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**From Supply- and Value Chain to Smartphone Ecosystems as Success Factors
in the Mobile Telecommunications Industry**

Thesis of PhD Dissertation

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1. Introduction

Importance of the subjectis emphasized by the radical changes in the mobile telecommunication industry and the growing success of Smartphones as the most important computing platform. The smartphone is a mobile phone that offers more advanced computing ability and connectivity than a contemporary feature phone The convergence of the telecommunications industry and the internet industry resulted in a radical transformation of the established value chain and created new ecosystems in the mobile telecommunications industry. The traditional and linear value chain approach, which can be seen as chain of activities that a firm operating in a specific industry performs in order to deliver a valuable product or service for the market, can't be used anymore to explain the business relations between the actors in the mobile telecommunications industry. This disruption created opportunities for new entrants but at the same time threats for incumbent players in particular amongst the group of handset manufacturer. Major changes were affecting the mobile telecommunications industry through technical factors, such as the evolution from the basic mobile phone which enabled voice and text messages services only towards the Smartphone which can operate with the superfast LTE network and replacing the PC in its functionality. Today we see the triumphal procession of the Smartphone which will be sold around 1 Billion times in 2013, the market for PCs and laptops dropped by 10% to 315 Million units only and tablets were sold with strong growth with estimated 200 Million units[1]. In addition to the technical development on the network and device side the evolution of underlying business models for the actors were driven by dynamics of the mobile operating systems of smartphone and their ecosystems.

Based on a literature research in the areas of supply chain, demand chain development, linear value chains, value networks and mobile ecosystems the chapter three will analyse the mobile telecommunications market with its challenges and opportunities today. The research part consists out of three different stream which range from macroeconomic analysis to end consumer research done with consumers in Hungary.

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[1] See: Frankfurter Allgemeine Zeitung, 11th January 2014, p. 15 based on calculations by Gartner and IDC

The market for traditional telecommunication services, in the recent years, is subject to commoditization and major changes. Reasons of this this development include an increased platform competition, a constant decrease of revenues for mobile operator through lower volume of text message and reduced voice services, overall a stagnating or even decrease of average revenues per user (ARPU) and an increased substitution through voice over IP (VOIP) by alternative service providers, but as well the technical development of the smartphone which is today more a computer than a traditional telephone. In recent years, the mobile device and mobile services markets have been affected by a sharp rise of smartphones. Smartphones have been developed by integrating technologies from the telecommunications industry, consumer electronics, PC industry, media industry and the different software sectors.

Compared to traditional phones, smartphones have stronger computing capabilities, better connectivity and advanced applications due to the power of mobile Ecosystems. Smartphones today combine functionalities of portable media players, digital cameras, GPS navigators, gaming equipment and office related functionalities like e-mails, conference calls and video calls. Smartphones are mobile phones that offer advanced computing ability and connectivity options. Smartphones are programmable mobile devices, running entire operating systems in a manner similar to traditional computers. These features enable new types of mobile services, which in turn shape the usage habits of smartphone users. As smartphones to create more applications for an increasingly wide range of uses, it will become an increasingly integral part of the everyday user. The programmability of the smartphone is a way to turn the device into the data collection platforms that provide detailed information about user smartphone usage habits. (Soikkeli et al. 2013)

Europe was once a mobile continent. It was invented not only by us, but the entire mobile innovation started in Europe. Manufacturers such as Siemens, Ericsson, Alcatel and Nokia phones built that everyone wanted globally, Europeans built mobile networks - worldwide. Especially the Scandinavian countries showed the world look like a mobile phone has how to build networks and quickly supplied a whole country with mobile. But that was then. Since yesterday, is one of the most prestigious European brands that once had nearly 40 percent of the global market share and thus was a world brand, not only European. Nokia stood for quality and innovation. By end of 2007 Nokia held about 65% market share within the smartphone category but after the announcement of the Nokia and Microsoft partnership the development of the Symbian OS was not continued.

Now, the Nokia device and service unit belongs to Microsoft and there is no European manufacturer involved in mobile phones anymore.

Supply – and value chain models changed over time significantly and new business models based on the different Ecosystems were established. When you compare the list of key handset manufacturers in the early days of the industry with today´s leaderboard you will see many different names. The thesis should help to understand the he changes in the mobile telecommunications industry and explain the key drivers for this development.

2. Motivation

I am working in the mobile telecommunications industry since 1997 and follow the technology trends and hardware business quite intensively. For me it is very interesting to see how traditional value chains change and new business models drive the entire industry in a different direction. The telecommunications industry is passing from periods of rapid increase of subscriber base to the more modest growth of what is commonly called industry maturity. The market penetration for mobile phones is exceeding 100% in most of the developed markets already. By end of year 2012 around 80% of the world's population has a mobile phone, which means there are around 5 billion mobile phones in existence. When I started my research work in 2009 it looked like services and applications can be the driver for growth in the mobile telecommunications industry but soon it was clear that consumers don't want to pay extra for it. Nokia had to change the their strategy big times as focus was in 2010 on services as revenue generator for the future and they failed with it. Mobile network operators were struggling to keep their revenues and profit targets due to the intensive competition. Voice tariffs, prices for text messages and prices for data packages are decreasing rapidly. After mobile network operators in developed markets achieved full penetration rates for mobile voice services, their major interest for revenue growth became increasing the use of mobile data services. These services were used to justify the development of the UMTS Networks (3rd generation mobile telephone standards), as well as the billions of euros spent in Europe on spectrum and updated network infrastructure. Competition for market share is very high and outbreaks of price, service are common during transition to maturity.

A lot of activities in the past decade to create a mobile Internet have focused on constructing a brand new value network designed from the beginning for mobile phones. This was driven in part by a desire to establish market control and power. These market players wanted to create a new value network that they controlled rather than join an existing network they did not control. Examples would include the "walled garden" approach of Western operators (T-Mobile, Vodafone, Telefonica and others) as well as Nokia's efforts to create enterprise services and earn money with consumer services like navigation, music and gaming. But there was also a belief that a new version of the Internet was needed before mobile data could succeed. The argument was that the wired Internet, built for large screens and keyboards, was not appropriate for use on mobile phones with small screens and no keyboards. However, the rapid success of the iPhone in the United States and Europe suggests these approaches have been misleading and incomplete. Rather than trying to recreate the Internet, Apple focused on re-creating the mobile phone to work properly when using the existing internet infrastructure and added a complete ecosystem of applications which was perceived and very well accepted by consumers. The first i-phone was sold on 7th January 2007 and with that the mobile telecommunications industry changed entirely. The smartphone category, which was actually existing already since mid 90s, developed exiting growth rates and became the ultimate driver for mobile data consumption.

Today there is a variety of smartphones from different vendors which do have similar functionality and features so that the differentiation comes more via the installed operating system and the respective application ecosystem then through hardware specification. New mobile services and applications seem to be a potential way out to improve the situation and generate new growth areas as consumers sign in for flat tariffs which include certain amount of voice and data services already and the fear of a bill schock when using features like navigation and web browsing are finally gone. Mobile device is an important gadget for many people day, regardless whether it is used for communication, entertainment or keeping up to date. With the advancement of mobile Internet, mobile devices are also used for many conventional PC based Internet applications and are known as Smartphones today. The landscape of mobile handset manufacturers changed significantly over the last 6 years. In mobile telecommunications, the traditional value chain which was pretty much controlled by incumbent players is now facing significant disruption. We saw well established players to exit the market (e.g. Siemens, Ericsson) and global leaders like Samsung and Apple gained strength.

I changed the focus of my research work to the Smartphone as the user interface towards the consumer. By the end of 2012 the amount of smartphones sold worldwide exceeds one billion units already and this trend continues strongly. The telecommunications industry has seen rapid technological convergence, and this has stimulated internationalism and corporate strategy development. It exhibits a distinctive regulatory dualism, consisting of EU harmonizing legislation and an extensive additional layer of national legislation. One of its key features has been the transformation of alliances aimed at gaining a strong position in the market with creation of mobile ecosystem as platforms. In the fast-changing and knowledge-intensive technology industries, partnership is often the fastest and least costly avenue to obtain the resource necessary to keep up with competitors. Besides the operating system coming from Apple (IOS) we see another strong platform which is the Android ecosystem with Google as provider for the Operating System (OS) and Samsung as the key producer of smartphones using the technology. Several challengers like Nokia together with Microsoft (Windows Phone OS) and Blackberry (former RIM) are fighting for market share and their longer-term existence. My thesis should help to understand the current situation and tries to work out how the value chain in mobile telecommunications will develop in the future.

2.1.   Research Models and goals

The telecommunications industry is a very vital and fast changing industry. Development of technology and introduction of new devices is happening at very fast speed. A basic question is if the consumers can follow these trends, adapt the new offerings and use it. It is important to examine the market research data properly to understand the relevance and try to understand the usage pattern of the consumers better. The reason that technology is developing fast makes it for players like telecommunications operators, mobile handset manufacturers, service providers and all other stakeholders essential to create offering which are basic to understand, playful to learn and create fun and interest when using it.

The basic strategy for collecting relevant literature was a keyword search in a list of scientific libraries:

- The ACM Digital Library[2]
- IEEE Explore[3]
- Springer Verlags digital library, SpringerLink[4]
- Science Direct. An online collection of published scientific research operated by the publisher Elsevier.[5]
- Thomason Reuters Web of Science. An online academic citation index.[6]
- Wiley.[7]

In addition to that I had access to many external sources of data from Gartner, Strategy Analytics and others which are not scientific but very helpful to understand the market dynamics and developments when it comes to platforms, ecosystems and value chain in mobile telecommunications industry.

The aim of my research is to identify the Stakeholders of the mobile telecommunications industry and examine their different roles in connection with changes in the supply- and value chain up to the latest developments of mobile ecosystem business models. The hypotheses of my research are centered on the different stakeholders. Mobile Operator which stand for the connectivity in the mobile industry are research object with hypothesis 1. The consumer, who is the center of interest for all other participants, is analyzed by different factors with hypotheses 2 to 4. The device manufacturers are research topic for hypothesis 5 and representing the user interface to the consumer with the different mobile phones and Smartphones introduced into the market. Content and services providers which are responsible for the mobile operating system (OS) are deeper investigated in hypothesis 6. The content and services providers which drive the mobile applications development are studied and represent my hypothesis number 7.

The practical research was done (Hyphothesis)

a.) as desk research (H1)

b.) online questionnaire (H2-H4) and

c) deep interviews with pre-defined target group (H5-H7)

and rolled out in three different steps.

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[2] http://dl.acm.org/
[3] http://ieeexplore.ieee.org/Xplore/home.jsp
[4] http://www.springerlink.com
[5] http://www.sciencedirect.com
[6] http://apps.webofknowledge.com
[7] http://onlinelibrary.wiley.com

First of all a desk research study was carried out from a macro-economic perspective to examine the regulation aspects of the mobile telecommunications industry in Europe. Based on the research a hyphothesis was developed:

H1 - In a comparison of European countries the penetration rate of mobile phone subscriptions has a relevant influence on the pricing and service level. Relationships between chosen variables like investment, employment and number of mobile subscriptions will be revealed and countries grouped based on factor coordinates.

For the next research part a questionnaire based Online research was accomplished (between October - November 2010) by more than 2100 participants who visited the Hungarian homepage of Nokia (www.nokia.hu). I aimed to reveal possible relationships between demographic features and mobile phone habits as consumers should behave different when it comes to mobile applications. Differentiation analysis by gender, demographics and geographics. At later stage the three hypotheses will be split into sub-groups to sharpen the focus.

H2: Men download more applications then women and are willing to pay more for it

H3: People living in the City have more often internet access and download more applications than people in rural area.

H4: Depending on the age group the willingness to pay (more) for applications is different

Material and methods: In order to get to know more about the mobile phone and smartphone user behavior of Hungarian end consumers we did an online survey on the Hungarian homepage of Nokia. We checked their willingness to pay money for different mobile applications and asked end consumers about their preferences. Based on the more than 2100 answers of the online survey, I defined three specific hypotheses groups and tried to proof those with standard statistical methods. My findings should help make use behavior transparent and clear for all interested in the mobile applications market. The topic is of major importance for mobile phone manufacturers, for network operators as well for application and other stakeholder in the mobile value chain.

For the last part of research I was analyzing the end consumer (students as specific target group) opinion, feedbacks and purchase decision making process regarding Nokia Lumia smartphones. Focus was put on the perception of customers and the importance and effectiveness of the distribution channel. The primary aim of this research is to understand and gain insights into student´s usage of smartphones and understand their expectations concerning needed features and functionalities. The second part looks deeper into the Windows Phone OS in particular and works out the challenges and opportunities for Nokia and Microsoft going forward in their partnership. The perception of users (buyers) and non-users (non-buyers) for Nokia Lumia devices in the related target market (Hungarians between the ages of 19-27 years old) was examined and differences analysed. Another goal was to figure out in detail the advantages for the new Mobile Ecosystem and find the drawbacks of Nokia Lumia devices and the Windows eco-system in the mind of this specific customers group.

This helped by establishing the knowledge about the general requirements to a phone and its marketing, branding, pricing and distribution strategy. The focus groups were covered by customized questions which lead to a discussion among the participants and in order to not restrict answers by the participants, these focus group meetings were held in Hungarian and the results were translated for the purpose of this paper. The second step brought legitimacy to the prior findings of the qualitative phase by supporting them on a broad and diversified spectrum.

 Aim of this research was to understand the relative position of the Nokia Smartphone range and their future development in the highly competitive smartphone market with the Microsoft Windows Phone 8 (WP8) Operating System. [8]

Following Hyphothesis were developed:

H5: Price and ease-of-use will be the most important regarding the purchase decision of a Smartphone.

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[8] Nokia introduced the first range of devices with the an Android Operating System just on 24th February 2014 in Barcelona during Mobile World Congress in Barcelona. This announcement is a significant change in the strategy of Nokia/Microsoft with the aim of gaining more global marketshare points in shorter period but was not part of my researchwork.

H6: For the purchase decision of a Smartphone the most important factor is the Operating system (OS) and the richness of applications.

H7: Telephony and text messages will remain the most important applications and features used in a Smartphone.

I have done a mapping of the hypotheses of this dissertation. In Figure 1 the logical connection between the different hypothesis is outlined and put into perspective. In total there will be seven different hypotheses to examine. The hypotheses cover the different parts of the business ecosystem in the mobile telecommunications industry. Hypothesis one is focusing on the mobile operator. Hypothesis two to four are covering the area of the consumer. Hypothesis five is centered around the mobile device manufacturer and the user interface challenges. Hypothesis six examines the enablers and support services whereas hypothesis seven is about the content and the applications available.

Figure 1: Stakeholders in the mobile telecommunications industry and hypotheses mapping
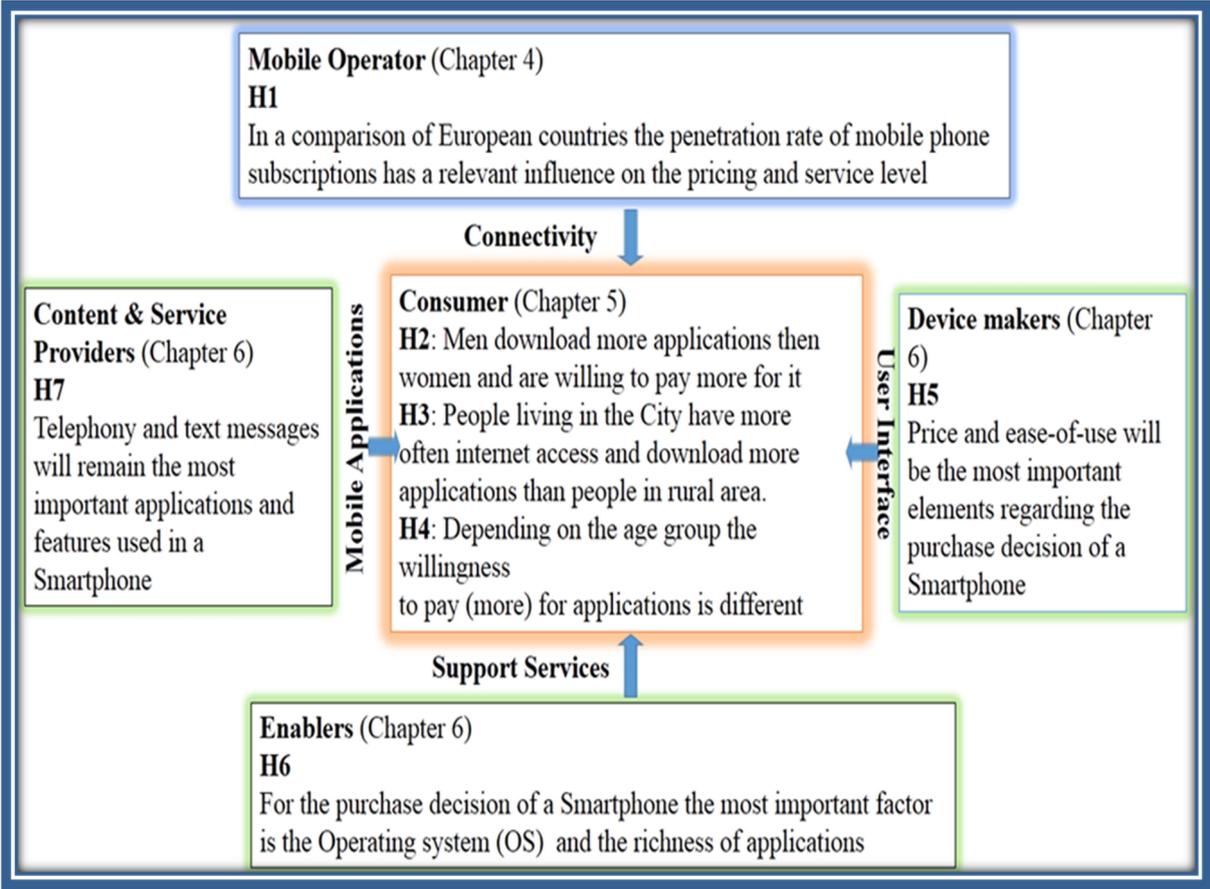
Source: Own figure

3.   Theoretical background

3.1 Supply chain management

While mobile phone hardware has been integrating more functions and technology over the past 20 years, industry supply chains in telecommunications, as well in the broader electronic industry, have been steadily disaggregating across corporate and national boundaries The mobile telecommunications industry has shifted through recent decades from a vast number of nation-based technologies commercialized by vertically integrated firms to a few global standards supported by global supply chains. (Dedrick & Kraemer, 1998).

Nollet et al. (2005) examined the context and content of a generic supply strategy and its strategy-making process. Adding mostly on fundamental strategic management theories, the paper explains the role of supply strategy in its managerial context. The meanings and use of the terms "strategy" and "strategies" are worked out in detail. In addition to that as well a practical conceptual framework for supply strategy formulation is given. A generic checklist, built by segmenting supply management decisions, is outlined to guide supply professionals in addressing strategic issues to create value to customers, avoiding confusion and optimizing available resources. In the past the strategic character of supply management has been largely recognized but at the same time classical frameworks guiding strategic thinking and strategy-making have not taken into account supply chain management at the same level as marketing and other functions. The contribution of supply chain management and supply "strategy" to corporate strategy goals and objectives is now reality (Nollet et al. 2005, p.137).

Supply chain management has become one of the most popular and fastest growing areas in the management area. Academic journals publish countless articles on supply chain management, universities offer courses and companies implement approaches and strategies offered by supply chain management. In the current competitive scenario supply chain management assumes a significant importance and is in focus for serious research attention. Companies are challenged with findings ways to meet ever-rising customer expectations at a manageable cost. Business must search out which parts of their supply chain process are not competitive, understand which consumer needs are not being met, establish improvement goals and implement the necessary changes rapidly. SCM is more than a new name for logistics.

SCM has assumed a significant role in firm's performance and has attracted serious research attention over the last few years. The literature research in this chapter will give an overview of already existing literature research papers of SCM and focus on mobile telecommunications industry from the manufacturer point of view.

Today almost all manufacturers and retailers are embracing the concept of supply chain management (SCM) to improve efficiency and effectiveness across supply chain and work-out the competitive advantages (Jain et al. 2010). The practice of global value chain analysis within international development is based on the science of global supply chain management and logistics. According to Alan E. Branch (2008), the supply chain is "the time-related positioning of resources ensuring the material, people, operational capacity and information are in the right place at the right time in the right quantity and cost." (Branch 2008, p.13) There is plenty of literature around supply chain management available and several research papers carried out literature reviews around the supply chain.

3.2   Demand chain

The Demand Chain is, as one would suspect, the mirror image of the supply chain. The demand chain is a sequence of backward-reaching processes, initiated by the end-customer, that enable companies to anticipate demand characteristics within a given market. Fisher (cited in Walters, 2002), identifies the problem of demand uncertainty as being the major driver for establishing a demand chain model for a company. Other problems that are caused by demand uncertainty include inventory obsolescence and holding costs. The increasing frequency of new product introductions also contributes to demand uncertainty.

A suggestion to solve the main problem of demand uncertainty and all of the sub-problems associated with it can be rectified through incorporating demand uncertainty into a company's production-planning processes. Outcomes of this methodology will include an accurate as well a quick response. These two methods involve more stringent process management used in conjunction with customer needs analysis. They involve designing internal company operating practices to be complimentary to demand.

Beech (1998) argues for an integration of the supply and demand chains: "The challenge can only be met by developing a holistic strategic framework that leverages the generation and understanding of demand effectiveness with supply efficiency.

1. First, organizations must bring a multi-enterprise view to their supply chains. They need to be capable of working cooperatively with other organizations in the chain rather than seeking to outdo them.

2. Secondly they must recognize the distinct supply and demand processes that must be integrated in order to gain the greatest value". (Beech 1998, P. 95)

He suggests three key elements:

a) The core processes of the supply and demand chains, viewed from a broad cross-enterprise point of view,

b) the integrating processes that create the links between the supply and demand chains and

c) the supporting infrastructure that makes such integration possible.

Juettner et al. (2007) are endorsing demand chain management as a new business model which is aimed at creating value in today's highly competitive environment and teaming up the strengths of marketing and supply chain capabilities. Demand chain management needs deep market knowledge and has to be carried out in such a form to effectively meet the ever changing customer needs. In their paper they propose a conceptual foundation based on literature review, findings from co-development workshops and focus group discussions with marketing and supply chain professionals. "Demand chain management involves (1) managing the integration between demand and supply process; (2) managing the structure between integrated processes and customer segments and (3) managing the working relationships between marketing and supply chain management". (Juettner et al. 2007, P. 377).

3.3   Value chain

Many academic publications deal with the changes in value creation with qualitative methodologies (Li & Whalley 2002, Fransman 2010, Peppard & Rylander 2006 and Basole 2009). Detailed analysis of their ideas will be outlined in this and the next chapters when talking about value chain and ecosystems. The deconstruction of the mobile

telecommunications industry and its increasing recombination with related sectors is described by Li & Whalley as a radical transformation where value chains are rapidly evolving into value networks, with multiple entry and exit points, creating enormous complexity for all stakeholders of the industry involved (Li & Whalley 2002, p. 451).

Internet service provider and mobile service provider are serving the same customer and their offerings are more similar than ever as the two different industries are growing together. The merged relationship between the different value chains in the value network has given rise to a series of emerging business models. They identify the distribution of value capture between the different parties that contribute to a product or service as an important issue for determining the viability and success of new market participants, and they call for empirical research and new tools for understanding this question better and to make better future predictions.

The value chain is the result of integration between the old supply chain notion and the old demand chain notion. The demand chain is essentially the mirror image of the supply chain. As we have seen, the supply chain is a string of economic players attempting to create value through an efficient, sequenced process. However, since demand is often uncertain, the principle of efficiency is not always achieved by using this philosophy alone. The demand chain offers companies a way to cope with fluctuations in demand, enabling companies to plan more efficiently and effectively for changes in demand. The culmination of both of these concepts has been the customer-centric value chain.

The participants in the mobile telecommunications industry are collaborating as the seller and the buyer, and their mutual aim is to satisfy the demand of the end customer by closely working together. The model can be used as a generic tool which focuses on strategy & planning, demand and supply management, execution and analysis of the current situation.

Figure 2 illustrates the different members of the supply chain and their need for integrated planning and visibility. The Collaborative Planning Forecasting and Replenishment Model (CPFR) which will be described deeper in my doctoral thesis gives us a kind of general framework for the processes applied in the different steps by the example of Nokia as device manufacturer.

Figure 2: Value chain as integrated planning tool with end-to-end visibility for mobile device manufacturer
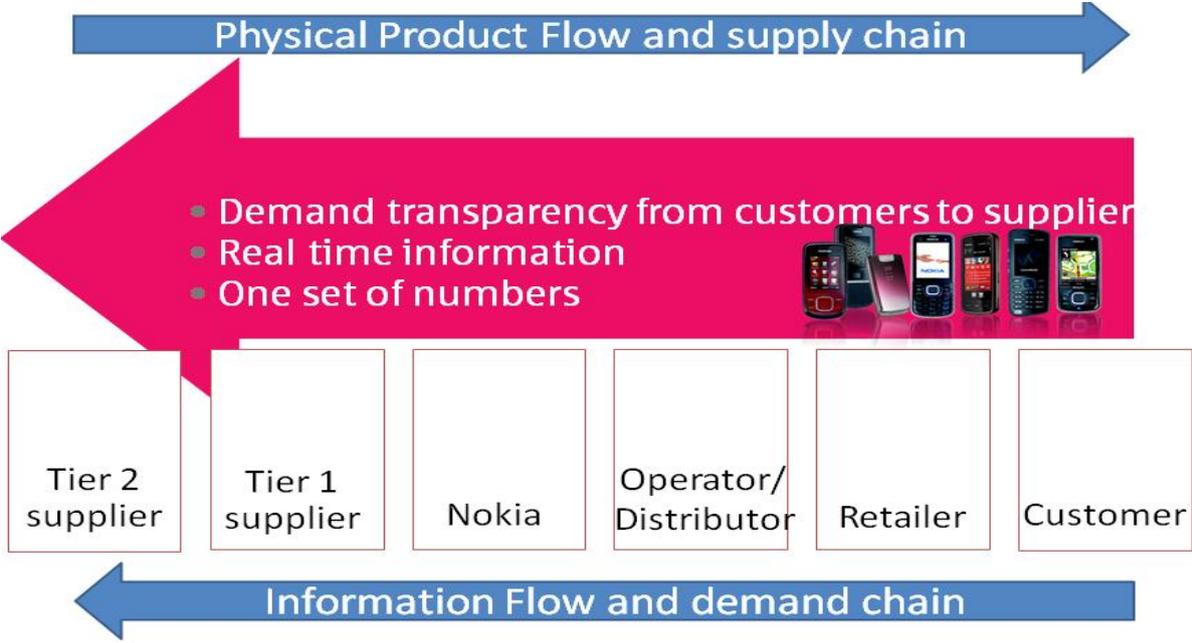
Source: Stoerkel, 2012 , p.115

It is widely acknowledged that in the era of fast internet, speed, agility and value creation are the most critical components of competitiveness today. Indeed, besides the right strategic decisions it is the availability of planned information that distinguishes good competitors from bad performing ones. This is because decisions are made quickly, inventories are not any more as important and the customer is replenished on a regular, continuous and uninterrupted basis. For Al-Mudimigh et al. (2004) it was ten years ago already obvious that information provides real time for communication and real time transactions therefore making the principle of developing relationships with customers and suppliers much easier than ever before. They had the question, as to whether an organization that has in the past found it difficult to compete effectively, is going to embrace the modern concepts of Value Chain Management (VCM) and invest significantly in IT. With that they can manage in real time and develop closer relationships with their customers and suppliers. For being successful companies have to re-engineer their supply chain capability. That means that the supply chain would have to focus on all the activities that get the chain of raw materials into an operation that runs friction free and is delivered economically for the customers. One of the end goals of supply chain management is to deliver the maximum value to the end customers on a given cost.

In order to limit defects in inventories, process speed, time to market achievements and improve the customer satisfaction the concept of VCM is concerned with the customer from start to finish. Furthermore it was examined which additional benefits to be accrued when the principle of VCM is adopted. Most important is that VCM provides organizations with the opportunity to develop their own value proposition. Organizations have to identify their core competencies and position themselves in the market place, according to their strength and fitting to their competitive abilities.

Particular good results will be achieved with VCM if there is a clear emphasis on co-operations and collaborations. For that you have to develop a new organizational mindset and new ways of behaving when it comes to sharing information. Particular in the case when it comes to future aspects on strategic planning, business growth and development plans and the direction that the business is planning to take in the future. The paper was showing and proofing that value chain management can be the logical extension of supply chain concept. More elements and stakeholders have to be integrated and aligned with tasks time, resource and needs an open mindset to share information with suppliers and customers. (Al-Mudimigh et all. 2004)

In logistic terms, value can be described as both value in place and value in time, hence all actors performing activities in order to get the right product to the right place at the right time are parts of a value chain. The concept of the "value chain" introduced by Michael Porter encompassed the value adding activities taking place within the boundaries of a company, from inbound logistics through operations, outbound logistics, marketing and sales to after sales service. The efficient operation of these primary activities offer a competitive advantage. The sequence of value adding activities that a product goes through before reaching the end-user can be described as a value chain. Michael Porter (1985) defined a company's value chain as a system of independent activities which are connected by linkages. These linkages are in place when the way in which one activity is performed affects the cost or effectiveness of other activities. Every company is a collection of activities that are performed to design, produce, market, deliver and support its product. All these activities can be represented using the value chain model. (Porter, 1985, p. 38)

3.4   Ecosystems in the mobile telecommunications

The concept of business ecosystem was firstly proposed by Moore already in 1993. He defined the business ecosystem as an economic consortium, which is based on the interactions of organizations and personalities. In a larger sense, it contains suppliers, production businesses, capital investors, industry associations, governments and other related organizations and populations. "To extend a systematic approach to strategy, I suggest that a company be viewed not as a member of a single industry but as a part of a business ecosystem that crosses a variety of industries.

Having the different connections between the actors and the complex network in mind, in the following subchapters we will evaluate the roles of the main players: Mobile network operator, mobile device manufactures, platform provider and application and content provider. Figure 3 shows the consumer being position as center of the mobile value chain and the different players generating the needed connectivity, build the user interface via devices based on different ecosystems with millions of applications as content in the consumer and business area.

Figure 3: Stakeholders in the mobile telecommunications industry and their roles
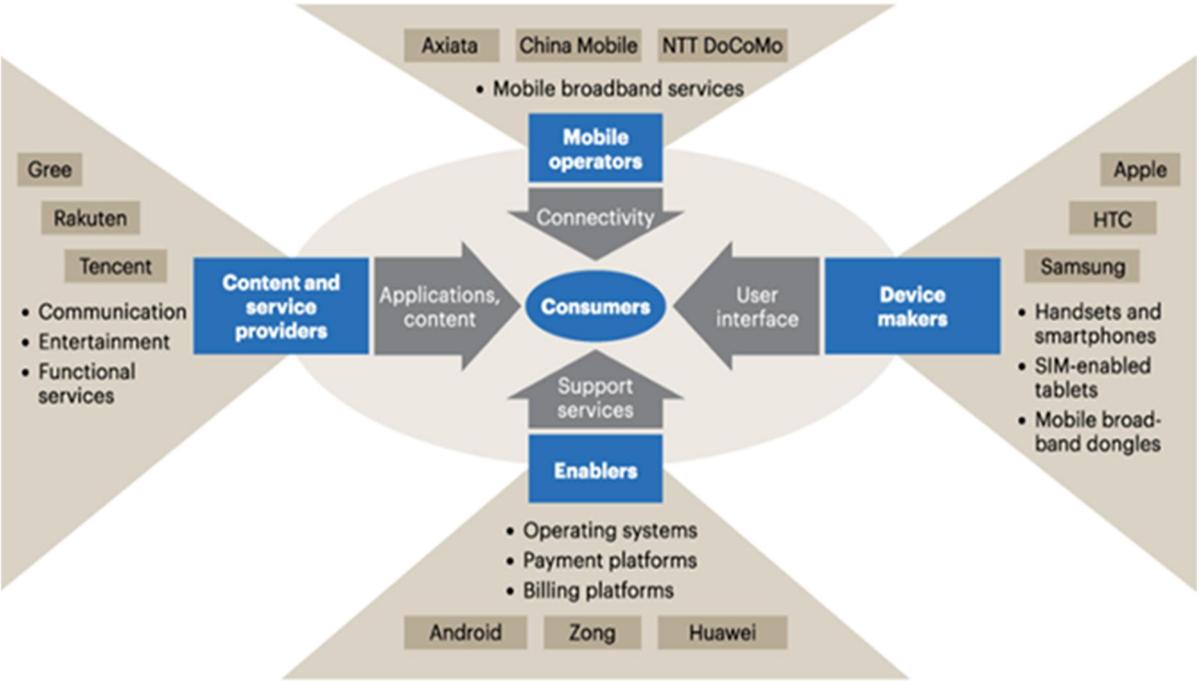
Source: AT Kearney analysis 2010, p.6

In a business ecosystem, companies evolve capabilities around new products, satisfy customer needs, and eventually incorporate the next round of innovations. For example, Apple Computers is a leader of an ecosystem that crosses at least four major industries: personal computers, consumer electronics, information and communications. The Apple ecosystem encompasses an extended web of suppliers that includes Motorola and Sony and a large number of customers in various market segments." (Moore 1993, p. 76)

For Elaluf-Calderwood et al. (2011) the digital ecosystems represent a fascinating and highly competitive field of innovation in the today's economy. Companies like Apple, Google and Microsoft are pursuing different forms of innovation strategies to maximize the value from the business models that they are involved. A lot of actual work and engagement must come from external developers to maximize the technology and generative potential. A digital ecosystem includes a platform that serves as a central element on which other players can act and collaborate.

Tilson et al. (2012) saw that the advent of the smartphone as a highly complex technology has been accompanied by mobile operating systems (OS), large communities of developers, diverse content providers, and increasingly complex networks, jointly forming digital infrastructures. The multi-sided and very relational character of such digital infrastructures raises issues around how change and control can be understood and managed. They discuss how change and control are paradoxically related in digital infrastructures and how they affect the evolution of such infrastructures. They examine these paradoxes by checking the change in, and competition between the two leading mobile operating systems: Apple's iOS and Google's Android and Microsofts Windows Mobile along with their related platform features and ecosystem and business model innovations. Another aspect is the validation of the dynamics of change of the two cases. They observe that multiple factors had a significant effect on the evolution of these platforms including user interface, development platforms, business models, and value extraction principles. They point out how these factors significantly affect the evolution of mobile platform ecologies as well as speculate about the future of mobile system platforms and its value for the end consumers.

On top of the basic literature research around supply-, demand- and value chain I will discuss the concepts of value networks and mobile ecosystems. Key interest of the research will be on the platform aspect of the industry which is called the "platformization" by a couple of authors (Ballon 2009, Gawer 2009).

In today's telecommunication markets, platform leaders have built their business models around crucial gatekeeper functionalities, aiming at controlling the wider value chain and capturing significant business in a very competitive manner against other ecosystems and even with pre-programmed conflicts within the respective ecosystem. The thought schools of service innovation and the different business models of the actors in the mobile telecommunications industry will be elaborated and the done research outlined. For the thesis of major interest is as well the smartphone as an urgent computing platform and the usage cases together with smartphone user behaviors studies.

4. Research design and empirial work results

The markets of mobile telecommunications are dynamic in their nature and consist of many interdependent actors. Active consumers, incumbent and new entrant mobile operators, as well as handset and equipment vendors are involved today. Since the introductions of mobile telephony in the early 1950s in Europe and other markets the demand for the service exploded. It looks like that the latent demand for mobile telecommunications services for many decades continued to be very strong. After the introduction of wireless technology the capacity of the services had to grow rapidly to meet the demand. Next and future generations of mobile telecommunications technologies bring higher and faster transmission speed and more versatile services for consumers.

Liberalization of the telecom markets in Europe drove new entrants into the market and curbed excessive pricing. (Dunnewijk & Hulten, 2007). "For decades the European telecommunications industry was characterized as a relatively stable environment, which encouraged firms to develop fixed set of routines in order to deal with their relatively placid surroundings. However, due to regulation, technological innovation and the convergence of information, communications and media markets, the European telecommunications industry has become much more turbulent environment. Consequently, the industry is now part of a worldwide, integrated communications system in which voice, data, and video are transmitted and transformed over integrated wire and wireless networks connected by network and customer devices." (Van Kranenburg & Hagedoorn (2008, p. 116)

Developed and widely available telecommunications services are key enablers of a new economy. In Eastern Europe countries are in transition, investment in telecommunications is generally perceived as one of the major drivers for economic growth. (Dvornik & Sabolic (2007) investigated the empirical correlation and causality between certain indicators of telecommunications activity and economic development. In their paper the indicators include total investment in the telecommunications sector and similar parameters such as penetration rate of services. In addition to that they also proposed additional indicators that may describe the modern telecommunications sector development better than fixed, telephony based traditional measures.

One of the reasons is the migration of users from fixed to mobile networks and from these basics to broadband internet access in recent years. They expect broadband internet users to move to mobile infrastructure which will be examined in the study in the chapter. The telecommunications industry is a very vital and fast changing industry. The existing empirical evidence on the relationship between size of a country or economy and its performance has been without too many countable results so far. Symeou (2011) has a long listing of studies around this topic, many of which have produced ambiguous results. To some degree, the ambiguity in existing studies might have methodological reasons. To a larger extent it may come from the strong assumption in the literature that larger economies are a sufficient condition for higher performance and the other way round.

Until today there are a number of studies which fail to empirically confirm these assumptions. Many did not find evidence of a performance difference between economies with different size and development level. His work employees stochastic frontier analysis to estimate economic measures of efficiency for the telecommunications sector of 139 economies and examined their relationship with economy size. In addition to that his paper controls for the effects of competition in telecommunications, privatization of state-owned providers, independent regulators and tried to evaluate the quality of political institutions on sector performance. (Symeou 2011, p. 426)

Economic growth, telecommunications development and productivity growth of the telecommunications sectors have been examined by Lam and Shiu (2010) who collected evidences around the world. Their paper studies the different relationships and assesses the impact of mobile telecommunications.

Their results indicate that countries with competition and privatization in telecommunications have achieved a higher factor productivity growth than those without competition and too high degree of governmental holdings in telecommunications industry. Furthermore the diffusion of mobile telecommunications services is found to be a significant factor that has improved the factor productivity growth of the sector in Central and Eastern Europe (CEE). (Lam and Shiu 2010, p. 185)

4.1 Desk Research

As we have seen earlier in previous chapter the development of technology and introduction of new devices is happening at very fast speed. A basic question is if the consumers can follow these trends, adapt the new offerings and use it. It is important to examine the market research data properly to understand the relevance and try to understand the usage pattern of the consumers better. The reason that technology is developing fast makes it for players like telecommunications operators, mobile handset manufacturers, service providers and all other players essential to create offering which are basic to understand, playful to learn and create fun and interest when using it. Our analysis will have examine whether the percentage of mobile phone subscriptions within a country can tell something about the usage patterns. The pricing of different services should be very relevant for the usage which will try to work-out as well as telecommunications sector and the employment structure should give us relevant data to draw conclusions.

H1 - In a comparison of European countries the penetration rate of mobile phone subscriptions has a relevant influence on the pricing and service level. Relationships between chosen variables like investment, employment and number of mobile subscriptions will be revealed and countries grouped based on factor coordinates.

The data is taken from the European Union statistics webpage (August 2011). Table 1 contains some factors, variables (number of mobile phone subscriptions, investment, employment – full time equivalent etc.) that affect the maturity of the telecommunications sector. The data derive form the webpage of Eurostat. I have worked with 15 observations (countries) and 8 different variables.

The basic aim of my examination was to reveal relationships between the chosen variables, and to try to group the countries based on the factor coordinates and give a transparent picture in a graph forma. For conducting the factor analysis, SPSS 15.0 for Windows and Minitab 15 will be used.

Results:

The factor analysis was conducted for eight variables affecting the maturity of the telecommunications sector. First of all, I examined that whether the variables are suitable for factor analysis or not. All of the examinations (correlation matrix, anti-image matrix, Bartlett-test, KMO criterion) confirmed that the variables are suitable for factor analysis. Then several methods were used to determine the number of the factors. After the interpretation and labeling of the factors, the distribution between the countries based on the coordinates of the first and second factors, were illustrated and it can be confirmed that our hyphothesis can be confirmed as the penetration rate of mobile phone subscriptions has a relevant influence on the pricing and service level in a country. The telecommunications infrastructure and its related services represent a major element in economic development, especially for countries in transition. Figure 4 illustrates the countries is relationship of the national pricing of telecommunication services and marketshare in combination with the number of subscritions.

Figure 4: Country map based on price, marketshare and penetration of mobile subscription
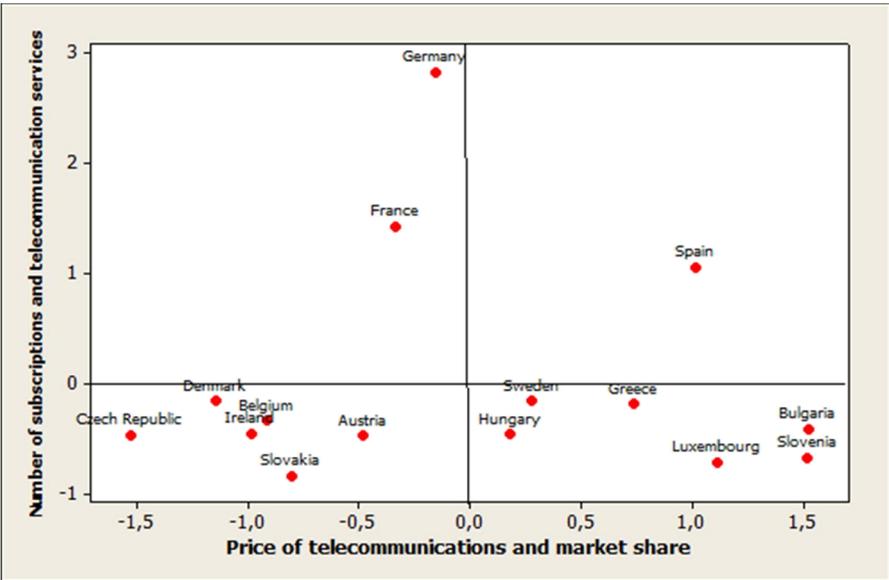
Source: own graphics

Countries that have the necessary telecommunications infrastructure and services are able to achieve information technology based growth more rapidly. There is a strong correlation visible between telecommunications and economic development and between investments in telecommunications and economic development. (Dvornik & Sabolic 2007, p. 386). An important driver of demand is price decreases. This was also true for the mobile telecommunications market. Additional support to the significant market growth came from the internet revolution and worldwide liberalization, privatization and deregulation of the mobile telecommunications markets. The aggregate price of mobile voice and data has decreased substantially as we saw and more advanced handsets – smartphones will increase the usage of services significantly within the next years with higher penetration and substitution of the normal phone which can only do calls and send text messages. (Dunnewijk & Hukten, 2007)

4.2 Online Research

The objective of this research is to investigate the habits and interest of mobile phone usage by end consumers in Hungary and their willingness to pay money for a mobile applications. On the www.nokia.hu homepage we placed a questionnaire and asked end consumers who were visiting our page for their opinion. Based on the more than 2100 answers in an online survey, I defined hypothesis and tried to proof those with statistical methods. My findings should help make use behavior transparent and clear for all the participants. The topic is of major importance for mobile phone manufacturers as well as for network operators and other partners within the value chain.

Mobile application stores (App stores) are showing high growth rates and the availability of mobile applications seems endless and you can get the feeling that there is an app for everything. One of the new growth generators seems to be applications (games, videos, useful tool, etc.) which you can download via phone or PC to add more functions to your device. To get to know more about the attitude and the willingness to pay money for such applications we asked end consumers who were visiting our page for their opinion. Based on the more than 2100 answers I defined hypothesis and tried to proof those with statistical methods. My findings should help to make the right decisions in the future. The topic is of major importance for mobile phone manufacturers as well as for network operators and other partners within the value chain.

For the statistical examination of my work I used the SPSS software version 15 (originally, Statistical Package for the Social Sciences). It was released in its first version 1968. It was developed by Norman Nie and Hadlai Hull. SPSS is among the most widely used programs for statistical analysis in social science. It is used by market researchers, health researchers, survey companies, government, education researchers, marketing organizations, PhD students and others. The original SPSS manual (Nie, Bent & Hull, 1970) has been described as one of "sociology's most influential books". In addition to statistical analysis, data management and data documentation are features of the base software.

Consumer behavior is different when it comes to mobile application usage. Differentiation analysis by gender, demographics and geographics. Later the Hyphotheses will be split further into sub-groups to sharpen the focus.

H2) Men download more applications then women and are willing to pay more for it.

H3) People living in the City have more often internet access and download more applications than people in rural area.

H4) Depending on the age group the willingness to pay (more) for applications is different.

In order to get to know more about the mobile phone and smartphone user behavior of Hungarian end consumers we did an online survey on the www.nokia.hu homepage. We check their willingness to pay money for a mobile applications and asked end consumers about their preferences. Based on the more than 2100 answers of the online survey, I defined three specific hypotheses groups and tried to proof those with standard statistical methods. My findings should help make use behavior transparent and clear for all interested in the mobile applications market. The topic is of major importance for mobile phone manufacturers, for network operators as well for application and other stakeholder in the mobile value chain. 2143 end consumer gave valid answers on their phone usage habits and what kind of communication tools they use: SMS, Internet, navigation systems, camera functionality etc. on their mobile devices

Results:

In this study I aimed to reveal possible relationships between demographic features and mobile phone habits. In order to reach this goal, three hypotheses (some of them have sub-hypotheses) were defined. In conclusion it could not declare undoubtedly that men are content to pay more for an application. A moderate relationship exists between the sex and the frequency of downloading free applications, and the frequency of downloading pay applications bears a weak relation to the sex. I have also revealed that having Internet access is in (weak) connection with the place of residence. But it can't be stated precisely and unequivocally that people living in the city have more often Internet access than people in the rural area. In addition, a weak relationship can be observed between the place of residence and the frequency of downloading free applications, but there is no relationship between the place of residence and frequency of downloading pay applications. My third hypothesis was rejected, so the willingness to pay for an application is independent of the age group.

Similar studies figured out that significant differences between different age groups exist as regards to the importance given to all the factors except 'post - purchase services'. The difference was highest for the 'brand' closely followed by 'core technical features' of the handset. Gender differences have also existed for these factors. For future research these studies can be extended to more number of variables such as different income groups, different occupations, and different personality traits and lifestyles of consumers. The future studies may further investigate reasons for differences between different consumer groups. (Singh & Goyal 2009)

The findings of my dissertation can help the smartphone industry to gain further understanding of the impacts of new features and applications available. The assumed relationships exist, but they are too weak to expand my findings to the population using mobile phones.

Int he future, my research can be continued: with the increase of smartphone sales the interest in that area will grow and more research from all over the world can be expected as the user behavior is changing rapidly with the new technology opportunities like large screen for browsing and superfast LTE networks.

4.3 Deep interviews

The computing world is now populated with smartphones which combine the features of a phone with a general purpose computer and equipped with digital cameras, global position and the opportunity to receive email and browse the Internet. The primary aim of this research is to understand and gain insights into student´s usage of smartphones and understand their expectations concerning needed features and functionalities. The second part looks deeper into the Windows Phone OS in particular and works out the challenges and opportunities for Nokia and Microsoft going forward in their partnership. The perception of users (buyers) and non-users (non-buyers) for Nokia Lumia devices in the related target market (Hungarians between the ages of 19-27 years old) was examined and differences analysed. Another goal was to figure out in detail the advantages for the new Mobile Ecosystem and find the drawbacks of Nokia Lumia devices and the Windows eco-system in the mind of this specific customers group. The study has to conduct Problem-Identification researches, which are going to be undertaken to help identify problems which are not necessarily apparent on the surface and yet exist or are likely to arise in the future regarding market characteristics and image of Nokia on the Hungarian market in the given target group (19-27 years).

The market overview already used in chapter three shows the global market shares of different operating systems when it comes to the smartphone segment globally. Numbers in Central East Europe incl. Hungary are similar and based on market research agencies like GfK (Gesellschaft fuer Konsumgueter Forschung) and IDC the share of Windows Phone 8 is around 10% value and volume (Q4 2013). When Nokia decided to stop producing Symbian devices they put all efforts into the cooperation with Microsoft and their Operating System Windows Phone8 (WP8) by developing and producing these smartphones called Lumia. As we can see WP8 is a challenger in the market and clearly behind the ultimate leader Android (OS by Google) and as well behind the Operating System IOS provided by Apple.

There are different problems to be answered. On the one hand there is the Management Decision Problem (MDP), which needs to answer how could Nokia improve the sales figures among the target market (age group of 19-27) on Lumia smartphones and how could they capture more market share on the Hungarian market?

On the other hand there is the Marketing research problem (MRP) with the broad statement: Consumer preferences and purchase intentions of the target group should be determined for the Lumia portfolio, and on the other hand the effectiveness of promotion and distribution activities should be evaluated. The different hypotheses are based on several research questions.

Following Hyphothesis were developed:

H5: Price and ease-of-use will be the most important regarding the purchase decision of a Smartphone

H6: For the purchase decision of a Smartphone the most important factor is the Operating system (OS) and the richness of applications

H7: Telephony and text messages will remain the most important applications and features used in a Smartphone

Given the exploratory nature of some aspects of the objectives, we performed detailed qualitative analysis, which was approved by a quantitative survey as well. Focused research was used to explore and understand the attitudes of potential consumers towards the devices, the mobile ecosystem and quantitative research will be used to measure how widespread these attitudes or perceptions are.

The quantitative research was conducted with 112 respondents. The response period was from 13th to the 22th of April 2013. The research is not representative because of its limitation of small sample size, guided distribution and fulfil, and of the over-represented university students in the sample. Therefore, the aim of this survey is rather gathering insights about the market segment and justify our assumptions derived from qualitative researches and observations. Gender distribution can be argued as reasonably equal; 58.9% of the respondents are female, while 41.1% are male. Based our on primary target group (19-27 years old), in 55.4% of cases the occupation is assigned to undergraduate student status and the 57.1% of respondents are has a bachelor degree as highest level of education.

Results:

The research helped to establishing the knowledge about the general requirements to a Smartphone with important features and general requirements for marketing, branding, pricing and distribution models.

Firstly, the most relevant attributes of a mobile devices was assessed based on the responses gathered by our quantitative research. Hypothesis 5 said, the price will be the major attribute regarding purchasing a phone as well as the ease-of-use will be of major relevance. This assumption can be approved just partly, while price is just the second most important factor among respondents with the value of 4.46. The most significant attribute regarding purchasing a mobile devices is the capability of the phone to use Internet on it which is a clear indicator that Smartphones will continue to grow compared to basic phones and feature phones as mobile devices.

Figure 5: Smartphone purchase decision making attributes
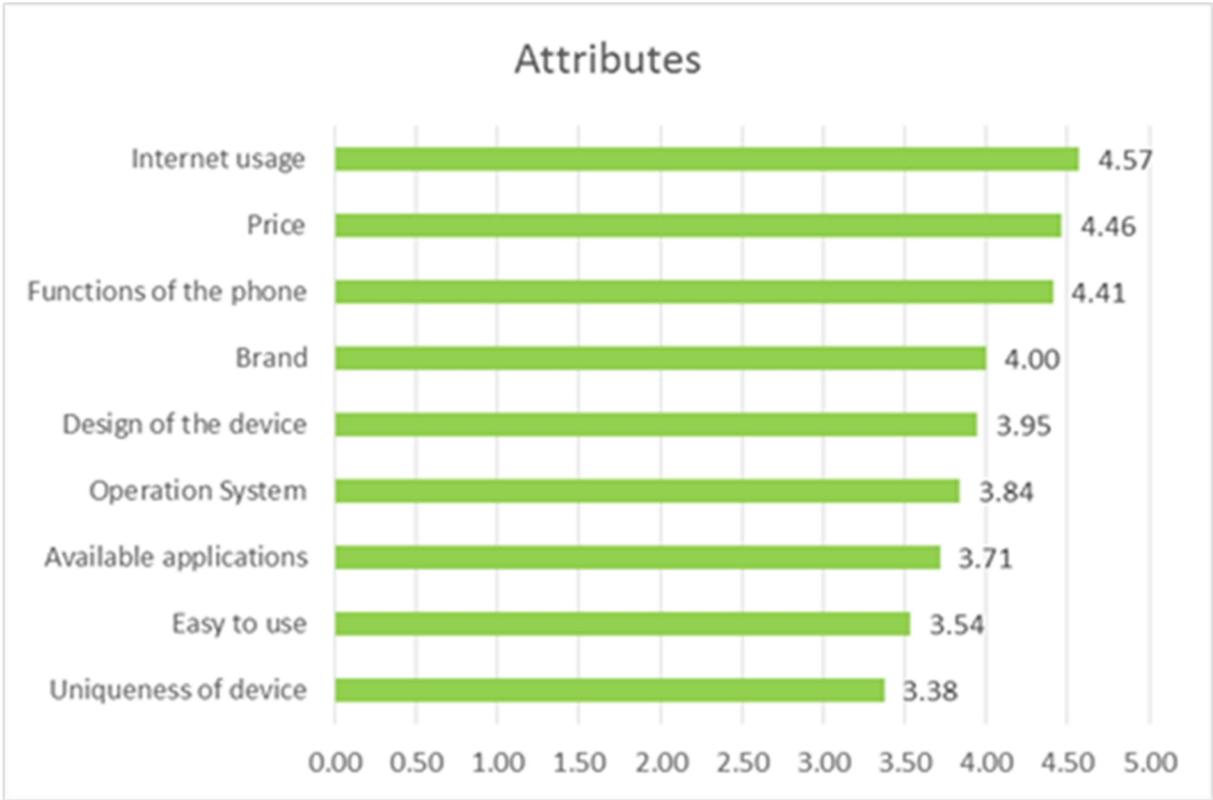
Source: CEMS Study 2013 Questionnaires results

Hyhothesis 6 examined the most important functions and features of a Smartphone and came to the clear results that the Operating system (OS) and the richness of applications is not the most important decision maker for students in Hungary as consumer group. Rather the hardware elements with design, quality and battery live matter. One reason might be the fact that within all three major Operating systems (Apple: IOS; Google: Android; Microsoft: Windows with Nokia as major manufacturer) have similar offerings, when it comes to applications and services, in consumer perception already.

Figure 6: Most important function for Smartphone
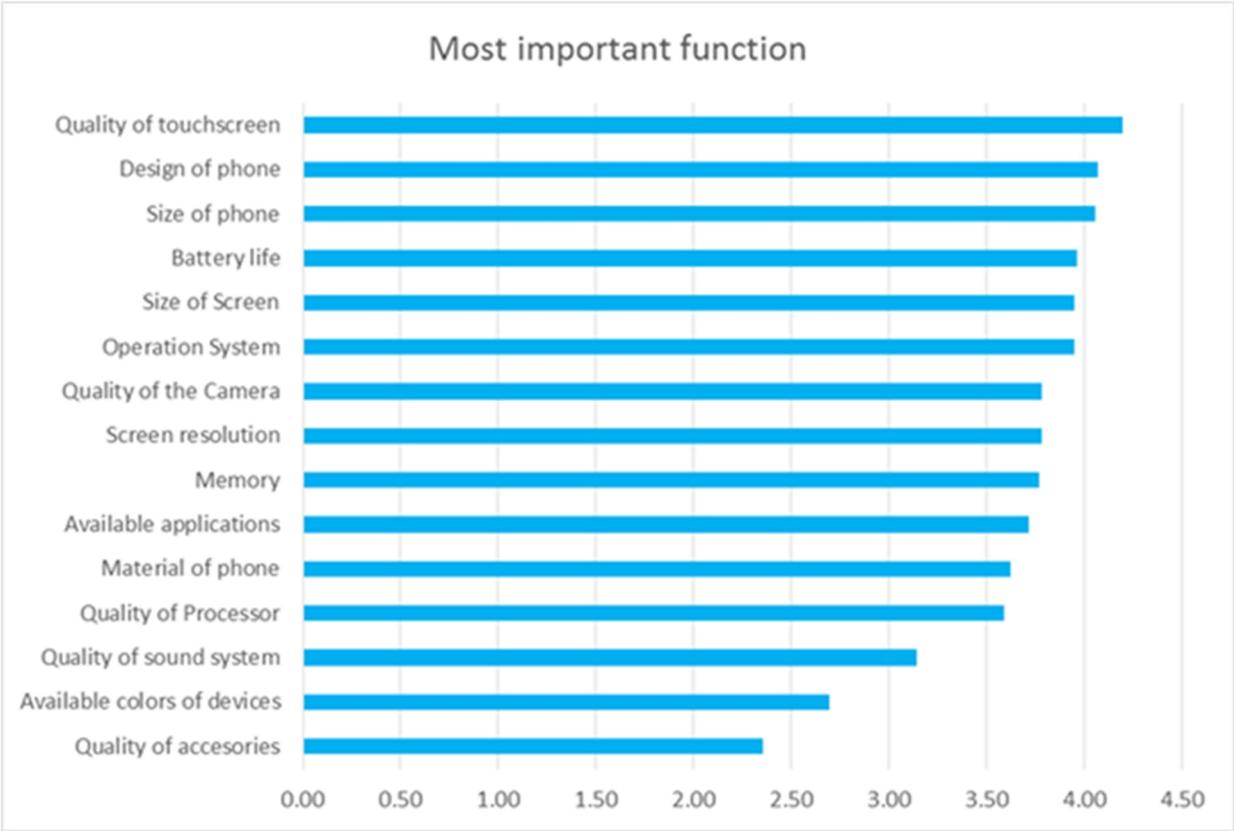
Source: CEMS Study 2013 Questionnaires results

Finally Hyhothesis 7 looked into the msot important application types of a Smartphone. Let me remember on the fact that mobile phones in the first 20 years only had two important applications. The phone call and text messages which should remain as the most important applications and features being used in a Smartphone.

Figure 7: Most popular application types
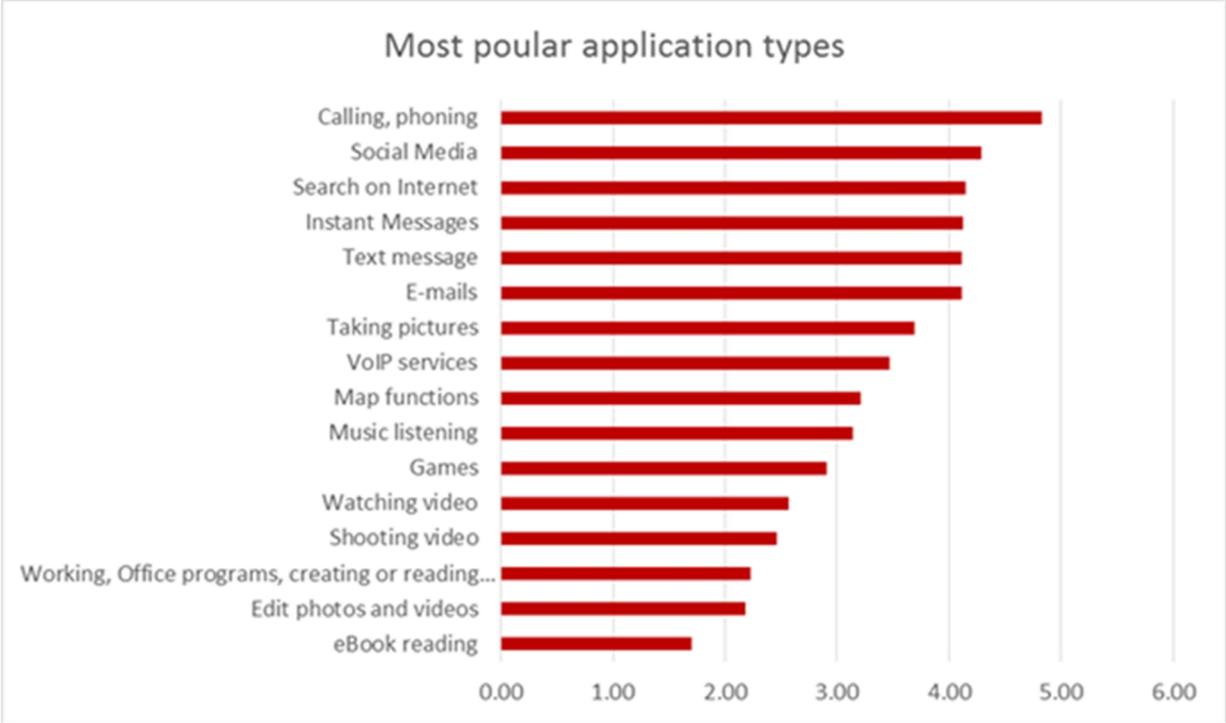
Source: CEMS Study 2013 Questionnaires results

We can partly confirm the hypothesis as the call function is still the most important application of a mobile phone, but social media sites and VoIP services are getting more and more relevant among this target group.

Interestingly, social media and instant messages prevent text messages among 19-27 years old customers. So that the classical text message (sms) as communication form is not anymore under the top three of the popular applications.

5. **Future outlook of the Smartphones industry**

As mobile devices learn more about our habits, pathways, interests, & affiliations, they will offer a more dynamic user experience. Expressed through the operating system & user interface, Smartphones will be adaptive & predictive, configuring applications, visualizations, and recommendations on-the-fly to deliver the most appropriate utility based on context, anticipated need, and user demands. Simple interface modified by gestures & driven by context delivers complex functionality from the learning Operating systems.

Smartphones will use faster networks (4G & 4G+) networks will enable fast cloud based services that give consumers unprecedented mobile computing power. The multimedia race requires high performance Devices, use cases (3D, Gesture recognition, multi Display, Gaming etc.) boosting need for device capability to support new customer value propositions.

High-end smartphones have similar computing power as tablets, hybrids, and notebooks. Smart internet connected wearable devices will be in their second iteration, on the verge of mass market breakthrough. Mobile device performance reaches level adequate for all laptop applications (games, office applications), as well as replacing dedicated cameras, navigators, media players and game consoles. As all mobile devices become connected to a cloud based supercomputer, Microsoft, Apple,Google and others have to address the needs of multiple form factor devices of a single user, running multiple client stacks.

As mobile internet use overtakes PC use, also the value of mobile users grows for the outside ecosystem beyond handsets and networks. We are beginning to see mobile device subsidies coming from outside the traditional players, as companies like Amazon, Tesco, and AliBaba start using mobile devices as consoles to their services. The mobile handset manufacturers need to plan on this trend to continue and accelerate, taking it into account for their product offering including both devices and services.

Competition will be between the cloud based services, accessible via multiple mostly mobile devices. User context and history should be preserved between devices even if the client stacks are different. Core of device gets more important as Device penetrates to new use cases and customer value propositions. Opportunity to devices manufacturers like Nokia to build advantage by differentiating with device performance to deliver against the expectations of the consumers who will continue to be in the middle of the interest in the mobile telecommunications industry.

Future research will have to concentrate on the latest features being used in the mobile telecommunications industry and monitor carefully the hardware and software developments in order not to miss consumer needs and interests.

6. New scientific results

In the followings I am summarizing the new scientific results of my dissertation.

1. I have formulated that the ecosystem around a mobile „smart" product is functioning as a special supply chain.

2. The scientific methods I used have proofed that only the parallel research of value chain – supply chain – demand chain in its complexity can bring appropriate results. It means that an examination in their constantly changing environment and complexity can contribute to the competitiveness and to the technological survival.

3. With the help of mathematical-statistical methods I have segmented the Hungarian Mobile phone market and I have drawn consecuences regarding preferences such as using applications, etc. (see H2, 3, 4, 5.)

4. With the help of factoral analysis I have proofed that for the purchase decision of a mobile device (such a Smartphone), the most important attributes and functions are related to device hardware and are centered around Internet usage. (see H6.)

These results can state as well, that in the age of time based competition science has to find new methods of getting results more quickly and apply them in practicewithout delay.

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