Shahrokh Nikou

Opening the Black-Box of IT Artifacts

Looking into Mobile Service Characteristics and Individual Perception

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Shahrokh Nikou

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Abstract

The exponential growth in the mobile telecommunications has created fierce competition for all participants in the mobile industry and enabled service and application providers to develop mobile services that can be used by a large number of users. From the users' perspective, the services should be innovative, useful and fit into their daily routines. From the network operators and service providers' perspectives services should be adopted by a critical mass of users and be used in a global scale to earn back huge investments made in network licenses and technology. The core objective of the current dissertation is to create an understanding of individual acceptance of IT artifacts i.e., mobile services and provide insight to the characteristics of the IT artifacts. Moreover, consumers' awareness of mobile service platforms is explored. To do so, empirical studies using various statistical methods and tools are conducted to evaluate service characteristics and investigate users' perceptions and acceptance toward IT artifacts. In addition, an experimental study is also conducted to investigate users' perceptions towards usefulness of the converged rich communication services which have recently been developed by a number of telecommunication companies, as an alternative to the dominant iOS and Android platforms.

The findings indicate that mobile services have to be evaluated and judged on their own merits, and not only with established acceptance theories. The results show that service characteristics such as innovativeness, usefulness, ease of use and context of use influence individual perceptions and these characteristics are highly relevant criteria toward the acceptance, adoption and use of mobile services. The results show that application costs are by far the most relevant criterion for selecting a service regardless of the platform. Furthermore, operating systems offered by Apple (iOS) and Google (Android) are preferred over other operating systems offered by Nokia (Symbian) and BlackBerry. New innovative services have to be developed while taking into account the differences in daily routines, frequency, urgency and intensity of use. Presumably, device manufacturers can win the platform battle against their rival 'Telecom operators', if they can provide innovative services and applications that fit into users' daily routines. In particular, this dissertation suggests that Telecom operators should settle for becoming a bit-pipe provider and let other market participants i.e., large companies e.g., Google and device manufacturers e.g., Apple be involved in the mobile service market.

The findings contribute to the discussion on mobile service platforms by suggesting that service platforms need to be aligned with users' preferences and devices they already use. In future research, researchers should pay more attention to issues such as service functionality and simplicity that play a significant role in consumers' decisions and refrain from research that only discusses mobile services and applications in generic terms. If scholars pay more

attention to techno-economics e.g., service characteristics, innovativeness, service platforms, payment, and context-of-use, new theories can be developed that might be relevant to study the next generation of mobile service.

Sammanfattning

Den kraftiga tillväxten inom mobil telekommunikation har skapat hård konkurrens bland alla företag i mobilbranschen och ett stort antal tjänster och tillämpningsprogram finns nu tillgängliga för en bred publik. Ur användarens perspektiv bör tjänsterna vara innovativa, användbara och passa in i ens dagliga rutiner. Ur nätverksoperatörernas och tjänsteleverantörernas perspektiv bör tjänsterna tas i bruk av en kritisk massa användare och användas på en global skala för att säkerställa avkastning på de stora investeringar i nätverkslicenser och teknologi som gjorts. Huvudsyftet med denna avhandling är att bättre förstå faktorer kring individuell acceptans av IT artefakter, i det här fallet mobila tjänster, samt att skapa insikt om egenskaperna hos dessa IT artefakter. Därtill undersöks konsumenters medvetenhet angående teknologiplattformer för mobila tjänster. Empiriska studier med olika statistiska metoder och verktyg har använts för att utvärdera tjänsternas egenskaper och för att undersöka användares uppfattningar och acceptans av tjänsterna. Därtill är en experimentell studie genomförd för att undersöka uppfattningar angående användbarheten av konvergerade rika kommunikationstjänster som nyligen har utvecklats av ett antal telekommunikationsföretag som ett alternativ till de dominerande iOS och Android plattformerna.

Resultaten tyder på att mobila tjänster måste utvärderas och bedömas på egna meriter och inte bara med hjälp av redan etablerade acceptans teorier. Därtill visar resultaten att tjänste-egenskaper såsom innovativitet, användbarhet, användarvänlighet och det sammanhang där tjänsten används påverkar uppfattningen om tjänsten. Dessa egenskaper är mycket relevanta kriterier beträffande acceptans och användning av mobila tjänster. Resultaten visar vidare att applikationskostnader är i särklass det mest relevanta kriteriet för att välja en tjänst oberoende av plattform. Operativsystem som erbjuds av Apple (iOS) och Google (Android) föredras framför andra operativsystem som erbjuds av Nokia (Symbian) och BlackBerry. Nya innovativa tjänster måste utvecklas där hänsyn tas till skillnader i dagliga rutiner, frekvens, brådska och intensitet av användning. Förmodligen kan hårdvarutillverkare vinna kampen mellan plattformer gentemot telekomoperatörer om de kan erbjuda innovativa tjänster och tillämpningar som passar in i användarens vardag.

Denna avhandling framför att telekomoperatörer skall godta en roll som leverantörer av bandbredd och låta andra marknadsaktörer som till exempel Google och Apple vara en del av den mobila tjänstemarknaden. Resultaten bidrar till diskussionen om mobila ekosystem genom att antyda att tjänsteplattformar måste anpassas till användares önskemål och till de enheter som de redan använder.

I framtida forskning bör forskare ägna mer uppmärksamhet åt frågor som tjänstefunktionalitet och användbarhet som spelar en betydande roll i konsumenternas beslut och avstå från forskning som bara diskuterar mobila tjänster och applikationer i allmänna drag. Om forskare ägnar mer uppmärksamhet åt ”tekno-ekonomi” som till exempel serviceegenskaper, innovativitet, plattform, betalningar och den kontext där tjänsten används, kan nya teorier utvecklas som kan vara relevanta inom forskning kring nästa generations mobila tjänster.

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List of original publications

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2. **Nikou, S.,** Bouwman, H., and De Reuver, M. (2012). The potential of converged mobile telecommunication services: a conjoint analysis. *info*, 14(**5**), 21-35.

3. **Nikou, S.,** and Mezei, J. (2012). Evaluation of Mobile Services and Substantial Adoption Factors with Analytic Hierarchy Process (AHP). *Telecommunications Policy*, DOI: 10.1016/j.telpol.2012.09.007.

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6. De Reuver, M., **Nikou, S.,** and Bouwman, H. (2012). Enriched presence information on converged communication platforms: A quasi-experiment. *Submitted to Convergence: The International Journal of Research into New Media Technologies*.

7. **Nikou, S.,** and Bouwman, H. (2012). The Diffusion of Mobile Social Network Service in China: The Role of Habit and Social Influence. *In Proceedings of the 46th Hawaii International Conference on System Sciences, HICSS: IEEE.*

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Part I

Research Summary

Chapter 1

Introduction

"The greatest enemy of knowledge is not ignorance; it is the illusion of knowledge".

– Stephen Hawking

For several years, individual acceptance of Information Technology (IT) has been the theme of interest in Information Systems (IS) research (Bhattacherjee and Sanford, 2006). Understanding IT acceptance is of decisive importance because if individual users do not accept it, then the expected benefits offered by IT artifacts as part of Information Systems cannot be realized. This becomes even more crucial when we see most of, if not all, prior information systems research have taken the core subject matter –being the Information Technology (IT) artifact– for granted or have been treated as a "black-box" (Orlikowski and Iacono, 2001). They found that IT is conceptualized mainly into five meta-categories, having common treatment (taken for granted) of information technology in (IS) research. These conceptualizations of information technology in IS research are categorized as (i) tool view, (ii) proxy view, (iii) ensemble view, (iv) computational view and (v) nominal view. According to Hevner et al., (2004) IT artifacts are broadly defined as (i) constructs (vocabulary and symbol), (ii) models (abstractions and representations), (iii) methods (algorithms and practices), and (iv) instantiation (implemented and prototype system).

To our knowledge, the characteristics of technological artifacts, 'being mobile service innovations in the current study', are given inadequate attention. Mobile telecommunication industry and therefore, mobile service innovations are the result of socio-technological development over the years and an outspoken example of the convergence of Internet, Media, Information Technology (IT) and telecommunication industry. Mobile services are digital services (other than traditional voice and messaging services) which are added to mobile phone networks or pre-installed on devices. One can argue that the future of mobile communication market is becoming increasingly dependent on a multiplicity of advanced mobile service innovations, as the benefits offered by such services are highly diverse. Acknowledging the fact that the basic mobile services such as telephony and texting did lead to the breakthrough of mobile technology as a disruptive innovation, it is worthwhile to emphasise that the current study is focussed more on incremental innovations related to advanced mobile services and applications which can be used by smart-phones. With regard to end-users, the current study aims to investigate users' behaviours from both perspectives, either smart-phone users or users of feature phones.

It is worth bearing in mind that not only different fields, but rather divergent disciplines study these issues based on their paradigms. For long, different areas in mobile telecommunication have been under investigation by many scholars, researchers and practitioners. One of the most attracting areas of research is the adoption and acceptance of mobile service innovations by individuals. From service providers' perspective the mobile service market has not yet reached its maturity level to earn back the huge investments made at the early stage of mobile service convergence (Constantiou, Damsgaard and Knutsen, 2007). In contrast, from consumers' perspective, value perception of mobile services is at the centre of interest. A technology may be perceived as being innovative, easy to use, and useful, but consumers may not adopt it if it does not fit into their daily routines (Petrova and MacDonell, 2010). In research in mobile service innovations, individual technology perception and individual characteristics are found to be the two important adoption factors. For example, Magnusson (2003) postulated that engaging ordinary users into mobile service development leads to the design of more creative and useful services than services suggested by professional. Moreover, combining individual characteristics with other relevant adoption factors, such as service and platform perception, provides better understanding of user acceptance of mobile services (Leong et al., 2011).

Although, there are enormous number of mobile services and applications available, adoption of many advanced services have been limited or have not proliferated e.g., mobile TV, some Web 2.0 applications and Mobile Banking (especially in Europe) (Constantiou, Damsgaard and Knutsen, 2006). An asynchronous adoption pattern of mobile services (Carlsson et al., 2005) raises the following issues and questions that we as IS researchers must engage in, deeply and seriously, to provide practical and theoretical insights for Information Systems research community; such as: why do users use only a certain type of services?; why do users make use of different services with different frequency (is the frequency inherent to the service?); how do users perceive service characteristics?; how do service characteristics affect the acceptance of mobile services?; how do mobile service platforms play a role in consumers' decisions?

To answer these questions, several theories: such as Technology Acceptance Model (TAM) (Davis, 1989), Diffusion of Innovation (DOI) (Rogers, 1995) or Unified Theory of Acceptance and Use of Technology (UTAUT) (Venkatesh et al., 2003) have been formulated and tested. These are by far the most applied and used theories in mobile telecommunication to study the individual or organizational acceptance and adoption of mobile services. The main focus of such theories is to see how and why a new innovation or technology is spread. There is an extensive body of literature in which researchers have used one or even a combination of different acceptance theories hoping to contribute to the understanding of the acceptance and sustainable usage of the mobile services. For example, López-Nicolás (2008) argue that traditional antecedents of behavioural intention, ease of use and perceived usefulness (two constructs in TAM), can be linked to diffusion-related variables. Shin (2007) uses TAM as a

conceptual framework to analyze the consumer attitude toward Wireless Broadband Internet in Korea, and Nysveen et al., (2005b) have conducted a study to investigate user intention to use chat services applying an extended adoption model based on TAM and Theory of Reasoned Action (TRA) (Fishbein and Ajzen, 1975). However, none of the traditional acceptance theories take service characteristics and individual perception of service characteristics into account.

It seems that the role of service characteristics and individual service perception are seldom problematized or have been given adequate attention in IS research. Therefore, one can argue that there is an essential need in the literature to open up the "black-box" of service characteristics and see how these play a role in decision making of individual acceptance. Given that service characteristics and individual service perception play a significant role in the adoption process, we have taken these issues as the central focus of this research, and attempted to investigate how service characteristics affect the acceptance of mobile services.

Furthermore, looking into articles in IS research focusing on mobile telecommunication industry, one can realize that mobile service platforms have recently received ample attention among researchers. For long, mobile operators were the sole mobile content service provider or aggregators in the telecommunication market. However, the service provision in recent years has been replaced by from mobile operators to proprietary platforms such as Google, and Facebook or device manufacture platforms –Nokia and Apple, for example. A platform may refer to a hardware configuration, an operating system, a software framework or any other common entity on which a number of associated components or services run (Poel, Renda and Ballon, 2007). There are currently three major platform categories in the mobile service domain; (a) device manufacture-centric (e.g., Apple), (b) network operator-centric (e.g., Orange or Vodafone Live) and (c) service provider-centric (e.g., Google or Facebook). Device manufacturers provide mobile software platforms in the form of mobile operating systems that function as middleware between the hardware of the handsets and the applications; as an example one can mention Apple with "iOS". Furthermore, Internet-based companies –like Google and Skype with their highly innovative, over-the-top, and often free mobile services have gained massive attention and competitive advantages over mobile network operators. In the mobile network operator-centric platform model, the network operator acts as a portal provider and the end-user accesses services via an operator portal.

Several issues that hinder or stimulate the individual acceptance and adoption of mobile services have been identified. There is also a serious debate among experts in mobile services domain regarding the relative merits of traditional acceptance theories (Bhattacherjee, 2006).

In addition, mobile telecommunication industry is now in the period of platformization (Ballon, 2009), consequently, the nature of service provisioning appears to be shifting from mobile network operators (as being the only (sole)

service provider) to mobile device manufacturers and proprietary service providers. With the above fundamental concepts serving as a base, the following sections engage deeply to its core subject matter e.g., service characteristics, individual service perception and mobile service platforms. By doing so, the current research hopes to shed some insights and guidance into solving the problem under investigation. After section 1, we will discuss technology in more detail before we introduce the research objective and questions.

1.1 Mobile Service Characteristics: Opening the "Black-box"

The adoption of mobile services depends on several issues that play a significant role, so it is of decisive importance to address them profoundly. Prior studies in individual technology acceptance treat the service characteristics as a "black-box" whose relative importance has remained uncovered (Venkatesh and Davis, 2000; Venkatesh et al., 2003; Venkatesh, 2006). Hence, understanding the dynamics of mobile service acceptance by individuals becomes increasingly important for both practical and theoretical reasons. Although, conceptually there is a difference between adoption and acceptance we will use the concepts interchangeably. From a theoretical point of view, addressing the areas that have not been explored previously, i.e., understanding the service characteristics and individual service perception, increases our common knowledge on technology acceptance in general and in mobile service acceptance specifically. From the practitioners' point of view, understanding those issues would help service designers, developers and providers to overcome issues that greatly influence the users' intention toward acceptance and adoption of mobile services.

Mobile handsets, with embedded software, can support users' performances in their day-to-day lives or in their communities. In other words, mobile applications and services enable users to access all kind of information, perform tasks, communicate, make banking transactions and even entertain themselves. The endless opportunities in mobile technology due to its ubiquitous character would lead to the assumption that the acceptance/adoption of these technologies becomes inevitable. However, regardless of the huge opportunities in mobile technology, several prior studies show the failure of the acceptance/adoption of many mobile service innovations (Bouwman et al., 2008), and (López-Nicolás et al., 2008).

Although the mobile services are ubiquitously available, in practice the users expect services to be available at any moment, and place, while they only use a service in a specific context (Kleinrock, 1996; Mallat et al., 2006), in other words, meeting latent and manifest needs. Here is the place that "mobility" plays a significant role in individual acceptance of mobile services. The concept of mobility itself is poorly understood. Mobility can be perceived as moving around, either in time or in a place – of objects, devices, people and application. Objects can be labelled with Radio-Frequency Identification (RFID) tags and

transmitters, to be traceable worldwide. People carry their mobile handsets at anytime, and anyplace to be in touch, while moving around.

In spite of being a very effective attribute of the mobile services, mobility is not the only characteristic which has to be taken into account for the acceptance process. Mobile services, based on their characteristics, can be categorized in many different ways. To find the logic behind the adoption/acceptance of services belonging to different categories, one needs to analyze them in different manners. Therefore, it is necessary to categorize mobile services efficiently (Bouwman et al., 2012; Kuo and Chen, 2006; Jeon and Lee, 2008; Varshney, 2005). One possible characterization is the following:

- Communication services (mobile telephony and SMS)
- Information services (mobile weather, mobile news)
- Entertainment service (mobile game, mobile music and mobile TV)
- Web 2.0 (mobile social networks)
- Transaction services (mobile banking, mobile shopping)

Some services have been around for quite a long time such as telephony and SMS and others recently became available in the market –like mobile social network services (Facebook) or mobile monitoring of RFID information. Some services are designed for individuals (e.g., mobile telephony & SMS); while some are designed for groups (e.g., mobile social network applications), whereas some have hybrid purposes (e.g., mobile games). Some services are clearly push-services (e.g., mobile email, mobile marketing messages) where content is provided, while others are pull-services, where users have to search or request for the relevant content (location information or mobile weather information). Some advanced services, explicitly exploiting the mobile nature, are expected to fit day-to-day routines and usage context –like information services related to location such as Google Maps, navigation service, weather or timetables of transports, shopping, and health. While, in contrast, communication services (SMS, MMS and mobile telephony) and entertainment services (Icon, ringtone) are considered less context-sensitive.

Moreover, in a discussion on user-generated content, Shao (2009) categorized mobile services into two groups:

1. Services which are more focused on consuming information and entertainment (consumption) –like watching videos, listening to music (mp3), searching for information and reading blogs.
2. Services which are more focused on social interaction and community formation (participating) –like mobile Wiki consultation, mobile chat, or on self-expression and articulation (production) –like sharing of photos based on location via mobile, or YouTube contributions.

In another study Feijóo et al., (2009) defined a taxonomy for mobile services which is based on two dimensions:

- Processed information (mobile stock market information) versus creative content (mobile game).
- Existing content adapted to mobile platform (mobile banking, mobile email) versus content which is explicitly designed and developed for mobile platforms (location based services).

Based on Feijóo et al., (2009) taxonomy, four groups of services stands out.

1. Content adapted to mobile platforms like search services, news, and mobile e-mail.
2. Mobile content that is repurposed like mobile TV, MP3 music, jokes, and games.
3. Mobile services which are specifically related to mobile functionality, like ringtones, icons and location aware services.
4. Mobile Web 2.0 services, including mobile social networking services.

The Feijóo et al., (2009) taxonomy is fuelled towards content and therefore to consumption. If we combine Feijóo and Shao's taxonomies, then the distinction between "adapted to mobile" and "specific to mobile" makes sense for "participating and producing", and "the creative versus process" dimension becomes relevant for both categories. These mobile service characteristics and different service categories discussed in the previous text will be used throughout the research. To do so, empirical studies will be conducted to investigate how different service characteristics affect users' service perceptions.

1.1.1 Perception of Service Characteristics

Mobile services are becoming increasingly important for end-users, because they are universal, ubiquitous and able to be personalized (Watson et al., 2002). Based on conceptualizations of IT artifacts in IS research given on page 3, one conceptualization of technology is viewed as a proxy. The conceptualization of technology as a proxy view has a focus on one or a few key elements in common that are understood to represent or stand for essential aspects, property or value of the information technology (Orlikowski and Iacono, 2001). Moreover, within the proxy view of technology then three types of proxy logics are identified, (i), technology as perception, (ii), technology as diffusion, and (iii), technology as capital. In this section, we discuss only the individual perception of technology specifically for mobile services to see how perceptions of service characteristics play a role.

The users of mobile services would at least expect that using a particular mobile service will add value to their day-to-day activities and enhance their performance. In other words, they expect that their daily task performance would greatly be dependent on using a particular service (Keen and Mackintosh, 2001). Value can have different dimensions. For instance, a study on value-based adoption of mobile Internet Kim et al., (2007) argue that end-users' perception of value of mobile Internet is a principal determinant of adoption intention and other beliefs are mediated through perceived value. In another study, the adoption of a mobile parking service was the central focus and (Pedersen and Nysveen, 2003) proposed that self-expressiveness and the extrinsic motivations of usefulness are important in explaining trial users' adoption of mobile parking service. Moreover, with regard to perceived hedonic value Liu and Li (2010) found that "being able to play a game in certain environments, such as during commute time", makes users "happy", apart from the playability of the game itself. In a study focusing on consumers' value expectations from using mobile services, Anckar and D'Incau (2002) argued that mobile services can provide five different values to consumers to fulfil their needs:

- Time critical needs and arrangements
- Spontaneous needs and decisions
- Entertainment needs
- Efficiency needs and professional ambitions
- Mobility-related needs

Prior studies, if not all, on mobile services have either focused on adoption of mobile content services in general such as (Bouwman et al., 2007), or have focused on factors affecting the adoption of mobile services (Kargin et al., 2009) and (Hyvönen and Repo, 2005). Moreover, many of them have focused on a specific category or a subset of mobile services for instance, mobile information services (den Hengst et al., 2004), mobile internet services adoption (Pedersen, 2005), adoption and use of mobile services (Aarnio et al., 2002), adoption challenges (Bouwman and Van de Wijngaert, 2009). However, it is clear that prior studies have been conducted on user related concepts within the framework of acceptance theories and models, such as TAM or related models (Davis et al., 1989; Venkatesh et al., 2003), or Diffusion of Innovation theory (Rogers, 1995) and Task Technology Fit (TTF) approach (Goodhue and Thompson, 1995). But, none of them have specifically addressed the role of value with regard to service characteristics or individual service perception underlying IT artifacts (mobile services).

It is worth bearing in mind that traditional acceptance theory, although they by far are the most widely used theories in many fields to understand individual technology acceptance, have been criticized that service characteristics, service perception and other relevant critical factors are ignored. For instance,

Bhattacherjee and Sanford (2006), Venkatesh and Brown (2001), Venkatesh et al., (2003) argue that external factors (e.g., critical mass, friend, family and peers) can shape user perception with regard to new technologies and thereby indirectly influence acceptance behaviour. However, there are some important factors, which are not taken into consideration during the development of some of mobile services such as the role of interpersonal (e.g., word of mouth) and external influences (e.g., mass media) in the perception of value of mobile services or mobile service characteristics (López-Nicolás et al., 2008).

Thus, we can conclude that individual mobile service perception can be attributed to different factors and determinants that are believed to impact the user's acceptance in the end, such as usage frequency, usage context, innovativeness of the service, value perception, cost, usefulness of service, ease of use, enjoyment, security and privacy arrangement, service functionality and Quality of Service (QoS).

To summarize, mobile services are ubiquitous and they can be personalized in many different ways. Many previous studies underestimated the importance of service characteristics. Therefore, based on the knowledge gaps identified in this section **study that take service characteristics and individual service perceptions simultaneously into consideration is required**. Hence, the current study aims to evaluate mobile services on a set of characteristics, in order to show that distinction between mobile services and service characteristics is highly relevant for acceptance studies.

1.1.2 Mobile Service Usage Frequency

Here, in this section we discuss technology diffusion and address questions such as why some particular types of mobile services are used more frequently than others. The focus is on diffusion of innovation theory (within the mobile service context) postulated by Rogers (1995). Rogers defines diffusion as the process by which an innovation is communicated through certain channels over time among the members of a social system. Some mobile services penetrate with group and diffuse among users differently than other services. Researchers are interested to know why some of the mobile services are not diffused or are not used as widely as expected. Moreover, some mobile services have different usage frequencies. While users may not check their bank account every 10 minutes, other mobile services are used quite extensively and frequently (SMS). The likelihood that the service is used frequently is important and it can be influenced by different sources. Situational aspects of mobile services have direct effect on the usage frequency. Figge (2004) argues that situation dependency increases the user acceptance of mobile applications by making it possible to receive general information about the context in which the user is accessing the service.

In an earlier study, Kim et al., (2009) found that perceived credibility, relative advantage, perceived ease of use, peer influences, self-efficiency, attitude, subjective norms, perceived behavioural control and perceived intention are important factors for recognizing how a service is diffused and how individuals make adoption and usage decisions. According to Kim et al., (2009) perceived cost explains a large portion of the variances in adoption intention and continued usage intention toward mobile data services. Thus, it is worth mentioning that some mobile services (due to the nature of service itself) are diffused faster among members of a social system and have much higher penetration and usage frequencies. Social networking services –like Facebook and Twitter (which are often offered for free), or some mobile communication services –like voice calls and short messages (SMS) have much greater likelihood to be used frequently. A better understanding of usage frequency and service diffusion process offers greater insights to service providers to address users' preferences for development of future mobile services.

1.1.3 Technology as a Tool vs. Task Requirements

Referring to the Orlikowski and Iacono (2001) conceptualization of IT artifacts in IS research, one category is where the technology is viewed as tool. Within this view, technology is represented in four different ways such as labour substitution tool, productivity tool, information processing tool and social relation tool. Generally speaking, (mobile) technology is expected to do what it supposed to do. Kling (1987, p.311) described the "tool" view of information technology as: "A computing resource (that) is best conceptualized as a particular piece of equipment, application or technique which provides specifiable information processing capabilities." Technology as a labour substitution tool is considered to increase the productivity, because fewer people can do more. Furthermore, technology as a productivity tool is considered to enable individuals and organizations to increase their productivity and to achieve better performance. Moreover, when technology is viewed as an information processing tool, technology improves individual productivity with regard to processing information. The last conceptualization of the tool view on technology is where technology is considered as a social relation tool. In this conceptualization, technology can alter social roles or communication behaviour. If we combine the definition of the conceptualizations of technology as a tool, it can be concluded that technology improves productivity and enhances an individual's task performances.

Moreover, according to Task-Technology Fit (TTF) model, TTF is the degree to which a technology assists an individual in performing his or her (portfolio of) tasks (Googhue and Thompson, 1995). Technology is a tool used by individuals to perform a task, and task is an action taken by individuals in turning input into an output. However, it should be noted that technology might be perceived as

innovative, but it might not be adopted if there is not a good fit with tasks it supports. In a mobile telecommunication context, individual people use mobile services for different purposes; accordingly mobile services should also meet the user's task requirements.

Some of the users use entertainment services –like mobile games and mobile TV to kill their spare time or entertain themselves, while some use mobile services/applications to be in touch with their friends –like SMS. Furthermore, some might use a particular service such as mobile payment to perform banking transactions or mobile shopping. Thus, it can be argued that, the nature of a task to be performed or a context that a service will be used in, must be taken into consideration while designing and developing a mobile service. The adoption of innovative mobile services such as mobile TV is not only affected by the differences in technical skills among consumers, as postulated in the adoption models, but by the cognitive processes of referencing and reasoning as well. The individuals' perceptions differ according to users' profiles and their socio-economic parameters and task requirement (Constantiou, 2009).

Users are in principle lazy, as proposed by Tetard and Collan (2009) and often they are reluctant to put extra effort in using mobile systems, for instance to learn how to perform banking transactions through their mobile phones. Services which require a lot of effort in performing a task are not likely to be used by lazy users. Effort to use specifically refers to the fact that users have to undertake a lot of activities to be able to use the service (Bouwman et al., 2012). Mobile services are used to carry out specific tasks that are related to specific moments and contexts. Innovative services are expected to be used in very specific contexts.

1.2 Mobile Telecommunication Standards and Technologies

Mobile service adoption and sustainable usage has an undeniable effect on the mobile telecommunication industry and mobile technologies. Hence, in order to have a better understanding of mobile service characteristics, a short review on the technological issues is relevant. Since the implementation of Global System for Mobile communications (GSM), a massive development in the area of wireless communication took place worldwide. A second technology after introduction of GSM networks was EDGE (Enhanced Data rate for GSM Evolution) and GPRS (General packet radio service). GPRS and EDGE offer a more cost-effective approach to accessing data networks, such as IP-based networks (Ballon et al., 2002). Another advantage is that EDGE offers an IP platform independent of communication standards. The rapid development in technology and increasing demand for accessing Internet via mobile devices have led to what is termed as the third generation of mobile technology: Universal Mobile Telecommunications System (UMTS) is an example of the 3G standard. The UMTS standard allows to develop more advanced multimedia

services, and to unify the disjointed standards of wireless networks. Currently most network operators based on 3rd generation of mobile network technology are upgrading towards Long Term Evolution (LTE). Long Term Evolution (LTE) also known as 4G (4th Generation), is the latest standard in the mobile network technology (Sesia, Toufik and Baker, 2011). It is noteworthy to mention that the first release of LTE did not fully comply with the IMT (International Mobile Telecommunications) advanced 4G requirements; although the pre-4G standard was a step toward LTE advanced radio technologies. The LTE advanced technology is initially designed to increase the capacity and speed of mobile telephone networks as well as to replace the GPRS Core Network. Together with high computing capability of smart-phones, tremendous growth in mobile telecommunication technologies and high-bandwidth UMTS LTE networks, service providers have unlimited opportunities to design and develop advanced mobile Internet services. In addition this raises a question of how the advancement of mobile telecommunication technologies impact the mobile service domain and consumers' service perception which will be briefly explained in the following section.

1.2.1 Impact of Technology

Advanced technology has a direct effect on service perception by consumers. Wireless communication has been found to be the fastest growing segment of telecommunications (Beaubrun and Pierre, 2001). Mobile devices and in particular smart-phones have become an everyday necessary device for billions of people. The number of mobile devices in many countries has already exceeded the number of fixed access lines. Mobile devices and services are characterized by their ability to identify end-users as they move, and to enable them to make or receive voice/video calls, retrieve information, make transactions or shopping, play games, listen to music via subscription to the services, etc.

Thanks to the advancement of technologies and mobile telecommunication standards, mobile services converge more and more. For instance transaction services have communication, information and entertainment features or social networking applications have communication and entertainment features.

1.2.2 Mobile Service Platforms

After years of increasing technological fragmentation, the mobile telecommunications industry is now in the period of platformization (Ballon, 2009). A platform coordinates interactions between two distinct entities being diverse networks and mobile handsets on the one hand and services/applications from third parties on the other hand. Mobile service platforms are becoming increasingly important in the mobile telecommunication industry after pervasive

growth in smart-phones usage. Mobile service platforms are capable of addressing heterogeneous end-user needs by providing them with a relatively large variation of rich communication, information and other converging services that can be easily personalized and customized based on users' preferences. Moreover, platforms also provide capabilities and to a large extent support for third parties and service developers. Therefore, mobile service provision and how end-users obtain mobile communication services have undergone profound changes. To our knowledge, irrespective of the market shares in telecommunication industry, network operator-centric, device manufacture-centric and service provider-centric platforms (full-IP companies) are competing to gain sustainable competitive advantages. It is worth bearing in mind that mobile platforms differ from each other to some extent but at the same time they also have some features in common.

The mobile service market was dominated by telecom carriers for a long time; however this market position has changed after the entrant of what is termed as disruptive mobile applications and services by full-IP companies and handset manufactures –like Apple. In a context of growing competition in the market for telecommunications services, the battle between telecom carriers and other mobile service platform providers is referred to as a platform battle. This convergence is related to the emergence of service platforms. These platforms enable the rollout of converging services more easily and will reduce the fragmentation of the mobile service industry.

While some platforms (Android) are open and accessible for application developers for free, others are not (Apple). Application developers, in order to participate in the application development process, must follow certain rules, often strictly governed by the platform provider in closed platforms such as Apple's platform. End-users, based on their preferences can access several application stores offered by platform providers to view, and download their desired applications. While, some app-stores offer unlimited applications (Apple App-stores), others have only a limited number of applications available (Nokia Ovi). Furthermore, while end-users have the opportunity to obtain their desired applications free-of-charge, for some services and applications they are required to pay a (certain amount of fee) in order to download the application.

Therefore, the current study aims next to understanding characteristics of services, to evaluate empirically the importance of mobile service platforms and investigate how end-users make decisions on adopting a specific mobile platform from several providers. In other words, the focus is not on consumers per se, but rather their preferences in relation to a platform enabling mobile services with different features.

1.3 Research Objective and Questions

Based on the knowledge gaps and problems identified in the previous sections, the following research objective is formulated. This is not at the exclusion of, nor in anyway aimed to diminish the value of other mobile service related issues. Rather it is simply a chosen concentrated focus built on several key considerations.

The objective of the current research is to provide insight into research in the individual acceptance of an IT artifact, i.e., mobile services and the characteristics of the artifacts such as service and platform.

Theoretical and practical studies in mobile service acceptance suffer from a disjointed understanding of service characteristics and users' technology/service perception. Scientific contribution and information orchestration provided in the literature on service characteristics and users' perceptions are scant and scarce. To pursue the answers to these questions, we expect to find a direction in literature and apply it to some empirical studies. Based on this motivation, the main question for the current study is formulated as follows:

- **Q1:** *How do technology and service characteristics affect the acceptance of mobile services?*
- **Q1.1:** *Does awareness of service platform influence user's behaviour toward service adoption?*

The objective of the main research question is to open up the "black-box" of service characteristics, and to investigate how different service characteristics affect users' behaviour. Several prior research attempts used traditional acceptance theories as their conceptual model to highlight the importance of different predictors that have impact on user's technology acceptance. But, many of them, if not all, underestimated the service and platform characteristics and users' perceptions toward it. Therefore, the current research aims to deploy different methods other than conventional models to find answers to the research question. To do so, the following question is formulated and will be answered throughout the study.

- **Q2:** *How can different research methodologies contribute to different explanatory models?*

1.3.1 Research Contribution to IS literature and Mobile Domain

The two research questions will be answered based upon several research papers. Each paper provides a partial solution to the main research problem or fills existing gaps in mobile domain literature. Thus, this dissertation combines the contributions of each paper in order to contribute to our understanding of the

nature of mobile industry and explicitly to the understanding of the characteristics of mobile services and to the perception of service and platform characteristics by users. The results of the study will contribute to mobile service innovations as well as the literature in order to gain a better understanding of different service and platform characteristics. The results of the current study are relevant to several players in the mobile business eco-system, for instance for mobile service providers, network providers, content and media providers and service platform providers. To this end, in order to validate the findings which will be obtained from the literature, previous academic research and empirical studies and to gain new insight into the phenomenon under investigation, several surveys are conducted among consumers.

1.3.2 Research Methodology

A quantitative research approach is used throughout the research aiming to gain rich understanding of mobile service and platform characteristics. To do so, as in many empirical studies, a survey methodology is used. We aim to use different methods and tool to analyze the surveys data –like Q-sort, Analytic Hierarchy Process (AHP), Conjoint Analysis (CA), and traditional survey while making use of Structural Equation Modelling (SEM) data analysis possibilities. The Q-sorting technique or Q-methodology is oriented towards the systematic study of human subjectivity (Brown, 1980; Brown, 1997). Q-methodology is concerned with why and how respondents believe or act the way they do (McKeown, 1988). In other words, the central topic, and the unit of analysis is not the respondent as such, but his or her opinion on certain objects, attitude or behaviour. Using this method allows us to evaluate mobile services based on several characteristics, (e.g., innovativeness and likelihood to use) and to show the difference between services is highly relevant for adoption and acceptance research.

The second approach to be used is Analytic Hierarchy Process (AHP). AHP proposed by Saaty (1980) is an approach to decision making that involves structuring multiple choice criteria into a hierarchy, assessing the relative importance of these criteria, comparing alternatives for each criterion, and determining an overall ranking of the alternatives. AHP assumes that the model can be completely expressed in a hierarchical structure showing the relationships of the goal, objectives (criteria), and alternatives. A questionnaire representing an AHP model is formulated. Several influential factors (service characteristics) that might have impact on the users' decision to adopt a mobile service are identified. Then, the service characteristics are analyzed based on users' preferences. Furthermore, some of the most used mobile services are selected and put in their corresponding categories (defined in section 1.1). An AHP model is then formulated to identify the most preferred service category according to respondent's preferences. By using the AHP, it is possible to find

the degree of preference for one service category to another with respect to each criterion.

The third method to be used is Conjoint Analysis to study new ways of communicating while simplifying the user experience significantly. Several innovative services based on a multimedia approach and making use of the IP Multimedia Subsystem (IMS) convergence capabilities are under investigation. As these services are new to the mobile market, the conjoint study is an appropriate method to assess the different weights individuals place on the variables presented to them in a given situation.

The fourth method is survey research in combination with Structural Equation Modelling (SEM). The aim of using this method is to find out how different determinants other than perceived usefulness and perceived ease of use may have an impact on users' intention to use platforms and more specifically mobile social network applications.

1.4 Overview of the Dissertation and Contribution from Original Papers

In order to answer the research questions in section 1.3, the remainder of the dissertation is organized as follows (see Figure 1.1).

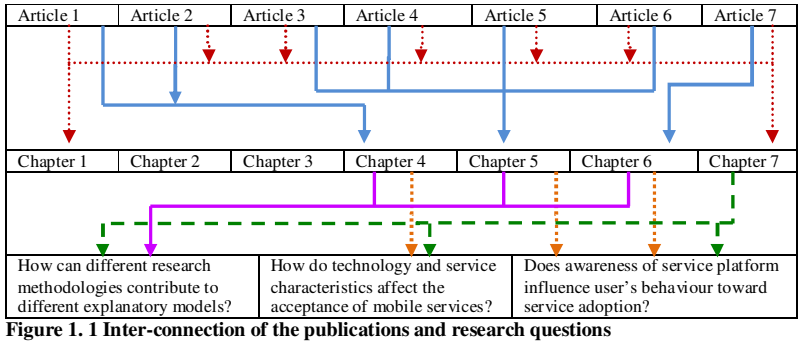

Figure 1. 1 Inter-connection of the publications and research questions

Chapter 1 has introduced the core layout and focus of the research. The contributions of the research to the body of the knowledge as well as practical implications were explained. In addition, the research objective, research questions and research approach were covered.

Chapter 2 provides a literature review and look to the relevant state-of-art in mobile telecommunications and mobile service platforms. The practical developments and theoretical frameworks are depicted.

Chapter 3 presents the research methodology in more detail and several statistical methods used in the study are explained profoundly. This chapter, moreover, provides grounding knowledge on how different analyzing methods and tools deal with the survey data.

Chapter 4 presents the main research findings and the contributions with regard to mobile service characteristics. In this chapter, we will evaluate service characteristics on a limited set of dimensions e.g., innovativeness, usefulness and contextual/situational aspects, we do so by making use of Q-Sort analysis. Moreover, we present the research results found based on the Analytic Hierarchy Process (AHP) regarding consumers' preferences toward various mobile service categories. Furthermore, in this chapter the most influential factors which are believed to influence and impact users' decisions toward accepting, adopting and making use of services will be discussed. This chapter focuses on two research methodologies, Q-Sort and Analytic Hierarchy Process, to show their relevance and applicability over the traditional technology acceptance models. This chapter is supported by the following publications.

- Bouwman, H., Bejar, A. and **Nikou, S.** (2012). Mobile services put in context: a Q-sort analysis", *Telematics and Informatics* 29(1), 66-81.
- **Nikou, S.,** and Mezei, J. (2012). Evaluation of Mobile Services and Substantial Adoption Factors: with Analytic Hierarchy Process (AHP). *Telecommunications Policy*, DOI: 10.1016/j.telpol.2012.09.007.

Chapter 5 introduces the research findings of consumers' awareness, expectation and preference concerning the mobile service platforms. Firstly: the results of a conjoint analysis toward the core characteristics of service platforms will be provided. Their differences and the similarities are identified. Secondly: the research focus shifts toward specific functionalities of recently developed converged communication services, on the basis of a conjoint analysis; we will show the research results by which respondents indicated their preferences. Finally: the Quasi-Experiment findings with regard to testing two prototypes of converged services are provided. This chapter is supported by the following publications.

- **Nikou, S.,** Bouwman, H., and de Reuver, M. (2012). Does Mobile Service Platform Play a Role in Consumer Decision Making? A Conjoint Analysis Approach. *Submitted to journal of Computers in Human Behaviour*.

- **Nikou, S.,** Bouwman, H., and de Reuver, M. (2012). The Potential of Converged Mobile Telecommunication Services: A Conjoint Analysis". *Info*, 14(5), 21-35.
- De Reuver, M., **Nikou, S.,** and Bouwman, H. (2012). Enriched presence information on converged communication platforms: A quasi-experiment. *Submitted to Convergence: The International Journal of Research into New Media Technologies*.
- **Nikou, S.,** Bouwman, H., and de Reuver, M. (2012). Do Consumers Care About Mobile Service Platforms? A conjoint analysis on consumer preference for mobile platforms. *In Proceedings of the 11th International Conference in Mobile Business (ICMB), Delft, The Netherlands, 20-21 June, 2012*.

Chapter 6 focuses on a specific type of communication platform e.g., social network services from generic point of view. More specifically, we investigate Chinese users' behaviour and intention toward mobile social network services. To do so, we extend Technology Acceptance Model (TAM) by adding extra variables such as Critical Mass and Use Context to construct our research framework. This chapter is supported by the following publication.

- **Nikou, S.,** and Bouwman, H. (2013). The Diffusion of Mobile Social Network Service in China: The Role of Habit and Social Influence. *In Proceedings of the 46th Hawaii International Conference on System Sciences*.

Chapter 7 provides the discussions and conclusion; moreover the research questions are answered in this chapter. The research theoretical and practical contributions will be addressed. In addition the research limitations are also presented.

Chapter 2

Literature Review

The aim of this chapter is to explore the impact of mobile service characteristics on individual acceptance, adoption and use of mobile services that have been previously ignored in IS research. Individual technology acceptance is not about the technology per se, but rather about the perception of technology. Besides, it has been shown that the acceptance, adoption and use of mobile services is the consequence of a subtle interplay among service characteristics, perception of service characteristics by users, user characteristics and usage context (Bouwman et al., 2012; Van de Wijngaert and Bouwman, 2009). Prior research on mobile service adoption, in terms of the validity and reliability of the results, has extensively used conventional acceptance models (TRA, TPB, TAM, TTF, and UTAUT) to predict users' behaviour. In most of the cases, if not all, scant attention has been paid to mobile service characteristics or less attention has been paid to the perception of service characteristics by users. In the same vein, user perception of mobile services from its introduction to its maturity has been given inadequate attention. In addition, another topic that has received considerable attention in 2010-11 has been the mobile service platform. To our knowledge, the majority of the studies on mobile service platforms have focused on strategic issues in managing multi-sided platforms. Scarce attention has been paid to consumers' awareness, perception and preference of the mobile platforms.

Information Systems (IS) literature on mobile service innovations stipulates that sheer endless opportunities would, more or less, support the assumption that, acceptance/adoption and use of these technologies is inevitable, and that is mainly due to the pervasive and ubiquitous character of mobile technology. Still, despite many commercialization attempts, many of the advanced mobile services have not yet made it into mass market. The central aim of this thesis is to provide insights into the acceptance/adoption and use of mobile services, taking the service characteristics, individual perception of service/technology characteristics and mobile service platforms into account. In this chapter we discuss these concepts from a theoretical point of view while grounding them in relevant literature. We begin by introducing the conventional acceptance theories. Next, we focus on mobile service characteristics and also discuss individual perception of service characteristics. Furthermore, we discuss users' characteristics and to a lesser degree the usage context. Then, we study mobile service platforms and evaluate the core concept. Finally, we discuss social networks, specifically mobile social network platforms, as an example of an outstanding emerging communications platform.

2.1 Conventional Acceptance Theory

For long, intention, acceptance, adoption and use of mobile services have been the central topic of research due to the tremendous growth in mobile service development. Although, there has been a lot of modifications and re-formulation of traditional technology acceptance in the literature over the years (Nysveen, Pedersen and Thorbjørnsen, 2005a), the basis for the majority of prior studies is framed by making use of Theory of Reasoned Action (TRA) (Fishbein and Ajzen, 1975), Theory of Planned Behaviour (TPB) (Ajzen, 1985), Technology Acceptance Model (TAM) (Davis, 1989) and Unified Theory of Acceptance and Use of Technology (Venkatesh et al., 2003). The Technology Acceptance Model (TAM) is by far the most largely used theory in IS research to study individual IT acceptance. Davis (1989) argued that there are two dominant determinants for system use, perceived ease of use (PEOU) and perceived usefulness (PU). The theoretical importance of perceived usefulness and perceived ease of use as determinants has been extensively verified by past empirical research such as in e-commerce adoption (Gefen and Straub, 2000; Lee and Benbasat, 2004), computer technology acceptance (Davis et al., 1989), health care (Holden and Karsh, 2010), mobile Internet (Lu, Yao and Yu, 2005), mobile commerce focusing on Wireless Application Protocol (WAP) adoption (Hung et al., 2003), mobile social network services (Nikou et al., 2012), adoption of advanced mobile services (Bouwman et al., 2012), and explaining intention to use mobile chat services (Nysveen, Pedersen and Thorbjørnsen, 2005b). The initial TAM model and its core concepts (PEOU and PU) are based on the Theory of Reasoned Action (TRA) and the Theory of Planned Behaviour (TPB).

The Theory of Reasoned Action (TRA) was proposed by Fishbein and Ajzen, (1975). They argued that, in general, individuals make systematic use of the information that is available to them. In the initial conceptualization of this theory, the relationships between attitude and behaviour can be explained through determinant variables such as belief, attitudes, behavioural intention and behaviour. One should note that according to the Theory of Reasoned Action, individual behavioural intention can be explained via (i) attitude toward the behaviour and (ii), the social influence perception whether to perform or not to perform behaviour. The social influence is considered as the Subjective Norm (SN) in the literature. A shortcoming of the TRA articulated by Fishbein, Azjen, (1975) is that the constructs within this theory cannot explain the attitude-behaviour relationships. Moreover, according to the Theory of Planned Behaviour (TPB) by Ajzen, (1991) which is in fact an extension of the theory of reasoned action, determinant variables in TRA are not satisfactory enough to explain the relationships between the attitude and behaviour. Other variables, such as perceived behavioural control and subjective norm should be added to TRA in order to better explain the relationships between the behavioural

intention (attitude) and behaviour. Armitage and Conner (2001) argued that the theory of reasoned action can only predict individual behaviour when there are no constraints. Figure 2.2 shows the TPB model.

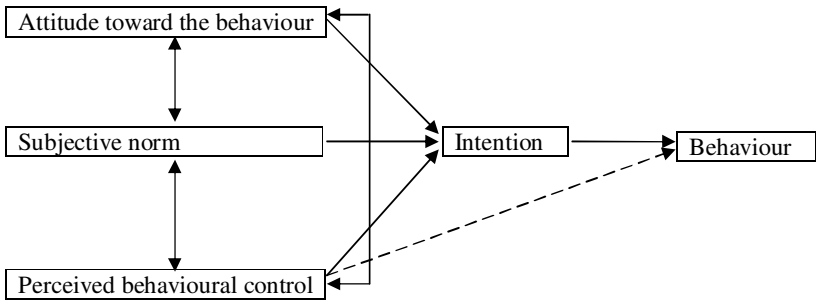

Figure 2. 1 Theory of Planned Behaviour Model, (Ajzen 1991)

The aim of TPB is to examine the individual's intention to perform a given behaviour and according to TPB such intentions can be explained through motivational factors that impact behaviour. In other words, the stronger the willingness (intention) to perform a task is, the more likely the particular behaviour will take place (Ajzen, 1991). In addition to the mentioned acceptance theories, in the next section, we discuss how an innovation is diffused among members of a social system, known as the theory of Diffusion of Innovation. Rogers (1995) proposed the theory of Diffusion of Innovation (DOI) to provide insight into how and why a technology or an idea is diffused among different people in a social system and in different cultures. According to Rogers (1995), 'diffusion is the process by which a technology or an innovation is communicated through certain ways between the people in a social system over the time'. Rogers furthermore, pointed out that innovation, time, communication channel and social system are the substantial elements of diffusion research.

According to (DOI), there are five phases (stages) of the diffusion among different people. These five phases are (1) knowledge, (2) persuasion, (3) decision, (4) implementation and (5) confirmation. In other words, an innovation diffused among different people from its initial stage, when the individual gets to know the innovation until the last stage (accepting or rejecting an innovation). In the Theory of Diffusion of Innovation (DOI), several influential factors by which individuals make a decision to adopt or reject an innovation were identified. These factors are (1) relative advantage, (2) compatibility, (3) complexity, (4) trialability and (5) observability. These five factors define how an innovation is improved compared to its previous version, how compatible a new innovation is with an individual's daily life. Moreover, how complex the

use of a new innovation is and how it is easy to use a new innovation or how visible the innovation is among the individual and member of social system. Rogers, furthermore, categorized the individuals among the members of a social system into five groups. The first group is called innovators; members of this group are the first to adopt a new innovation. The second group is the early adopters; members of this group are individuals mainly in their youth, with high education and income. The early majority is considered as the third group and members within this group require a long time to adopt a new innovation, and are of an above the average social status. The fourth and fifth groups are the late majority and the laggards, respectively. The late majority usually adopts an innovation after the average of the people in a social system adopted and the laggards are the last group of people who adopt an innovation. The following figure (2.2) illustrates the adopter's classifications.

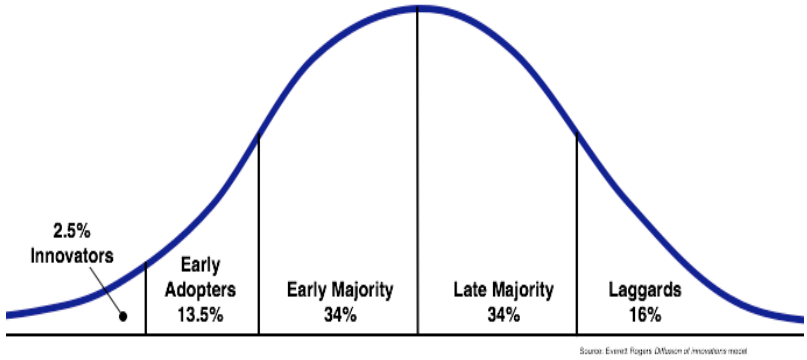

Figure 2. 2 Diffusion of Innovation (adopter's classification)

http://en.wikipedia.org/wiki/File:DiffusionOfInnovation.png

2.1.1 Unified Theory of Acceptance and Use of Technology

Venkatesh et al., (2003) introduced a unified view of user acceptance of information technology. In the original UTAUT model, four main determinants of intention and usage and four other, moderating variables acting as the key relationships are included. The goal of this theory is to provide a detailed understanding of individual and organizational acceptance of IT artifacts. The four main determinant variables are performance expectancy, effort expectancy, social influence, and facilitating conditions. Furthermore, they also identified four moderating factors i.e., gender, age, experience, and voluntariness of use to be used to understand the user acceptance and usage behaviour. Figure 2.3 shows the connection of the core determinants as well as the moderating factors related to use behaviour.

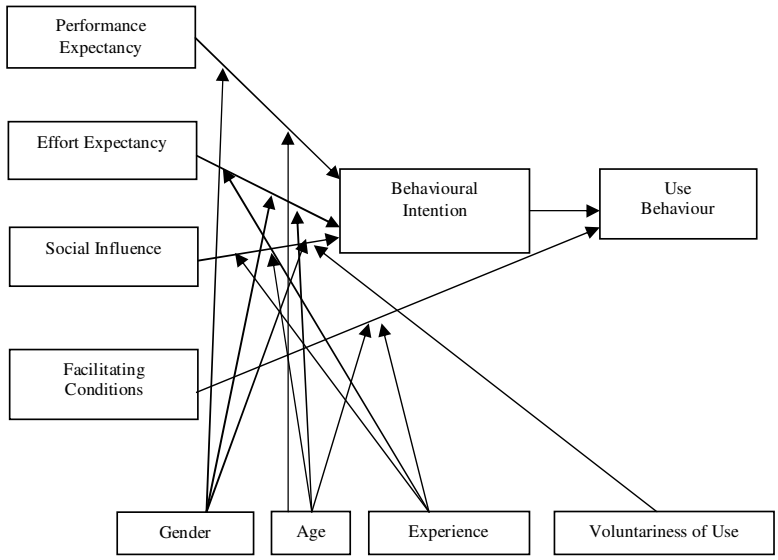

Figure 2. 3 UTAUT (Venkatesh et al., 2003)

Performance expectancy, according to (Venkatesh et al., 2003), is the degree to which an individual believes that using a particular system or technology will improve the performance. It is worth bearing in mind that, performance expectancy in the UTAUT theory is similar to the perceived usefulness in TAM. Moreover, effort expectancy is the degree of ease of using a particular system or a technology, resembling the perceived ease of use in the TAM model. Social influence is considered as the degree to which an individual perceives that individuals important for him/her believe he or she should use the new system. Social influence is the same as subjective norm in Theory of Reasoned Action (TRA) and Theory of Planned Behaviour (TPB). Facilitating conditions are defined as the degree to which an individual perceives that technical infrastructures can support him/her to use the technology or a system. Facilitating conditions resembles the perceived behavioural control in the Theory of Planned Behavioural (TBP).

2.2 Alternative Models

Mobility itself is a vague concept and rather difficult to understand. It can be considered as moving around both in time or space of devices, services, people and objects. Moreover, various types of mobility can play a significant role in usage of mobile services and applications. For instance, RFID tags and transmitters can be used to trace objects worldwide. Furthermore, mobile

devices with the embedded software can roam around and help users to be more productive in their day-to-day lives and social networks. In other words, objects, people and devices connected to mobile Internet can be traced according to the location data. People carry their Internet enabled mobile devices to be in touch at anytime and anyplace. They can retrieve real-time information, news or perform transactions regardless of their location (Siau and Shen, 2003). It is impressive to look at the number of prior studies on acceptance and adoption of mobile services motivated by the Technology Acceptance Model (TAM) and by the Diffusion of Innovation theory (Bouwman and van de Wijngaert, 2009; Bouwman et al., 2007; Carlsson, Walden, and Bouwman, 2006a; López-Nicolás, Molina-Castillo, and Bouwman, 2008; Verkasalo et al., 2010) . Still, alternative theories with emphasis on the fit of mobile technologies in daily routines and on Lazy User concept are being used extensively. One of the most wildly used concepts is Braudel's assumption. According to this assumption ''the structure of daily life defines the limits of what is possible'' as freedom becomes value when it changes the limits of the possible in the structure of everyday life (paraphrased by Keen and Mackintosh, 2001, p. 31). They showed how technology enables people to break with structural conditions that limit them in their daily practice (Braudel, 1979). They pointed out that, people make use of technologies in their daily routines, if they find that using a new technology offers them freedom, makes life easier, more pleasant and it makes economic activities more valuable. Silverstone and Haddon (1996) also discussed domestication of new technologies by arguing that the technologies have to fit everyday life. Moreover, they pointed out that users make use of a new technology in such a way that it is able to fit their behaviour after acceptance and adoption. Rogers (1995, p. 17) framed this as reinvention.

In the same grain, Tétard and Collan (2009) discussed about the effort needed by the user to choose a solution for a problem when a set of alternative solutions are available to them. They argued that in principle users choose the solution that requires the least effort, because day-to-day routine behaviour typically requires very limited effort, whereas for the users unknown solutions might require a lot of effort. We can argue that the concept of Lazy User is related to the Task Technology Fit, media choice and switching cost in the sense that typically users in these approaches make a rational and conscious choice and decision between the alternatives available to them. It is worth bearing in mind that, making a decision to choose a certain solution is context dependent. Investment in time and cost can also be considered as two other dimensions of the effort. In other words, how much effort a user must invest in order to get familiar with and use a specific technology or how much a new solution will cost?

2.3 Mobile Service Classifications

Mobile services, based on their characteristics and functionalities, differ from each other and they can be categorized in many different ways (Hyvönen and Repo, 2005; Kuo and Chen, 2006). Some services can be characterized as communication services, while others can be classified as information, entertainment or transaction services (see table 2.1).

Table 2. 1 Mobile Service Classification

Communication	Mobile Telephony, SMS, Mobile Video Telephony
Information	Mobile Weather Information, Mobile News, Mobile Search Services
Transaction	Mobile Shopping, Mobile Banking, Mobile-Micro Payment
Entertainment	Mobile Game, Mobile TV, Mobile Icon and Ringtone, Mobile Music, Mobile Joke
Web 2.0	Mobile Health, Mobile RFID, Mobile Social Network Services, Mobile Wiki

Some of the mobile services such as SMS and mobile telephony have been around for long time, while others may have been introduced recently or appear as prototypes –like mobile RFID and switching between devices. Moreover, while some of these mobile services are focused on groups, others may be used for individual purposes. In some services users have to search for relevant content to retrieve information (pull service) –like checking the weather forecast or news. Some are labelled as push services, where the content is provided to the users –like mobile email. Shao's (2009) taxonomy made a clear distinction between services with regard to user-generated content, some services are labelled as 'consuming' information and entertainment –like watching video, listening to music (MP3), reading blogs and searching for information; others are labelled as 'participating' as these services focus on social interaction and community formation –like posting in virtual communities and social networks. The third type of mobile services is labelled as 'production', with the focus on self-expression and articulation –like providing personal pages through websites, YouTube and My Space contribution.

Furthermore, according to Feijóo's (2009) taxonomy, mobile (content) services are differentiated based on two dimensions and four categories. The first dimension is related to the existing content that is adapted to a mobile platform such as mobile banking and mobile email versus content that is deliberately developed for mobile such as mobile location based services and mobile augmented reality. The second dimension is defined as process information such as stock market information versus creative content services that are created for cultural aesthetic or entertainment such as mobile game. Based on these two dimensions, four groups of services emerge. The first group can be considered as the existing services adapted to mobile such as search services and mobile email. Mobile TV, mobile game and mobile music (MP3)

are considered as content that are repurposed to mobile and are classified as the second group. Feijóo, defined the third group of mobile services as specifically related to mobile functionalities, examples of these types of services are mobile icon and mobile ringtones or mobile location based services. The fourth group of services are mobile Web 2.0 services such as mobile Health and mobile social network services. Based on these four service categories, Feijóo's taxonomy is geared towards content and therefore to consumption. The distinction between existing content adapted to mobile versus content which is deliberately developed for mobile use as well as creative versus process information makes sense for participating and producing, if we combine Shao's and Feijóo's taxonomies for participating and producing. Therefore, we propose the following typology of services (see table 2.2).

Table 2. 2 Mobile Service Typology

Consuming	1.1	Process information adapted to mobile (search services, ,mobile surfing)
	1.2	Creative content adapted to mobile (mobile TV, mobile RSS)
	1.3	Processed information mobile specific (mobile health, micro-payment)
	1.4	Creative content mobile specific (mobile ringtone and icon)
Participating	2.1	Adapted to mobile (mobile email, mobile Wiki consultation)
	2.2	Specific to mobile (SMS, MMS, mobile private social networking)
Producing	3.1	Adapted to mobile (mobile Twitter and mobile blogging)
	3.2	Specific to mobile (mobile reality mining)

2.4 Characteristics of Mobile Services

Albeit, technological advancement in mobile telecommunications in recent years has enabled mobile service providers, within their resources and computing power, to reinforce their strategic market position by offering new, sometimes innovative, services. It is improbable that consumers' need for advanced communication services is limited only to the technological advancement and innovations, and not to service characteristics and users' perception of service characteristics. Moreover, there is a mutual consensus between academics and practitioners that technological advances and innovative mobile services do not directly lead to widespread acceptance, adoption and use of mobile services (Baldi and Thaung, 2002; Bauer, Reichardt, and Schüle, 2005; Constantiou, Damsgaard, and Knutsen, 2006; Van de Wijngaert and Bouwman, 2009).

So, it is essential to pay attention to key elements and specific characteristics of the technology or a service under study when focussing on individual technology acceptance. The importance of specific characteristics of a service becomes even more obvious when a very specific type of mobile service is under

research. For instance, mobile commerce services have different adoption characters than mobile entertainment services. Hung et al., (2003) argue that the Wireless Application Protocol (WAP) plays a significant role in the widespread usage of mobile commerce services. Likewise, they found that connection speed, service cost, user satisfaction and personal innovativeness are the critical factors for adoption of mobile commerce service to be successful. In the same manner, Liang and Wei (2004) pointed out that mobility and reachability are two main characteristics for adoption of mobile commerce services.

Providing mobile services typically requires the collective actions of different players in a mobile business eco-system (De Reuver, 2009), such as mobile network operators, full-IP based companies (Google and Facebook), content/application providers and device manufacturers. On the other hand, essential aspects (context of use, usefulness, ease-of-use, innovativeness, likelihood to use, content quality, flexibility of the service, cost of service, and an appropriate business model) must be taken into account, while designing and developing a service. It has been found that there is a strong negative correlation between innovativeness and effort to use as well as between innovativeness and situational context (see also (Bouwman, Bejar, and Nikou, 2012), for empirical evidence). There is also a negative correlation between the advancement of mobile services and the adoption. For instance, Carlsson et al., (2006b) found that the development of mobile services, mobile commerce and mobile Internet has been intense for years, but adoption has not progressed as expected. Moreover, Liu and Li (2010) found that the hedonic value of mobile services has direct impact on users' intention to use mobile game services. Contextual usage of mobile services, on the other hand, has also been found to be an important variable. For instance, Bouwman and Van de Wijngaert (2009) argue that the intention to use mobile services is dependent on the situational context.

Furthermore, factors such as, (i) payment mode (the way usage of service is charged), (ii) service functionality (simplicity, accessibility), (iii) added value (mobility, entertainment and social image enhancement value) and (iv) service perception (quality, cost and performance) are major inter-related issues and influence users' intention to adopt different mobile services characterized previously (see table 2.1). With regard to mobile communications and specifically mobile VoIP services, Tobin and Bidoli (2006) found cost of service, security, QoS, complexity and privacy as the most important independent variables that will affect the adoption of VoIP and other converged IP services. VoIP services have been identified as potentially disruptive services by (Verkasalo, 2006). Moreover, Santos, Cardoso, Ferreira, Diniz, and Chaínho (2010) indicated that the success of social networking services such as Facebook and Twitter and their use via mobile devices lies in providing users with mechanisms to communicate their daily activities more easily and efficiently. It is relevant to mention that consumers' satisfaction and their choices are highly related to call and service quality (Shin, Kim, and Lee, 2011). Based on conjoint analysis, they argued that these attributes have significant impact. In a similar

study using conjoint analysis (Jeon, Kim, and Sohn, 2010) found that price turned out to be the most important factor for consumers' preference for digital convergence services.

To elaborate more on this topic, one can observe that there are different ways to charge mobile service users; Munnukka (2006) explored different pricing methods applied for charging mobile services and found that customer price perceptions differ significantly depending on the charging methods they had in use. Different payment methods significantly influence users' choices and preferences. Tétard and Collan (2009) argue that users are in principle lazy and they are reluctant to put more effort to learn how to use new technologies. Service accessibility and simplicity with regard to service functionality have been found to be a crucial factor. Mattila (2003) argued that service accessibility is one of the most important issues affecting the adoption of current and future mobile services. Accessibility of a service is not limited to cognitive aspects of adoption, but also includes availability and access to service in the physical sense. Other attributes of service functionality such as simplicity and flexibility are seen as important casual design values by (Kultima, 2009). Moreover, added value of mobile services is also seen as an important factor (Zhao, Lu, Zhang, and Chau, 2011), therefore, a clear understanding of what makes mobile services valuable can help to understand the concept of value in mobile domain. Value in mobile domain is a rather vague and yet a poorly understood concept. Different mobile services offer various types of values to users –like entertainment and enjoyment which can be experienced by using mobile games or the mobile TV type of services. In discussing the results, we will use service characteristics, such as ease of use, innovativeness, likelihood to use, usage context and usefulness of services in combination with factors such as payment mode, service functionality, added value and perception of (quality, cost and performance).

2.5 Next Generation of Communication Services

Due to the rapid development and growth in mobile telecommunications industry, more and more mobile converged rich communication services are emerging. End-users' needs for richer communication services with relatively new functionalities are becoming increasingly evident (Yoo, Lyytinen and Yang, 2005). On the other hand, the boundary between the fixed Internet and mobile Internet is eroded, meaning that many services which were used to be accessible only on fixed devices (PC) are now available on mobile platforms as well. As such, these new converged communication service, disregard for their modalities either on fixed or on mobile devices, would more or less offer the same service experience to users. Generally speaking, users are able to access the same content and services from any device or even switch between media or device within the same communication session. This concept of converged multimedia

service initiative is pushed by telecom operators (e.g., in the Open Mobile Alliance working group Converged IP Messaging) but also in the Rich Communication Suite (RCS) under the GSMA umbrella (Henry et al., 2009).

In the current thesis one specific group of rich communication service functionalities which have recently developed by using Rich Communication Suite (RCS) standard is discussed explicitly. Some of these functionalities have been around for many years and users are familiar with the group communication and presences/availability features. For example, the availability/presence service allows users to see on which device their friends would like to be reached (Day, Rosenberg and Sugano, 2000). Some other functionality, such as switching between devices and media, are new. Telecom operators aim to provide innovative communication services that cannot be replicated by over-the-top providers like Skype. This concept is based on the Converged IP Messaging (CPM) framework as specified by the Open Mobile Alliance (OMA) forum. The Open Mobile Alliance (OMA) is a standard body which develops open standards for the mobile phone industry. CPM enables to create many interpersonal, interactive and multimedia communication services that run on the top of IP Multimedia Subsystem (IMS) core networks (Kim, 2011) and Systems Architecture Evolution in LTE (Long Term Evolution) (Dahlman, Parkvall, Sköld, and Beming, 2007). IMS (Camarillo and Garcia-Martin, 2008) is an architectural framework for delivering Internet Protocol (IP) multimedia services. The main purpose of the IMS is to aid the access of voice and multimedia applications from wireless and wire line terminals (Joseph et al, 2005). This new range of converged multimedia services leverage the IMS/SIP (Rosenberg et al., 2002) technology and protocol to provide seamless interoperability between different networks and switching between device/media communication services within the same session. Switching between devices and media are the two major functionalities of the converged rich communication services: they enable users to switch between devices without interrupting the communication session.

In addition to switching between devices and media functionality, file-sharing is also a feature in converged rich communication services. This service leverages the Cloud infrastructure services, also known as Infrastructure as a Service (IaaS) mechanism to deliver computation infrastructure (Gonçalves and Ballon, 2011). File sharing allows sharing multimedia content among friends via a drive space in the operator network on multiple devices including TV, mobile phone and PC. In discussing the empirical results of the thesis, we will show how these new converged communication services are perceived by users. Moreover, in discussing the experimental results, two prototype applications will be discussed in details: Content Anywhere (the users can share videos; photos or text by pushing content to a personal network storage controlled by the operator) and Social TV (the users can contact friends who are watching the same program and initiate a chat session).

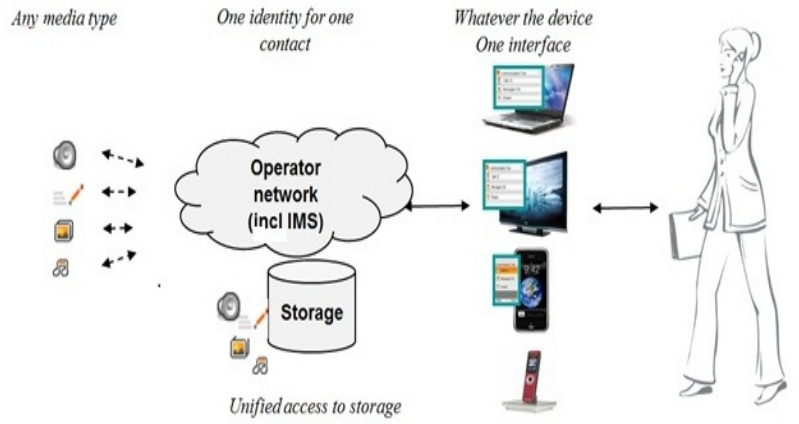

Figure 2. 4 Architecture for converged communication services

2.6 Context of use

The context, especially with regard to mobile applications, is seen as an important variable, and due to the possibility of developing context-aware or location-based services in the mobile domain, the concept of context has received an ample attention by researchers in recent years (Bouwman and Van De Wijngaert, 2002; Gummerus and Pihlstöm, 2011). However, context has been a rather ambiguous concept. Schilit, Adams and Want (1994) divided context into three categories: computing context, user context and physical context. Chen and Kotz (2000) added time as a fourth category. McCreadie and Rice (1999) drew a distinction between context – the larger picture in which the potential user operates – and situation, the particular set of circumstances or the direct environment in which the potential user is behaving. Gerstheimer and Lupp (2004) and Mallat et al., (2009) suggested that a focus on user's social context (individual, group or organization), place or physical context (fixed, mobile), tasks and processes (daily life, day to day leisure or business or professional processes) and temporal context are important in understanding the use of 3G mobile applications. Pedersen and Ling (2003a) distinguished between the modalities of mobility to work and leisure. Specific demographic groups are as proxies for distinctions between end-user contexts: (a) public and private context, (b) dynamic context, and also discussing the various roles and identities that users assume in different contexts. Lee and Jun (2005) found that specific context correlates with the use of specific services. Bouwman and Van De Wijngaert (2002) and Bouwman and Van de Wijngaert (2009) showed that context explains communication behaviour in a broad sense as well as

acceptance and use of mobile systems. Some services clearly fit some contexts while other services do not. It is therefore important to categorize services and relate them to contextual aspects.

2.7 Mobile Service Platform

Mobile service platforms have recently become increasingly important and an integral part of mobile communication ecosystems after pervasive growth in smart-phones usage. A platform may refer to a hardware configuration, an operating system, a software framework or any other common entity on which a number of associated components or services run (Poel, Renda and Ballon, 2007). In other words, a platform coordinates interactions between two distinct entities in mobile communications mobile handsets from one side and services/applications from third parties from the other side. This is due to the fact that mobile service platforms are capable of addressing heterogeneous end-user needs by providing the users with a relatively large variation of rich communication, information and other services that can be easily personalized and customized based on users preferences. Moreover, platforms also provide capabilities and to a large extent support for third parties and service developers. Therefore, mobile service provision and how end-users obtain mobile communication services have undergone profound changes. To our knowledge, currently there are three main mobile service platforms in the mobile communications market. These platforms, irrespective of their market shares, are mobile network operator-centric, device manufacturer-centric and service provider-centric. The following subsections introduce the main characteristics of each platform in details. These platforms differ from each other to some extent but at the same time they also have some features in common.

2.7.1 Mobile Network Operator- Centric Platform

In this model, the network operator acts as a portal provider and end-users access services via the operator's portal. These so called 'walled garden' models for mobile Internet have largely been terminated in Europe, but still play an important role in Japan (Weber, Hass, and Scuka, 2011). Moreover, operators are looking for walled garden type models for the next generation of communication services as enabled by Rich Communication Suite (RCS) (Nikou, Bouwman, and De Reuver, 2012). Network operators have the tendency to be protective of their customers and networks, and thus impose strong selection criteria on the services that content providers and application developers can offer (Jaokar and Fish, 2006). Mobile service and application developers are required to pay commission fee for using the telecom portal as a channel for service distribution. As a result, operator portals often have only a limited number of applications and services available to end-users. Selected

developers and partners are given the tools to develop services specifically for the operators' portal and they are bound to a predefined format. However, the network infrastructure gives network operators an advantage in guaranteeing security and privacy. Operators may leverage their trusted image as well as superior privacy and security arrangements to retain customers (Chen and Lu, 2011). To this end, we can argue that network operator-centric platforms are typically closed and offer a limited number of private, secure and reliable services. Vodafone Live is an example of operator-centric platforms.

2.7.2 Device-Centric Platform

Several device manufacturers provide their own platforms: Nokia, Apple, BlackBerry, and HTC. In this model, the service platform is incorporated in the mobile device in the form of mobile operating systems and application store (Ballon, 2008). In this model, device manufacturers provide tools to developers in the form of Software Development Kit (SDK) to engage them in the application development and service creation process. Mobile services and applications can be obtained through the platform of the device provider, i.e., an Appstore. A vast variety of applications can be found in App-stores either for free or to be purchased. Applications developed by Apple, Nokia, Windows mobile, HTC and BlackBerry are offered through App-stores, Ovi, Market place, Market and BlackBerry App World, respectively. How restrictive the rules are for third party developers can be different: for example, Apple and BlackBerry are relatively strictly governed (De Reuver et al., 2011) and have placed restrictions on developers and third party participation for using the platform. Moreover, applications and services provided by these players in their App-stores are often unlimited in number. Platforms offered by these two device manufacturers (iOS (Apple) and BlackBerry OS from BlackBerry) are typically closed, which forces developers to follow often strict rules, set by the device manufacturers in order to participate in the application development process. Whereas, platforms from other device manufacturers (Nokia Ovi and HTC Android) are typically open and developers have much more freedom to participate in using the platform.

2.7.3 Service Provider-Centric Platform

Platforms offered by service providers are open, which means that application developers can easily participate in service development. Google+ and Facebook are the two examples of such platforms. Although Google can also be considered as a device manufacturer e.g., with their Nexus One smart-phone, nonetheless, in the current study, it is considered as a service provider centric platform only. An issue that can potentially weaken the service providers' position in communication market is the security and privacy

arrangement. In fact, the service providers do not own the network infrastructure, thus they cannot ensure the privacy and security arrangement which in turn could adversely affect the end-users' experience.

Mobile service platforms are basically different with respect to the operating system, but this may have implications on security and privacy arrangements. Furthermore, several other elements such as type of platform (e.g., Open or Closed), the number of available applications (e.g., limited vs. unlimited) and application cost (e.g., free or payable) may also have implications on end-users preferences. Therefore, it is necessary to summarize the main characteristics of each platforms discussed earlier (see table 3). These differences will be later used in discussing the conjoint analysis results (see chapter 5).

Table 2. 3 Mobile service platforms' characteristics

Characters	Operator Platform	Device Platform	Service Provider Platform
Operating Systems	-NA-	Apple (iOS), Nokia (Symbian), BlackBerry OS	Google (Android)
Privacy Arrangement	Guaranteed	Best Effort Delivery	Best Effort Delivery
Security Arrangement	Guaranteed	Best Effort Delivery	Best Effort Delivery
Number of Application	Limited	Unlimited	Unlimited
Application Cost	Payable/Free	Payable/Free	Payable/Free
Type of Platform	Closed	Closed/Open	Open

2.8 Social Network Services

In this section, we begin by describing the social networks from a generic view but later the focus will be specifically on mobile social network services as a subset of rich communication services. The social network service phenomenon can be defined as web-based services that allow individuals to create a public or semi-public profile, create a list of others with whom they share a connection and view or traverse their list of connections (Ellison, 2007). According to another definition postulated by (Kwon and Wen, 2010) SNS is an individual web page that allows online, human-relationship building by collecting useful information and sharing it with specific or unspecific people. Social network services have gone beyond the traditional social network paradigm.

In traditional social network theory the intention and focus are on connecting some social entities such as individuals, groups or organizations to share mutual interests and values by socially meaningful often face-to-face relationships (Garton, Haythornthwaite, and Wellman, 1997). But, in recent years the focus of social network has shifted toward establishing online virtual communities using the computer as a mediating communication tool (Kwon and Wen, 2010). As a

result of this paradigm shift, social network services have attracted the attention of a massive audience due to the diversity in application and usage possibilities.

Social network services are varied in their features, capabilities and target groups. For instance, some only provide photo-sharing or video-sharing features, while others offer built-in blogging (Yuta, Ono, and Fujiwara, 2007), instant messaging and voice-calling capability. Some web-based SNSs support mobile interactions –like Facebook, Tencent QQ, Twitter, MySpace, and Cyworld. Target audience can also be varied from specific geographical regions, like Hyves in the Netherlands or Orkut in Brazil. Some sites are designed with specific ethnic, religious, sexual orientation, political, or other identity-driven categories in mind (Huang and Liu, 2009). Over the years, social network services have become integrated in users' daily life and are increasingly popular to provide different types of services to millions of people globally in recent years.

For example, Facebook was launched at Harvard University first, and then introduced to high school networks, followed by corporate networks and finally became available for everyone. Facebook has been founded in 2004, it is now available in more than 70 languages, and has more than 800 million active users, of which 80% are from outside of the U.S. and Canada (Facebook, 2012). In China, the largest internet community Tencent QQ has over 145 million concurrent users as of Sep 2011 (Tencent, 2012). Cyworld founded in 1999, is the most popular social network in South Korea. Moreover, Renren.com as the largest Chinese social network platform founded in 2005 provides relationship and interaction platform to improve the efficiency of communication within a group of individuals (Li, 2011).

The users of mobile social network services generally have different needs and intentions: they either use the service to build relationships, maintain relationships, keep in-touch within their network community or perform a task. For instance, social networks can be used for real-time video/audio sharing (Chang, Liu, Chou, Chen, and Shin, 2007), during election campaigns (Robertson, Vatrapu, & Medina, 2010), or to form and maintain social capital (Ellison, Steinfield, and Lampe, 2007). Current types of applications allow individuals to build their personal profiles, invite others to access their profiles, share interests and exchange photos, emails and instant messages between each other (Kaplan and Haenlein, 2010). Furthermore, firms use social network platforms as a distribution channel to gain competitive advantage and promote their services or products (Stauss, 2000).

2.9 Summary

In this chapter, we discussed conventional acceptance and adoption theories and differentiated their core characteristics, their relevance and shortcomings compared to other alternative models. According to Orlikowski and Iacono

(2001) and an extensive review on IS literature we argue that traditional acceptance theories treat the IT artifacts as a "Black-Box" and they cannot be used solely to investigate the individual behaviour toward acceptance, adoption and use of mobile services. Moreover, according to Shao's and Feijóo's taxonomies we introduced mobile service typology in which five mobile service categories were defined. In the same grain, mobile service characteristics, were also addressed, their relevance and importance with regard to users' perceptions and preferences. Furthermore, the major mobile service platforms, operator-centric, device manufacturer-centric and service provider-centric models were discussed. The differences and the similarities of service platforms were distinguished. Mobile social network which is considered as very specific communication platform was also described.

Chapter 3

Research Methodology

In the previous chapters, several issues and problems were formulated concerning the adoption, acceptance and use of mobile services. We also discussed the conceptualizations of several theoretical models developed to study the phenomenon under investigation. The advantages and disadvantages of the traditional acceptance theories were analyzed. In this chapter, the aim is to offer a brief introduction of the research methodology from a general point of view and later to focus on methods and tools which are adopted for the purpose of the current study. In particular, Q-Sorting, Conjoint Analysis, Analytic Hierarchy Process (AHP) and Structural Equation Modelling were employed to conduct empirical research and to perform the data analysis. We begin by discussing the two standard research paradigms in Information Systems research from a philosophical point of view, i.e., positivism and interpretivism.

3.1 Information Systems Research Paradigm, Positivism and Interpretivism

Positivism, in terms of quantity of publications, has a dominant position in information systems research, but interpretivism is gaining attention in IS research and specifically in organizational research (Lee, 1991; Orlikowski and Baroudi, 1991). While some researchers are in favour of the positivist research approach, others may favour interpretivism. Generally speaking, a positivist research approach builds on inferential statistics, hypothesis testing, experimental, quasi-experimental design and mathematical analysis. Whereas, the interpretivist research approach employs ethnography, case study, phenomenology and hermeneutics (Lee, 1991). Walsham (1995) argued that the interpretivist approach adopts the position that our knowledge of reality is a social construction by human actors. On the other hand, positivism treats social events as science-like phenomena that can be understood via empirical research (Babbie, 1993). Moreover, Wardlow (1989) states that the positivist paradigm has been developed from the assumption that there are universal laws that govern social events. Researchers, in order to be able to describe, predict, investigate and control social events or phenomena, should uncover these laws. The differences between the two research approaches have been termed as objective versus subjective, quantitative versus qualitative or nomothetic versus idiographic (Burrell and Morgan 1979; Luthans and Davis, 1982). With the research objectives we have stated in chapter one, a positivist research approach seems to be more relevant, as the current study has a quantitative approach and data collection is done with survey research as well as a quasi-experiment.

However, it is important to emphasise that adopting qualitative research using case studies and interviews as alternative methods can indeed provide additional and sometimes more in-depth insights to the analysis done in this thesis. Moreover, we are aware of the fact that these two traditional research methodologies can be seen as complementary and not mutually exclusive. In the following sections, we present a number of different methods and analysing tools adopted for this study such as Q-Sort methodology, Conjoint Analysis, and Analytic Hierarchy Process (AHP) in addition to Structural Equation Modelling (SEM). However, as the data collection in this thesis is based on surveys, a short description with regard to survey research methodology will be given below.

3.2 Survey research methodology

According to Tanur (1982), survey can be defined as the way of collecting information based on the characteristics, beliefs, actions and behaviour of a large group of individuals (referred to as a population). Moreover, Pinsonneault and Kraemer (1993) argued that survey research methodology is a research approach that uses surveys to improve the scientific knowledge by: (a) developing quantitative depiction of some aspects of the study population; (b) using predefined and standardized questions to be asked from individuals; (c) collecting data from a proportion of the target population that can be used to generalize the research results to the entire population. They also argued that the survey research methodology can be used for: (a) exploration (when researcher aims is to find preliminary understanding of the phenomenon under study): (b) description (when researcher aims to find what is happening in a population and participants' perceptions and behaviours with regard to a specific phenomenon under study) and (c) explanatory (when researcher aims to test a specific theory and casual relations).

Survey research methodology is being widely used in social science and quantitative research. When a survey method is used, researchers often create a model that has a number of dependent and independent variables. Then a number of hypotheses are defined to test the relationships between the variables (Pinsonneault and Kraemer, 1993).

Newsted et al., (1998, pp.553) differentiated several advantages of survey method compared to other methods such as: survey is simple to score and code, survey is easy to administer, survey enables researchers to determine the relations between variables and constructs, it can be used to compare the results between different groups and places and enables us to quantify the findings of quantitative research.

3.3 Q-Sort Method: Predicting adoption

Q-methodology enables researchers to conduct a systematic study of human subjectivity (Brown, 1980). McKeown and Thomas (1988) describe that Q-methodology as being concerned with why and how respondents believe or act the way they do. In other words, the unit of analysis is not the respondent per se, but rather his or her opinion on certain objects, people viewpoints, beliefs, attitudes or behaviours (Brown, 1980; Cross, 2005). More specifically, unlike the ordinary survey data where the rows represent the answers of a specific respondent and the columns the statements, in Q-sort, the rows stand for the opinions, attitudes, or behaviour and the columns for the respondents. In a Q-sort analysis, a large number of objects, concepts, topics or items (known as Q-set), typically 48 or 64, are presented to respondents. They are asked to place these on a scale that ranges, for example from disagree to agree, depending on the nature of the items or characteristics of the object, in addition to their individual viewpoints. The strength of an opinion can be expressed by placing an item at the extreme ends of the scale. In this way Q-sort forces respondents to make clear which values they connect with some preferences they relate to concepts.

It is worthwhile mentioning that in this research the focus is on an individual's perception on the basis of a set of mobile service characteristics such as innovativeness, efforts people have to make in order to use these services, usefulness, the contextual-dependency and the likeliness with which they are going to use this service in 5 years time. As an outcome, all the mobile services considered as our objects are positioned in table resembling the shape of a normal distribution (see figure 3.1). The aim is to make it clear which objects are related to the most extreme values, and which objects are non-discriminatory or do not appeal to the respondent. Needless to say, from the respondent's perspective the objects do not need to be normally distributed; however, Q-sort forces the respondent to think about what he or she considers to be really important, seeing the defined dimensions. Consequently, the extremes become more visible.

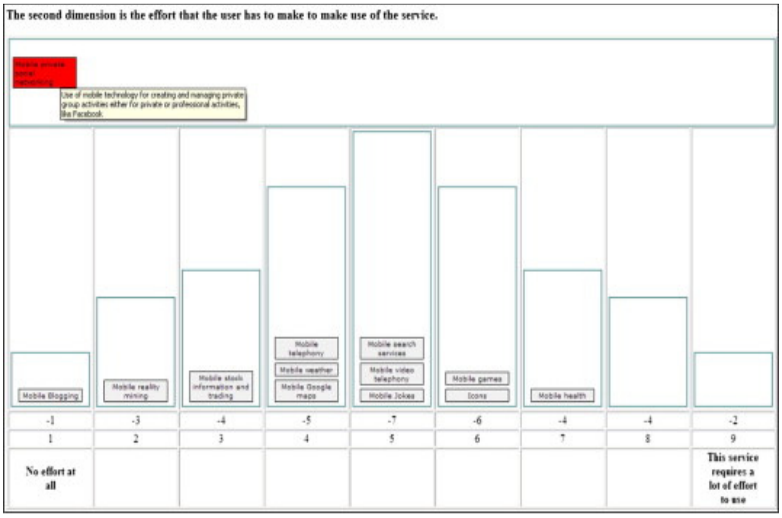

Figure 3. 1 The Q-Sort, The Normal Distribution for 48 Objects

In a Q-sort approach, respondents give their subjective meaning and viewpoint to the set of statements first, and then factor analysis is conducted to cluster the respondents with similar viewpoints. In other words, Q- sort methodology is an inversion of factor analysis, meaning that Q estimates the correlation between individuals (Stephenson, 2006). The correlation between individual rankings reveals the fact that there are similar viewpoints. It is worth bearing in mind that, Q-sort will not correlate an individual's viewpoints with other individuals if each individual would have his own specific likes and dislikes. However, if there are common viewpoints, then they could be factorised and individuals could be mapped to a particular factor or cluster (Van Exel, De Graaf and Brouwer, 2007).

On each factor extracted, a z-score will be calculated for each of the items or statements (Van Exel and De Graaf, 2000). Next, the statements are ranked according to their z-scores (from one with the highest z-score to another with the lowest one). It represents the ranking of services made by a fictitious respondent who is totally in agreement with the opinion represented by the factor. The advantage of Q-methodology over other methods is that a combination of a large number of items and a quantitative method of data analysis can be used.

Selecting (collecting) a set of objects is considered as one the most important tasks in Q-methodology; in our case a list of 48 services were constructed (Appendix 1). These 48 services are among the best known, as well as the most innovative services, over which respondents were likely to have an overview.

Besides, the number 48 enables the researcher to collect the results in the shape of a normal distribution (see Appendix 1 for a more detailed description).

3.3 Analytic Hierarchy Process (AHP)

At the end of chapter 1, we discussed that service characteristics play a significant role in acceptance, adoption and use of mobile services. We also briefly introduced factors which are believed to influence a user's decision with regard to using mobile service. Factors, such as Service Functionality, Payment Mode, Added Value and Perception of Quality, Cost and Performance are included in this study. There are several methods and models that can be used to measure user's perceptions and behaviours; in the context of the current study, Analytical Hierarchy Process (AHP) appears to be an appropriate method to be used. Analytic Hierarchy Process (AHP) is a multi-criteria decision making method introduced by Saaty (1997). Note that, customers' expectations are many times unclear and ambiguous; moreover, human assessment and evaluation of qualitative attributes are always subjective and imprecise. Determining the correct importance weights for factors influencing the adoption of mobile services based on users' preferences is essential since they directly affect the users' intention towards the adoption of mobile services. Determination of the importance of these factors also enables service providers and mobile service/application developers to design and develop services that fit user requirement.

AHP provides a solution for decision makers to create the hierarchical structure of a complex problem, using the relationships of the overall priority, objectives (criteria), and alternatives: the final outcome of the method is a ranking of the decision alternatives. AHP consists of four main steps: (1) the decomposition of the problem into sub-problems; (2) pair-wise comparison of the elements; (3) consistency evaluation and (4) synthesis of the results to obtain a final ranking. In the decomposition step, the components of the problem are organized in a hierarchical structure. When creating the hierarchy, the method allows dependencies only among elements in the same cluster and the only possible direction of impact is toward the top of the constructed structure.

After the hierarchical tree is constructed, pair-wise comparisons are made in terms of importance for all combinations of elements within a sub-problem with respect to the parent. When comparing a pair of elements, a ratio of relative importance expressed on a verbal scale is generally used (see table 3.1): for instance, if the decision maker strongly favours functionality over added value, the numerical value 5 is used.

Table 3. 1 The Linguistic Description of the Numerical Scale in AHP

Intensity of importance	Definition	Explanation
1	Equal importance	Two activities considered equally important
3	Moderate importance of one over another	One activity is marginally favoured over another
5	Essential or strong importance	One activity is strongly favoured over another
7	Very strong importance	One activity is very strongly favoured and its dominance is demonstrated in practice
9	Extreme importance	The evidence favouring one activity over another is of the highest possible order
2, 4, 6, 8		Intermediate values between two adjacent judgments

Using the pair-wise comparisons, a matrix of judgements can be constructed. The basic assumption of AHP is the reciprocity of the pair-wise comparisons:

$$a_{ij} = 1 \big/ a_{ji},$$

i.e., the judgement 5 for the pair (functionally, added value) implies that the value in the matrix for the pair (added value, functionality) is 1/5.

$$A = \begin{pmatrix} a_{11} & a_{12} & .. & .. & a_{1n} \\ 1/a_{12} & a_{22} & & & a_{2n} \\ .. & & .. & & .. \\ .. & & & .. & .. \\ 1/a_{1n} & 1/a_{2n} & .. & .. & a_{nn} \end{pmatrix}$$

In the next step of the process, these judgements are used to determine the vector of local priorities of the factors in a sub-problem with respect to their parent: for this vector, we will use the notation $\underline{w} = (w_1,\ldots,w_n)$. According to Saaty's (1980) theory, every element in the matrix is an estimation of the ratios of the corresponding local weights:

$$a_{ij} \approx w_i / w_j .$$

In the ideal case, we expect the decision maker to be consistent in making the judgements: if factor A is preferred over B by 2 times and factor B is preferred

over C by 3 times then A is preferred over C by 2*3=6 times, i.e., for every i,j,k, the elements of the matrix satisfy the equation

$$a_{ij}a_{jk} = a_{ik}.$$

Based on the matrix of pair-wise comparisons, the weight vector can be obtained in different ways; the most used method employs the theory of eigenvectors and eigenvalues. In the ideal case of consistency, the weight vector is the eigenvector of *A* corresponding to the maximal eigenvalue *n*: one can obtain it by solving the matrix equation

$$A\underline{w} = n\underline{w}.$$

When the matrix of judgements is not fully consistent, the maximal eigenvalue, λ_{max} is different from *n*. The solution of the equation provides an estimation of the weight vector.

$$A\underline{w} = \lambda_{\max}\underline{w}.$$

The reliability of this estimation can be measured by the Consistency Ratio (CR): this measure indicates how consistent the comparisons are relative to a large number of purely random judgements. Perfectly consistent judgments result in a consistency ratio of 0; CR= 1 indicates that judgments were made randomly. As a general rule, a consistency ratio which does not exceed (0.10) is considered acceptable.

In the last step of the analysis the synthesis of the local weights is performed to obtain the global weights of the attributes by multiplying the local priorities by the priority of the antecedent elements. The unique and most important feature of AHP lies in the fact that it can provide a numerical evaluation and comparison of concepts which are incommensurable with other methods. It is worth bearing in mind that this numerical evaluation and the priorities of attributes highly depend on the main goal of the decision making situation: different overall priorities can result in significantly different results. The final results of the method would be most likely different if we considered the same set of attributes from the point of view of mobile service designers rather than consumers. Since in our analysis we consider the opinion of a group of respondents and not a single decision maker, an additional step is required: the aggregation of the individual priorities into an overall result. When applying AHP in group decision making, usually a set of three important properties is considered when choosing the appropriate aggregation function:

1. Unanimity: if A is prioritized over B then the overall priority of A must be higher than the priority of B
2. Homogeneity: if all individuals judge a ratio t times as large as another ratio, then the aggregated judgment should also be t times as large
3. Reciprocity: The synthesized value of the reciprocal of the individual judgments should be the reciprocal of the synthesized value of the original judgment

Aczél and Saaty (1983) proved that the arithmetic mean and the geometric mean satisfy the first two properties when aggregating individual judgements but the geometric mean is the only choice if we want to ensure that reciprocity is also satisfied.

AHP has been widely used in weighing user requirements and preferences in many research projects (Chou, Lee, and Chung, 2004; Giokas and Pentzaropoulos, 2008; Kuo and Chen, 2006) and to evaluate users' requirements regarding the adoption of mobile commerce (Büyüközkan, 2009), different m-commerce payment systems (Chou et al., 2004), success factors of mobile commerce (Gioug, Dooyeon, and Sungyul, 2006) and mobile phones (IsIklar and Büyüközkan, 2007).

One of the objectives of this thesis is to use AHP (Saaty, 1980), to identify which factors are important for consumers for using a mobile service. Moreover, we are also interested in studying which categories of mobile services (introduced in chapter 1) are preferred by consumers. Hence, as AHP is a multi-criteria decision making tool, it seems relevant to use this tool for identifying the most important mobile service category. AHP is an appropriate approach for the current research, because it combines all of the mentioned factors into a model and quantitatively measures the importance of user requirements. AHP is often conducted with a small group of experts who are capable of performing subjective pair-wise comparisons of decision criteria (Saaty, 1980). It is argued that making the right decision is a complex task; therefore the AHP methodology is used in our research to help respondents to find the mobile service categories which best suit their preferences as well as to identify the most influential factors with regard to mobile service acceptance and adoption. This study, therefore, contributes to the acceptance and adoption research by prioritizing factors which influence mobile service adoption and fit user preferences.

3.4 Conjoint Analysis

In this section, Conjoint Analysis (CA) is introduced. Conjoint analysis is a statistical technique to determine, measure, and predict consumers' behaviour and how they value different features that define a product or a service (Green and Srinvasan, 1978; Green and Srinivasan, 1990). Conjoint analysis is by far

the most widely used approach in marketing research. Conjoint analysis addresses the trade-offs people make while choosing different features of products or services (Green, Krieger, and Wind, 2001). Conjoint analysis has several advantages over other methods which makes it an appropriate choice in many situations. Unlike traditional methods, conjoint analysis assumes that there are several factors affecting the decision process of end-users simultaneously. Moreover, conjoint analysis estimates the importance value that consumers place on several features of a service or product while making purchasing decision. Ordinary least squares regression or logit analysis is used to obtain importance values or utilities from the respondents' answers. In contrast with traditional survey approaches where respondents are asked to estimate how much value they place on each attribute, conjoint analysis attempts to capture the preferences in a series of choices or ratings. These choices or ratings, when taken together, allow researchers to compute the relative importance of each attribute under consideration. In other words, instead of "stated importance", conjoint analysis uses "derived importance" values for each attribute or feature (Garver, Williams, and LeMay, 2010). This method can be applied to determine an individual's perception and willingness to adopt new converged rich communication services provided by telecom operators. Moreover, CA can reveal the importance of different functionalities underlying converged communication services and how different functionalities impact users' decisions to use a mobile service. Furthermore, conjoint analysis appears to be a robust model which is applicable to study mobile service platforms and to differentiate the characteristics of platforms.

3.4.1 Design of the Conjoint Instrument

While designing a conjoint analysis project, there are several basic steps to be considered. The first step is to determine the data collection approach to use (online survey or pen-and-paper questionnaire). The second step is to identify the attributes (the product features), furthermore, level of attributes, where the level can be defined as the set of values the attribute can take. In conjoint analysis the levels of attributes describing a service or product are combined to form a description of hypothetical bundles (Lee et al., 2006). The next step is to choose an appropriate conjoint analysis method. After an extensive review of previous studies where conjoint analysis was used as the research approach (Kohne, Totz, and Wehmeyer, 2005; Pagani, 2004; Shin, Kim, and Lee, 2011; Van de Wijngaert and Bouwman, 2009), a full-profile conjoint analysis (also known as full-concept) approach was chosen to be used in the thesis. This approach provides information on what users truly value in a product or a service (each attribute level and the corresponding utilities). Moreover, the full profile conjoint analysis (full-profile conjoint for short) assumes that all of the attributes are independent from each other. In general, full-profile conjoint is an

appropriate approach when the number of attributes is not very large. Conjoint analysis presents respondents with a realistic description of alternative hypothetical service concepts (Green and Srinivasan, 1978). Respondents are asked to rank, order, and score or rate a set of profiles (cards) according to their preference, one at a time. In a full-profile conjoint analysis, each profile describes a complete product or service consisting of a different combination of levels of all attributes.

The last issue that needs to be addressed is the role of utility and part-worth values. The analysis of the data is performed with the conjoint procedure (command syntax) and results in a utility score. These utility scores are called part-worth, for each attribute level. The obtained utility scores provide a quantitative measure of the preference for separate attributes of the product (assigned to the multiple attributes). Larger values indicate greater preference.

Conjoint analysis has extensively been used in research to assess the impact of selected product/service characteristics on customer preferences for products/services (Akin, 2011; Green and Srinivasan, 1978; Jeon et al., 2010; Kim, Choe, Choi, and Park, 2008; Lee, Lee, and Sohn, 2009; Shin et al., 2011) and in other fields such as, marketing (Min, Kim, Kwon, and Sohn, 2011), transportation (Carlsson, 2003), health (Bryan and Parry, 2002) and cross-cultural differences (Thyne, Lawson, and Todd, 2006).

In this study we are interested in users' willingness to adopt the new converged rich communication services. The service concepts in the use cases provide various service elements (e.g., voice calling, messaging, video conferencing and photo sharing) that are offered via various session types (e.g., mobile cellular network, WiFi, fixed network) and modalities (e.g., mobile phone, TV, PC). The service concepts use common building blocks; for example, address books and switching over modalities. Conjoint analysis enables us to extract consumer behaviour through a quantitative measurement whereas other traditional/conventional ratings surveys and analyses do not provide the importance and the utility of the different attributes a product or service is composed of. In this sense conjoint analysis provides insights into the role of the functionalities (attributes) of the platforms and services under study.

3.4.2 Conjoint profile cards and orthogonal design

A full profile conjoint consists of all the possible combinations of the attributes and levels. For instance, the combination of 7 attributes with ($4 \times 3 \times 2^5$) levels of attributes respectively creates 384 possible service profiles. When the number of conjoint is large, orthogonal design can be used to reduce the number of profiles. Owing to the fact that previous research (Johnson and Orme, 1996; Pignone et al., 2011), suggests that it can be a tedious task for respondents to answer all the questions when the number of profiles is too high, a fractional factorial design is used to present a suitable fraction of all possible combinations

of profiles. The resulting set is called an orthogonal array. An orthogonal array/design considers only the main effect of each attribute level and not the interaction effects between attributes. To do so, in the current study, SPSS software version 18 was used to generate the orthogonal design, resulting in 16 unique cases/cards or stimuli out of the 384 possible service profiles which are small enough to include in a survey and large enough to assess the relative importance of each attributes and their levels. Mobile service characteristics in relation to service adoption can be evaluated or analyzed with different types of methods such as, conventional survey and Q-sort analysis. However, as the converged rich communication services under investigation in this study are not commercially launched in the market yet and are new for the respondents, a conjoint analysis approach was selected for this study and it is an appropriate approach to assess consumers' perceptions and to answer the research question.

3.5 Experimental Design

Knowing how to reach a person is becoming increasingly difficult nowadays, as consumers can choose more and more devices and modalities to communicate. Enriched presence information that shows the preferred device and modality of a person will reduce this complexity. Operators could offer such enriched presence information to differentiate their services from Internet actors. Recently, converged communication standards like Rich Communication Suites have been developed to enable enriched presence information, but this has not led to commercial service offerings yet. This thesis tests usefulness of enriched presence features for two prototypes built upon IMS, RCS and CAB standards, which differ regarding the device on which they are used (i.e. TV versus mobile/ PC) and the use context (i.e. leisurely consuming TV while chatting versus actively sharing of content while chatting). An experimental setting was designed for testing two rich communication services as prototypes. The design of the experiment can be described as a classic Pre-test/Post-test Control Group design (Cook and Campbell (1979). The subjects of the experiment are randomly assigned to an experimental condition (R), (Fischhoff, 1975), either Content anywhere or Social communication on TV. The experiment starts either with the use case Content Anywhere (Xe1) or Social TV (Xe2) to prevent order effects. Observations were done before and after the execution of the tasks as prescribed in the use case scenario (see Appendix 5).

R O1 Xe1 O2 Xe2 O3

R O1 Xe2 O2 Xe1 O3

The design of the experiment guarantees internal validity and reduces the effects caused by most of the disturbing factors. The experiments do not control for measurements effects; i.e. the fact that subjects are observed and have to fill

out a questionnaire. In discussing the result, the detailed description of the hypotheses and descriptive analysis will be shown.

3.6 Structural Equation Modelling (SEM)

Structural Equation Modelling (SEM) is a statistical technique for assessing and modifying theoretical models. SEM can be used to represent, test and estimate the causal relationships among observed (measured) and unobserved variables (latent constructs) by using the qualitative causal assumption and statistical data (Hoyle, 1995; Rigdon 1998). Structural equation modelling can be used for theory testing as well as theory development as it is possible to use SEM for both exploratory and confirmatory modelling. The two preliminary goals of SEM are: (a) to understand the patterns of correlation/covariance among variables and: (b), to explain their variance with the model specified (Kline, 1998). In contrast to traditional statistical methods where only one statistical test is utilized to verify the significance of the analysis, SEM utilizes multiple statistical tests (e.g., Comparative Fit Index (CFI) and Chi-Square) to verify the acceptability of model fit to the data. The chi-square test determines the difference between expected and observed covariance matrices: the closer the chi-square value is to zero, the less difference can be found between the expected and observed covariance matrices. Moreover, with regard to Comparative Fit Index (CFI), the threshold value is between 0 to 1; values close to 1, indicate a better model fit, in order for the model to be accepted, the CFI value should be greater than 0.90 (Hu and Bentler, 1999). It is worthwhile mentioning that, there are other statistical tests (e.g., Root Mean Square Error of Approximation (RMSEA) and Nonnormed Fit Index (NNFI)) in the SEM technique which will be presented when discussing the results.

3.7 Summary

In this chapter, we described the research methodology and introduced a number of methods and tools such as Conjoint Analysis, Q-Sort, Analytic Hierarchy Process (AHP) and Structural Equation Modelling (SEM). These methods are used in different research projects to identify the service characteristics and investigate users' perceptions and preferences toward new technologies. The results of our empirical and exploratory research are presented in the following chapters.

Table 3. 2 An overview of the methods used in the study

Study	Method	Core	Sample	Variables	Mobile service/platform
1	Q-sort	Service characteristics	120 (40 Dutch; 40 Finnish; 40 Spanish)	-Innovativeness - Effort - Usefulness - Fit context - Likelihood to use	48 mobile services
2	AHP	Perception of service characteristics	100 Finnish	- Payment(4 modes) - Functionality (simplicity, usability, accessibility, flexibility) - Added value (mobility, Content Quality, Context specificity, enjoyment) - Perceptions (Perceived Services Quality, Perceived Costs, Perceived performance)	20 mobile services
3	Conjoint	Handset based Platforms characteristics: OS, privacy and security, # of apps, app costs, platform type	166 (53 Finland, 88 China, 25 Netherlands)	- Intention to use -Intention to switch - Intention to use more apps - Willingness to pay (WTP) - Intention to download more apps - efficient life - WTP (month)	Four device platforms: iOS, Android, Blackberry, Symbian
4	Conjoint	Switching devices, switching media, presence info, group communication, file sharing	82 (27 France, 33 Netherlands, 22 Spain)	-Likelihood to use - Fitting day-to-day routines - Enjoyment - Willingness to pay (WTP) - Innovativeness - Reliability - Security and Privacy	One network centric platform (Converged mobile telecom services)
5	Experiment	Two apps: Content Anywhere and Social TV	62 (Netherlands)	- Perceived usefulness	One network centric platform (Converged mobile telecom services)
6	Survey	Social Network Services	273 (China)	- Mobility - Critical Mass - Perceived ease of use - Perceived usefulness -Use context -Social influence - Behavioural intention - Actual Use	SNS platform Tencent QQ

Chapter 4

Mobile Service Characteristics: Opening the "Black-Box"

In the previous chapter, research methodology was discussed from the generic point of view. Several methods and tools were introduced which are used in this study. Moreover, in the introduction chapter we referred to the argument of Orlikowski and Iacon (2001) that IT artifacts in Information Systems research are taken for granted and technology is treated as a "black-box". In this chapter, we begin by presenting some of the results which are obtained by making use of Q-sort methodology and Analytic Hierarchy Process (AHP). The intention to use this method and tool lies behind their applicability to evaluate the characteristics of mobile services and users' preferences. We used Q-sort methodology to evaluate 48 mobile services on a limited set of characteristics e.g., usage context, usefulness, efforts required by users to use the service, likelihood to use and innovativeness of the service. These services were selected on the basis of mobile service categorization introduced in chapter 2. Moreover, adoption of mobile services is attributed directly to user's decision. Individual users make use of mobile services based on their preferences and day-to-day routine needs toward mobile services. As AHP is a multi-criteria decision making tool, it seems relevant to make use of this tool to investigate the factor or factors and service characteristics that impact a user's intention to adopt a service. Furthermore, AHP provides required grounding to identify the most preferred category of mobile services introduced in chapter 1.

4.1 Q-Sort Analysis

4.1.1 Sample

The sample consists of 120 respondents. Students from a Dutch, Spanish and a Finnish University (each 40) were invited to participate in this research project. The reasons for inviting students to participate in our research were that they form a homogeneous group and share (almost) similar characteristics and students are from a generation which is most likely to adopt and make use of mobile services under research. In addition, they are more aware of the most recent advanced mobile services and applications compared with average users. The students in the sample have different backgrounds– engineering, marketing, and management. For instance, Spanish students in the sample were more business oriented, whereas the respondents from The Netherlands and Finland were more with engineering backgrounds. It is necessary to mention that in Q-

sort methodology, the representativeness of the respondents toward a specific population is not really relevant, and like in quasi-experiments the interest is more on the 'experimental' factor than on external validity. In contrast to traditional survey method, where the principle is that the larger the number of subjects (respondents), the better the validity of the results. In Q methodology, the relationship is reversed and it is the correlation between subjects (participants or sorters) that is important. In other words, the individual viewpoints are kept whole, rather than atomized across variables. A large number of statements across a smaller number of sorters can provide the same validity in a statistical sense as the usual survey approach (Eden, Donaldson, and Walker, 2005). However, we intended to select respondents who are familiar with services to be sorted. In addition, bearing in mind that, in the Q-sort method homogeneous groups offer the opportunity to see the real differences with regard to the core concepts (in our case, the mobile services under study.

The majority of the respondents were male (72.5%). The Dutch sub-sample contained 6 females (15%), the Finnish 14 (35%) and the Spanish 13 females (32%). The sample is clearly skewed towards male respondents with the young males being the most likely early adopters. t-test was performed to test the differences: the results appeared to be random in most the cases. Only with regard to the use of traditional services like ringtones, icons and games, and more advanced services like audio-visual queries and RSS, the findings indicated that women have more different opinions than men. The difference between the three sub-samples was analyzed separately: the data of the Q-sorts was transposed, and analysis of variance (ANOVA, Bonferroni) was run with country as factor and each of the 48 mobile services as dependent variables (see table 4.1). We found significant differences for a limited number of services and for some dimensions e.g. usage context and innovativeness. These differences were typically between two out of the three countries. The differences were not found to be significantly different among all three countries for most of the services with one exception: the results for mobile audio-visual queries based on photos were different among all (pairs of) countries. The other deviation appeared to be random. In terms of the usefulness and use context, for instance weather services are used more on the basis of the climate and thus can be regarded as country specific. In addition, usage of mobile banking services varies regarding innovativeness among all (pair of) countries. The results showed that Dutch respondents are more familiar with navigation services; this service is being broadly used in The Netherlands, compared with Finland and Spain. This may lead to the assumption that the differences can therefore be attributed to the idiosyncrasies of the three countries under study. Having seen these idiosyncrasies and the evident of random character, we decided to include all the data for further analyses.

Table 4. 1 List of Services to be Included in the Q-Sort

Item	Services	Item	Services	Item	Services
1	M-telephony	17	Mobile chat	33	M-Advertising
2	SMS	18	Mobile TV	34	M-private social networking
3	MMS (M-multimedia services)	19	Ringtones	35	Personalized mobile webpage services
4	M-email	20	Icons	36	Professional community centred mobile services
5	M-video telephony	21	Download music	37	M-Google maps
6	M-news	22	MP3 player	38	Sharing of photos based on location via mobile
7	M-weather	23	Mobile games	39	Sharing of contact information based on location via mobile
8	Mobile search services	24	Mobile Jokes	40	M-WiKi consultation
9	Mobile surfing of the internet	25	Check timetables of flights, train or public transport on mobile	41	M-audio visual queries based on photos made by users
10	Event specific mobile services	26	Mobile reservation of tickets for travelling: trains, flights	42	M-monitoring of RFID information
11	M-health	27	Mobile information and or reservation of Hotels	43	Set up of a Mobile Wiki
12	M-shopping	28	Safety camera used via mobile	44	M-reality mining
13	M-reservation of movie, or theatre tickets	29	Burglar alarm on mobile	45	M-Twitter
14	M-banking	30	Mobile localization service for office , shops	46	M-Blogging
15	M-stock information and trading	31	Localization of persons significant to user (friends, family, children)	47	M-RSS
16	Mobile micro-payments	32	Mobile navigation service	48	M-Group Alert

4.1.2 Q-Sort: A Normal Distribution

To illustrate how Q-methodological survey operates, the process was explained via an online tool (Figure 4. 1) which was specifically developed for this study. As it can be seen, in the top left corner the mobile services appear in random order. Based on her or his preference, the respondent has to drag and drop the service into one of the columns of the normal distribution according, in this case, to the effort that is required to use the service. The numbers in the first row under the distribution indicate the number of services still missing in each column. The second row represents the punctuation assigned to the services that are in that column. In this case, the more to the right a service is placed, the

more effort its use requires (scales are from “no effort required” to “a lot effort is required”). When a service is selected and dropped onto one of the columns, the next service automatically appears. If needed, the respondents are allowed to make changes by moving the services from one column to another. In addition, when the respondent leaves the pointer over a service, a detailed description appears. Once all the 48 mobile services are placed in the table, the respondent can submit the data and proceed to the next step. This procedure is repeated for the five criteria under study. For innovativeness (Q1), the dimensions were “not innovative at all” – “very innovative”. Since effort (Q2) defined as effort either in mastering usage (learning to use the service) or effort in day-to-day usage (ease of use), the dimensions was “no effort at all” – “this service requires a lot of effort to use”. For usefulness (Q3), the dimensions were “not useful at all” to “extremely useful”. Situational context (Q4) can be described as one’s assessment of the degree to which the use of a service is dependent on the physical or temporal context, meaning that he or she will use some services independently of time and place (anytime, anyplace), while others are used only in a limited set of situations or at limited time slots (this specific situation and this specific moment). Situational context was ranked on the dimensions “service can be used anywhere and/or anytime” – “service can only be used in very specific situations and/or moment”. The likelihood to use (Q5) was ranked from “highly unlikely to be used in 5 years time”, “to highly likely to be used in 5 years time”. The time to fill out the questionnaire ranged from 30 min to an hour.

4.1.3 Results

With the results of the survey, containing the combined Q-sorts for each respondent, exploratory factor analysis was performed, making use of the PQ method tool based on PCA (Principal Component Analysis). The applicability of PQ method is validated by Brown (1996). According to the findings, most of the variance was explained by the first factor extracted on each criterion (see Table 4.2). Next, we performed Varimax rotation with the factors extracted. Finally, factor solutions were retained for each concept based on eigenvalues; the cumulative explained variance was over 50%, the interpretability of the factor and researchers’ judgement over whether the factor contributes to the understanding of the mobile services. Considering the results in more details, for innovativeness a three factor solution is found, for effort to use a service we consider four, for usefulness a three factor solution is considered, for situational context we consider five factors, and for likelihood to use we consider a four factor solution (see Table 4.2).

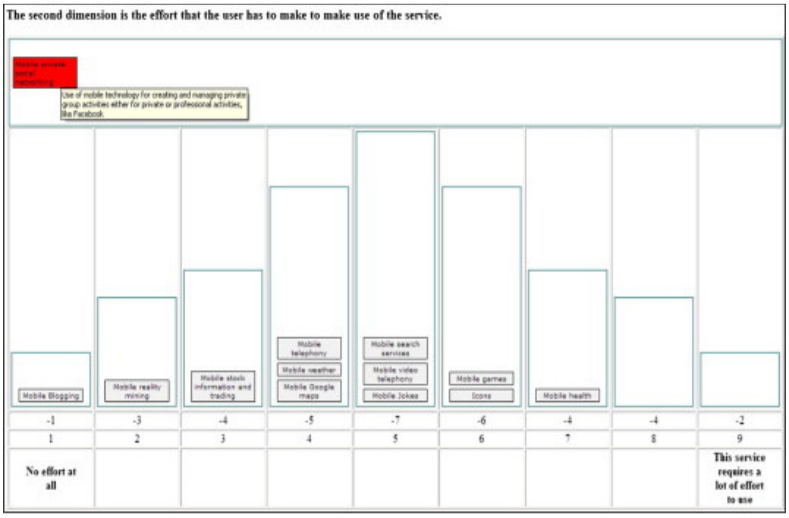

Figure 4. 1 The Q-Sort, the Normal Distribution for 48 Objects

Table 4. 2 Principal component factor analysis

	Eigen value	*Explained Variance (%)*	*Cumulative explained variance (%)*
Innovativeness			
F1	48.171	40	40
F2	7.758	7	47
F3	5.277	4	52
Effort			
F1	42.851	36	36
F2	8.751	7	43
F3	4.972	4	47
F4	3.837	3	50
Useful			
F1	48.823	41	41
F2	6.748	6	47
F3	4.246	4	51
Fitting Situational context			
F1	35.293	29	29
F2	10.698	9	38
F3	5.799	5	43
F4	5.001	4	47
F5	4.089	3	50
Likely to be used in 5 years			
F1	44.464	37	37
F2	7.095	6	43
F3	5.129	4	47
F4	4.538	4	51

Based on Q-methodology guidelines, several key elements with regard to the analysis and interpretation of the Q-sort have been recommended. These are: (i) factor loadings, (ii) normalized factor scores and (iii) the relevant statements. Thus, each factor consisting of 48 mobile services has been rank ordered according to innovativeness, effort to use, usefulness, context-sensitiveness and the likelihood to be used within 5 years time for further analysis. Moreover, the intention is not to present all the scores for the services on all dimensions as such, but rather to present only the extremes.

With regard to innovativeness, a three factor solutions was identified (see table 4.3). The first factor is dominated by process oriented information, specifically created to be used for mobiles and the information is both created and produced by the users such as mobile reality mining and localization of persons significant to user (friends, family, and children) services. The applications that produce information in a mobile setting are the most prominent.

This group of respondents considers creative content adapted to mobile as the least innovative, with mobile TV as the only exception. The second factor represents the group of respondents that are more focused on mobile Web 2.0 applications and community oriented services like group alerts. Typically these are applications that are focused on participating and producing content, either adapted or specific to mobile.

These respondents consider process information adapted to mobile as the least innovative. Moreover, the group of respondents that represents the third factor apparently takes a more historical look than the other groups by including mobile telephony and SMS as innovative services, and process oriented information adapted to mobile as the less innovative services. This can lead to the assumption that apparently innovativeness does not mean and refer to the same concept for all respondents (see table 4.3). More information concerning the service typology can be found in chapter 2 (table 2.2).

According to the respondents in all three countries and based on separate analyses of the three sub-samples, the results show that the Web 2.0 mobile services are considered to be the most innovative ones. It should be mentioned that the Spanish respondents had slightly different opinions: they considered some of the transaction services as the most innovative. It is worth bearing in mind that the respondents in all three countries have considered Mobile micro payment among the most innovative ones. It can be the objective of this service, as it is new and implies complex technology. The first factor of the first dimension (innovativeness) is to a large extent dominated by process information focused mobile services in all the three countries. The respondents in all three countries hold the same opinions regarding the least innovative services. According to the research findings, the respondents considered communication and entertainment services as the least innovative ones. These types of services are creative content adapted to mobile or creative content specific to mobile.

Table 4. 3 Innovativeness of services based on normalized factor scores

Most Innovative					
Factor 1	**Service Typology**	**Factor 2**	**Service Typology**	**Factor 3**	**Service Typology**
44 – M-reality mining	3.2	33 – M-advertise	1.1	1 – M-telephony	2.1
31 - Localization of persons significant to user (friends, family, children)	1.3	44 - Mobile reality mining	3.2	41 - Mobile audio visual queries based on photos made by users	3.2
42 - Mobile monitoring of RFID information	1.3	41 - M-audio visual queries based on photos made by users	3.2	5 - Mobile video telephony	2.1
16 - Mobile micro-payments	1.3	42 - Mobile monitoring of RFID information	1.3	2 - SMS	2.2
20 - Icons	1.4	9 - Mobile surfing of the internet	1.1	40 - Mobile WiKi consultation	2.1
1 - Mobile telephony	2.1	1 – M-telephony	2.1	14 – M-banking	1.1
19 - Ringtones	1.4	37 - Mobile Google maps	1.1	12 - Mobile shopping	1.1
2 - SMS	2.2	25 - Check timetables of flights, train or public transport on mobile	1.1	15 - Mobile stock information and trading	1.1
Least Innovative					

With regard to the second dimension (effort to use and to familiarize oneself with mobile services), the results indicated a four factor solution. The first factor showed that the services which are within the communication service category are considered as the "easy" ones (require less effort), while the services that require a lot of effort are rather mixed (transaction and Web 2.0 services). For instance, the set-up of a mobile Wiki and personalized web pages (which are specifically developed for mobiles), are also considered to be hard to get familiar with or to use in daily practice (together with other services such as mobile banking, shopping and mobile reality mining), see Table 4.4.

The second factor is implicitly driven by the assumption that some services are more pull-services, which require a lot of effort from the users (e.g., mobile blogging), whereas others are push-services, which require less effort in general (typical examples, in the case of mobile RSS services, are group alerts, burglar alarms, mobile TV, and mobile advertising).

The third factor revealed that users have to make a lot of effort in order to make optimal use of some services. The respondents are required to actively contribute to these service to make use of it, for instance, installing applications for monitoring personal health, playing games, taking pictures or recording videos and sending these as MMS messages, while specifically process information adapted to mobile is expected to require less effort.

The central point in factor 4 is generally more focused on services that require participation in or production of content, but the distinction between a lot

of effort and less effort to use the services is mainly defined by the fact that the content is produced or adapted to mobile. On average, services that are based on adaptation of existing internet services require less effort to use than services that are specifically developed for mobile. Moreover, the analyses of the subsamples according to the respondents indicate that mobile communication and entertainment services require very low effort to use; this pattern of opinions is the same for all the countries.

The first factor in all three subsamples is dominated by process information adapted to mobile services. On the other hand, it is worth to note that the services which require high effort to use do not follow the same pattern in all countries. For instance, some of the mobile transaction services (Mobile Banking and Mobile Shopping) are considered high effort to use services in Finland and Spain; whereas, the Dutch respondents do not hold the same opinions concerning the transactions services. However, the first factor is weakly dominated by process information adapted to mobile services in all three countries. Interestingly, respondents from all the three countries considered that, set up of a Mobile Wiki and Mobile reality mining require the highest effort to use compared to other services, typically these services are in the Web 2.0 category.

Generally, we can argue that the most well-known and most widely used services (communication and entertainment) require the least effort to use according to the respondents in all the three countries. The most useful services are mobile telephony, SMS, mobile email, mobile internet surfing and mobile Google maps. Obviously, these are the core services with which other services have to be bundled. The first factor in this dimension indicated that next to basic telephony, SMS, email and process information adapted to mobile are the most useful services. Telephony, SMS and email are all three services directed to participation. Moreover, creative content adopted services like music, mobile TV, games and jokes services are considered to be less useful as mobile Web 2.0. The second factor in this dimension is more likely to consume process oriented applications, such as mobile banking, travel ticket and hotel information and reservation, and micro-payments.

Table 4. 4 Effort needed to use services based on normalized factor scores

Lot of Effort							
Factor 1	**Service Typology**	**Factor 2**	**Service Typology**	**Factor 3**	**Service Typology**	**Factor 4**	**Service Typology**
43 - Set up of a Mobile WiKi	3.1	46 - Mobile Blogging	3.1	41 - Mobile audio visual queries based on photos made by users	3.2	29 - Burglar alarm on mobile	1.1
14 - Mobile banking	1.1	43 - Set up of a Mobile WiKi	3.1	28 - Safety camera used via mobile	1.1	46 - Mobile Blogging	3.1
44 - Mobile reality mining	3.2	23 - Mobile games	1.2	23 - Mobile games	1.2	15 - Mobile stock information and trading	1.1
12 - Mobile shopping	1.1	17 - Mobile chat	2.1	38 - Sharing of photos based on location via mobile	3.2	48 - Mobile Group Alert	2.2
22 - MP3 player	1.2	33 - Mobile Advertising	3.2	14 - Mobile banking	1.1	5 - Mobile video telephony	2.1
19 - Ringtones	1.4	44 - Mobile reality mining	1.1	15 - Mobile stock information and trading	1.1	41 - Mobile audio visual queries based on photos made by users	3.2
2 - SMS	2.2	29 - Burglar alarm on mobile	1.2	12 - Mobile shopping	1.1	39 - Sharing of contact information based on location via mobile	3.2
1 - Mobile telephony	2.1	18 - Mobile TV	1.3	33 - Mobile Advertising	1.1	37 - Mobile Google maps	1.1
Not Effort at all							

Table 4. 5 Usefulness of the services based on normalized factor scores

Most Useful					
Factor 1	**Service Typology**	**Factor 2**	**Service Typology**	**Factor 3**	**Service Typology**
1 – M-telephony	2.1	14 - Mobile banking	1.1	17 - Mobile chat	2.1
2 - SMS	2.2	26 - Mobile reservation of tickets for travelling	1.1	18 - Mobile TV	1.2
4 - Mobile email	2.1	44 – M-reality mining	3.2	5 - Video telephony	2.1
9 - Mobile surfing of the internet	1.1	42 - Mobile monitoring of RFID information	1.3	12 - Mobile shopping	1.1
33 – M-advertise	1.1	19 - Ringtones	1.4	3 - MMS	2.2
19 - Ringtones	1.4	2 - SMS	2.2	48 – M-Group Alert	2.2
20 - Icons	1.4	23 - Mobile games	1.2	2 - SMS	2.2
24 - Mobile Jokes	1.2	22 - MP3 player	1.2	29 - Burglar alarm on mobile	1.1
Least Useful					

Similar to the first factor, creative content – either mobile entertainment applications (e.g., Ringtones) specifically developed for mobile or adapted – are considered to be the least useful services. Presumably, the focus of this factor is on functional applications (see Table 4.5). The third factor is more oriented towards hedonistic use: mobile television, chat and video telephony are seen to be more attractive to the respondents, whereas, participating or producing services like mobile group alert are less likely to be used. The analyses of the three subsamples indicate the same opinions for all the three countries.

The fourth dimension (the mobile services which fit a certain situation or are context dependent) results in a five factor solution. This is a rather striking and remarkable result. The findings indicate that there is large number of different situations and use contexts that respondents considered important and require a close attention.

In the first factor, services that are related to consuming and producing, process information like event specific mobile services and mobile monitoring RFID information are considered to be more contextual related services, while more generic services like SMS, telephony, and creative content (e.g., MP3 player) are considered to be used in any situation or context.

The first factor is obviously dominated by process information mobile specific services in all the three countries. Communication services (SMS, MMS and Mobile Telephony) and entertainment services (Icon, Ringtones and MP3-Player) are considered the least context-sensitive by most of the respondents in all three countries. Most of these services belong to creative content mobile specific and participating specific to mobile.

The respondents that represent the second factor, considered that simple creative content adapted to mobile, like ringtones, jokes, games, and downloading of music are the most contextual related, whereas services like telephony and SMS are considered to be the least situation and context dependent.

The third factor indicated a distinction between services that are adapted to the mobile, but only to consume or to participate. The respondents in this group considered that Web 2.0 services adapted to mobile are the least fitting specific situations. While event specific mobile services and safety camera used via mobile are considered to be the most situation and context dependent services. The fourth factor is rather difficult to interpret, but clearly process information adapted to mobile is considered to be the least context and situation dependent (e.g., mainly travel related and location related) services.

Implicitly it might indicate that these respondents are not very mobile themselves and consider these services not fitting their situation. The fifth factor is defined by process information adapted to mobile (see Table 4.6). The respondents in this group considered that the burglar alarm on mobile and safety camera used via mobile are the most situational dependent services, whereas they hold the same opinions that sharing of photos based on location via mobile and mobile advertising are the least context related services.

The fifth dimension deals with the services that will be used in the near future. The results of analysis indicated that the same services that are considered to be useful, like telephony, SMS, email, Internet, Google maps, MP3 players and navigation services are going to be used in the near future. These are typically services from the participating domain and services focused on the processing of information. Consistent with other dimensions under research, jokes, ringtones and icons service are considered as outdated services. Also mobile Web 2.0 services, for instance twitter and blogging, are the least likely to be used (see Table 4.7). The second factor focused on creative content; i.e. entertainment type of services and respondents in this group showed interest in using this type of services. In contrast, m-commerce services (processes adapted or specific to mobile) are not very likely to be used by this group of respondents.

The results of the third factor are more likely to be focused on participation in and production of content. Services like twitter, chat, and news are attractive to them, while the least likely to be used are process oriented services focused on transaction, navigation, localization or travel services. The last group of respondents, representing the results of factor 4, are more interested in innovative and process information services specifically developed for mobile. The analyses of the three subsamples do not show any meaningful differences.

Table 4. 6 Situation and context dependence of services based on normalized factor scores

Most fitting situational context									
Factor 1	**Service Typology**	**Factor 2**	**Service Typology**	**Factor 3**	**Service Typology**	**Factor 4**	**Service Typology**	**Factor 5**	**Service Typology**
10 - Event specific mobile services	1.3	20 - Icons	1.4	10 - Event specific mobile services	1.3	4 - Mobile email	2.1	29 - Burglar alarm on mobile	1.1
42 - Mobile monitoring of RFID information	1.3	24 - Mobile Jokes	1.2	28 - Safety camera used via mobile	1.1	9 - Mobile surfing of the internet	1.1	28 - Safety camera used via mobile	1.1
16 - Mobile micro-payments	1.3	19 - Ringtones	1.4	5 - Mobile video-telephony	2.1	48 - Mobile Group Alert	2.2	11 - Mobile health	1.3
44 - Mobile reality mining	3.2	23 - Mobile games	1.2	1 - Mobile telephony	2.1	8 - Mobile search services	1.1	14 - Mobile banking	1.1
19 - Ringtones	1.4	32 - Mobile navigation service	1.3	46 - Mobile Blogging	3.1	26 - Mobile reservation of tickets for travelling: trains, flights	1.1	41 - Mobile audio visual queries based on photos made by users	3.2
22 - MP3 player	1.2	4 - Mobile email	2.1	24 - Mobile Jokes	1.2	13 - Mobile reservation of movie, or theatre tickets	1.1	37 - Mobile Google maps	1.1
1 - Mobile telephony	2.1	37 - Mobile Google maps	1.1	15 - Mobile stock information and trading	1.1	27 - Mobile information and or reservation of Hotels	1.1	33 - Mobile Advertising	1.1
2- SMS	2.2	1 - Mobile telephony	2.1	14 - Mobile banking	1.1	25 - Check timetables of flights, train or public transport on mobile	1.1	38 - Sharing of photos based on location via mobile	3.2
Least fitting a situational context									

Table 4. 7 Use of services in near future (less than 5 years) based on normalized factor scores

Most Likely to be Used							
Factor 1	**Service Typology**	**Factor 2**	**Service Typology**	**Factor 3**	**Service Typology**	**Factor 4**	**Service Typology**
1 - Mobile telephony	2.1	19 - Ringtones	1.4	45 - Mobile Twitter	3.1	29 - Burglar alarm mobile	1.1
2 - SMS	2.2	3 - MMS	2.2	17 - Mobile chat	2.1	42 - Mobile monit of RFID informati	1.3
4 - Mobile email	2.1	23 - Mobile games	1.2	35 - Personalized mobile webpage services	2.1	28 - Safety camera used via mobile	1.1
9 - Mobile surfing of the internet	1.1	20 - Icons	1.4	6 - Mobile news	1.1	32 - Mobile navig service	1.3
43 - Set up of a Mobile WiKi	3.1	15 - Mobile stock information and trading	1.1	3 - MMS (Mobile multimedia services)	2.2	33 - Mobile Advertising	1.1
20 - Icons	1.4	26 - Mobile reservation of tickets for trains, flights	1.1	14 - Mobile banking	1.1	34 - Mobile private social networking	2.2
33 - Mobile Advertising	1.1	16 - Mobile micro-payments	1.3	13 - Mobile reservation of movie, or theatre tickets	1.1	17 - Mobile chat	2.1
24 - Mobile Jokes	1.2	14 - Mobile banking	1.1	27 - Mobile information and or reservation of Hotels	1.1	45 - Mobile Twitter	3.1
Least Likely to be Used							

4.1.4 Correlation between the service characteristics

When we focus on the factors that extracted the highest variance, i.e. the first factors for the five dimensions, strong correlations between innovativeness and effort to use as well as between innovativeness and situational context have been found. In other words, the findings indicate that new innovative services, like reality mining (augmented reality), monitoring of RFID information, and localization of persons significant to users are going to be used in very specific contexts, and require a lot of effort (see Table 4.8). Innovative services which require a lot of effort from the users are not likely to be used by lazy users. On the other hand, according to the results, we did not find any correlation between innovativeness and usefulness or usage within 5 years. It is most likely that services like augmented reality and usage of RFID in combination with mobile are not going to be used by the majority of the respondents. Surprisingly, these

types of services are considered to be useful by the most of the respondents. It is noteworthy that we found the negative correlation between usefulness and usage within 5 years, implying that only mobile services that require less effort are most likely to be used within 5 years. Table 4.8 shows the correlation between the five dimensions.

Table 4. 8 Correlation between the five dimensions

	Q1–F1 innovativeness	Q2–F1: effort	Q3–F1: useful	Q4–F1: fitting situation	Q5–F1: will be used in 5 years
Q1–F1 innovativeness 1	1				
Q2–F1: effort	.77**	1			
Q3–F1: useful	.		1		
Q4–F1: fitting situation	.60**	.72**		1	
Q5–F1: will be used in 5 years			-.37**		1

**Correlation is significant at the 0.01 level (2-tailed)

4.1.5 Discussion

The main objective of this empirical research was to focus on service perceptions. To do so, we examined how mobile services are perceived, evaluated, judged and scored by the respondents (from The Netherlands, Finland and Spain) who participated in our research project. The perception of mobile services by the respondents was investigated on the basis of a limited set of core dimensions; i.e., innovativeness, usefulness, the fitting of specific situation and contexts, likelihood to be used in five years and the effort needed to use a service. In our research we have used the service classifications based on the two taxonomies postulated by Shao (2009) and Feijóo (2009). Although these classifications were particularly applicable and appropriate to interpret our research results, the findings indicated that mobile services have to be evaluated, assessed and judged on their own merits. Our findings also verify the earlier research (Orlikowski and Iacono, 2001) that IT artifacts have been taken for granted and they all have been measured and evaluated in the same way. Innovativeness and usefulness of mobile services are two widely used concepts in Technology Acceptance Model (TAM) and Diffusion of Innovation (DOI) research. However, other dimensions e.g., fitting of specific situations and contexts, likelihood to use and effort requires to make use of a service seemed to be relevant as well. The results indicate that advanced mobile services –like navigation and localization applications services were considered to be the most innovative services. Web 2.0 applications, surprisingly, were considered to be innovative by only a small group of respondents. However, the findings showed that innovative services are going to be used in very specific contexts by users and typically these types of services require a lot of effort to make use of them.

Strikingly, the research findings indicated that content adapted to mobile, except Mobile TV, was barely considered to be innovative. Finnish and the Dutch respondents considered that the majority of the Web 2.0 services are the most context-sensitive services. Spanish respondents, on the other hand, considered only mobile reality mining and localization of persons significant to user (friends, family and children) as context-sensitive. In addition, micropayments, reservations for tickets (movies or transport) and reservations of hotels were the most context-sensitive services according to the majority of the respondents in all three countries. These services are used to perform particular tasks that are related to specific times and places. Information services related to location such as Google Maps, navigation service, weather or checking timetables of transports, shopping, banking, stock information and trading, and health are also considered to be context-sensitive. Thus, it can be concluded that context is an important core dimension for the acceptance, adoption and use of mobile services. In the next section, the focus is to investigate a similar problem with a different method.

4.2 Analytic Hierarchy Process (AHP)

In this section we begin by introducing the survey results obtained by applying AHP. The first part presents the findings regarding the selection of the most preferred mobile service category by users. Five mobile service categories were presented to the participants and they were asked to select the most preferred category based on their preferences. It should be noted that the unit of analysis in this research is not the services per se, but rather the respondents' decisions and opinions. In the second part, we explain and show the findings of the same survey in which the aim is to find the most influential mobile service factors e.g., functionality and payment mode. The evaluation of the results is based on the same respondents' opinions and judgments. Finally, the intention to compare the findings of the first and second part is to see if any pattern among the respondents' judgments can be found.

4.2.1 Sample

We used paper-and-pencil questionnaire. The questionnaire was designed through a set of informal interviews with experts who were familiar with AHP (see Appendix 2). After the draft was completed, the questionnaire was pre-tested by eight respondents who were familiar with the mobile domain and Analytic Hierarchy Process (AHP). We explicitly pre-tested the questionnaire to verify the accuracy and to check for ambiguous expressions. In the next step, an adjusted questionnaire was distributed to a convenience sample of 100 students, researchers, lecturer and employees in two different Universities in Turku/ Finland in September 2010. It is important to mention that when AHP is used, it

is not relevant to use a "representative sample" because the unit of analysis is the decisions made and not "who" made the decisions. Moreover, Duke and Aulla-Hyde (2002) argued that in many different AHP studies a small sample have been used unlike in conventional consumer surveys and statistical analyses where it is recommended to have a large number of samples. Shrestha, Alavalapati, and Kalmbacher (2004) pointed out that AHP is usually used to survey people who have knowledge about the topic under investigation and therefore a large sample is not needed. Table 4.9 shows the demographic information of respondents who participated in this research. The sample was dominated by the male respondents (74%) and the majority of the participants were Finnish. The average age of the respondents was 30.1 years.

Table 4. 9 Demographic data for respondents

Demographics	Item	Subjects	
		Frequency	Percentage
Gender	Female	13	26%
	Male	37	74%
Nationality	Finnish	32	64%
	Non-Finnish	18	36%
Profession	Students (Bachelors, Masters, PhD)	26	52%
	Non student	24	48%

In total we have received 66 (which makes the response rate 66%) questionnaires, after careful investigation we finally used 50 questionnaires which were completed and met the consistency ratio (CR) requirement. In practice, consistency ratio exceeding 0.10 occurs frequently, therefore, in our data analysis, we decided to accept questionnaires which had consistency ratio up to 0.12 for identifying the most preferred mobile service category (henceforth it is called model one) and 0.14 for identifying the most influential factor (henceforth it is called model two). The intention behind this lean selection was to have the same number of respondents for both models. In general, the high consistency ratio indicated that at some points comparing the attributes was difficult even for an expert. Therefore, in order to control the consistency ratio, respondents with a technology background were invited to participate in our research project.

4.2.2 Design of the AHP Instrument (Model One)

Prioritizing of the mobile service categories according to the user's preferences is a typical complex multi-criteria decision making problem. In this research, five mobile service categories (Mobile Communication, Entertainment, Information, Web 2.0 and Transaction services) were considered as the main criteria (see Figure 4.2). Categorization of the mobile services were on the bases of an extensive review of mobile telecommunication literature (Bouwman et al., 2012; Büyüközkan, 2009; Hyvönen and Repo, 2005; IsIklar and Büyüközkan,

2007; Kuo and Chen, 2006). Furthermore, different mobile services within each category were selected on the bases of prior research (Gioug et al., 2006; Liang and Yeh, 2011) and were considered as the attributes/alternatives for each criterion (see Figure 4.2). According to the AHP design recommendation, the first row of the model represents the goal or the objective of the research. The second row is referred to the criteria and the third row is known as the attributes or alternatives for each criterion.

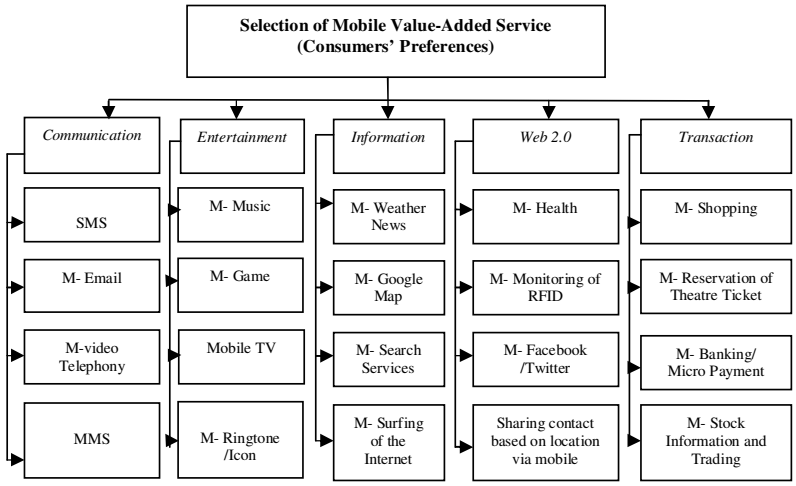

Figure 4. 2 AHP model for selecting the most important mobile service category

In the following, each criterion and its attributes are discussed in more details.

Mobile Communication Services: are the most used mobile applications (Ishii, 2004; Kim et al., 2004). These services include SMS, MMS, mobile video call and mobile email.

Mobile Entertainment Services: offer consumer services such as, ringtones, games, gambling, music, mobile TV. The combination of entertainment and mobility features appear to be intuitively tempting for many mobile service users. Likelihood of killing time and having fun at the same time when wired entertainment applications are unreachable can be the plausible reason. Hedonic and entertaining values of entertainment services are identified as one of the important constructs that will affect consumers' intention to use a mobile service (Shih, 2011; Tan and Chou, 2008; Yen, 2012). Entertainment services vary from

one to another, however, Mobile music, Mobile game and Mobile ringtones/Icons and Mobile TV are used in this research.

Mobile Information Services: offer consumers the opportunity to retrieve any kind of information they might need, such as weather/news information, search services, Internet surfing, and street maps. In addition, the positioning system services can identify the user's location exactly (location-based service). Mobile information services can be used when the user is on the move, and the mobile telecommunication network supports the interactions through an Internet channel between the user and service provider, or systems of a service provider. The tremendous growth in telecommunication standards and technologies as well as the Internet provide a channel that not only allows tourism businesses to provide more information, but also reduces the tourists' concerns when looking for travel information (Mallat, Rossi, Tuunainen, and Öörni, 2009). The mobile weather/news, mobile Google Map, mobile search services and mobile surfing of the Internet are just examples of this service category which is used in this study.

Mobile Web 2.0 Services: are considered as the next generation of mobile Internet services that use the social web (Kamel Boulos and Wheeler, 2007). Social networking –like Facebook and Twitter, are examples of social web that enable users to build their personal profiles and share information between each other. Web 2.0 is a new way of designing software and creating business solutions (Koskela, Kostamo, Kassinen, Ohtonen, and Ylianttila, 2007). Mobile Web 2.0 brings services to the mobile Internet and by contrast, Mobile Web 2.0 provides services that integrate the social web within the concepts of mobility, personal, localized, and always-on (Nikou, Mezei and Bouwman, 2011). Mobile Web 2.0 services enable the users to browse mobile accessible web 2.0 services, for example, checking weather forecast, reading RSS feeds/ breaking news, and Mobile RFID services. In our research we have used Mobile health service (clinical diagnostic), Mobile monitoring of RFID information, Mobile Facebook/Twitter and sharing of contact information based on location via Mobile as the alternative Web 2.0 Services.

Mobile Transactional Services: can be used to perform business and banking transactions. These services include mobile shopping, mobile banking, mobile stock information, and online ticketing (Mallat, Rossi, and Tuunainen, 2004). In this study, Mobile shopping, Mobile reservation of movie or theatre ticket, Mobile banking/micro payment and Mobile stock information and trading are considered as the alternative mobile transaction services.

4.2.3 Results of Model one

Mobile Communication, Entertainment, Information, Web 2.0 and Transaction services were identified as the highest level factors in the hierarchy of the AHP model. The data were analyzed to obtain the priority rankings and weights for the main factors (see table Tables 4.10). The results indicated that the communication mobile services category had the highest weight (0.41) and dominated the other service categories. The research findings indicate that the respondents considered the mobile communication services as the most important and the entertainment services as the least important mobile service categories. The results not only illustrate that the respondents were more concerned with the usefulness of mobile communication and information services, but also verified the results of the previous section. Communication services such as SMS and mobile telephony required the least effort by the user to make use of these types of services. Therefore, it is most likely that mobile communication services will be widely used by users. Information Services ranked as the 2nd most important services indicating that respondent's value the benefits and productivity gained by services such as mobile search, mobile news/weather and mobile surfing of the web. Strikingly, the importance weights of Web 2.0, Transaction and Entertainment services were very close to each other: their low importance weights compared to other service categories (Communication and Information) indicated they do not become part of the everyday life for the majority of the respondents, although these services can be important. Our findings showed that for a service provider the most important concern should be to provide communication services; without this the other services will not have any major impact on the customer's behaviour.

Table 4. 10 Priority ranking and weight of main factors

Priority Ranking	Service category	Weight
1	Communication	0.41
2	Information	0.23
3	Web 2.0	0.13
4	Transaction	0.13
5	Entertainment	0.10

Table 4.11 illustrates the global weights of all the alternative services. The five top services in the table are dominated by different Communication and Information services as it was expected based on the priorities of the main categories (see table 4.10). According to the results, SMS is the most important service followed by Mobile E-mail, Mobile Surfing and Mobile search services. SMS dominates the other services accounting for 20% of the total weights, and based on the total weight, Mobile E-mail has also become an essential part in using mobile services. Interesting to observe that the first 4 services in the list have an aggregated weight of 0.5, (if we consider the first 9 services in the list,

this value is 0.8), which indicates that although the customers can choose from a huge list of services, only a few of them explain the reasons behind the usage of mobile services. Among the Mobile Information category, Mobile Surfing of the Internet and Mobile Google map are considered as the most important services by the respondents, but they are not as dominant as SMS and Mobile E-mail. Mobile Web 2.0 applications such as Mobile Health, Facebook and Twitter are becoming increasingly important to many individuals, as this can also be observed in this service category; the other Web 2.0 services are also equally important to the consumers. Mobile Ringtones were used to be a highly profitable and popular mobile service; however, the result indicates that Mobile Ringtone/Icon has lost its popularity, as this service stood out as the least important mobile service.

Table 4. 11 Priority ranking and weight of attributes

Priority ranking	Service	Relative weight	Category
1	SMS	0,204	Communication
2	Mobile E-mail	0,119	Communication
3	Mobile Surfing of the Internet	0,084	Information
4	Mobile Search Services	0,060	Information
5	Mobile Google Map	0,058	Information
6	MMS	0,052	Communication
7	Mobile Music	0,048	Entertainment
8	Mobile Banking/Micro Payment	0,045	Transaction
9	Mobile Reservation of Movie or Theatre Tickets	0,036	Transaction
10	Mobile Health	0,034	Web 2.0
11	Mobile Video Call	0,034	Communication
12	Mobile Facebook/Twitter	0,034	Web 2.0
13	Sharing of Contact Information Based on Location via Mobile	0,034	Web 2.0
14	Mobile Weather/News	0,032	Information
15	Mobile Shopping	0,026	Transaction
16	Mobile Monitoring of RFID Info	0,025	Web 2.0
17	Mobile Game	0,023	Entertainment
18	Mobile Stock Information and Trading	0,019	Transaction
19	Mobile TV	0,017	Entertainment
20	Mobile Ringtone/	0,014	Entertainment

4.2.4 Design of the AHP Instrument (Model Two)

The objective of the second model was to find the most influential factor that influence users' decision and judgment toward mobile services. The main factors (Payment mode, Functionality, Added value and Perception of Quality, Cost and Performance Enhancement) for mobile service adoption were identified based on an extensive review of literature (Bouwman et al., 2012; Büyüközkan, 2009; Hyvönen and Repo, 2005; IsIklar and Büyüközkan, 2007; Kuo and Chen, 2006).

Next, we also identified several attributes within each criterion. These attributes were based on (Gioug et al., 2006; Liang and Yeh, 2011). Figure 4.3 shows the hierarchical structure of the research model.

According to Figure 4.3 the main goal is to determine the most influential factor of mobile service adoption and it can be obtained by investigating the

mutually independent concepts of payment mode, functionality, added value and perception of quality, cost and performance (henceforth referred to as PQCP); this is the first level of the hierarchy. These objectives can be decomposed individually in the second level of the tree: for example functionality can be described in terms of simplicity, usability, accessibility and flexibility. The elements of the different clusters on the second level are assumed to be independent from each other (i. e., there is no connection between simplicity and bundled pricing strategy). The following section explains each criterion and its attributes in more details.

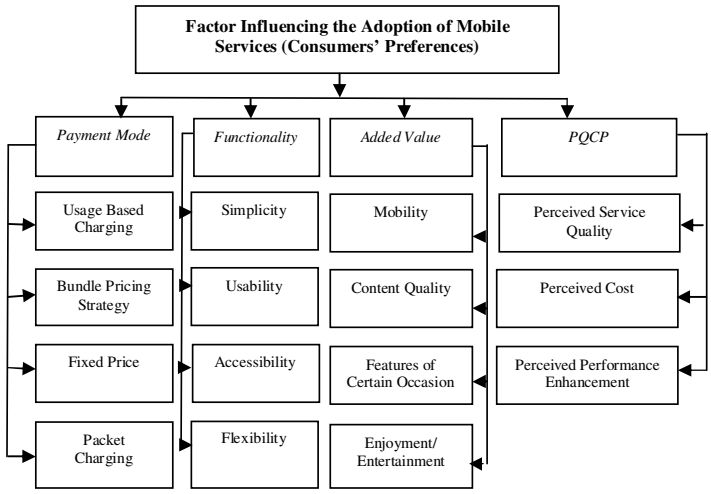

Figure 4. 3 AHP Model for Factor Influencing the Mobile Service Adoption

Payment method: We have considered including four alternative payment methods to the research model. These are usage based charging, bundle pricing strategy, fixed price and packet charging. A brief explanation will be presented in the following.

- **Usage Based Charging:** Consumers are charged based on realized consumption. Usage based charging capability allows mobile network operators and content provider to further monetize and be able to differentiate and capitalize their service offerings.
- **Bundle Pricing Strategy:** Offering a number of alternative mobile services together (as a package) with different price categories. Bundle pricing is a different approach that by-pass both theoretical and practical complexities of pricing for a single mobile user, or a single service.

Bundle pricing has many advantages such as cost savings in production and transaction costs and sorting consumers according to their valuation (Bouwman, Carlsson, Molina-Castillo, and Walden, 2007).

- **Fixed Price:** Consumers are charged at a fixed rate (monthly). For example, the monthly payment is the most popular payment mode in using the Internet in many countries.
- **Packet Charging:** The service (Internet access) is charged on the basis of packet-based method. For instance, Internet connection usage can be charged based on the number of kilobytes of data transferred. General packet radio service (GPRS) is a packets oriented mobile data service on the 2G and 3G cellular communication systems and increases opportunities for higher revenues and enables new, differentiated services and tariff dimensions to be offered.

Functionality: Is the ability of the mobile services to enable a user to perform certain tasks. The functionality of mobile services is considered to be the interface between mobile technology and the user. The following concepts are the attributes of service functionality.

- **Simplicity:** The use of the mobile services should require only minimum knowledge of the technology. The mobile services must be very simple to learn and to use and it should be intuitive. If a service requires a lot of effort to be used, it is most likely that users will not use it.
- **Usability:** Within the broader context of product development, usability is associated with the ease with which people can employ a tool or other human made object in order to achieve a particular goal (Nielsen, 1994). The usability concept is relevant to the design of a mobile service: the more user-friendly the service is, the more likely the service will be adopted and used.
- **Accessibility:** Mobile services should be accessible anytime/anywhere, as users carry the mobile devices while they are on the move. Accessibility is closely related to the concept of mobility. Because access occurs in different places, the mobile applications must be adapted to the context according to the density of the request.
- **Flexibility:** The capability of the mobile services to adapt to personal profiles or requests according to the users' preferences. The flexibility of the mobile applications relates to the adaptation of data capacity to answer to various data traffic volumes of the user according to the type of requests.

Added Value: The benefits gained by using the mobile services compared to other technologies, such as services based on desktop-computers, are considered as value. The user must be convinced that using a particular mobile service/application would acquire a value that other conventional models do not

provide. It can be argued that this perception is the key user factor. However, if a mobile service is fit for use, or it conforms to our requirements, we are dealing with an application that is value adding. Carlsson and Walden (2002) argued that a mobile service will be considered as an added value service, when it improves the user productivity.

- **Mobility:** Is the capability of accessing real-time information and communication, while the user is on the move. Mobility itself is a very important element; it provides access to services and location when such services would be otherwise inaccessible.
- **Content Quality:** Is the capability of offering recent, correct and timely contents and information. Mobile content-service providers will be able to attract more customers as well as to sustain their current customers by allocating their resources to improve the quality of services that affect customers' satisfaction. This can only be achieved if the mobile content-service providers know what exactly the customers' needs are. It is also important that they understand the customers' usage contexts.
- **Features of Certain Occasion:** The occasion where use of a particular mobile service is the only available solution (such as, buying a mobile ticket, when one does not have cash). Some of the mobile services are going to be used in very certain occasions, while others may be used in any kind of occasions.
- **Enjoyment/Entertainment:** Entertainment is considered as a capability of mobile services to fulfil entertainment needs of its users. Entertainment services and their service perception by users are considered to be an important predictor that will impact users' intention to use mobile services.

Perception of quality, cost and performance (PQCP): Service quality, cost and performance enhancement are attributes that represent critical elements of the customer's satisfaction. Mobile service providers are required to improve the quality of their services, having an appropriate revenue model and develop services that can improve users' performances in their daily lives. Price has been identified as an important element affecting the diffusion of new products and services (Munnukka, 2006). Among the several factors which affect customers' intention towards acceptance and adoption, price and quality of service are playing a significant role. In other words, Alan (2001) argued that there is a trade-off between price and service quality which is most often considered as customer satisfaction.

- **Perceived Service Quality:** Quality of service refers to how well a customer is being served. Service quality has a positive effect on consumers' perception toward mobile services.
- **Perceived Cost:** Indicates the customers' satisfaction with cost of using the services. To improve customer's satisfaction, the mobile service cost

must be aligned with the service quality. In other words, users are willing to pay more if the service quality is guaranteed.

- **Perceived Performance Enhancement:** Users expect that their daily-routine performances will be improved by using a particular mobile service. If the functionality of a service meets users' needs and improves their performance, then there is high chance that particular service will be accepted and adopted.

4.2.5 Results of Model Two

Payment Mode, Functionality, Added Value and PQCP were defined as the main criteria (Factors) in our second AHP model. The result of data analysis showed that Functionality had the highest weight (0.34). Accordingly, the majority of the respondents indicated that the usability and the accessibility of the mobile services are by far the most important attributes. Moreover, our findings revealed that Added value (0.28); PCQP (0.24) and Payment Mode (0.14) were considered as the 2nd to 4th most important factors respectively. However, according to the results, one can argue that there are relationships between different factors, for instance, respondents are more concerned about the service (content) quality or mobility value of the services, rather than the service cost. This implies that respondents are willing to pay more for a service, if it can guarantee the highest quality and be accessible anywhere/anytime. Table 4.12 shows the result of the priority ranking and weight of the main factors.

Table 4. 12 Priority ranking and weight of main factors

Priority ranking	Service category	Weight
1	Functionality	0.35
2	Added Value	0.28
3	PQCP	0.24
4	Payment Mode	0.14

Attributes within the service Functionality, such as flexibility, accessibility and usability were considered to be the interface between the mobile technology and the user. Accessibility and the Usability as attributes of the Functionality were ranked as the first two most important attributes, whereas Mobility and Content Quality as attributes of the Added Value factor were ranked as the 3rd and 4th in the table. Strikingly, Payment Mode and its attributes were considered as the least important according to the respondents' judgement. Usage Based Charging (0.03), Bundle Pricing Strategy (0.03) and Packet Charging (0.03) were ranked as the last 3 attributes respectively. Table 4.13 shows priority ranking and relative weight of each factor items (attributes). The items belonging to the PQCP factor were ranked in position 5, 6 and 7, because of the similar local weights. As in model 1, we can also see that a few factors account for a high proportion of the weights; in other words, 55% of the priorities is

accumulated within the first 6 attributes and (80% in the first 10 attributes). Generally speaking, we can argue that the majority of the respondents participated in this research project are more concerned about service functionality and to lesser degree about the value gained by using a particular mobile service. Although, other factors seem to be extremely relevant for service adoption, service providers need to pay special attention to service functionality and offer services that help users to gain value.

Table 4. 13 Priority ranking and weight of main attributes

Priority ranking	Factor item	Relative weight	Factor Category
1	Accessibility	0.115	Functionality
2	Usability	0.103	Functionality
3	Mobility	0.087	Added Value
4	Content Quality	0.087	Added Value
5	Perceived Performance Enhancement	0.086	PQCP
6	Perceived Service Quality	0.080	PQCP
7	Perceived Cost	0.075	PQCP
8	Flexibility	0.072	Functionality
9	Simplicity	0.057	Functionality
10	Features of Certain Occasions	0.057	Added Value
11	Fixed price	0.048	Payment Mode
12	Enjoyment/Entertainment	0.044	Added Value
13	Usage Based Charging	0.034	Payment Mode
14	Bundle Pricing Strategy	0.028	Payment Mode
15	Packet Charging	0.026	Payment Mode

4.2.6 Combining Model one and two

As earlier pointed out, we are also interested in investigating the results and to see if we can find a similar pattern between the factors and service categories. Table 4.14 shows the interaction between the service categories and factors. The values in the table specify, for every possible combination of service categories and factors, how many participants ranked the corresponding concepts as the most important ones. For instance, one can see that 10 respondents ranked Communication services and PQCP as their first priority in Model 1 and Model 2, respectively. It is worth bearing in mind that added value has only occurred in connection with two service categories (Communication and Information services). The results suggest that the respondents who ranked the Added value as the most important factor consider only services within these two categories as value-added services. Furthermore, 15 out of 21 respondents who indicated Functionality as their first priority, ranked communication Services as their first mobile service preference. This means that 30% all of the respondents had the same opinion in general. In other words, the findings suggested that the Communication services are by far the most important service category for the majority of the respondents. Moreover, the same respondents indicated that the

Functionality and Perception of Quality, Cost and Performance were the most influential factors which play a significant role toward service adoption.

Table 4. 14 Service category vs. Factors comparison (priority ranking)

	Payment mode	PQCP	Functionality	Added value	Total
Entertainment	0	0	1	0	1
Communication	4	10	15	7	36
Transaction	0	1	1	0	2
Web 2.0	0	0	1	0	1
Information	0	2	3	5	10
Total	4	13	21	12	50

4.2.7 Discussion

In our exploratory research, the focus was on factors that might have influence on users' decision. Moreover, we were interested in identifying the most preferred service category according to the respondents' preferences. We made use of Analytic Hierarchy Process (AHP) to assess the respondents' judgments and service perception. Our findings indicated that for the majority of the respondents who participated in this research project Functionality of mobile services was by far the most important factor. The results showed that the respondents were willing to pay more for mobile services if the services could provide value to users. Strikingly, the way consumers were charged (Payment Mode), was the least important factor, suggesting that service providers should take into their consideration other factors such as Functionality, Added value and PQCP rather than Payment mode while designing and developing a mobile service. We also found that the large number of respondents who indicated service Functionality as the most important factor selected the Communication services as their most preferred category. This implies that respondents prefer services which required the least effort to be used to provide acceptable service quality and to improve their daily-task performance. Moreover, the results showed that entertainment services were not appreciated anymore by users. Web 2.0 services, on the other hand, were preferred by a small group of respondents. Our findings also confirmed the results of the earlier research, where we found that Web 2.0 services are going to be used in very specific contexts and typically these types of services require a lot effort from the user's side to be used. The respondents also indicated that information services such as checking the News/Weather information and surfing on the Internet are important for them.

4.3 Conclusion

In this chapter the focus was on service perceptions and service characteristics. In our exploratory research we made use of two different methods to investigate the phenomenon under study. The intention to use Q-sort and AHP was the applicability and the relevance of these methods. The unit of analysis in this research was the service perception and respondents' view points and not the respondents per se. The intention of using AHP in our research is twofold: (a) its relevance and appropriateness for evaluating individuals' decisions and judgments; (b) AHP is considered to be a robust multi-criteria decision making tool to investigate the users' preferences. Thus, we extensively presented the results of the importance of the mobile service characteristics on a limited set of dimensions e. g., innovativeness, usefulness and use context. With regard to context, Ng-Kruelee, Swatman, Rebne, and Hampe (2003) argued that the individual adoption behaviour is in constant flux under the effects of the key contextual actors such as, society, government and industry. Moreover, we discussed how different service characteristics impact users' decisions toward the acceptance, adoption and use of mobile services by making use of Q-sort methodology. Furthermore, we evaluated the relationships between the service characteristics and presented the research findings on how mobile services are perceived, judged and considered by the respondents. Next, we presented the results found by making use of Analytic Hierarchy Process (AHP). Hence, we showed the research findings on the basis of the users' perception toward a limited set of factors (characters) of mobile services presented to them e.g., service functionality and payment mode. In addition, we illustrated the AHP results with regard to the most preferred mobile service category based on users' preferences.

Chapter 5

Mobile Service Platform

To our knowledge, the bulk of literature on mobile service platforms focus on strategic level of managing multi-sided platforms, whereas empirical research on consumers' preferences, their expectations and awareness toward mobile service platforms is still lacking. In this chapter we start by discussing the mobile service platforms from the generic point of view. We do so by identifying the core characteristics of service platforms, their unique functionalities as well as their commonality and differences. We use conjoint analysis to investigate whether the consumers are aware of mobile service platforms or not and what their preferences are. Next, we focus on a very specific type of mobile services (Convergent Communication Services) by which Telecom operators have implemented Rich Communication Suite (RCS) standards and Converged IP Messaging (CPM) to develop services that cannot be replicated by Internet players such as Google. The core concept of the current research is the perception of service functionalities –like Converged Address Book (CAB), Switching between Media and Devices, Availability and Presences feature. Then we provide the conjoint analysis results of an empirical research. Finally, we present and discuss the results of a Quasi-Experiment in which two prototypes were tested. These two prototypes are built upon recently developed converged communication standards.

5.1 What is a mobile service platform?

A mobile service platform may refer to a hardware configuration, an operating system or a software framework (Poel, Renda, and Ballon, 2007). In other words, a platform is an interface that manages interactions between two separate entities: mobile handsets and applications in mobile communication. Mobile service platforms have become an increasingly important part of mobile communications after tremendous growth in smart-phones usage. Moreover, platforms also provide capabilities and, to a large extent, support for third parties and service developers. As a result, service provisioning and the way end-users access mobile services and applications have changed. As far as we are aware, there are three major platforms in the mobile telecommunication market, these are, irrespective of their market shares, network operator-centric, service provider-centric, and device manufacturer-centric. The following subsections introduce the main characteristics of each platform in sufficient detail to be able to distinguish their unique characteristics in addition to their commonalities and differences.

5.1.1 Mobile Network Operator- Centric Platform

This model has by far been the dominant mobile service platform in the mobile communications domain in past years. In this model, the network operator works as a portal provider through which end-users can obtain mobile services. These so called walled garden models for mobile Internet have largely been terminated in Europe; nonetheless they still play a significant role in Japan (Weber, Hass, and Scuka, 2011). Moreover, operators are looking for walled garden type models for the next generation of communication services as enabled by the Rich Communication Suite (RCS) (Nikou, Bouwman, and De Reuver, 2012). Network operators have the tendency to be protective of their customers and networks, and thus impose strong selection criteria on the services that content providers and application developers can offer (Jaokar and Fish, 2006). Generally, service and application developers have to pay a certain amount of commission fee for using the Telecom portal for service distribution. Application and service developers are given the tools Software Development Kits (SDKs) to design and develop services specifically for the operators' portal within the boundaries of a predefined format. Thus, operator portals often have very limited number of services available to end-users. But, on the other hand, owning the network infrastructure, enables mobile network operators to guarantee the end-users' security and privacy related issues. Network operators may leverage their trusted image as well as excellent privacy and security arrangements to retain customers (Chen and Lu, 2011). Typically, platforms provided by the network operators are known as closed platforms. A closed platform refers to a platform to which the participation of third parties and application developers are restricted. An operator platform offers a limited number of services (often to be purchased), which are private, secure and reliable. For example, Vodafone Live is an operator-centric platform.

5.1.2 Device Manufacturer-Centric Platform

Nokia, Apple, BlackBerry and HTC are examples of device manufacturers that provide their own platforms. In this model, the service platform acts as a mobile operating system between the mobile device and application store. According to (Gartner, 2011), "the worldwide mobile OS market currently is dominated by four major players: Symbian, Android, Research In Motion and iOS". At the end of 2010, major OS market shares were: Symbian OS (40.1%), Android OS (17.7%), iPhone OS (15.4%), Blackberry OS (17.5%) and others (9.4%). In this scenario, developers are given tools in the form of Software Development Kits (SDKs) to engage them in the application development and service creation process. How strict the rules are for participation of third party developers differ: for instance, Apple and BlackBerry are relatively strictly governed (De Reuver et al., 2011) and have placed more restrictive rules on

developers and third party participation for using the platform. Platforms offered by these two device manufacturers (iOS (Apple) and BlackBerry OS from BlackBerry) are typically known as closed platforms, that forces developers to follow, often strict rules, set by the device manufacturers in order to participate in the application development process. Platforms from device manufacturers (Nokia Ovi and Android HTC) are typically called open platforms, which mean that the participation of application developers in the service development process is less restricted. Applications and services provided by device manufacturers are accessible via App-stores and are often unlimited in number, either for free or for a price. Applications developed by Apple, Nokia, Windows mobile, HTC and BlackBerry are offered through App-stores, Ovi, Market place, Market and BlackBerry App World respectively.

5.1.3 Service Provider-Centric Platform

Google+ and Facebook are two examples of service provider platforms. Although Google can also be recognized as a device manufacturer, e.g. with their Nexus One smart-phone; nevertheless, in the current study, it is considered a service provider centric platform only. Platforms provided by service providers are typically open platforms, which mean application developers can easily participate in service development. In this scenario, the application developers are again given tools (SDK) to get engaged in the service development process. Issues such as security arrangement and end-users' personal profiles can potentially put the service providers' position in danger. In reality, the service providers do not own the network infrastructure; accordingly they cannot guarantee the privacy and security arrangements which in turn could adversely affect the end-user's experience. Diverse applications and services can usually be obtained via the services providers' portal, either for free or to be purchased.

Mobile service platforms are basically differing from each other with respect to the operating system, but this may have implications on security and privacy arrangements. Moreover, other essential characteristics such as openness or closeness of platform, the number of available applications (e.g., limited vs. unlimited) and application cost (e.g., free or payable) may also have an effect on end-users' expectations, judgments and preferences. Therefore, it is crucial to summarize the core characteristics of each platform discussed earlier (see table 5.1). These characteristics are independent variables in the current research. These similarities and differences will later be used to formulate the conjoint questionnaire.

Table 5. 1 Mobile service platforms' characteristics

Characters	Operator-Centric Platform	Device-Centric Platform	Service Provider-Platform
Operating Systems	-NA-	Apple (iOS), Nokia (Symbian), BlackBerry OS	Google (Android)
Privacy Arrangement	Guaranteed	Best Effort Delivery	Best Effort Delivery
Security Arrangement	Guaranteed	Best Effort Delivery	Best Effort Delivery
Number of Application	Limited	Unlimited	Unlimited
Application Cost	Payable/Free	Payable/Free	Payable/Free
Type of Platform	Closed	Closed/Open	Open

5.1.4 Dependent variables

In addition to the core characteristics of different platforms discussed previously, we have identified several dependent variables related to users' intentions to choose and use a mobile service platform. These dependent variables will be used in our questionnaire in order to be able to get a better understanding of participants' judgments. The objective is to provide insight into how consumers make decisions, their awareness and expectations regarding mobile service platforms. We claim that there are several decision making processes at different stages of the customer life cycle (De Jong, 1996) i.e. adopting, switching to, using and experiencing a platform. A short introduction is given below for each of the constructs.

Intention to choose a platform:

Indicates the attractiveness of different features composing a mobile service platform to end-users and how it influences users' intention to adopt a particular mobile platform (Hammershøj, Sapuppo, and Tadayoni, 2009). Acceptance, adoption and use of new mobile services are to a large extent associated with mobile platforms. Since mobile platforms assimilate various mobile services and contents, users' perception is greatly influenced by various underlying features within each mobile service platform (e.g., mobile operating systems, application cost and type of platform).

Intention to switch to a new platform:

By defining this variable, we aim to assess what the end-users' intentions toward substitution to a new platform are. End-users' willingness to switch indicate whether they want to change their current handsets and thus adopt different service platforms or they prefer to keep the old ones. Various platform core characteristics (e.g., number of available applications, security and privacy arrangements) would stimulate or hinder end-users intention to switch. With regard to the information platform domain, e.g. Shapiro and Varain (1999, p.11) pointed out that "switching is always costly, for instance many of us have

experienced the costs of switching from one brand of computer software to another: data files are unlikely to transfer perfectly, incompatibilities with other tools often arise, and most important, retraining is required". In other words, if the benefit offered by a platform provider is adjustable to the user's preference and expectation, then willingness to change may increase.

Intention (likelihood) to use more applications:

Technological advancement in mobile telephony and growth in mobile services and applications are changing the way people work, live and interact with others. Mobile applications are expected to provide a new way of performing tasks and to ultimately offer values that previously the user has not possessed. The effect of a platform can be measured from different perspectives (e.g., the number of available applications). Thus, we aim to evaluate the effect of adopting a platform based on the users' intention to use applications offered by the corresponding platform (Ballon, 2009). Prior research, based on the Technology Acceptance Model (TAM) or modifications of the TAM, is excessive and indicates that perceived usefulness of the mobile applications and services plays a significant role in users' perception and intention of using the mobile services and applications (Amberg, Hirschmeier, and Wehrmann, 2004; Bouwman et al., 2010; Leong et al., 2011).

Willingness to pay more for application:

Indicates the extent to which end-users' are willing to pay for using and downloading new services (Bauer et al., 2005). The more useful and attractive the applications are, the more the users are willing to pay to obtain the applications. Willingness to pay has been identified as one of the main predictors toward service adoption in many studies (Berman, Battino, and Feldman, 2011).

Intention to download more applications:

This can be an indication of the attractiveness of the applications of a platform and the availability of various mobile apps supported by that platform. Users tend to have heterogeneous requirements and demands regarding the usage of mobile services. While some users download mainly entertaining applications, others might be interested in downloading communication applications. Hence, users use their mobile phones to access more advanced services (Hill and Troshani, 2010). If using an application improves the user's performance, then we can assume that the intention to download more applications will be increased.

Productivity and efficiency:

It is an indication of the implication of a platform on the users' productivity with regard to performing daily routines. In other words, if the platform fits in the users' day-to-day routine, then it is easier for them to organize and perform their daily tasks in a more efficient and more effective way. According to Task

Technology Fit (TTF), a technology might be perceived as innovative, but it might not be adopted if there is not a good fit with tasks it supports (Goodhue and Thompson, 1995). Users expect that using a particular service enhances their day-to-day activities and improves their performance. In other words, they expect that their daily task performance would greatly depend on using a particular service (Keen and Mackintosh, 2001). Dennis, Fuller, and Valacich (2008) argued that in order to improve the communication performance, individuals should use a variety of media to perform a task, rather than just one medium.

Willingness to pay more for monthly subscription:

Willingness to pay increases if there is an unlimited number of applications available on the mobile platform (Urban, 2007). Amberg, Hirschmeier, and Wehrmann (2004), found that a fee for using the mobile services and applications would not be easily accepted by users. Furthermore, they pointed out that, although a service itself may be regarded as useful and easy to use, still cost related issues play a significant role that needs to be taken into close consideration.

5.2 Design of the conjoint instrument

As previously discussed in chapter 3, there are some requirements and steps for designing a conjoint analysis. The first step is to determine the data collection approach to use (online survey or pen-and-paper questionnaire). The second step is to identify the attributes (the product features) and level of attributes. In the current research we formulated attributes and level of attributes on the basis of the core characteristics of the mobile service platforms defined in table 5.2.

The next step is to select a conjoint analysis approach. Consistent with prior studies where conjoint analysis was used as the research approach (Kohne, Totz, and Wehmeyer, 2005; Pagani, 2004; Shin, Kim, and Lee, 2011; Van de Wijngaert and Bouwman, 2009), a full-profile conjoint analysis approach seemed to be an appropriate choice for the current research project. Making use of a full profile approach enables us to assess what users truly value in a product or service, more specifically, enabling us to measure the corresponding utilities of each level of attributes. In addition, a full profile conjoint assumes that all of the attributes are independent from each other. In general, full profile conjoint is an appropriate approach when the number of attributes is not very large. Respondents who participate in conjoint analysis are presented a realistic description of alternative hypothetical service concepts (Green and Srinivasan, 1978). In a full-profile conjoint analysis, consisting of different combinations of levels of all attributes, each profile or stimuli describes a complete product or service. Then, the respondents are requested to rank, order, and rate or score a

set of profiles (stimuli) according to their judgments and preferences, one at a time. In the current study the combination of all the attributes and levels creates 384 (4 x 3 x 2 x 2 x 2 x 2 x 2) possible service profiles/conjoints (see table 5.2). Johnson and Orme (1996) and Pignone et al., (2011) suggest that it would be a tedious task for respondents to answer all the questions when the number of profiles is too high. As we have 384 possible service profiles based on the number of attributes and levels, to reduce the number of profiles, we made use of an orthogonal design resulting in 16 unique profiles. Full profile conjoint analysis uses what is termed a fractional factorial design to present a suitable fraction of all possible combinations of profiles.

Table 5. 2 Attributes and the levels of attributes

Attributes	Levels			
Operating Systems	Symbian (Nokia)	iOS (Apple)	Android (Google)	BlackBerry OS
Service Platform	Operator-Centric Platform		Device-Centric Platform	Service-Provider Platform
Privacy Arrangement	Guaranteed		Best Effort Delivery	
Security Arrangement	Guaranteed		Best Effort Delivery	
Number of Application	Limited		Unlimited	
Free vs. Payment Apps	Free		Payable	
Type of Platform	Open		Closed	

5.2.1 Sampling

We used web-based as well as paper-and-pencil questionnaires for data collection. The questionnaires were distributed in two Northern European countries (Finland and The Netherlands) as well as in China. The data was collected in China in December 2011 and in Finland and the Netherland in February-March 2012. To check the translation accuracy of the questionnaire, it was first designed in English and then translated to Chinese by two Chinese individuals. In the next step, the same questionnaire was translated back to English. In order to make the respondents familiar with the objectives of the research, a short description explaining the different characteristics of a service platform was provided. The questionnaire was pre-tested by 6 experts and smart-phone users who had enough knowledge of conjoint analysis as well as in mobile communication services to verify the questionnaire and to check for ambiguous expressions. Finally, an adjusted questionnaire was distributed among the 258 respondents in those three countries. We received 166 (response rate 64%) complete questionnaires back in response. The participants were aged 21-70 years with the average age 28.2 years. The sample is dominated by males (66.45%). The majority of the respondents who were invited in this research

project owned a smart-phone (66.02%) and all of the respondents held some sort of academic degree (see table 5.3).

Table 5. 3 Respondents' background information

Platform/ operating Systems	Android (Google) 25.47% (N=40)	iOS (Apple) 11.49% (N=18)	BlackBerry OS (BlackBerry) 3.8% (N=6)	Mobile Widows (Microsoft) 3.2% (N=5)	Symbian (Nokia) 35.66% (N=56)	Others 20.38% (N=32)
Occupation	Working at Telecom 0.63% (N=1)		Working at another firm 7.59% (N=12)	Student 76.58% (N=121)		Other 15.18% (N=24)
Education	Bachelor 34.81% (N=55)		Master 46.83% (N=74)	PhD 16.45% (N=26)		Other 1.89% (N=3)
Smart-phone	Yes: 66.02% (N=103)			No: 33.97% (N=53)		
Gender	Female 33.54% (N=54)			Male 66.45% (N=106)		
Age	From 21 to 70 (Average 28.2)					

We were also interested in finding if there was any differences between the respondents in Finland (N=53) and The Netherlands (N=25). In total 29 of the respondents had foreign nationalities, out of the 78 respondents residing in the Netherlands and Finland. However, the initial assumption and the core hypothesis is that there are no differences among respondents from Finland and Netherlands. To confirm the hypothesis, we performed a number of t-test for core concept. Before starting the t-test, we checked for skewness and kurtosis values. According to Marcoulides and Hershberger (1997), values between -1 and +1 are recommended and they are considered as the acceptable values. In our research, most of the variables had skewness and kurtosis values within acceptable region. The t-test revealed that, on a total of 112 possible relations there were only five significant differences, (see Table 5.4). Nonetheless, we can with some modesty conclude that we can combine the two samples for further analysis as they do not differ from each other.

Table 5. 4 Independent Samples Test

	Conjoint 2	Conjoint 7	Conjoint 9	Conjoint 12
Q1 (I would choose this platform)		t= -2.54 , p<.01		
Q2 (I would switch to this platform from my current platform	t=2.39, p<.02		t=2.26, p<.03	
Q6 (I would be able to organize my life much easier, efficient and effective)			t=2.37, p<.02	t=2.46, p<.02

In the next step, we performed the *t*-test between Finnish/Dutch and Chinese respondents. The initial assumption and the core hypothesis was that there were significant differences among Finnish/Dutch and Chinese. The *t*-test results indicated that there are 91 significant differences out of 112 possible relations. Thus, we can conclude that it is meaningful to compare the results of the conjoint analysis from Finland/Netherland and China with each other.

5.2.2 Results

According to the data analysis, we found that conjoint (service profile) 11 had the highest score based on the respondent preferences. However, the results showed that the score in China is slightly higher. In this conjoint profile, security and privacy arrangements are guaranteed and users have freedom to download unlimited free applications. Presumably, this profile is by far the preferred service platform for the respondents; Table 5.5 shows the mean and standard deviation value for conjoint 11 for both Finnish/Dutch and Chinese respondents. It is worth bearing in mind that conjoint (service profile) 6 is the least preferred service platform according to the respondents' judgments. The focus in this profile is on: limited number of applications available to end-users, payable applications and best effort delivery of security arrangement.

Table 5. 5 Intention to choose & to switch, likelihood to use, willingness to pay, intention to download, life efficiency and intention to pay more for monthly payment

Card ID 11	Q1	Q2	Q3	Q4	Q5	Q6	Q7
Netherlands & Finland (N=78)	μ =5.07 SD=1.84	μ =4.81 SD=1.86	μ =4.79 SD=1.86	μ =3.68 SD=1.91	μ =4.96 SD=1.74	μ =5.16 SD=2.01	μ =3.42 SD=2.00
China (N=88)	μ =5.64 SD=1.47	μ =5.35 SD=1.54	μ =5.78 SD=1.34	μ =3.91 SD=1.77	μ =5.69 SD=1.28	μ =5.69 SD=1.33	μ =3.48 SD=1.79

Operating Systems (Android), Service Platform (Device-Centric Platform), Security Arrangement (Guaranteed), Privacy Arrangement (Guaranteed), Number of Application (Unlimited), Application Cost (Free), Type of Platform (Open)

Moreover, the research findings indicated that the respondents in Finland/Netherlands are willing to pay the highest price for conjoint 11 (μ= 3.68, SD= 1.91, N=78) and lowest for conjoint 6 (μ= 2.00, SD= 1.39, N=78). The respondents in China also have the same opinion as the Finnish/Dutch respondents for paying highest price for conjoint 11 (μ= 3.91, SD= 1.77, N=88), but the lowest willingness to pay is for conjoint 3 (μ= 2.20, SD= 1.34, N=88). Although, the respondents from all three countries were willing to switch from their current platform to a new one, they were not willing to pay a high fee to download new applications. In other words, willingness to pay for obtaining the services and applications was very low and this issue can be considered as an important insight for the platform providers.

5.2.3 Conjoint analysis results

The relationships between the attributes and dependent variables, as being used in conjoint, can be evaluated if the data meet certain conjoint requirements. Firstly, the validity of the conjoint model has to be assessed; this can be done by using the value of Pearson's r as well as Kendall's tau (Sorenson and Bogue,

2005). Pearson's r and Kendall's tau value are recommended to be (>.80) and (>.70), respectively. In our models these values were above the benchmark for both the Chinese and the Finnish/Dutch respondents, showing that there is a strong relationship between the rating and the utilities and we can perform further analysis. We used simple dummy variable regression analysis to evaluate the utility of the attributes. Based on the results with regard to intention to choose a platform (Q 1), for Finnish/Dutch respondents, an operating system with importance value of (28%) and for the Chinese, application cost with importance value of (37%) are the most relevant attributes; the highest utilities are for Google (Android) (.475) and free application cost (.590) respectively. It is worth to mention that BlackBerry OS has the highest negative utility for the respondents in Finland/Dutch (-.462) and in China (-.394). This indicates that BlackBerry OS is by far the least preferred operating system. The findings reveal that for Finnish/Dutch respondents the operating system is the most relevant criterion to select a service platform, while for Chinese, the application cost is the most relevant criterion (see table 5.6).

Table 5. 6 Conjoint results for the dependent variable questions, Q1-Q4

	Importance Value							
Dependent Variables	Q1: Intention to choose Platform		Q2: Intention to Switch Platform		Q3: Intention to use more applications		Q4: Willingness to pay more for applications	
	FIN/NL	China	FIN/NL	China	FIN/NL	China	FIN/NL	China
Operating Systems	28%	23%	30%	25%	19%	23%	27%	34%
Service Platform	4%	4%	8%	6%	5%	1%	7%	9%
Privacy Arrangement	7%	8%	10%	12%	7%	5%	9%	13%
Security Arrangement	13%	11%	13%	15%	13%	8%	14%	13%
Number of Application	11%	9%	9%	5%	13%	12%	10%	8%
Application Cost	27%	37%	21%	31%	38%	42%	25%	23%
Type of Platform	10%	8%	9%	6%	5%	9%	8%	0.32 %

The highest and lowest importance values are highlighted

Concerning the respondents intention to switch from their current platform to a new one (Q 2), the conjoint results indicated the same pattern as in question 1. Finnish/Dutch respondents gave the highest importance value (30%) to operating systems among other attributes; within this attribute, Google (Android) operating system has the highest utility value of (.565). The Chinese respondents scored the highest for the application cost attribute with importance value of (31%) and the utility value of free application cost is (.540) (see table 5.6). It should be mentioned that Chinese respondents scored the operating systems as the second most important criterion.

With regard to the intention to use more applications (Q3) and willingness to pay (Q4), it can be seen that the application cost attribute in question 3 and operating systems attribute in question 4 are by far the most important criteria

for all the respondents. The findings show that the respondents intend to use more applications if they are offered free applications. The respondents gave high scores to this attribute and the utilities are (.584) and (.617) for Finnish/Dutch and Chinese respondents, respectively. Moreover, with regard to willingness to pay (question 4), the majority of the respondents in all three countries is more concerned with the operating systems in service platforms. The Finnish/Dutch users prefer Android OS with a positive utility value of (.313), and the Chinese respondents mostly prefer Apple (iOS) with a positive utility value of (.328). For more details (see table 6 and Appendix 3).

Concerning the intention to download more applications (Q5), and organizing life to be much easier (Q6), the Finnish/Dutch and Chinese respondents indicated that the application cost is the most important attribute and the importance rate of this criterion is (38%) for Finnish/Dutch and (43%) for Chinese, (see table 5.7). Free applications attribute to a positive utility value of (.665) and (.620) for Finnish/Dutch and Chinese in Q5, and (.354) & (.418) in Q6, respectively. Surprisingly, for Finnish/Dutch respondents the provider of service platform is the least important criterion with an importance rate of (6%) in question 5. Chinese respondents also give the lowest score to provider of the service platform with an importance value of (2%). For more details see Appendix 3 (Q5-Q7).

Table 5. 7 Conjoint results for the dependent variable questions, Q5-Q7

	Importance Value					
Dependent Variables	Q5: Intention to download more Apps		Q6: Ability to organize life efficiently		Q7: Willingness to pay more monthly	
	FIN/NL	China	FIN/NL	China	FIN/NL	China
Operating Systems	20%	21%	24%	27%	18%	32%
Service Platform	6%	2%	10%	2%	9%	5%
Privacy Arrangement	9%	5%	4%	2%	11%	10%
Security Arrangement	10%	7%	14%	9%	15%	13%
Number of Application	10%	12%	10%	13%	11%	6%
Application Cost	38%	43%	29%	35%	27%	30%
Type of Platform	7%	10%	9%	13%	9%	4%

The highest and lowest importance values are highlighted

In the last dependent variable we were concerned with the respondents' willingness to pay more for their subscription fee. According to our findings, the Finnish /Dutch respondents indicate that for them the application cost is the most important attribute and they scored this criterion with an importance value of (27%). Chinese respondents, on the other hand, gave the highest preference to the type of operating system with the importance value of (32%). The results show that the respondents from China are willing to pay a higher monthly

subscription fee if the operating system is Apple (iOS) (the utility value is (.255)). For more details see table 5.7 and Appendix 3 (Q5-Q7).

5.2.4 Discussion

In this section, the focus was on mobile service platforms to assess the Finnish/Dutch and Chinese respondents' perceptions, awareness, preferences and their expectations toward the core characteristics of service platforms. We used conjoint analysis as our research approach and we identified several core characteristics of a service platform –like application cost, type of platform (open or closed) and mobile operating systems. Moreover, we also identified several dependent variables –like intention to change a platform or willingness to pay more for downloading applications. These variables seem to be relevant to the objectives of the research and play a significant role in a respondent's decisions. The conjoint results show that for the majority of the respondents the application cost and to a lesser degree, the type of mobile operating systems, are the most important and relevant criteria. Moreover, the individual level of the conjoint analysis procedure shows that willingness to adopt a new mobile service platform is not influenced by the platform provider or the number of applications. More specifically, the results indicate that respondents in Finland and The Netherlands prefer the Android mobile operating system the most, whereas for Chinese respondents the Apple iOS is the most preferred operating system. In addition to what is covered in this section with regard to the users' decisions and preferences, it is also important to acknowledge that we are aware of the role of the institutional and organizational actors in the adoption process as the other side of the equation. For example, how different device manufacturers with their wide range of product portfolios play a role in the mobile sector. Moreover, large companies such as Google and Facebook by offering innovative services are trying to attract more users. Thus, it is not just the choice of the individual that play a role in adoption process; it is also the interactions between the institutional factors and large organizational actors that more or less force the individual to adopt one or the other type of services and products.

It is worthwhile mentioning that telecommunication operators may regain their market position by cannibalizing the traditional business model 'the Walled Garden approach' with an open platform strategy. Moreover as discussed in chapter 5, network operators can add more innovative services by using IMS and RCS technology and standard to their service portfolio.

Next, we present research results where the focus is on the functionalities of a very specific type of mobile services developed by mobile telecom operators. Telecom operators involved in this research project developed various IP Multimedia Subsystem (IMS) based technologies to provide richer communication services. We again make use of conjoint analysis as our research

approach as it seems relevant to use this method because the services are not yet commercially launched.

5.3 Converged mobile telecommunication services

In this section, we start to present the results of a joint research project in which network operators (Orange and Telefonica); platform and software companies (SQS, Itatel, ACision, Movial and Pace France) have been collaborating. The objective of this research project is to develop innovative converged telecommunication services that cannot be replicated by over-the-top communication services like VoIP, WhatsApp, Facebook. European operators have experienced decline in their Average Revenue per User (ARPU) in recent years, moreover, they fear losing their profitable voice and SMS services to IP-based companies such as Google and Facebook. Our previous findings indicated that the provider of the service platform is much less concerned about consumers. It also verifies the argument of Gonçalves and Ballon (2011): they postulated that operator centric-platforms should adopt a platform mindset and incorporate the right balance of platform characteristics that guarantee platform adoption and avoid market/platform fragmentation.

Therefore, operator centric-platforms can make use of several advanced technologies and standards –like Rich Communication Suite (RCS) and IP Multimedia Subsystem (IMS) to develop more innovative rich communication services to fight back and find new growth business opportunities. IP Multimedia Subsystem allows rapid development of session-based communication services, which enable users to switch between their PC, mobile and even TV seamlessly within the same communication session (video or telephony session). However, it seems unlikely that users' needs and demands for richer communication services is only restricted to the advanced technologies and innovations.

Nonetheless, despite the efforts of operators to develop operator-centric platforms based on initiatives such as OMA (Open Mobile Alliance), it is still important to examine whether operators' platforms may be preferred by end-users. Therefore, in the current research we aim to investigate the end-users' willingness to adopt rich communication services offered by operators and to what extent issues like reliability and security impact their decision. We do so by presenting five rich communication service functionalities derived from technological trends like RCS, IMS and mobile cloud computing. These five service functionalities are: (i) switching between devices (PC, TV, or Mobile), (ii) switching between media (text, video, or voice), (iii) Availability/Presence feature, (iv) File Sharing and (v) Group Communication. A short description of these service functionalities is given below.

1. Switching between devices allows users to switch between their devices without interrupting the communication session (service continuity), for example from PC to TV or mobile phone. This functionality improves the end-user experience through the interoperability between operators.
2. Switching between media allows end-users to switch between communication types without interrupting the communication session (service continuity), for example from voice to text or video.
3. Availability/presence service enables end-users to see on which device their friends are visible and they would like to be reached.
4. Group Communication service allows end-users to set an advanced teleconference service that allows multiple devices and multiple media to be used, including multimedia (a combination of IM, voice and video calls).
5. File Sharing enables end-users to share multimedia content between their friends via a drive space in the operator network (mobile cloud computing) on multiple devices including TV, mobile phone and PC.

5.3.1 Dependent variables

Based on the above argumentation and according to the conjoint analysis requirements, we have specified several dependent variables. These dependent variables help us to understand how different service characteristics and functionalities are perceived by end-users. In the questionnaire we will use these variables and a brief introduction is given bellow (see also Appendix 4).

Likelihood of use:

This question enables us to evaluate whether the new services are attractive to users or not and helps to understand the impact on user s' intention to use rich communication services. Ho and Kwok (2002) argued that if the mobile service provider can provide personalized services, it is more likely that the services become attractive to end-users. Moreover, Nysveen, Pedersen, and Thorbjørnsen (2005a) pointed out that the services can be tailored to preferences in segments based on for example, gender, age, and context of use, thus increasing the likelihood that the service will be used.

Fitting into day-to-day routine:

By asking this question, we would like to determine the usefulness of a service and see whether the service can improve the users' task performance. If the service is useful, then the chance that the service fits into users' daily activities is high and it will probably be used. It has been argued that the mobile services should be designed in such a way that they improve users' daily operational activities (Bouwman, Carlsson, Molina-Castillo, and Walden, 2007; Gerstheimer and Lupp, 2004).

Enjoyment:

Enjoyment and entertainment deal with the hedonic aspects of mobile services which are designed to entertain the users. By asking this question we aim to know to what extent the users would enjoy using the services. The hedonic values that an individual gains by using a service may differ depending on the type of services in use, for instance, leisure or business services, (the use of a service for leisure resembles the entertaining aspects rather than efficiency (Eriksson and Strandvik, 2009)).

Willingness to pay:

It is an indication to the end-users' willingness to pay for using a new service. Determining the willingness to pay has been one of the main research objectives in many studies (Berman, Battino, and Feldman, 2011; Zhang and Ma, 2011; Bauer et al., 2005). These authors argued that if a service is implemented with reference to and demand of the users' context, then they are ready to pay.

Innovativeness:

Every technological innovation focuses on and targets a certain group of audience. By asking this question from the participants, the concern is to find how innovative new mobile services are perceived by end-users. In our prior empirical study discussed in the previous chapter, we found that the services might be highly innovative –like Mobile RFID, but users will not use it due to extra effort they need to put in for using the service.

Reliability:

The ability of the network operators to perform a designated set of functions under certain conditions for specified operational times (Snow, Varshney, and Malloy, 2000). It is necessary for mobile service providers, in order to be able to deliver what they are supposed to and to provide service satisfaction for the users, to have a reliable and robust infrastructure. Varshney, Vetter, and Kalakota (2000) argued that trust will grow if operators increase their network reliability and redundancy.

Service Security and Privacy issues:

We are concerned with the importance of the security issues and these are important to end-users. Users' data and personal information have to be secured when using the services. Security related issues are critical, as they may impact the users' perceptions toward service quality. For example, Varshney and Vetter (2001) and Andreou et al. (2005) argued that the security issues are the key determinates for designing mobile commerce services. Moreover, end-user privacy issue addresses the users' concern about being tracked and whether they find the services intrusive. Kaasinen (2003) found that privacy protection in location-aware services is related to the right to locate a person, use the location,

store the location and forward the location. Furthermore, Ackerman, Darrell, and Weitzne (2001) pointed out that end-users often make the trade-off between privacy intrusion and benefits. The users would accept losing privacy to some degree, if the benefit is perceived as large enough.

5.3.2 Conjoint Instrument

Although, it is possible to define various attributes, we tried to select the most relevant features in the five discussed rich communication functionalities. Therefore, five attributes and two levels of each attributes (2*2*2*2*2) were chosen (see table 5.8). The combination of all the attributes and the levels generates 32 combinations.

Table 5. 8 Service functionalities, attributes and the levels of attributes

	Attributes	Levels
1	File Sharing	Yes / No
2	Availability/Presence	Yes / No
3	Switching between Media (Video, Voice and Text (IM)	Yes / No
4	Switching between Devices (Mobile, PC and TV)	Yes / No
5	Group Communications	Yes / No

Orthogonal design was used to reduce the number of profiles in order to minimize the participant's task in the research. Orthogonal array/design considers only the main effect of each attribute level. In the current study, a computer program (SPSS software version 18) was used to generate an orthogonal array, resulting in 8 unique cases out of the 32 possible service profiles: this number is small enough to be included in a survey and large enough to assess the relative importance of each attributes and their levels. Table 5.9 shows the 8 unique cases.

Table 5. 9 List of conjoint profiles

Card ID	File Sharing	Switching Device	Switching Media	Availability/Presence	Group Communication
1	-	-	-	√	-
2	√	-	√	√	-
3	√	-	-	-	√
4	√	√	√	√	√
5	-	√	√	-	-
6	-	-	√	-	√
7	√	√	-	-	-
8	-	√	-	√	√

√= functionality is mentioned; - = functionality is not mentioned

In the next step, a scenario was created for each of the 8 conjoint profiles. These scenarios have been written in such a way that they resemble a realistic service usage for the respondents. To validate the accuracy of the scenarios we asked the project partners to verify them (see Appendix 4). Moreover, 10

identical questions repeated in all 8 conjoints were derived in relation to the dependent variables which were explained previously.

5.3.3 Sample

Data were collected by making use of a web questionnaire as well as a paper-and-pencil questionnaire that was distributed in three countries, in France, Spain and The Netherlands in May, 2011. The questionnaire was pre-tested by a number of experts who were well acquainted with the conjoint analysis as well as mobile communication services to verify the accuracy of the questionnaire and to check for ambiguous expressions. Moreover, the project partners also verified the accuracy of the questionnaire. Then, we distributed the adjusted questionnaire among the respondents. We received 82 complete questionnaires. There were 16 females (19.51%) and 66 males (80.48%) of ages 22-70 years in the sample; the average age was 38 years. It is worthwhile mentioning that most of the respondents (90%) owned a smart-phone and every respondent held some sort of academic degree (see table 5.10).

Table 5. 10 Respondents' background information

Handset	Nokia: 21%	HTC: 20%	iPhone: 19%	BlackBerry: 13%	Ericsson: 9%	Samsung: 7%
Country of residence	France 33% (N=27)		Netherlands 40% (33)		Spain 27% (N=22)	
Occupation	Telecom Operator: 59%		Working in academia or student: 24%		Other firms: 16%	
Education	Bachelor: 30%		Master: 60%		PhD: 10%	
Gender	Male: 83% vs. Female: 27%					
Age	Between 22 and 70 years (Average: 38 years)					

To see whether there are differences among the respondents among three countries, they were classified into three groups, France (N= 27), Spain (N = 22) and The Netherlands/others (N = 33). The analysis showed that 8 out of the 33 respondents residing in the Netherlands had foreign nationalities. The initial assumption and the core hypothesis was that there are no differences among respondents from France (group 1); Spain (group 2) and The Netherlands/others (group 3). We employed ANOVA, assuming equal variance (Bonferroni) (Rupert and Miller, 1997) and equal sample size to test this hypothesis. The ANOVA test is the initial step in identifying factors that are influencing a given data set. Bonferroni, on the other hand, is the statistical test that suggests the "p" value for each test must be equal to alpha divided by the number of tests.

We checked for skewness and kurtosis values before the ANOVA test. Marcoulides and Hershberger (1997) pointed out that the values between ± 1 are in threshold region and are acceptable, and in our case most of the variables have skewness and kurtosis values within the recommended region. As the samples are slightly different in size the Games-Howell (Hayes, 2005) method was employed for every single question, which is a Post Hoc test that does not

assume equal population variances or sample. Six significant differences were found out of the 80 possible relations (see Table 5.11). The number of the differences is bit more than expected based on the random error, however, we can with some modesty conclude that the three samples do not differ in such a way that they cannot be combined for further analysis.

Table 5. 11 Analysis of variance

	Conjoint 1	Conjoint 2	Conjoint 5	Conjoint 7	Conjoint 8
Q2, Fit into day-to-day routines		F= 4.686, p <.05		F = 5.085, p<.01	F = 3.566, p <.01
Q3, Enjoyment			F = 5.177, p<.01	F 5.357, p <.01	
Q4, Willingness to pay	F = 3.847, p<.05				

5.3.4 Result

The results showed that conjoint (service profile) 3 received the highest score based on the participants' preferences. In conjoint 3, the focus of the service functionality is on the work and personal productivity, such as fit into day-to-day routine, likelihood to use and enjoyment. According to the findings, this is by far the most attractive use case (service profile) to the respondents.

- *Conjoint 3: You are finalizing a task for work. Before sending the results to your boss, you want to get feedback from two colleagues. Through your enhanced address book, you invite both of them to join a group conference call to discuss about your work. They can access the Word files easily by clicking a button on the conference call screen. One of them joins the conference call from his PC, while the other is on his way home and joins from his mobile phone.*

In contrast, conjoint (service profile) 4, received the lowest score indicating that this conjoint is the least preferred service profile to the respondents. This service profile focuses on sharing contents and switching between the devices and media. According to the majority of the respondents, this is the least likely to be used service and the least enjoyable service.

- *Conjoint 4: You are organizing a party at your son's school. You would like to plan a conference call with a group of other parents to discuss your plans. In your enhanced address book, you see that some of them are currently available only via instant messaging while some are available for voice calling as well. You call those that are available for voice calling and set a time with them to have the conference call the*

next day. You schedule the group conference with your enhanced address book, and the system sends an invitation to everyone with the time, date and title information. The next day at 11 AM, everyone joins the group conference from his PC or mobile phone (you use your PC), and you start chatting. After a while you need to discuss a complex issue, you press a button and directly have everyone online in a video call While discussing the different options for the party, you send the others pictures and a draft program to their personal network storage, which can be viewed during the meeting. After a while you need to leave from home so you switch from your PC to your mobile to continue with the conversation while in your way.

Table 5. 12 illustrate the value of the mean/standard deviation for conjoint 3

The attributes and their levels for Conjoint (profile) 3						Likely to use	Day-to-day routine	Enjoyment
Card ID	File Sharing	Switching Device	Switching Media	Availability/ Presence	Group Communication	μ = 5.62 SD= 1.56	μ = 5.37 SD= 1.59	μ = 5.46 SD= 1.40
3	√	-	-	-	√			

In further analysis the respondents' willingness to pay for using the services was evaluated. The research findings showed that the respondents were willing to pay the highest average fee for conjoint (service profile) 3 (μ = €2.14, SD = €1.37, N = 82). Moreover, the respondents indicated that they wanted to pay the least amount for conjoint (service profile) 1 (μ = €1.35, SD = €0.74, N = 82).

- *Conjoint 1: You would like to call a friend to invite him to your birthday party. You access the enhanced address book on your mobile phone, and you see that he is only available for chatting, and not for voice or video calling; probably he is in a meeting. You send the invitation for the party via an instant message from your PC.*

It is interesting to notice that approximately 70% of the respondents would be willing to use the services immediately or within one year. The majority of the respondents indicated they found some of the service functionalities innovative and it would be nice to start using them.

5.3.5. Conjoint Analysis Results

It is recommended to check the conjoint data first to see if the data have met the certain conjoint requirements. Moreover, it is important to check the data in the current research in order to see how different attributes of the service

functionalities, as being used in the conjoints, contributed to the different dependent variables. We can assess the validity of the conjoint model by checking the values of Pearson's r and Kendall's tau (Sorenson and Bogue, 2005). In our models, except for the models on day-to-day routine (question 2) (Kendall's tau is 0.47 with $p<0.5$) and on privacy (question 8) (Kendall's tau is 0.40 with $p<0.85$) the values are high enough to indicate strong relationships between the rating and the utilities. Therefore, model 2 and 8 are removed from further analysis.

Simple dummy variable regression analysis was used to assess the utility of the attributes. Concerning the likelihood that respondents would use these services (question 1), the results show that the switching between media on the same device and availability/presence with importance rate of 42% and 39%, respectively, are the most relevant criteria, although the utilities are negative: (-.30) and (-.28), respectively. It is worth bearing in mind that file sharing is the only attribute with positive utility (.016): it implies that file sharing is the most likely to be used functionality.

Table 5. 13 Conjoint results for the first four questions

Attributes	Levels of Attributes	Q1, Likelihood of use		Q3, Enjoyment		Q4, Willingness to Pay	
		Utility	Importance	Utility	Importance	Utility	Importance
File Sharing	Yes	.016	(2%)	.107	(17%)	.066	(14%)
Switching Devices	Yes	-.120	(16%)	.041	(7%)	.031	(7%)
Switching Media	Yes	-.304	(42%)	-.146	(23%)	.059	(13%)
Availability/Presence	Yes	-.282	(39%)	-.294	(47%)	-.203	(45%)
Group Communication	Yes	-.009	(1%)	-.035	(6%)	.094	(21%)
Pearson's r		.92	p <.001	.83	p <.005	.87	p <.003
Kendall's tau		.71	p< .007	.65	p< .05	.78	p< .004

To assess question 3 (enjoyment), we found that Availability/presence information (-.29) and Switching between media (-.14), although having negative utilities, are the two most relevant criteria for the respondents to use the services. The respondents indicated that the Switching between devices (.04) and the file sharing (.10) based on the positive utilities values are somewhat important to them. Group communication has a negative utility.

With regard to question 4 where the respondents were asked to indicate their willingness to pay, Group communication (.94) and file sharing (.66) appear to be the most important. Striking is that availability/presence (-.20) has a negative impact and respondents are not willing to pay this functionality. There is a positive utility for switching between media (.59) and switching between devices (.31), suggesting that these service functionalities contribute to willingness to pay (see table 5.13).

Concerning the innovativeness of these mobile converged rich communication services, the respondents indicated that switching between

devices is the most important criterion and attribute to a positive utility (.45). Availability/presence, on the other hand, is considered to be the least innovative criterion with negative utility (-.23). This implies that availability/presence, although important, plays a negative role in the contribution to innovativeness. The other attributes: switching between media (.14), file sharing (.06), and group communication (.02) have positive utilities, therefore. The findings show that although respondents are not familiar with switching functionalities, they strongly appreciate this feature and consider them innovative.

With regard to reliability (question 6), we found that group communication functionality is the most preferred feature and its importance rate is (.26). According to the respondents Availability/presence is considered to be the second most important criterion, although it has negative (-.15) utility value.

The same pattern can be observed regarding the security (question 7): availability/presence feature has the highest importance rate, but with very strong negative (-.27) utility value. Apparently respondents experienced a risk when availability/presence is being implemented. Group communication and file sharing are considered to be important criteria for this question, as both have positive utilities (.17) and (.15) respectively. A similar pattern is found for file sharing (see table 5.14). Switching between media/devices has low importance. Obviously the Switching between media function does not have a lot of impact on the respondents' decision. Based on the findings, we can argue that Telecom operators, having robust network infrastructures, could retain consumers if they offer services which are more reliable and secure.

Table 5. 14 Conjoint results for the second four questions

Attributes	Levels of Attributes	Q5, Innovativeness		Q6, Reliability		Q7, Service Security	
		Utility	Importance	Utility	Importance	Utility	Importance
File Sharing	Yes	.063	(7%)	.047	(11%)	.157	(25%)
Switching Devices	Yes	.453	(49%)	-.010	(2%)	.011	(2%)
Switching Media	Yes	.142	(15%)	.014	(3%)	.015	(3%)
Availability/Presence	Yes	-.234	(26%)	-.152	(36%)	-.272	(43%)
Group Communication	Yes	.025	(3%)	.206	(48%)	.175	(28%)
Pearson's r		.90	p <.001	.95	p <.000	.88	p <.002
Kendall's tau		.86	p< .001	.86	p< .001	.70	p< .01

5.3.6 Conclusion

In this exploratory research, the focus was on very specific functionalities of five converged rich communication services provided by operator-centric platforms. These functionalities were built upon IP Multimedia Subsystem (IMS), Converged Address Book (CAB) and Rich Communication Suite (RCS) standards and technologies. The objective was to provide richer communication

services that were more innovative and could not easily be duplicated by other IP companies (Facebook and Google). The conjoint analysis results revealed that the respondents were willing to pay a little sum for using these services and they indicated that switching between devices and switching between media are very innovative features and functionalities. Moreover, the results showed that conjoint 3 (profile 3), where the focus of service functionality is on the productivity, received the highest score and considered to be the most preferred service profile. Moreover, in most of the conjoint models, the availability/presence feature received the highest attention from the respondents. According to our findings based on the individual level of the conjoint analysis procedure, willingness to adopt the new Rich Communication Services is mostly influenced by the group communication feature and to a lesser degree by switching between media. Further analysis showed that the respondents were ready to adopt these services immediately or as a maximum within the year.

5.4 Enriched presence information on converged communication platforms

In this section the results of a quasi-experiment are presented: two service prototypes were tested by a number of users in an experimental setting. In previous sections, the importance of the mobile service platforms was discussed from the generic point of view and the results of an exploratory research were analyzed. The core characteristics of mobile platforms were addressed and their similarities and the differences were identified. Then, we also showed the consumers' perceptions, expectation and preferences with regard to the specific functionalities of five mobile converged services which were built upon the IMS, Converged Address Book (CAB) and RCS technology and standards. These services were pushed by the telecom operators, platform and software companies in a joint collaborative research project. In this section, we aim to discuss the results of our experiment in which users have actually tested two out of five service functionalities previously discussed (section 5.3). We were interested to evaluate users' perceptions toward the new services and investigate whether we could find any significant difference in users' intention to adopt those services before testing and after testing the services.

5.4.1 Prototypes

The two prototypes tested in this experiment are built upon recently developed mobile converged communication standards. An important trend in the telecommunications industry is that fixed and mobile networks are converging which is enabled by technologies such as IP Multimedia Subsystem and Systems Architecture Evolution in LTE (Dahlman, Parkvall, Sköid and

Beming, 2007). Using the IMS technology enables the service providers to integrate voice and multimedia applications from wireless and wire line terminals (Camarillo and Garcia-Martin, 2008). IMS makes use of the Session Initiation Protocol (SIP) to ease the integration with the Internet. It is worthwhile mentioning that SIP (Rosenberg et al., 2002) is by far the most widely used signalling protocol for controlling multimedia communication sessions (voice and video calls) over the Internet Protocol (IP). On the other hand, using the fixed-mobile convergence with all IP-networks, operators can exert more control on the quality of service of communication sessions, which is generally still an issue with mobile VoIP services from Internet actors –like Skype (Cuevas, Moreno, Vidales and Einsiedle, 2006; Nguyen, Yegenoglu, Sciuto and Subbarayan, 2001).

Several standards have recently been developed to define services that can use the IMS and SIP technology and protocol. The standard body Open Mobile Alliance (OMA) has developed standards to allow access from any device or network to content (i.e., through CPM: Converged IP Messaging) and address-books (i.e., through CAB: Converged Address Book). Moreover, Rich Communication Suite (RCS) is a parallel initiative in which most telecom operators and manufacturers participate. RCS has standardized several rich communication functionalities including enriched presence information and interoperability between devices (switching between devices and media). Partly, RCS functionality is overlapping with OMA standards as it also offers content sharing. RCS provides richer presence information on the user's device. It should be pointed out that OMA standards and RCS standards have not been implemented into mass-market services yet, as applications are limited to very small scale trials (Gartner 2010).

In the current research two prototype applications were developed within a European project in which several large operators and software vendors participate. The aim of this project is to provide new, innovative communication services that cannot yet be replicated by the Internet players and that utilize the standards as discussed. The innovative element of both prototypes is not just the service concept, but more importantly the fact that they utilize the OMA and RCS standards which have not been done before.

5.4.2 Prototype 1: Content Anywhere

The "Content Anywhere" service concept enables the users of mobile phone and PC to share videos, photos or text with their friends in their enriched address-book. Sharing can be done by pushing content to a personal network storage controlled by the operator. The permission from the sender should be granted in advance in order for the others to access the personal network storage. According to this service concept the users can view presence and availability information, for instance on which device the contact is currently available,

before sharing the files. From the technical point of view, the service uses WiFi connection and utilizes file sharing service based on an extension of Rich Communication Suite (RCS 1.0). Text, video and photo sharing in this experiment are unidirectional. Presence information is enabled through OMA SIMPLE Presence enabler.

5.4.3 Prototype 2: Social TV

The "Social TV" service concept enables users to use a TV in a social manner. Users can contact their friends who are available and watch the same TV channel. With this service, users can chat and share (multi-media) information: audio, videos, photographs with/without audio and text. Users can also view presence information of their contacts, including which channel they are watching. The social TV service sends proactive notifications if a contact switches to the same channel the user is viewing. From a technical point of view, the service runs on a Set Top Box (STB) that is connected to the operator network and uses cable/WiFi connection.

5.4.4 Experimental setting and selection of the subjects

The setting of the experiment is artificial in the research project. An office room was prepared to be used for the experiment. The room was arranged with typical office (laboratory) equipments and 2 TV sets: the setting was not really natural, but a mixture of an office environment and a lab setting. A general procedure for each test and experiment expectations were shortly explained to the participants in the experiment. The allocated time for the experiment was 60 minutes for each group (2 people (subjects)). Six to eight experiments were executed per day. Separate devices were used for the experiment and for collecting questionnaire data. The experiments were executed during five working days, started on Friday September 23rd and ended on Thursday September 29th, 2011.

The participants (test subjects) were asked to execute the steps according to a given short scenario description, see Appendix 5. Two experiment leaders, one form Delft University of Technology and one form Orange Telecom, were supervising the experiment and gave support to subjects if needed to execute tasks. The subjects were students from Delft University of Technology. The students were involved in classes on research methods and / or classes discussing mobile technologies and/or ICT related business aspects. The students were offered a small fee to compensate for their time investment. We strived for a group of subjects that is as homogeneous as possible in order to prevent the disturbing effects of possible differences in age, social and economic status and so on. While this sacrifices external generalizability, it improves internal validity. We had some control over possible disturbing effects of

background characteristics of the students by limiting the subjects to the student population. Nevertheless, we can statistically control possible effects of differences with regard to the background of the students of education program, gender, age and nationality. A total of 31 groups (62 students) participated in the experiments and tested both applications. Severe technical problems occurred in some experiments; therefore we used the data of 53 students for further analysis. The subjects were between 19 and 32 year with 66% between 21 and 25 years old. Male students dominate the sample: 73%. Almost half of the participants were Dutch and the other half was students from other European countries, China, India, South America. The majority of the participants use smart phones (84%): Nokia telephones (29%), HTC (23%), Apple (16%), and Samsung (15%). Only 6% of the participants have Blackberry phones; the other participants used different brands like Ericsson and Siemens. The main research interest is to investigate if IMS, RCS and CAB can be utilized to develop a service concept that is useful for consumers. Moreover, we aim to study whether users' perceptions toward usefulness of the services would change after testing the services. We do not analyze explicitly the ultimate intention to use the prototypes per se, as this depends on various factors which were out of the scope of the experiment (for instance price (Cheong and Park 2005), social influence (Hong and Tam, 2006), personal innovativeness (Lu, Yao and Yu, 2005), and compatibility (Wu and Wang, 2005).

5.4.5 Research model and experimental design

The Technology Acceptance Model (TAM) has by far been the most used theory in research on individual technology acceptance. According to TAM, intention to adopt a mobile service can be assessed by perceived usefulness (PU) and ease of use (PEOU). PU can be defined as 'the degree to which an individual believes that using a particular system would enhance his or her job performance' and PEOU as 'the degree to which an individual believes that using a particular system would be free of physical and mental effort' (Davis, 1989). Although, the importance and the relevance of TAM is recognized (Liang and Yeh, 2011; Mallat et al., 2008) some authors emphasize that it treats the technology as a "Black-Box" (Orlikowski and Iacono, 2001; Nikou, Mezei and Bouwman, 2011). Furthermore, TAM has been criticized for its limited general applicability and its inability to explain the adoption of technology by consumers, due to its incomplete (Teo and Pok, 2003) deterministic, (McMaster and Wastell, 2005) organizational (Nysveen and Pedersen and Thorbjrnsen, 2005a) and tautological focus and nature (Bouwman and Van de Wijngaert, 2009).

In this research project, we focus on how the use of both prototypes (service concepts) influences the users' perception with regard to the usefulness of enriched presence features. Ease-of-use, on the other hand, is a secondary

interest as it was clear from the outset that further development is needed to improve the interface and accessibility of the services. Therefore, we formulate the following hypotheses:

- **Hypothesis 1a:** *Trying out Social TV application will increase perceived usefulness of TV-specific presence features*
- **Hypothesis 1b:** *Trying out Social TV application will increase perceived usefulness of generic presence features*
- **Hypothesis 2:** *Trying out Content Anywhere application will increase perceived usefulness of generic presence features*
- **Hypothesis 3:** *Trying out Social TV and trying out Content Anywhere will have similar effect on perceived usefulness of generic presence features*

The design of the experiment can be described as a classic Pre-test/Post-test Control Group design (Cook and Cambell, 1979). In this experiment the subjects were randomly assigned to an experimental condition (R), (Fichhoff, 1975). They either started with the Content Anywhere or Social Communication on TV. The experiment starts either with the use case Content Anywhere (Xe1) or Social TV (Xe2) to prevent order effects. However, we can control possible order effects before we discuss the results (see Section 5.4.8).

R O1 Xe1 O2 Xe2 O3
R O1 Xe2 O2 Xe1 O3

The design of the experiment guarantees internal validity and reduces the effects of most disturbing factors. The experiments do not control for measurements effects; i.e. the fact that subjects are observed and have to fill out a questionnaire.

5.4.6 Survey measures

We measured the perceived usefulness by asking the respondents to indicate to which extent they found that enriched presence features are useful. The same questions were posed both before the participants performed the experiment and after testing each of the prototypes. Exploratory factor analysis was used to construct factors from the items. Table 5.15 illustrates the results for three runs of factor analysis: on the items before the experiment, the items after using Social TV and on the items after using the Content Anywhere service concept. According to the factor analysis results, the scales were robust, that is, the same items converge into a factor before and after the experiment. Aggregate metrics were computed by computing the average score on the items in each factor.

Table 5. 15 Exploratory factor analysis on perceived usefulness measures

	Before experiment (KMO = .49)		After using Social TV (KMO = .71)	After using Content anywhere (KMO = .66)	
How useful would you find it if you could: (7-point scale: Not useful at all – Very useful)	TV-specific presence α = .81	Generic presence α = .56	TV-specific presence α = .88	Generic presence α = .78	TV-specific presence α = .81
Check on which device he/she is reachable before starting to communicate		.72			
Check if he/she prefers voice, chat of video-telephony before starting to communicate		.75			
See which persons in your address-book are watching the same TV program	.74				
Chat on your TV with people in your address-book	.91				
See presence / availability of other persons in your address-book	.85				
Check if he/she is available before starting to communicate				.87	
Check if he/she prefers voice, chat or video-telephony before starting to communicate				.85	
Invite multiple persons to the communication session (group communication)				.72	
See which persons in your address-book are watching the same TV program			.83		
Chat on your TV with people in your address-book			.87		
See presence / availability of other persons in your address-book			.90		
Check if he/she is available before starting to communicate					.91
Check on which device he/she is reachable before starting to communicate					.86

5.4.7 Test for disturbing factors

As in the case of other technological prototype testing, in our experiment we encountered some severe technological errors. Out of the 62 test subjects, 9 were removed due to major technological problems. Out of 53 remaining test subjects, 14 subjects had minor technological problems like crashing of the device or prolonged response times and failure of Set Top Box. We computed mean differences between the experiments with technical issues and those without technical issues. Only 2 out of 120 questionnaire items are significantly different, so we could with some modesty conclude that the technical problems encountered during the experiment do not pose a threat to the mean values for the questionnaire items.

Concerning order effects, comparing the subjects that started with Content Anywhere and those who started with Social TV, there were only 5 out of 120 questionnaire items which are statistically significantly different. Therefore, we argue that order effects do not create a major threat to the validity of the findings. However, we found that for those who started with Social TV, perceived usefulness of presence items score a bit higher. Furthermore, we also

compute for other disturbing factors such as type of study program and education level, i.e. bachelor, undergraduate, graduate. We found only a few significant differences. Moreover these items are rather random: we can conclude that disturbing effects are limited.

5.4.8 Hypotheses testing

Social TV service and its specific presence features allow users to see who is watching (friends in their address-book) the same TV program. They can then start chatting on TV with friends who permit to do so. The hypothesis (1a) is supported by the data (within-subjects effect: $F(1) = 38.32$, $p = .000$). Based on our findings, the respondents indicate that they find presence features on TV more useful after they actually tested the Social TV application. This effect is not disturbed significantly by the order (which application they tested first), the experiment leaders or any technical problems that might have occurred. However, we find that the nationality of the respondents does play a role. It is worthwhile mentioning that, although for both Dutch and foreign participants the opinion increased similarly after trying the Social TV application (within-subjects effect: $F(1) = .146$, n.s.), on an absolute scale, foreign participants were more positive than Dutch participants (between-subjects effect: $F(1) = 6.08$, $p = .017$), see Figure 5.2.

Concerning hypothesis 1b, we find that the respondents' opinion based on the generic presence features did not significantly increase after they tried the Social TV application (within-subjects effect: $F(1) = .75$, n.s.), therefore this hypothesis is not supported. Although there were several technical issues with the STBs and the social TV application, this does not pose a significant disturbing effect (within-subjects effect: $F(1) = .49$, $p = .489$). The results indicate that order has a major disturbing effect, in other words, in which order the participants tried out the two prototypes, see Figure 5.3. According to the figure 5.3, one can observe that if the subjects started with Social TV application, their perception on usefulness of generic presence features increases after testing Social TV. In contrast, if the subjects already tested Content Anywhere, they become more negative about the generic presence features after testing Social TV (within-subjects effect: $F(1) = 14.75$, $p = .000$). Presumably, the generic presence features of the Social TV application were not prominent.

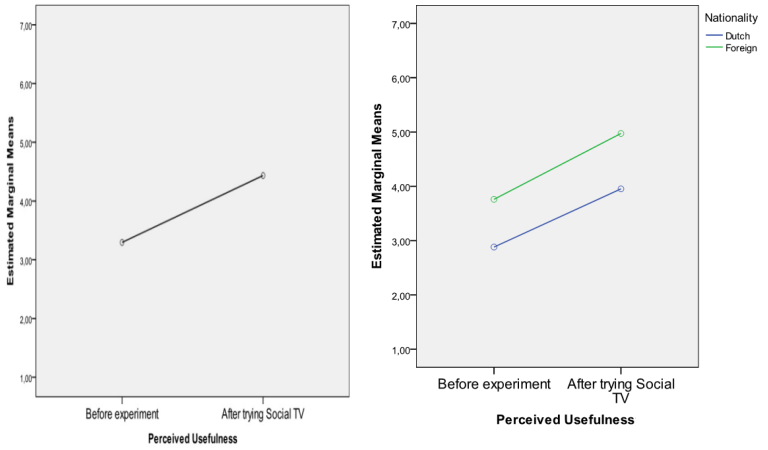

Figure 5. 1 Perceived usefulness of Presence features: before/after Social TV

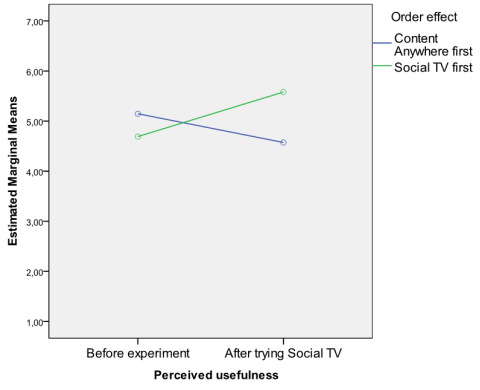

Figure 5. 2 Order effect: Content Anywhere or Social TV

Regarding hypothesis 2, based on the results we can conclude that this hypothesis is supported (within-subjects effect: F (1) = 10.28, p = .002). The respondents' perceptions with regard to generic presence features have positively improved after they tested the Content Anywhere application. We find again that the order in which the participants test the applications does play a role (see figure 5.4). Participants who tried out Content Anywhere first are not really impacted by this application, while the participants who started with the Social TV application are (F (1) = 16.15, p = .000). Possibly, the generic

presence features of Content Anywhere were much better than those of Social TV.

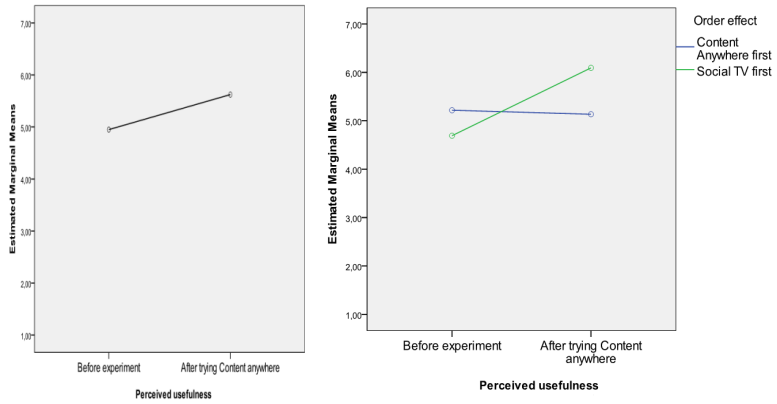

Figure 5. 3 Perceived usefulness of generic presence features: (before and after Content Anywhere)

Concerning Hypothesis 3, the data analysis shows that the Content Anywhere application has the most effect on perceived usefulness of generic presence features (F (1) = 10.318, p = .002) for the respondents. The order in which the two prototypes were tried out poses a major disturbing effect, see Figure 5.5.

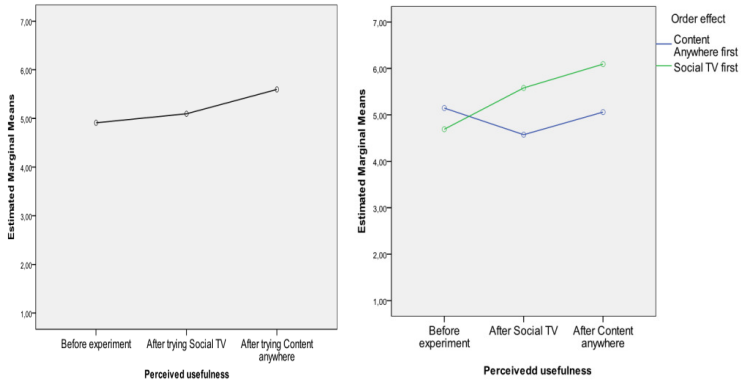

Figure 5. 4 Perceived usefulness of generic presence features: comparing both experiments

The participants who started with Content Anywhere become less positive about the usefulness of the generic presence features, while the participants who started with Social TV application become more positive ($F(1) = 15.59$, $p = .000$). Therefore, hypothesis 3 is not supported by the data.

5.5 Summary

In this chapter we presented the results of three research projects. First, we discussed the users' awareness, expectation and perceptions with regard to mobile services platforms. We identified the core characteristics of service platforms and their similarities and differences. Our research findings, making use of conjoint analysis, indicate that the provider of a service platform does not play a significant role in a user's opinion with regard to adoption of service platform. Moreover, the results show that respondents in China are more concerned with Apple iOS, whereas the respondents in Finland and The Netherlands are concerned with Google Android Operating System. Strikingly, both samples i.e., Chinese or Finnish/Dutch have strongly indicate that for them the application cost is by far the most important criterion.

Next, we discussed the new innovative mobile converged communication services which have been recently developed by telecom operators. On top of the IMS, RCS and CAB platform these new service functionalities, e.g. switching between devices/media, availability/presence features are built. We discussed the conjoint analysis results in which five service functionalities were tested and the majority of the respondents indicated that although these service functionalities are innovative, they are not willing to pay a lot for the services. Moreover, the results reveal that the respondents are more positive toward the Group Communication feature of the service and a lesser degree to switching between devices and file sharing.

Finally, we presented the results of an experiment in which two prototypes are under investigation. The main concern was to find whether the participants' opinion will change after trying out the services. The services functionalities in this experiment are the Content Anywhere and Social TV applications. The respondents using the Content Anywhere are allowed to share photo, text or any kind of multi-media content. The content for sharing will be stored in the users' personal network storage, and others after permission has been granted can have access to the content. In the Social TV application the users can check through their enhanced address-book which of their friends are available and watching the same TV channel; by sending a notification, they can start chatting, exchanging photos and placing a call. The results show that the participants' opinion changes positively after they tried out the TV application. Moreover, the findings indicate that the order, in which the participants start the application (Social TV or Content Anywhere), does play a significant role.

In the next chapter, we discuss the mobile social network services and specifically their usage in China. Social network services are built upon communication platforms and are becoming increasingly important in communication industry.

Chapter 6

Social Network Services

In this chapter, we discuss the mobile social network services (henceforth it is called SNSs) and the focus is specifically on Chinese users' behaviours and intentions to make use of the Tencent QQ application.

To explain individual behaviour and intention to use social network services, new variables according to the specific characteristics of the technology or system (mobile SNSs in here) have to be integrated to the TAM model. Prior research indicated that the Technology Acceptance Model (TAM) provides reasonable explanations for examining individual acceptance of mobile service innovations (Kaasinen, Mattila, Lammi, Kivinen, and Välkkynen, 2011; López-Nicolás, Molina-Castillo, and Bouwman, 2008; Luarn and Lin, 2005). Nonetheless, it is argued that additional explanatory variables are needed to be incorporated within the TAM (Lu, Yao and Yu, 2005; Pedersen and Nysveen, 2003; Rogers, 1995; Venkatesh and Davis, 2000; Wang, Lin, and Luarn, 2006) in order to explain and to predict better the acceptance behaviour. Thus, in this research project, individual mobile accessibility (mobility), use context, social influence and critical mass constructs will be used to investigate the individual behaviour and actual use of SNSs and specifically mobile SNSs. Table 6.1 and Figure 6.1 summarizes the definition of each determinant construct and depicts the conceptual research model, respectively.

Table 6. 1 Definition of the constructs

Construct	Definition	Reference
Mobility	Ability to access mobile social network services ubiquitously, regardless of time and place (anytime/anywhere)	(Coursaris and Hassanein, 2002; Mallat, Rossi, Tuunainen, and Oorni, 2006)
Critical mass	A small segment of the population that chooses to make a big contribution to the collective action, while the majority do little or nothing	(Allen, 1988; Markus, 1987; Oliver, Marwell, and Teixeira, 1985)
Perceived ease of use	The degree to which a person believes using a mobile social network service would be free of effort	(Davis, 1989)
Perceived usefulness	The degree to which a person believes using a mobile social network service would enhance his or her task performance	(Davis, 1989)
Use context	The very concrete environment in which a technology is going to be used	Van de Wijngaert, Bouwman, 2009
Social influence	Social influence is defined as the degree to which an individual perceives that important others believe he or she should use the new system	(Venkatesh et al., 2003)
Behavioural intention	Behavioural intention measures a person's relative strength of intention to perform a behaviour	(Fishbein and Ajzen, 1975)
Actual use	Behavioural intention to use a system predicts the actual use	Fishbein and Ajzen, 1975; Van der Heijden, 2004; Taylor and Todd, 1995

6.1 Hypothesis

According to TAM, individuals accept, adopt and make use of the new technology if they find that using a particular system would be easy and require little effort to conduct their tasks. In the context of the current research project, we argue that if a mobile SNS is easy to use, then it is more likely that its adoption will be increased; therefore, we postulate the following hypotheses:

- **Hypothesis 1a:** *Perceived ease of use has a direct positive effect on intention to use mobile SNSs.*
- **Hypothesis 1b:** *Behavioural intention has a direct positive effect on actual use of mobile SNSs.*

Various motivation theories have pointed out that behaviour 'usage' can be determined by both intrinsic and extrinsic motivation (Davis, Bagozzi and Warsha, 1992; Teo, Lim and Lai, 1999). Individuals adopt a technology if they believe that usage would be useful and they gain benefits by using that particular technology. In the context of mobile social network service, we can therefore propose the following hypotheses.

- **Hypothesis 2a:** *Perceived usefulness has a direct positive effect on intention to use mobile SNSs.*
- **Hypothesis 2b:** *Perceived ease of use has a direct positive effect on intention to use mobile SNSs through perceived usefulness.*

Users make use of mobile SNS only if using the service helps them to perform their tasks. Moreover, perceived ease of use has also been found to have a direct affect on perceived usefulness. If a technology is difficult to use, then that particular technology is less likely to be perceived as useful (Teo, Lim and Lai, 1999).

6.1.1 Mobility

The concept of mobility can be explained as moving around, either in space or in time. The benefits of mobile technologies are labelled as anytime and anywhere having two dimensions: "spatial and temporal" (Kleinrock, 1996). Moreover, Järvenpää et al, (2003) pointed out that people make use of their mobile devices and services to be in touch, while moving around. The intention to use mobile social network services depends on the ability of accessing services anywhere and anytime. China Internet Network Information Center (CNNIC, (2012)) reported that in 2011 the number of users of social networking sites has reached a milestone of 235 million users, increasing by 59.18 million of users compared to 2010: this implies that social network services have found

their ways into everyday life of people. Furthermore, CNNIC (2012) pointed out that the role of SNSs is in the establishment, maintenance and development of personal relationships and that it has become increasingly important as a platform for social interaction in recent years. Thus, we can observe that mobility has a positive influence on perceived usefulness and perceived ease of use of mobile SNSs. Therefore, we suggest the following hypotheses:

- **Hypothesis 3a:** *Mobility has a direct positive effect on perceived ease of use of mobile SNSs.*
- **Hypothesis 3b:** *Mobility has a direct positive effect on perceived usefulness of mobile SNSs.*

6.1.3 Social Influence

Social influence or subjective norm has been introduced by Fishbein and Azjen, (1975). This construct has been identified as one of the four direct determinants of user acceptance and intention to use a technology in UTAUT theory (Venkatesh, Morris, Davis and Davic, 2003; López-Nicolás, Molina-Castillo, Bouwman, 2008). Venkatesh, Morris, Davis and Davis (2003) defined the social norm as the degree to which people have the impression that important others believe they should use a new system. According to the concept of social norm and its relationship with the intention to use mobile SNS, we propose that users start making use of such services if (i) people who influence their behaviour think they should use the service, and (ii) people who are important to them think they should use the service. Therefore, we can postulate the following hypotheses.

- **Hypothesis 4a:** *Social influence has a direct positive effect on intention to use mobile SNSs.*
- **Hypothesis 4b***: Social influence has a direct positive effect on perceived usefulness of mobile SNSs.*

6.1.3 Critical Mass

Critical mass and its relevant issues have been introduced by Oliver, Marwell, and Teixeira (1985) arguing that collective action usually depends on a 'critical mass' that behaves differently from typical group members. Shapiro and Varian (1999) argued that a critical mass of users is needed to receive an acceptable level of value from using a product or a service. Social network services are considered as a subset of interactive media. Moreover, it has been argued that "widespread usage creates universal access, a public good that individuals cannot be prevented from enjoying even if they have not contributed to it" (Markus 1987, p.491). It has also been pointed out that the use of

interactive media entails reciprocal interdependence, in which earlier users are influenced by later users or vice versa. Mallat, Rossi and Tuunainen (2004) argued that for mobile banking services to be adopted, a critical mass of users is needed. They continued that the overall business challenge for micropayment service providers is to achieve a critical mass of both consumers and merchants. The benefits of mobile SNSs for the users are diverse: for instance, by using their mobile handsets, users can exchange or share information via direct real time communication. Still, critical mass can be created by using the presence/availability feature that enables the users to check which contact is online; using SNS, the more people are online the more relevant SNS becomes (Allen, 1988). However, it is important to emphasise that there were some standalone services, e.g. Sudoku and to-do list, which do not engage other users and therefore do not require a critical mass of users for service diffusion. Moreover, cross cultural differences introduced by various regulatory regimes play a significant role in the adoption and the diffusion of a service. While, for instance mobile game services are very popular in China and Japan, in Europe these types of services may not be very attractive for the general population. We therefore, propose the following hypotheses:

- **Hypothesis 5a:** *Critical mass has a direct positive effect on perceived usefulness of mobile SNSs.*
- **Hypothesis 5b:** *Critical mass has a direct positive effect on social influence.*

We intend to test alternative models with inverse causality between these two latent constructs, as causality between critical mass and social influence maybe inverse (hypothesis 5b).

6.1.4 Use Context

The concept of context is rather vague. Various perspectives and views in context have been postulated, from technical, social, physical, spatial, design as well as cultural diversities perspectives (Han et al., 2005). Gerstheimer and Lupp (2001) found that users' (individual, group and organization), place (fixed and mobile) and type of process (business or leisure) are the most relevant issues with regard to context. Moreover, Van de Wijngaert and Bouwman (2009) defined that use context (UC), refers to "the very concrete environment in which a technology is going to be used". Thus, we propose the following hypothesis.

- **Hypothesis 6:** *Use context has a direct positive effect on intention to use mobile SNSs.*

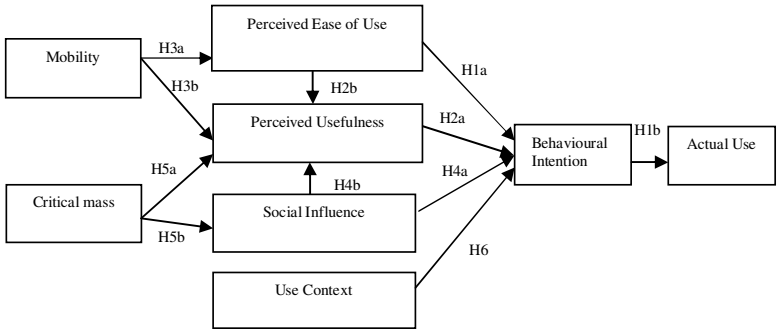

Figure 6. 1 Conceptual model for mobile social network services

6.2 Sample

The data was collected by making use of an online survey technique within the 28 days (from 26.12.2011 to 15.01.2012). In order to check the accuracy of the questionnaire, we conducted a pre-test among 6 users and then the adjusted questionnaire was distributed among the participants. We received 273 usable questionnaires (out of 302). We strived for homogeneous respondents; therefore a convenience sample was selected from individuals, mostly students. The respondents were collected from potential regular users of a mobile social network service available in China via Chinese SNS sites. The sample include 179 male respondents (65.5%) and 94 (34.4%) females. The potential respondents' age varies from 15 to 49 years with the average age of 23.5 years. Most of the respondents indicated that they use the QQ mobile social network application. The QQ is a social network application offered by the Chinese Tencent provider. From the reliability and usability perspectives of a sample, it is recommended that the sample size should be more than five times greater but less than ten times greater than the number of parameters (Bentler and Chou, 1987). Hoelter (1983) recommends a sample size of at least 200 respondents for a critical model testing. In our research, we argue that our model satisfies those recommendations and further analysis for validity and reliability of the model test can be performed.

6.2.1 Measurement

In order to determine a comprehensive list of measures, the bulk of prior studies have been extensively reviewed. All measures for each construct in the current study were selected from previously validated measurements. To fit the

specific context of mobile SNSs, some of the measures have been slightly modified. Measures for perceived ease of use and perceived usefulness were derived from measures used in TAM, and based on studies by Lin and Lu, (2011) and Zhang and Lu, (2011). The measures for mobility and critical mass were derived from Mallat, Rossi and Tuunainen, (2004) and Markus, (1987). The measures for social influence were derived from Davis, Bagozzi and Warshaw, (1992) and Kim, Kim, Kim, (2010). All items were measured using a 7-point Likert scale from "Strongly disagree" to "Strongly agree". All items in this study were normally distributed. Table 6.2 shows the list of items within each constructs.

Table 6. 2 Question items used in the study

Construct	Items	Measure
Mobility	M1	I would like to be able to use mobile social network services to keep in touch everywhere I am
	M2	I would like to be able to keep in touch with my friends by using mobile social network services no matter where I am
	M3	I would like to be able to keep in touch with my friends by using mobile social network services no matter what time it is
Critical Mass	CM1	Many of my friends and relatives frequently use the mobile social network services
	CM2	I use the mobile social network services because I want to use the same communication media people around me use
	CM3	I use the mobile social network services because people around me use the mobile social network services in common
Perceived Ease of Use	PEU1	My interaction with the mobile social network services would be clear and understandable
	PEU2	I would find the mobile social network services easy to use
	PEU3	Learning to operate the mobile social network services is easy for me
Perceived Usefulness	PU1	I would find the mobile social network services useful in my life
	PU2	Using the mobile social network services enables me to accomplish my daily tasks more quickly
	PU3	Using the mobile social network services increases my productivity
Social Influence	SI1	People who influence my behaviour think that I should use the mobile social network services
	SI2	People who are important to me think that I should use the mobile social network services
	SI3	People who are important to me would recommend using the mobile social network services
Use Context	UC 1	If I have nothing else to do
	UC 2	If I feel bored
	UC 3	If I travel for a long time on a bus, a flight or a train
Behavioural Intention	BI1	I am willing to use the mobile social network services in the near future
	BI2	I am likely to use the mobile social network services in the near future
Actual Use	AC1	I use the mobile social network services frequently
	AC2	Overall, I use the mobile social network services a lot

6.2.2 Measurement Model

The model included 22 items describing eight latent constructs: mobility, critical mass, perceived usefulness, social influence, use context, perceived ease of use, behavioural intention and actual use. We have used IBM SPSS Amos 19 and SPSS 18 software to compute the results and to test reliability and validity of the measurement model. The analysis results show that the measurement model has a good fit with the data. The Cronbach's alpha (α) values were over

the 0.6 level, indicating that all measures have acceptable reliability with regard to their respective constructs (see table 6.3). Composite reliability (CR) and the average variance extracted (AVE) values were all above the recommended thresholds (0.6) and (0.5) respectively, showing good internal consistency (Fornell and Larcker, 1981). In addition, the square roots of the AVE of the constructs are all greater than the correlation estimate with the other constructs. We also evaluated the constructs for discriminant validity. Campbell and Fiske (1959) pointed out that a value of more than 0.85 indicates that discriminant validity is likely to exist between two constructs (correlation) and they possibly overlap and measure the same thing. In our case, after evaluating the discriminant validity, all the constructs had lower value than recommended (0.85). See table 6.3 for more details.

Table 6. 3 Descriptive statistics and reliability

Constructs	Items	Mean	SD	Cronbach's α	AVE[a]	SCR[b]	R^2	Lowest *t*	Factor Loading
Perceived Usefulness	PU1	5.31	1.34	0.85	0.68	0.86	0.52	12.94	.719
	PU2	4.79	1.35				0.81		.896
	PU3	4.73	1.39				0.71		.845
Perceived Ease of Use	PEOU1	5.17	1.28	0.89	0.73	0.89	0.68	15.81	.822
	PEOU2	5.40	1.26				0.80		.893
	PEOU3	5.64	1.15				0.70		.835
Behavioural Intention	BI1	5.49	1.29	0.95	0.90	0.95	0.91	29.94	.951
	BI2	5.57	1.26				0.90		.944
Social Influence	SI1	4.97	1.41	0.95	0.86	0.95	0.89	24.36	.942
	SI2	4.93	1.40				.092		.962
	SI3	4.90	1.42				0.77		.876
Mobility	MO1	5.29	1.39	0.95	0.86	0.95	0.84	26.47	.915
	MO2	5.38	1.30				0.86		.929
	MO3	5.37	1.31				0.87		.931
Critical Mass	CM1	5.03	1.37	0.87	0.69	0.87	0.66	14.30	.811
	CM2	5.25	1.28				0.82		.905
	CM3	5.02	1.34				0.60		.775
Use Context	UC1	5.34	1.25	0.90	0.75	0.90	0.87	17.35	.930
	UC2	5.37	1.21				0.76		.869
	UC3	5.48	1.19				0.63		.791
Actual Use	AU1	4.78	1.71	0.94	0.90	0.94	0.92	22.56	.957
	AU2	4.79	1.76				0.87		.931

[a] Average variance extracted
[b] Scale composite reliability

6.3 Results

To test the research model and confirm the relationships between the hypotheses, we used the Structural Equation Modelling (SEM) technique. The fit of the model is satisfactory: $\chi 2$ (195) = 570.125. The explained variance of the constructs in the model is satisfactory: (a) Behavioural intention 70%; (b) social influence 66%; (c) actual use 48.5%; (d) perceived ease of use 47.4%; (e)

perceived usefulness 32.3%. Figure 6.2 shows the results of the analysis: the bold lines show significant relationships and dotted lines show the hypotheses which are not supported. We used six different fit statistics to test our research model: the root mean square error of approximation (RMSEA), the goodness-of-fit index (GFI), the adjusted GFI (AGFI), the normed fit index (NFI), Tucker-Lewis index (TLI), and the comparative fit index (CFI). The analysis results show that these model fit indices all satisfy the recommended guidelines; therefore, we can conclude that our research model presents a good fit (Browne, Cudeck, 1993) to the data. For more details see table 6.4.

Table 6. 4 Model Fit Indices

Model Fit Indices	GFI	AGFI	NFI	CFI	TLI	RMSEA
Recommended value	> 0.9	> 0.8	> 0.9	> 0.9	> 0.9	> 0.8
Obtained Value	0.89	0.81	0.91	0.94	0.93	0.84

Figure 6.2 illustrates the model, the hypotheses results and the fit indices for measurement. The results show that critical mass has strong impact on social influence; hence, hypothesis H4b is supported. As we expected, perceived ease of use and social influence positively affect behavioural intention and lead to usage of mobile SNSs, thus hypotheses H1a and H5a were supported. Behavioural intention has also been found to have a positive influence on actual use, hence hypothesis H1b is supported. Moreover, we found that social influence has a positive impact on perceived usefulness; hence, we can observe that hypotheses H5b is supported as well.

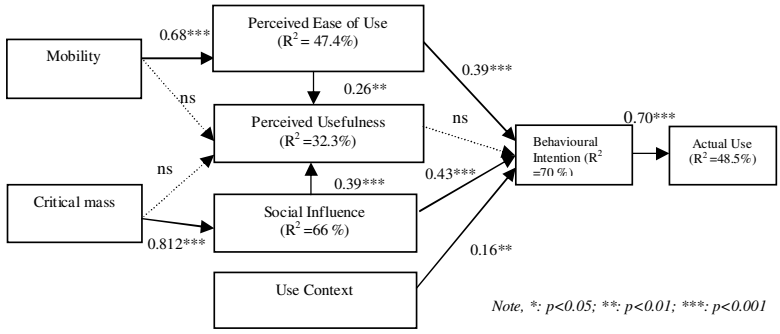

Figure 6. 2 Analysis results

The results also show that the perceived usefulness (hypotheses H2a), does not have any significant impact on behavioural intention to use mobile SNSs and H2a is not supported in the model. It seems that users intend to use mobile social network services because their friends are using it and presumably for them

usefulness of the services does not play a significant role. It can also be concluded that for these users social influence has a much stronger impact than the perception of usefulness. This can be seen more as a result than as a driver.

The results showed that perceived ease of use (hypothesis H2b) has a positive effect on perceived usefulness and also has a direct effect on behavioural intention to use mobile social network service; hence, these hypotheses ware supported by the model. With regard to the mobility construct, we could not find any direct relationship with perceived usefulness and hence H3b was not supported by the model. Moreover, the results show that (H3a) was supported, indicating that mobility has a significant impact on ease of use. We did not find any direct relationship from critical mass toward perceived usefulness; as a result (H4a) was not supported in the model. However, we found indirect relationship through social influence. According to our findings, use context has a strong effect on behavioural intention; therefore, hypothesis H6 is supported.

6.4 Summary

In this research project the focus was on social network services and more specifically on the usage of mobile social network services in China. The social network services as a special case of communication platforms have gained massive attention among users worldwide. The research results showed that mobility, critical mass, use context and social influence impact the users' intention to use mobile SNSs to a large extent. Furthermore, our findings, on the basis of an extended TAM model, indicated that perceived usefulness has no effect on the behavioural intention of the respondents who participated in this research project. Our model verified the findings of earlier research that the Technology Acceptance Model and its two constructs are not appropriate to predict users' intentions toward the acceptance, adoption and use of mobile services (Venkatesh, Morris, Davis, and Davis, 2003).

Chapter 7

Discussion & Conclusion

In this chapter the focus is on providing an overview of the main research findings and their relation to the research questions formulated in the Introduction chapter. Several empirical and exploratory research projects using different research methodologies have been carried out in order to explore the black box of mobile service characteristics and to find relevant answers to the research questions. Therefore, we begin by highlighting the core findings and results on mobile service adoption and mobile service characteristics. Next, the contribution of the research findings to the body of knowledge and theory is discussed. Furthermore, the research results are analyzed in terms of the implications to the research domain and recommendations for practitioners. Finally, we conclude by discussing the main limitations concerning the current study and providing directions for future research.

7.1 Main findings

The core objective of the current thesis is to create an understanding and insight into individual acceptance, adoption and use of an IT artifact, (i.e., mobile services), and the characteristics of the IT artifact, such as the type of service and platform. Furthermore, we formulated the main research question as:

- *How do technology and service characteristics affect the acceptance of mobile services?*

This study has been one of the first to consider how characteristics of services and underlying technology interact with the typical concepts used to explain acceptance, adoption and use in the information systems community. The findings suggest that mobile services have to be evaluated and judged in their own right, with their own merits and not solely based on concepts in acceptance theories as is commonly done in many studies. Our research confirms the suggestions from Orlikowski and Iacono (2001) that IT artifacts should no longer be treated as 'Black-Box' and taken for granted in Information Systems Research (ISR). We showed how and why different dimensions such as innovativeness, usefulness, ease of use and context of use will influence individual perceptions toward the acceptance, adoption and use of mobile services.

The results in chapter 4 show that although some services might be considered as being technologically advanced and innovative, they will not be adopted if extra effort is needed to use the service (ease-of-use) or that does not

fit into the users' day-to-day routines. Moreover, the findings indicate that some services are only going to be used in a very specific context or occasion (use context). The degree to which certain services are preferred over other services can be attributed to the use context and effort to use the services; to a lesser degree to innovativeness of the services. In our exploratory study discussed in chapter 5, we found that communication services such as SMS and mobile telephony are (still) considered the most useful services by the majority of the respondents who participated in the research project. The findings confirmed the Lazy User concept (Tetard and Collan, 2009): the services that are easy to use (ease-of-use) and do not require lots of efforts are most likely to be used in the future. Also, the results showed that existing services such as mobile news which are merely adapted to the mobile channel are not considered to be innovative by a massive group of people except mobile TV.

The study findings in chapter 4 showed that service characteristics and some of the traits of services such as simplicity of service user interface, usability and accessibility (a service which can be found at anywhere/anytime) are by far the most relevant influential factors compared to other factors such as payment mode (how the users are charged) for the users to make a decision to accept, adopt and make use of a service.

In future research, researchers should pay more attention on criteria that play a significant role in consumers' decisions and refrain from research that only discuss mobile services and application in generic terms. As we saw in this study, service characteristics and users' service perceptions can reveal valuable insights to ISR community to be used in future acceptance research. We argue that a mobile service should be evaluated based on the dimensions relevant to its use. For instance, there are services which can be only used in a very specific context such as location based services or mobile monitoring of RFID information. This implies that mobile RFID types of services are highly dependent to the context where they are going to be used.

The study findings suggest that service and technology characteristics should be taken into a close consideration while carrying out research on acceptance of mobile services. The characteristics of a service and enabling technology often play a moderating effect on the importance of factors that explain adoption. For instance, innovativeness and context of use are not relevant dimensions to evaluate basic communication services (see chapter 5), but they are highly relevant for advanced applications and services that are built upon new technology and standard such as Rich Communication Suites (RCS) and Internet Protocol Multimedia Subsystem (IMS) (see chapter 5). If scholars pay more attention to techno-economics e.g., service characteristics, innovativeness, service platforms, payment, business model and to context-of-use, new theories can be developed that might be relevant to study the next generation of mobile services which can be developed upon 4th generation of mobile network e.g., Long Term Evolution(LTE). 4G LTE provides higher network capacity and high-speed data transmission which can be used in wireless communications.

Moreover, we found that there is a lack of empirical research in the literature that takes consumers' perceptions with regard to service characteristics and techno-economics into an account.

The results from an experimental research with regard to the users' perception toward service usefulness in chapter 5, in which two service prototypes, the Content Anywhere and the Social TV applications were tested, show that consumers' general opinion and the usefulness perceptions of services are increased greatly after testing compared to before the experiment. However, the results show that the order of testing of the services had an impact on consumers' perceptions. If the subjects started with the Social TV application, their perception on the usefulness of generic presence features increased after testing Social TV. If the subjects had already tested the Content Anywhere, they become more negative about the generic presence features after testing the Social TV.

The results of the Structural Equation Modelling (SEM) investigating users' intention to use mobile social network services indicated that constructs defined in the Technology Acceptance Model – Perceived Usefulness (PU) and Perceived Ease of Use (PEOU) – should not be used as the only predictors to assess the users' intention to adopt social network services. Other variables dealing with (positive) network externalities (Shapiro & Varian, 1996) –like use context, critical mass and social influence –must be taken into close consideration, while studying individuals' behavioural intention to use SNSs. Therefore, these variables are included in our conceptual model as they have been shown to be significant predictors of consumers' intention to use a service. The statistical analysis verifies our extension of the traditional TAM model as the results show that critical mass and social influence strongly impact users' intention in the context of mobile SNSs usage. Entertaining aspects of mobile social network services did not play a critical role in consumers' decisions. Presumably, people use these types of services to build their personal profiles and share mutual interest among others and hedonic aspects are the least important factor.

The second research question deals with the mobile service platforms:

- *Does awareness of a service platform influence user's behaviour toward service adoption?*

In chapter 5, we focused on mobile service platforms and the core objective was to investigate, which platform a mobile service is offered plays a role in the acceptance, adoption and use of the service by consumers. Mobile service platforms have become increasingly important in recent years and do play a significant role in consumers' decision. The study findings in chapter 5 indicate that the provider of the service platform is important to some extent, device-centric and service provider-centric platforms were slightly preferred over

network operator platforms. The study results with regard to mobile service platform in chapter 5, confirm that telecommunication companies (Telcos) should settle for becoming a bit pipe provider (Cuevas, Moreno, Vidales and Einsiedler, 2006; De Reuver, 2011; De Reuver, Bouwman, Prieto and Visser, 2011). As consumers strongly preferred service platforms from manufacturers over those of operators, we provide empirical evidence for the frequent assertion that telecom operators should settle to become a bit pipe provider. Moreover, the results show that application costs are by far the most relevant criterion for selecting a service regardless of the platform. Furthermore, the findings indicate that operating systems offered by Apple ('iOS') and Google ('Android OS') are preferred over other operating systems (Nokia 'Symbian' and 'BlackBerry OS'). In order to prevent losing to the competition, we suggest that Nokia try to offer new advanced devices and open them to more broadly adopted platforms like Android, while BlackBerry really have to exploit their current platform and uses their superior capability in providing secure and reliable services in such a way that Rich Communications Suites (RCS) services become available. These types of services have to be aligned with viable business models and different strategies in order to retain the consumers and regain the competitive market advantages. Presumably, device manufacturers can win the platform battle from their rival Telecom operators, if they can provide more innovative services and applications that fit in users' daily routines. While platform competition between device manufacturers and complementary third party OTT service providers will lead to the development of more innovative services. The results show that, 'Open' platforms such as Google ('Android Market') where application developers can freely participate in the application development process were considered by consumers as slightly better than 'Closed' platforms (such as the Apple platform). Interestingly, service platforms offered by Nokia ('Ovi') and BlackBerry ('App World') were not considered to be attractive platforms. Previously, mobile operators had full control over and access to users and users' data, making the participation of application developers extremely depend on them and creating disjointed power mechanisms. However, the operator's dominance has decreased after the tremendous growth in mobile telecommunication. Nonetheless, the exponential growth of the mobile application marketplace has created fierce competition for all market players in the mobile sector. Full-IP based companies, such as Apple and Google, use different policies, approaches and business models to establish the market dominance with their own operating systems and app stores. Therefore, the study findings with regard to mobile service platform suggest that telecommunication companies should open up their resources to the third parties such as application developers and take a new approach such as open portal rather than following the walled garden strategy.

To gain control in the platform battle, operators are developing converged communication platforms based on Rich Communication Suite, IP Multimedia Subsystem and Converged Address Book. We evaluated five service features

that are offered by these platforms: group communication, file sharing, switching between devices, switching between media and social TV (Presence feature). Especially group communication is considered valuable and switching between media and devices is considered very innovative. Issues like reliability, security and interoperability (Switching between Devices or Media) are evaluated as utmost important for the users. This suggests that mobile operators should use their trusted image to retain the consumers by aligning the system's functionality with users' requirements. If consumers want to adopt these services, they are looking for providers that can guarantee these issues. In combination with open platform enabling a wide variety of APIs this might be the proposition that will help Telecoms to compete with the OTT providers and device manufacturers. As such, converged communication platforms can be utilized by telecom operators to retain control over the platforms for consumers. However, the conjoint analysis on platform preferences (see chapter 5) does show that a lot of promotion and marketing will be needed to make consumers aware of advanced services offered by operators. Another concern for operator platforms is that consumers indicated that they expect the new converged communication services to be offered for free and preferably from players like Google, Skype and Whatsapp. Consumers are more willing to adopt services from third parties and application developers rather than the mobile telecommunication network operators. The plausible explanation can be the service delivery channel and time to the market. Services offered from Telecoms usually appear in the market with delay due to long standardization process, while other service providers do not deal with this issue. So, the study suggests that Telecoms should shorten their time-to market when introducing new platforms and services if they want to remain in the competition.

With regard to mobile service platforms, this study has shown that users are aware of service platforms by providing empirical evidence, and platform characteristics (i.e., application cost and type of Operating System) significantly impact their decisions. Propositions based on consumers' awareness of the service platform were tested in surveys using conjoint analysis, structural equation modelling and prototype experiments. The service platforms become even more important when we look at the new applications developed by different service providers. While there are some applications that fit into any types of platforms e.g., WhatsApp and mobile Facebook, other applications are designed specifically to be used with a particular operating system and mobile device. As we saw in this study, cost of application is the most important criterion for consumers to choose a platform. Preferably, application should be for free. Although the consumers indicate that the provider of the platform is not important, they however prefer and expect to adopt services which are offered through device manufacturers and service providers such as Google. According to our findings we argue that the mobile network operators' position in mobile service market is threatened by other platform providers and they are encountering a big challenge to sustain the market position. One solution for

them presumably can be: taking a strategic decision to open up their resources to the participation of the application developers to design and provide more appealing applications to the consumers, while exploiting their reputation of being reliable, secure and taking care of privacy.

The third research question is concerned with the research methodology as follows:

- *How can different research methodologies contribute to different explanatory models?*

To the best of our knowledge, this study has been one of the first to use several research methodologies and models in mobile communications domain. The intention behind using different methods was to find what kind of methodology would be both innovative and relevant to study the core concepts (in the research) and to compare it with other methods used in adoption research. The central focus and the unit of analysis in this dissertation were not the users per se, but rather their behaviour, opinions, attitudes and judgment. Therefore, the Q-sort methodology was found to be an appropriate and relevant method to be used. The main concern in Q-sort methodology is to find out why and how people believe or act the way they do. The results of the analysis suggest that Q-sort is a relevant method for evaluating the core characteristics of mobile services and for making a distinction between the services that are relevant for adoption and acceptance research. Another focus of the current research was on how and why users make decisions toward the adoption of mobile services as well as on certain adoption factors presented to them. Therefore, the Analytic Hierarchy Process (AHP) has been used to investigate the perception of service characteristics. Using AHP enabled us to investigate what the main adoption factors and mobile service categories are and how consumers make their judgements and decisions. AHP uses several criteria and alternatives in order to make the decision process easier for consumers. In our case, we found that AHP is a relevant tool to help consumers to make their judgments on certain alternatives offered to them. The main difference between Q-sort and AHP compared to conventional approaches is the way they treat IT artifacts and go beyond the conventional adoption factors. Traditional acceptance theories consider only the usefulness and ease of use of services important, whereas service characteristics and user perceptions of service characteristics are often neglected and ignored. Such characteristics can only be studied by adopting these alternative research methods Q-Sort and AHP and refraining from typical SEM approaches. It is worthwhile to emphasise that, this is not an exclusion of typical Structural Equation Modelling approaches, rather it is simply a focus built on several key considerations related to the service characteristics.

In the same grain, conjoint analysis (CA) was found to be an appropriate method to investigate users' service perceptions. In conjoint analysis, several

attributes of a service or a product are presented to the consumers. Then consumers make their decisions according to their preferences and their interest in the service attributes. In two separate studies CA was used. The first research focus was on the consumers' awareness of mobile service platforms and CA made it possible to differentiate the core characteristics, the similarities, and the differences among mobile service platforms. By linking various attributes of service platforms to our conjoint model we have increased the understanding of how service platforms are perceived and how to evaluate consumers' behaviour and opinions in relation to platform characteristics. The main advantage of using conjoint analysis is the evaluation of the users' preferences with regard to services which are not yet commercially launched in the market. Using conjoint analysis enables us to predict users' needs and expectation with regard to services which are built upon Rich Communication Suite (RCS) and Long Term Evolution (LTE) standard and technology.

Finally, we used the structural equation modelling technique (SEM) to study consumers' intentions on using mobile social network services. This is done by including several other variables rather than the original constructs in TAM (PU and PEOU) in our conceptual model. Although we used two well defined constructs from TAM (PU and PEOU) to predict user's intention to use SNSs, the results showed that variables such as critical mass and social influence play a significant role in the use of mobile SNSs. In other words, the findings suggest that traditional acceptance theories are not appropriate to be used solely to predict users' intention to accept, adopt and make use of mobile services. It is worthwhile bearing in mind that, by using different methods and tools and not just relying on traditional acceptance theory and by including techno-economics criteria as well as usage context, we argue that researchers can obtain more valuable and better results in conducting research on adoption and acceptance of mobile services. Different mobile services have different characteristics and usage criteria, therefore using various research methods can provide different insights. We suggest that in future research on acceptance, adoption and use of mobile services more innovative research approach should be carried out. Moreover, future research may benefit from the results found in this dissertation by adopting the research methods and tools used in the study.

7.1.1 Integration of the studies into a theoretical model

In this study we focused on issues –like Techno-economic (where service, technology characteristics and financial issues play a significant role in consumers' decisions). Moreover, we look at the factors influencing the users' behaviours with regard to service acceptance, adoption and use. Furthermore, we examine how services on different dimensions and criteria i.e., Use Context, Personal Characteristics, Actual Use, and Effect of Use are evaluated and judged

by consumers. The following figure illustrates the main issues and their interdependencies discussed throughout this study. The figure synthesizes the findings and provides a first opening up of the black box of mobile services.

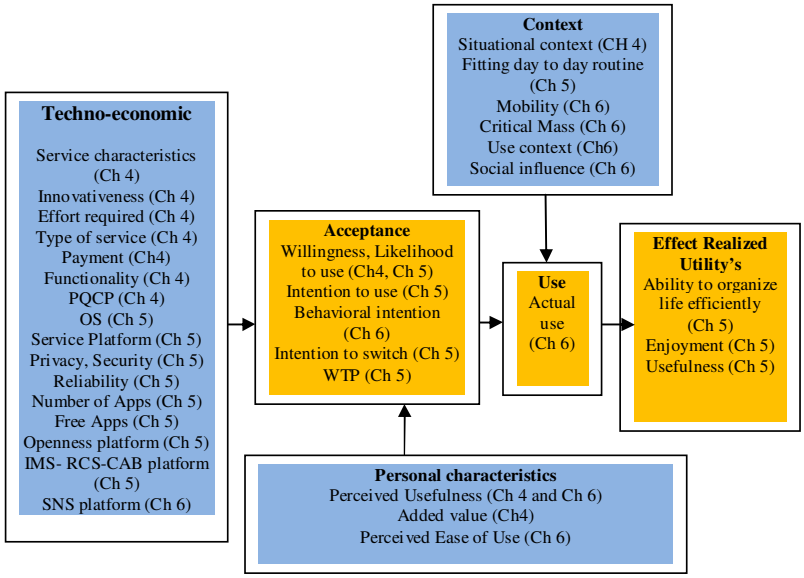

Figure 7. 1 The research contributes to new theory

7.2 Contribution to Theory

This dissertation provides evidence from multiple studies with multiple methods that technology and service characteristics should not be treated as a 'Black-Box' as most adoption and acceptance studies do. Many prior studies, if not all, focus only on a specific type of mobile services or mobile Internet services in general and assess them with common measures, without looking into services' characteristics. Using service typologies introduced in this dissertation and synthesized in section 7.1 can help to deal with the nuances between services. This study is one of the first to consider technology, service characteristics and perception of service characteristics by users in a dynamic perspective by applying various methods in several empirical studies and experimental research. In contrast to what is commonly argued in literature in Information Systems research, we empirically showed that research on mobile service adoption should not solely rely on using different variations of traditional adoption theories, but rather other relevant methodological approaches should be taken into practice. By using various methods, we have increased our

understanding as to how different service characteristics influence users' behaviours and perceptions. For instance, by using Q-sorting approach, we tried to provide insights how services on five core dimensions; i.e., innovativeness, effort to use and usefulness, were perceived, judged and scored by the users.

With regard to the service platforms, this study showed that existing literature is disjointed, highly conceptual and limited to only the differences between Operating Systems. Moreover, this study found that in the existing literature the empirical research on consumers' platform awareness and perception is scant. Therefore, we improved the general knowledge and understanding of mobile service platforms by providing empirical evidence as well as experimental findings. This study provides empirical evidence that platforms only matter to consumers in a very specific way: they influence the price of services. Platforms developed by mobile network operators are hardly discussed in literature, and this thesis fills that gap by studying converged communication services offered by operators. As such, this dissertation bridges the gap between the typical supply-side focused literature on mobile platforms and the typical demand-side focused literature on mobile services.

7.3 Practical implications and recommendation for practitioners

The results in this dissertation are highly relevant for the players currently involved in the mobile platform battle. For telecom operators, the results suggest that to reassert their power over other actors and to win this battle, they should try to shorten their service delivery life cycle which is often occurred due to standardization process. They should also emphasize their position as secure, reliable and privacy obeying providers. Our research findings regarding Rich Communication Services showed that although consumers prefer to obtain them from the full IP-based providers, these services are perceived as technologically advanced mobile services which hold specific features such as switching between media and devices (network interoperability), security and reliability. Moreover, the results highlighted a message to the telecom operators to take advantage of several technological advancements and offer more innovative services where switching between devices and media features are available. If they manage to do so, then this can be considered as a competitive advantage for network operators to leverage their infrastructures because these functionalities are the major obstacles and cannot be provided by full IP-based service providers. While there is a debate between the professional and scientific domain whether network operators or device manufacturers should provide a platform, we empirically found that provider of the platform does not play a significant role for users. For many users, if not all, tangible aspects e.g., application costs are much more important than intangible issues like privacy

and security. As such, we suggest there is still a way back to the platform battle for telecom operators, although not an easy path.

Service designers and application developers should pay close attention to consumers' demands and preferences. If they want their services and applications to be adopted, they must design and develop services which are more attractive and appealing to the consumers. Issues like service accessibility, simplicity and usability are very important to users. Opening up the black box of IT artefacts is highly important, not just for scholars but also IT developers. It is no longer sufficient to discuss the generic usefulness and usability of IT artefacts, as the exact type of value drivers, techno-economic factors and context variables all moderate these factors. Short iterative cycles in which IT artefacts are developed, proofed with users and refined are therefore highly important, suggesting a lightweight approach to human-centred design.

7.4 Limitations and future research

This dissertation cannot be closed unless we admit some limitations which have to be considered in making generalizations. First of all, there are differences between the countries and the different cultures. The findings of this study are on the basis of empirical researches conducted in Finland, The Netherlands, Spain, France and China. We are aware of some national idiosyncrasies that play a role for some services. We also admit that there are some gender related differences in our samples and would be more acceptable if we could investigate according to the characteristics of participants in more detail. Nonetheless, we admit that due to the homogenous character of the participants, we are not able to run a more refined analysis, as could have been done in cluster analysis. The findings of this dissertation cannot be generalized and claimed that they are valid for the entire Finnish, Spanish, French, Dutch or Chinese population. The samples are not chosen randomly; therefore, the findings represent solely the opinions of the respondents who participated in our research projects. However, our intention was to generalize to service characteristics rather than user groups. Moreover, we are aware of the shortcomings of AHP as they have been discussed in the literature (Belton and Gear, 1983; Pérez, Jimeno, and Mokotoff, 2006). It is pointed out that AHP has some limitations in certain situations (as any other mathematical models). The main criticism concerning AHP is the presence of rank reversal: the inclusion of a copy of a non-optimal alternative can modify the original ranking. However, these shortcomings do not affect the findings. Moreover, we are aware of the fact that in our research, some services could be classified in more than one category. Nevertheless, in our case always the more adequate category is selected, for instance, mobile stock information is rather a transaction service than an information service.

In chapter 5 the focus was on the limited characteristics of the services while we conducted our experimental research and we did not take into account ease-of-use, which is likely to be an important requirement as well for converged communication services. For future research, a more extensive survey needs to be conducted in order to assess whether ease-of-use of the services play significant role in consumers' decisions. On a methodological level, the central focus of the study in chapter 5 is to look into the several service platform attributes that are believed to play significant role while assessing service platforms. Therefore, we make use of an orthogonal design that focuses on the main effects and not on interaction effects. In future research this will be explored in more details; for instance, to discuss whether privacy and security issues are unrelated. Finally, we are aware of the fact that we use a limited set of predictors (constructs) in our mobile social network study and having other predictors such as habit in the conceptual model may result in different findings.

We strongly focused on the choices of individuals regarding mobile services, and did not go into depth regarding institutional factors that may shape these decisions. Of course, in reality, mobile services are not offered in a vacuum. Influence of peers and media is important (Nicolas et al., 2010), but also the interrelation with the platforms on which services are offered plays a role. Bundling of services with platforms or handsets and pricing schemes which favour certain services over others can also play a crucial role. Moreover, there is clearly the effect of critical mass and network effects which favours certain early dominating services and platforms over latecomers. The legacy of user equipment and the regulatory regime in a particular location will play an important role. In other words, the supply side of the equation can certainly not be omitted to fully understand how consumers prefer certain services over others. We do assert that this dissertation helps to elicit the user-side, while keeping supply-side dynamics constant, and thus solve that part of the equation. Our interrelation of platform battle with service adoption choices in chapter 5 give a first attempt to bridge this gap, but this should be elaborated on in further studies.

A final limitation is the reliance on quantitative methods as done in this dissertation. Qualitative methods could have been used to gain even more in-depth insights in how users deal with the characteristics of mobile services, and allows more room for discovering novel concepts. Moreover, the self-report nature of surveys and often lack of direct control of researchers on who answers the survey with what precision are issues that can be tackled by combining quantitative with qualitative methods. However, we argue that the richness and diversity of quantitative methods applied in this dissertation also covers a part of this issue.

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Appendix 1

List of Services to be Included in the Q-Sort

1	Mobile telephony	Voice calls
2	SMS	Text messages via a mobile device (from one person to another)
3	MMS (Mobile multimedia services)	Multimedia messages via a mobile device (e.g. photo from one person to another)
4	Mobile email	Reading/sending mobile e-mail via a mobile device
5	Mobile video telephony	Video calls via a mobile device
6	Mobile news	News via e.g. web or text messages
7	Mobile weather	Weather via e.g. web or text messages
8	Mobile search services	Search services (search of phone number, address etc.) via e.g. web or text messages
9	Mobile surfing of the internet	"Surfing" the Internet (e.g. information retrieval) with a mobile device
10	Event specific mobile services	Event-specific services (receipt of real-time information on the mobile device
11	Mobile health	Health services (appointment with the dentist, weight watching, monitoring health etc.) via e.g. web
12	Mobile shopping	Shopping (ordering/buying books, CDs or other products) via e.g. web or text messages
13	Mobile reservation of movie, or theater tickets	Reservation a/o purchase of cinema-, theatre- or concert tickets via e.g. web or text messages
14	Mobile banking	Routine bank services (paying bills etc.) via e.g. web or text messages
15	Mobile stock information and trading	Following of share prices via e.g. web or text messages
16	Mobile micro-payments	Small payments via a mobile device (vending machines, bus trips and other payments via e.g. web/SMS
17	Mobile chat	Net chatting via e.g. web or text messages
18	Mobile TV	Watching TV via a mobile device
19	Ringtones	Ordering of ring tones via e.g. web or text messages
20	Icons	Ordering of icons, logos or wallpapers via e.g. web or text messages
21	Download music	Purchasing/downloading of music to the mobile device
22	MP3 player	Making use of the mobile phone for listening to MP-3 music files
23	Mobile games	Entertainment services: downloading of games and/or playing via e.g. web or text messages
24	Mobile Jokes	Entertainment services: ordering and/or sending of humor messages (April fools joke, crypto message, gags etc.) via e.g. web or text messages
25	Check timetables of flights, train or public transport on mobile	Travelling: Checking of flight/train timetables via e.g. web or text messages
26	Mobile reservation of tickets for travelling: trains, flights	Travelling: Reservation and/or purchase of flight/train tickets via e.g. web or text messages
27	Mobile information and or reservation of Hotels	Travelling: Presentations of hotels and/or reservation of a hotel room via e.g. web or text messages
28	Safety camera used via mobile	Security services: Installed camera that can be accessed via the mobile phone

29	Burglar alarm on mobile	Security services: alarm that in case of break-in sends an alert, via e.g. text message, to the owner of the real estate/security company/ police
30	Mobile localization service for office , shops	Localization services: localization of a certain target (office, coffee shop, hotel etc.) via e.g. web or text messages
31	Localization of persons significant to user (friends, family, children)	Localization services: localization of a family member based on the location of her/his mobile device (without calling/sending text message)
32	Mobile navigation service	Use of navigation functionality via mobile phone
33	Mobile Advertising	Reading or viewing free advertisement offered either via a webpage or a text message
34	Mobile private social networking	Use of mobile technology for creating and managing private group activities either for private or professional activities, like Facebook
35	Personalized mobile webpage services	Use of mobile customizable web start page which users are capable of personalizing to suit their preferences
36	Professional community cantered mobile services	Use of mobile technology for creating and managing communities for professional activities, like LinkedIn and, or Health care community
37	Mobile Google maps	Access to Google Maps, a global mapping service, via a mobile device
38	Sharing of photos based on location via mobile	A mobile service which enables users to organize and share their photos and videos, like Flickr
39	Sharing of contact information based on location via mobile	Mobile social networking based on localization of community members
40	Mobile WiKi consultation	Access to a mobile WiKi.
41	Mobile audio visual queries based on photos made by users	Capture an image or record an audio-visual clip on your mobile and run an application to do a query, based on the captured, image, clip via your mobile device
42	Mobile monitoring of RFID information	Passive monitoring of Radio Frequency Identification tags via a mobile devices
43	Set up of a Mobile Wiki	An easy way to set up you own mobile wiki
44	Mobile reality mining	Information collection by mobile device sensors (e.g. location, physical activity) to infer human relationships and behaviour.
45	Mobile Twitter	A mobile micro blogging service which enables user to post or receive short messages from virtually any location and share these with friends
46	Mobile Blogging	A mobile blogging service which enables user to post or receive messages from virtually any location and share these with friends
47	Mobile RSS	Mobile Really Simple Syndication: timely updates on your mobile from favored websites or to aggregate feeds from many sites into one place
48	Mobile Group Alert	Group SMS to alert a specific selection of persons based on localization or membership of a group.

Appendix 2

Table A1

Example of the pair-wise comparison questionnaire
Compare the relative importance with respect to "Factors Influencing the Adoption of Mobile Services" (Consumers' Preferences)

Factors Influencing the Adoption of Mobile Services (Consumers' Preferences)		
Payment Mode	⑨⑧⑦⑥⑤④③②①②③④⑤⑥⑦⑧⑨	Functionality
Payment Mode	⑨⑧⑦⑥⑤④③②①②③④⑤⑥⑦⑧⑨	Added Value
Payment Mode	⑨⑧⑦⑥⑤④③②①②③④⑤⑥⑦⑧⑨	PQCP
Functionality	⑨⑧⑦⑥⑤④③②①②③④⑤⑥⑦⑧⑨	Added Value
Functionality	⑨⑧⑦⑥⑤④③②①②③④⑤⑥⑦⑧⑨	PQCP
Added Value	⑨⑧⑦⑥⑤④③②①②③④⑤⑥⑦⑧⑨	PQCP

Table A2

Example of the pair-wise comparison questionnaire Compare the relative importance with respect to
Selection of Mobile Value-Added Services (Consumers'' Preference)

Selection of Mobile Value-Added Services (Consumers' Preference)		
Communication	⑨⑧⑦⑥⑤④③②①②③④⑤⑥⑦⑧⑨	Entertainment
Communication	⑨⑧⑦⑥⑤④③②①②③④⑤⑥⑦⑧⑨	Information
Communication	⑨⑧⑦⑥⑤④③②①②③④⑤⑥⑦⑧⑨	Web 2.0
Communication	⑨⑧⑦⑥⑤④③②①②③④⑤⑥⑦⑧⑨	Transaction
Entertainment	⑨⑧⑦⑥⑤④③②①②③④⑤⑥⑦⑧⑨	Information
Entertainment	⑨⑧⑦⑥⑤④③②①②③④⑤⑥⑦⑧⑨	Web 2.0
Entertainment	⑨⑧⑦⑥⑤④③②①②③④⑤⑥⑦⑧⑨	Transaction
Information	⑨⑧⑦⑥⑤④③②①②③④⑤⑥⑦⑧⑨	Web 2.0
Information	⑨⑧⑦⑥⑤④③②①②③④⑤⑥⑦⑧⑨	Transaction
Web 2.0	⑨⑧⑦⑥⑤④③②①②③④⑤⑥⑦⑧⑨	Transaction

Appendix 3

Conjoint results for the dependent variable questions (Q1-Q4)

		Q1: I would choose this platform		Q2: I would switch to this platform from my current platform		Q3: I would use more application		Q4: I would be willing to pay more for mobile applications	
		Utility		Utility		Utility		Utility	
		Finnish/Dutch	Chinese	Finnish/Dutch	Chinese	Finnish/Dutch	Chinese	Finnish/Dutch	Chinese
Operating Systems	Symbian (Nokia)	-.359	-.167	-.340	-.068	-.280	-.133	-.278	-.148
	iOS (Apple)	.348	.347	.300	.307	.127	.280	.258	.328
	Android (Google)	.475	.214	.565	.312	.310	.242	.313	.257
	BlackBerry OS (BlackBerry)	-.462	-.394	-.526	-.551	-.157	-.389	-.294	-.437
Service Platform	Operator Centric Platform	.002	-.073	-.138	-.100	.010	-.018	-.029	-.088
	Device Centric Platform	.062	.005	.148	.003	.066	.016	.092	-.027
	Service Provider Centric platform	-.065	.068	-.011	.097	-.076	.002	-.063	.116
Privacy Arrangement	Guaranteed	.123	.124	.181	.203	.103	.075	.099	.147
	Best Effort	-.123	-.124	-.181	-.203	-.103	-.075	-.099	-.147
Security Arrangement	Guaranteed	.216	.173	.230	.266	.190	.126	.157	.154
	Best Effort	-.216	-.173	-.230	-.266	-.190	-.126	-.157	-.154
Number of Application	Limited	-.170	-.154	-.168	.-097	-.194	-.175	-.119	-.090
	Unlimited	.170	.154	.168	.097	.194	.175	.119	.090
Application Cost	Free	.447	.590	.370	.540	.584	.617	.280	.260
	Payable	-.447	-.590	-.370	-.540	-.584	-.617	-.280	-.260
Type of Platform	Open	.163	.123	.162	.104	.080	.139	.093	-.004
	Closed	-.163	-.123	-.162	-.104	-.080	-.139	-.093	.004
Pearson's r		.998 p<.000	.987 p<.000	.981 p<.000	.998 p<.000	.996 p<.000	.990 p<.000	.954 p<.000	.985 p<.000
Kendall's tau		.946 p<.000	.912 p<.000	.862 p<.000	.979 p<.000	.933 p<.000	.912 p<.000	.778 p<.000	. 929 p<.000

Conjoint results for the dependent variable questions (Q5-Q7)

		Q5: I would download more applications		Q6: I would be able to organize my life much easier, efficient and effective		Q7: I would be willing to pay more for my monthly subscription	
		Utility		Utility		Utility	
		Finnish/Dutch	Chinese	Finnish/Dutch	Chinese	Finnish/Dutch	Chinese
Operating Systems	Symbian (Nokia)	-.317	-.236	-.301	-.316	-.184	-.175
	iOS (Apple)	.093	.322	.219	.319	.118	.255
	Android (Google)	.351	.200	.271	.156	.227	.225
	BlackBerry OS (BlackBerry)	-.126	-.286	-.189	-.159	-.160	-.305
Service Platform	Operator Centric Platform	-.051	.024	-.052	.004	-.074	-.031
	Device Centric Platform	.135	-.032	.149	.015	.140	-.021
	Service Provider Centric Platform	-.084	.008	-.097	-.019	-.066	.052
Privacy Arrangement	Guaranteed	.149	.075	.053	-.019	.130	.085
	Best Effort	-.149	-.075	-.053	.019	-.130	-.085
Security Arrangement	Guaranteed	.175	.098	.170	.102	.172	.112
	Best Effort	-.175	-.098	-.170	-.102	-.172	-.112
Number of Application	Limited	-.169	-.169	-.122	-.159	-.128	-.053
	Unlimited	.169	.169	.122	.159	.128	.053
Application Cost	Free	.665	.620	.354	.418	.320	.254
	Payable	-.665	-.620	-.354	-.418	-.320	-.254
Type of Platform	Open	.118	.146	.108	.159	.108	.037
	Closed	-.118	-.146	-.108	-.159	-.108	-.037
Pearson's r		.997 p<.000	.995 p<.000	.997 p<.000	.994 p<.000	.991 p<.000	.986 p<.000
Kendall's tau		.924 p<.000	.946 p<.000	.967 p<.000	.912 p<.000	.845 p<.000	.933 p<.000

Appendix 3

List of profiles (conjoint cards)

Card ID	Operating Systems	Service Platform Provider	Privacy Arrangement	Security Arrangement	Number of Application	Application Cost	Type of Platform
1	BlackBerry OS	Operator-Centric Platform	Best Effort Delivery	Best Effort Delivery	Unlimited	Free	Open
2	iOS (Apple)	Device-centric Platform	Best Effort Delivery	Best Effort Delivery	Limited	Free	Open
3	BlackBerry OS	Operator-Centric Platform	Best Effort Delivery	Guaranteed	Limited	Payable	Open
4	Symbian (Nokia)	Device-centric Platform	Best Effort Delivery	Guaranteed	Unlimited	Payable	Closed
5	Android (Google)	Operator-Centric Platform	Best Effort Delivery	Guaranteed	Limited	Payable	Closed
6	BlackBerry OS	Device-centric Platform	Guaranteed	Best Effort Delivery	Limited	Payable	Closed
7	Android (Google)	Service-provider centric platform	Guaranteed	Best Effort Delivery	Limited	Payable	Open
8	BlackBerry OS	Service-provider centric platform	Guaranteed	Guaranteed	Unlimited	Free	Closed
9	iOS (Apple)	Service-provider centric platform	Best Effort Delivery	Guaranteed	Unlimited	Payable	Open
10	Symbian (Nokia)	Operator-Centric Platform	Guaranteed	Guaranteed	Limited	Free	Open
11	Android (Google)	Device-centric Platform	Guaranteed	Guaranteed	Unlimited	Free	Open
12	Android (Google)	Operator-Centric Platform	Best Effort Delivery	Best Effort Delivery	Unlimited	Free	Closed
13	Symbian (Nokia)	Service-provider centric platform	Best Effort Delivery	Best Effort Delivery	Limited	Free	Closed
14	iOS (Apple)	Operator-Centric Platform	Guaranteed	Best Effort Delivery	Unlimited	Payable	Closed

15	Symbian (Nokia)	Operator-Centric Platform	Guaranteed	Best Effort Delivery	Unlimited	Payable	Open
16	iOS (Apple)	Operator-Centric Platform	Guaranteed	Guaranteed	Limited	Free	Closed

totally disagree (1) totally agree (7)

1. I would choose this platform. ① ② ③ ④ ⑤ ⑥ ⑦
2. I would switch to this platform Instead of my current platform. ① ② ③ ④ ⑤ ⑥ ⑦
3. I would use more applications. ① ② ③ ④ ⑤ ⑥ ⑦
4. I would be willing to pay more for mobile applications. ① ② ③ ④ ⑤ ⑥ ⑦
5. I would download more application. ① ② ③ ④ ⑤ ⑥ ⑦
6. I would be able to organize my life much easier, efficient and effective. ① ② ③ ④ ⑤ ⑥ ⑦
7. I would be willing to pay more for my monthly subscription. ① ② ③ ④ ⑤ ⑥ ⑦

Appendix 4

Card	Description
1	You would like to call a friend to invite him to your birthday party. You access the enhanced address book on your mobile phone, and you see that he is only available for chatting, and not for voice or video calling; probably he is in a meeting. You send the invitation for the party via an instant message from your PC.
2	Your wedding ceremony's photos are ready and you want to share them with your friend. You send the pictures to her personal network storage, and she automatically gets the notification. You check her status through your enhanced address book. You notice that she is currently available for voice calling or video calling, but not for instant messaging. You decide to call her to discuss the pictures. She logs on to her computer and views the pictures. You would like to see her face while she is viewing the pictures, so you switch to video calling by simply pushing a button on your screen, without interrupting the conversation.
3	You are finalizing a task for work. Before sending the results to your boss, you want to get feedback from two colleagues. Through your enhanced address book, you invite both of them to join a group conference call to discuss about your work. They can access the Word files easily by clicking a button on the conference call screen. One of them joins the conference call from his PC, while the other is on his way home and joins from his mobile phone.
4	You are organizing a party at your son's school. You would like to plan a conference call with a group of other parents to discuss your plans. In your enhanced address book, you see that some of them are currently available only via instant messaging while some are available for voice calling as well. You call those that are available for voice calling and set a time with them to have the conference call the next day. You schedule the group conference with your enhanced address book, and the system sends an invitation to everyone with the time, date and title information. The next day at 11 AM, everyone joins the group conference from his PC or mobile phone (you use your PC), and you start chatting. After a while you need to discuss a complex issue, you press a button and directly have everyone online in a video call While discussing the different options for the party, you send the others pictures and a draft program to their personal network storage, which can be viewed during the meeting. After a while you need to leave from home so you switch from your PC to your mobile to continue with the conversation while in your way.
5	You have missed your partner so much and would like to talk to him/her. At first you start to chat (instant messages) from your mobile, (s)he receives the messages on the PC. As you have to leave in your car, and in order to continue with the conversation, you switch to a voice call just by pressing a button, and seamlessly use your hands-free kit in your car. You arrive home while talking on the phone, and in order to be more comfortable while talking and also see your partner you decide to directly switch to your TV for a video call, just by clicking a button in your mobile, and without interrupting the conversation.
6	Your boss has asked you to arrange a group conference call with some of his colleagues around the world. You manage to arrange it. Your boss starts the session through audio calling by using hands-free on his mobile phone while he is on his way to go to the airport, since it is not safe to have video calling while driving. Once in the airport, he clicks a button on his mobile phone and switches to video-calling to better clarify some proposal, without interrupting the conference call.
7	You have recently returned from your honeymoon with a pile of nice photos and videos taken from the place you have visited. You want to share them with your mother, so you start sending the videos from your mobile phone to the family's online repository. You call your mother to discuss the videos with her. Your mom would like to view them on a big screen, and switches the TV on. By clicking a button on her mobile phone, the conversation is seamlessly moved to the TV, and she continues to talk with you while viewing the pictures on the TV.
8	You are planning a joint vacation trip with a group of friends, and would like to discuss the plans so far. You check the enhanced address book on your mobile to see your friends' status. Luckily, all of them are available for a video call at this moment. You set up the video call from your mobile phone. As you would like to see them on a bigger screen, you then switch to the PC, without interrupting the video call.

Measures for dependent variables

Dependent variable	Survey question	Scale
Likelihood of use	Q1, How likely is that you would use this service?	Likert 7-point scale: Very unlikely – Very likely
Fitting into day-to-day routine	Q2, Would this service fit into your day- to- day routine?	
Enjoyment	Q3, Would you enjoy using this service?	
Willingness to pay	Q4, Choose the maximum amount you would be willing to pay for this service per month.	0€, 1€, 2€, 3€, 4€, 5€, 6€
Innovativeness	Q5, This service is highly innovative	Likert 7-point scale: Strongly disagree – Strongly agree
Reliability	Q6, This service should be absolutely reliable	
Service Security	Q7, This service should be absolutely secure	
Service Privacy	Q8, This services should respect my privacy	

Appendix 5

Experiment

Appendix 2: Scenarios for the quasi-experiment

The scenarios only provide the steps to be taken and leave some space for subjects to figure out how to deal with the technology and applications at stake.

Use case 1: Content Anywhere

Role description and tasks - Bob

The goal of the experiment is to plan a weekend trip you want to organize for your fraternity. You will do so by exchanging pictures that you have on your mobile phone and discussing them with your friends Tom and Richard.

- Start an instant message conversation with your friend Richard from your PC
- View the photo that Richard sends you on your PC
- You have an alternative, of which you have a picture on your mobile phone. Ask permission to Richard to send him pictures using the application `Contacts' on your mobile phone.
- Send the picture from your mobile phone to Richard. You can send the picture using the application called `Contacts' on your mobile phone.
- Discuss the pictures on the chat with Richard
- You would like to share your picture with your friend Tom, but he is not online. Send your picture to Tom

Role description and tasks – Richard

The goal of the experiment is to plan a weekend trip you want to organize for your fraternity. You will do so by exchanging pictures that you have on your mobile phone and discussing them with your friends Bob and Alice.

- Start an instant message conversation with your friend Bob from your PC
- Ask permission to Bob to send him pictures using the application `Contacts' on your mobile phone.
- Send the photo of one chalet you found in the Ardennes to Bob. The photos are stored on your mobile phone. You can send the picture using the application called `Contacts' on your mobile phone.
- Check the photo that Bob sends you
- Discuss the pictures on the chat with Bob
- You would like to share your picture with your friend Alice, but she is not online. Send your picture to Alice

Use case 2 Social Communication on TV

Role description and tasks – Alice

The goal of the experiment is to start a chat conversation with Tom once you are sure he watches the same channel as you do.

- You are watching TV (BBC1)
- After some time, switch to BBC2.
- Wait until Tom initiates a chat with you. Reply to him with short messages.
- After chatting for some time, check out the picture of the chalet that is stored in your account.

Role description and tasks– Tom

The goal of the experiment is to start a chat conversation with Alice once you are sure she watches the same channel as you do, and to suggest her to watch a picture stored in both your accounts.

- You are watching TV (BBC2). Wait until Alice also changes her channel to BBC2.
- Once you are sure that Alice views the same channel, start to chat with her about the TV show. Please use only short text messages.
- Write to Alice in the chat that she should view the picture of the chalet which is stored in both your accounts.
- View the picture for yourself too.

Part II
Original Publications

The contribution of the author to the original publications

1. Joint author. Responsible for the statistical analysis of the Q-sort. Wrote most of section 3.
2. Main author. Design the conjoint questionnaire with the co-authors. Wrote most of the paper (sections 2, 3, 4 and 5 completely).
3. Main author. Design the AHP questionnaire with the co-authors. Wrote most of the paper (sections 1, 2, 3, 4 and 7).
4. Main author. Design the conjoint questionnaire with the co-authors. Wrote most of the paper.
5. Main author. Design the conjoint questionnaire with the co-authors. Wrote most of the paper.
6. Joint author. Wrote sections 1, 2 and part of section 6.
7. Main author. Design the questionnaire with the co-authors. Wrote most of the paper.

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