank,(2003), How to master cross-enterprise collaboration. *Supply Chain Management Review* 7 (4), 18–27.

Brennan, R. and P. Turnbull, (1999), Adaptive behavior in buyer-supplier relationships, *Industrial Marketing Management*, 28 (5) 481-95

Brennan, R., P. Turnbull and D. Wilson, (2003), "Dyadic adaptation in business-to business markets", *European Journal of Marketing*, 37 (11) 1636-65

Chopra Sunil & P. Meindl (2000), *Supply Chain Management: Strategy, Planning and Operations*, 4th Edition, Pearson Prentice Hall

Chopra, S., Meindl, P., (2001), Supply Chain Management. Prentice-Hall, New Jersey.

Christensen, L. T., A. F. Firat, S. Torp, (2008), The organization of integrated communications: toward flexible integration, *European Journal of Marketing*, Vol. 42 Iss: 3/4, 423 - 452

Christopher, M. (2000), The agile supply chain: competing in volatile markets, *Industrial Marketing Management*, Vol. 29, pp. 37-44.

Denzin, N. K., & Y. S. Lincoln, (1994), *Handbook of qualitative research*. Thousand Oaks, CA: Sage.

Denzin, N. K., & Y. S. Lincoln, (2000), Handbook of qualitative research (2nd ed.). Thousand Oaks, CA: Sage.

Fleur van Veenstra, A, M. Janssen and B. Klievink, B.(2009), Strategies for Orchestrating and Managing Supply Chains in Public Service Networks. *Electronic Journal of e-Government* Volume 7 Issue 4, 425 – 432

Fliedner, D., & R. J. Vokurka (1997), Agility: Competitive weapon of the 1990s and beyond? *Production and Inventory Management Journal*, 38 (3), 19−24.

Garlan, D. (2000), Software Architecture: a Roadmap Proceeding. *Proceedings of the Conference on The Future of Software Engineering ICSE '00* ACM New York.

Goffin, K., F. Lemke, F., M. Szwejczewski, (2006). An exploratory study of close supplier manufacturer relationships. *Journal of Operations Management* 24 (2), 189–209.

Golicic, S.L., J.H. Foggin, J.H.,T.T. Mentzer, (2003), Relationship magnitude and its role in interorganizational relationship structure. *Journal of Business Logistics* 24 (1), 57–75.

Harrison, A., M. Christopher, M. and R. van Hoek, (1999), ``Creating the agile supply chain", *School of Management Working Paper*, Cranfield University, Cranfield.

Hoek, R.I., A. Harrison.,M. Christopher, M., (2001), Measuring agile capabilities in the supply chain. *International Journal of Operations and Production Management* 21 (1/2), 126-147.

Holweg, M., S. Disney, S, J. Holmström, J. Småros, (2005) Supply Chain Collaboration: Making Sense of the Strategy Continuum, *European Management Journal*, Volume 23, Issue 2, Pages 170-181

Hsuan Mikkola, J. and T. SkjOtt-Larsen,(2004), Supply-chain integration: implications for mass customization, modularization and postponement strategies. *Production Planning & Control*, Vol. 15, No. 4, 352–361

Hudson, L. A. and J. L. Ozanne (1988), Alternative Ways of Seeking Knowledge in Consumer Research, *The Journal of Consumer Research*, Vol. 14 No. 3, 508-521.

Jap, S.D., (2001), Perspectives on joint competitive advantages in buyer-supplier relationships. *International Journal of Research in Marketing* 18 (1–2), 19–35

Johansson, R. (2003), Case Study Methodology, *Proceedings from International Conference Methodologies in Housing Research Royal Institute of Technology*, Stockholm, 14

Kazim, S, (2008), On the benefits of CPFR and VMI: A comparative simulation study, *International Journal of Production Economics*, Volume 113, Issue 2, 575-586.

Khan, O, M. Christopher, M, B. Burnes, (2008), The impact of product design on supply chain risk: a case study, *International Journal of Physical Distribution & Logistics Management,* Vol. 38 Iss: 5, 412 – 432

Lambert, D. M. (2006), Supply Chain Management, Processes, Partnerships, Performance, 2nd edition, SCMI

Lee, H., V. Padmanabhan, V., S. Whang , (1997), The bullwhip effect in supply chains. *Sloan Management Review* 38 (3), 93–102.

Lee, H.L. (2003), Aligning supply chain strategies with product uncertainties, *Engineering Management Review,* IEEE , vol.31, no.2, 26

Lincoln, Y. S.,&Denzin, N. K. (2003), *The landscape of qualitative research: Theories and issues.* Thousand Oaks, CA: Sage.

Lord, P (2011), Insights on Inventory Management: Challenges and Best Practices for Industrial and High-Tech Companies, *a report by Gartner Group*.

Lynn, M.L. (2005), Organizational buffering: managing boundaries and cores, *Organization Studies*, 26 (1) 37-61

Manthou, V., M. Vlachopoulou, M. And D. Folinas, (2004), Virtual e-Chain (VeC) model for supply chain collaboration. *International Journal of Production Economics* 87 (3), 241–250.

Mason-Jones, R., B. Naylor, B., D.R. & Towill, (2000), Engineering the agile supply chain. *International Journal of Agile Management Systems*, 2(1), 54−61.

McIvor, R., P. Humphreys, (2004), *Early supplier involvement in the design process: lessons from the electronics industry*, Omega, Volume 32, Issue 3, Pages 179

Mei, C., Qingyu, Z,(2011), Supply chain collaboration: Impact on collaborative advantage and firm performance, *Journal of Operations Management,* Volume 29, Issue 3, 163-180

Menezes, J and C. Pinto (2011), Service as the encounter point in an adaptive network: the Siemens-CP case, *Proceedings of the 27th IMP conference*, paper 338, Glasgow, Scotland.

Mentzer, J.T., W. DeWitt, W., J.S. Keebler, S. Min, N.W. Nix, C.D. Smith, ,Z.G. Zacharia,(2001). Defining supply chain management. *Journal of Business Logistics* 22 (2), 1–25.

Metters, R. (1997), Quantifying the bullwhip effect in supply chains. *Journal of Operations Management* 15 (3), 89–100.

Neuvo, Y. (2004), Cellular Phones as Embedded Systems. *Solid-State Circuits Conference, Digest of Technical Papers. ISSCC*, San Francisco, USA

Orton, J.D., and K.E. Weick, (1990), Loosely coupled systems: A reconceptualization, *The Academy of Management Review*, 15 (2) 203–223

Perrow, C. (1984). *Normal Accidents: Living With High-Risk Technologies*, Princeton University Press, New York

Prasad, A., P. Prasad, P. (2002), The coming age of interpretive organizational research. *Organizational Research Methods*, 5, 4-11.

Prater, E., Biehl, M., & Smith, M. A. (2001), International supply chain agility tradeoffs between flexibility and uncertainty. *International Journal of Operations and Production Management*, 21(5/6), 823−839.

S. Wadhwa, K.S. Bhoon, F.T.S. Chan, (2006), Postponement strategies through business process redesign in automotive manufacturing: Knowledge innovation, *Industrial Management & Data Systems*, Vol. 106 Iss: 3, 307 – 326

Sandberg, J. (2001), *Invisible management: The social construction of leadership*. London: Thomson.

Sandberg, J. (2005), How do we Justify Knowledge Produced Within Interpretive Approaches? *Organizational Research Methods*, Vol.8 No. 1, 41-68.

Sheu, C., H.R. Yen, D. Chae, (2006), Determinants of supplier-retailer collaboration: evidence from an international study. *International Journal of Operations and Production Management* 26 (1), 24–49.

Simatupang, T.M., R. Sridharan,(2002), The collaborative supply chain. *International Journal of Logistics Management* 13 (1), 15–30.

SkjØtt-Larsen, T, P.B. Schary, J. Mikkola, H. Kotzab; (2007) *Managing the Global Supply Chain*, Third Edition, Liber, Copenhagen Business School Press

Stank, T.P., S.B. Keller, P.J. Daugherty, (2001), Supply chain collaboration and logistical service performance. *Journal of Business Logistics* 22 (1), 29–48.

Tellis. W. (1997), Application of a case study methodology. The Qualitative Report, :http://www.nova.edu/ssss/QR/QR3-3/tellis2.html

Tolone, W. J. (2000); Virtual situation rooms: Connecting people across enterprises for supply chain agility. *Computer Aided Design*, 32, 109−117.

Tuten, T.L., D.J. Urban (2001), An Expanded model of business-to-business partnership foundation and success. *Industrial Marketing Management* 30 (2), 149–164.

Van Hoek, R. (2001), The rediscovery of postponement, a literature review and directions for research, *Journal of Operations Management*, 19, 2, 161 – 184

Vangen, S., C. Huxham (2003), Enacting leadership for collaborative advantage: dilemmas of ideology and pragmatism in the activities of partnership managers. *British Journal of Management* 14 (Suppl. 1), S61–S76

VICS(2004) Collaborative Planning, Forecasting and Replenishment(CPFR): An Overview, https://committees.vics.org/committees/cpfr/CPFR_Overview_US-A4.pdf

Waller, M., M.E Johnson and T. Davis, T. (1999), Vendor-managed inventory in the retail supply chain, *Journal of Business Logistics*, Vol. 20, Issue 1, 183-203.

Y.Y Yusuf, A Gunasekaran, E.O Adeleye, K Sivayoganathan, (2004) Agile supply chain capabilities: Determinants of competitive objectives, *European Journal of Operational Research*, Volume 159, Issue 2, 1 , 379-392.

Yin, R. K. (2003). *Case study research: Design and methods* (3rd ed.). Thousand Oaks, CA: Sage.

Yonghui F, P. Rajesh, (2004) Supply-side collaboration and its value in supply chains, *European Journal of Operational Research*, Volume 152, Issue 1, 281-288,

Zainal, Zaidah (2007), Case study as a research method. *Jurnal Kemanusiaan* bil.9, http://www.fppsm.utm.my/download/cat_view/13-jurnal-kemanusiaan/24-bil-09-jun-2007.html

Zander, M. (2010) "*Technical and economical trends in wireless applications*," ESSCIRC, *2010 Proceedings of the ESSCIRC*, 37-44.