CATEGORIZING NETWORKED SERVICES: THE ROLE OF INTRINSIC-, USER NETWORK- AND COMPLEMENT NETWORK ATTRIBUTES

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- Research Paper-

STRUCTURED ABSTRACT

Purpose

This paper investigates the properties and attributes of networked services and proposes a general categorization scheme for such services. It is argued that services can be categorized on the basis of whether their dominant source of value stems from intrinsic-, user network-, or complement network attributes.

Design/Methodology/Approach

Two separate studies were conducted to test the validity and applicability of the categorization scheme. First, industry experts categorized a set of pre-selected mobile services based on the services' dominant source of value. Second, a large-scale end-user study of the same services was conducted for testing cross-service differences between the proposed service categories in terms of what drives perceived customer value.

Findings

The study results largely support the proposed categorization scheme. The two studies suggest that categorizing networked services as driven by either intrinsic-, user network-, or complement network attributes is fruitful and help pinpoint fundamentally different drivers of

perceived customer value. The drivers investigated in the end-user study explain 60% of the variance in customer value.

Research limitations/Implications

The current categorization scheme will have stronger and clearer implications when the full array of antecedents and consequences of intrinsic-, user network-, and complement network attributes have been investigated.

Practical implications

The categorization scheme may provide managers with important guidelines regarding the kinds of business models and marketing means that will work best for the three different categories of networked services.

Originality/Value

The paper contributes with a conceptual framework for understanding and categorizing both extrinsic and intrinsic drivers of service value. It extends and integrates previous work on network effects and adoption research and also offers empirical insight into an under-researched topic.

Keywords: Network, externality, service, category, mobile, adoption

INTRODUCTION

There is currently a strong interest among both researchers and industry professionals in trying to understand consumer behavior in networked- and mobile markets (cf. Khanna, 2005; McElligott, 2005; Nysveen, Pedersen and Thorbjørnsen, 2005; Fang, Chan, Brezezinski and Xu, 2006). Most organizations and businesses use networked- and mobile services, such as SMS messaging and mobile Internet, for both internal and external purposes. Understanding how these services differ from traditional services and how this, in turn, affects consumer behavior is thus of vital importance for maximizing the effects of external marketing efforts (Merisavo et al, 2006; Riivari, 2005) and for determining appropriate business models when providing such services (Methlie and Pedersen, 2007; Campanovo and Pigneur, 2003; Faber et al, 2003).

Networked services, such as messaging, gaming and mobile Internet, differ in many ways from traditional services in that the value of these services is in part determined by attributes *not* associated with the service itself. Such attributes are often referred to as *extrinsic attributes*. Here, we focus on the extrinsic attributes associated with the networks that provide and use the service (Lee and O'Connor, 2003). Illustrating examples are social utility services, such as Facebook.com and Youtube.com, or communication services such as mobile messaging or MSN messenger: A common denominator of these services is that the perceived value of using the service is very contingent on the size and properties of the user network. For instance, if no one of your friends or business associates uses a particular service, then you most likely perceive very little value of using it regardless of its other qualities. Such effects are also often referred to as network externalities, i.e. the fact that the perceived benefit of using a service increases with the share number of users, and this is particularly prominent for many IT- and communication related services (cf. Katz and Shapiro, 1992;

Gupta, Jain and Sawhney, 1999). Moreover, attributes relating to complementary services also influence the perceived value of networked and mobile services. For instance, the value of a mobile payment system increases in line with the number of other, compatible mobile commerce services. By the same token, consumers are more willing to buy a particular software if a large variety of other related programs are available on the same platform.

Hence, we argue that extrinsic service attributes are essential in the creation of customer value, yet these attributes are often neglected in consumer- and technology adoption research. Increased insight into these service attributes and –effects should be fruitful for a larger audience than IT savvies, as network services are ubiquitous in almost every organization involved with marketing.

The role and effects of extrinsic service attributes have received little attention in the context of consumer markets. Whereas industrial economics and information systems researchers have investigated network effects in many different professional settings, less attention has been directed towards understanding the role and effects of extrinsic attributes for business-to-consumer services (cf. Stremersch, Tellis, Franses and Binken, 2007). Also, we argue that there is great heterogeneity in the universe of consumer networked- and mobile services in that the key drivers of customer value stem from many different sources. The advent of new Internet-based services, location-based services and terminal specific features (e.g. MP3 players, cameras, software) will further contribute to diversity and heterogeneity in this service landscape. Consequently, we argue that developing a categorization scheme based on the services' dominant source of value will aid researchers and industry professionals in designing marketing strategies and business models for such services.

In this paper, we focus on both intrinsic and extrinsic attributes of mobile services and propose a tentative categorization scheme for these services based on prior research in economics, information systems and marketing. The purpose of the paper is twofold: First, to derive a categorization scheme for mobile services that also takes into account attributes of the user network and the complement network. Second, to validate the applicability of this categorization scheme by conducting: a) a study of industry professionals; and b) a cross-service study of mobile end-users. Subsequently, the paper should provide industry players with a managerially and strategically useful way of categorizing networked mobile services. Moreover, the development of the model for the cross-service study will also contribute to the growing body of literature on antecedents of customer value.

The remainder of this article is organized as follows: First, we present different characteristics of mobile services and propose a categorization scheme for mobile services based on the attributes presented and their differential sources of perceived value. Second, we present a study of industry professionals aimed at allocating various mobile services to the proposed categories. Third, we present a conceptual model of drivers of perceived value of mobile services and test a set of cross-service hypotheses on six different samples of mobile end-users. Subsequent sections discuss the findings and present potential implications for scholars and industry players.

THEORETICAL BACKGROUND

We base our current research and categorization scheme on two distinct yet very solid streams of research. First, theories of network effects (or network externalities) have, since the seminal works of Rohlfs (1974) and Katz and Shapiro (1986; 1992), developed into a mature state and sparked a number of empirical articles on direct and indirect network effects within the domains of industrial economics and information systems research (cf. Suarez, 2005; Asvanund et al, 2004). A key contribution of this research is the documented positive effects of extrinsic attributes on the perceived value of networked services. Direct network effects pertain to how properties of the user network influences the perceived value of the service. For instance, the perceived value of a communication service such as SMS messaging, dramatically increases the more consumers use the service. The theory of indirect network effects argues that the availability of complementary services influences the perceived value of a networked service or product. The prototypical example of indirect network effects is how the supply of software and the demand of hardware affect each other positively.

The second stream of research we rely on is the long tradition of studies on technology- and services adoption (cf. Fang, Chan, Brezezinski and Xu, 2006; Nysveen et al, 2005). This research relies heavily on adoption- and attitude models such as the technology acceptance model (Davis, 1989), and extensions of the theory of reasoned action (Fishbein, 1980) and theory of planned behavior (Ajzen, 1991). The study by Fang et al. (2006) is representative of this tradition of research in technology adoption, where an important aim is to identify essential attributes of technologies and/or services and investigate the effects of these on intentions to use and actual use of the technology. However, with a few notable exceptions (cf. Wang, Hsu and Fang, 2004), this stream of research focuses exclusively on attributes of

the services per se and disregards the value that stems from network based extrinsic attributes such as network size and availability of complementary services.

Consequently, in combining these two streams of literature, we argue that mobile and network service attributes emerge from two fundamentally different sources. *Intrinsic attributes* refer to the inherent attributes of the service itself, whereas *extrinsic attributes* refer to attributes associated with the networks that provide and use the service. This conceptualization of intrinsic and extrinsic *attributes* thus departs slightly from conceptualizations of intrinsic and extrinsic *motivation* in technology adoption research (cf. Davis, Bagozzi and Warshaw, 1992; Shang, Chen and Shen, 2005) where intrinsic motivation pertains to users' intrinsic rewards such as need for enjoyment, excitement and competence, and extrinsic motivation refers to extrinsic rewards such as increased efficiency, perceived usefulness and lower search costs.

In line with theories of direct- and indirect network effects, we argue that the extrinsic attributes that emerge from the networks that provide and use the service are of vital importance. Hence, our conceptualization of intrinsic and extrinsic attributes of networked services also represents an extension of the traditional typology of intrinsic and extrinsic sources of value suggested by Holbrook (1996), and underlines how different network services in fact are from traditional products and services where extrinsic attributes often originate from complementary supplier services and consumer investments (Mathwick, Malhotra and Rigdon, 2001).

By *intrinsic attributes* is here meant attributes designed into the service itself, as well as experiences derived from the augmented product (Lee and O`Connor, 2003). The influential technology acceptance model (Davis, 1989) identifies ease of use and usefulness two key

attributes of technologies and services. These two concepts have been investigated in a large number of studies, including the use of mobile phones (Kwon and Chidambram, 2000) and mobile services (Fang et al, 2006; Nysveen et al, 2005). Other attributes of mobile services that pertain to intrinsic properties are perceived enjoyment (Nysveen et al, 2005) and playfulness (Fang et al, 2006), which have also been found to significantly predict intentions to use mobile services.

However, for services with network externalities, the relative importance of intrinsic service attributes may be heavily deflated or inflated depending on the attributes of the network that provides and uses the service. For instance, it really does not matter if your new mobile chat service is extremely easy to use if you are the only person in the world using that particular service. Extrinsic attributes may thus be vital for the perceived value of networked services.

For networked services, *extrinsic attributes* pertain to properties of the networks that provide and use the service. These extrinsic attributes provide value to the service and are unique to network services. Consequently, according to Lee and O'Connor (2003, p.244): *Extrinsic value is the set of benefits derived from outside the product (service) itself, such as the size of the installed base and the availability of compatible and complementary products that enable greater use of the base product.* We argue that these extrinsic attributes can be divided into *user network attributes* and *complement network attributes*. These two concepts are in many ways analogous to the twin concepts of direct and indirect network effects. However, here, we focus selectively and intentionally on service *attributes* which *may or may not* provide value to the service. The concept of network *effects* implicitly assumes that such positive effects on value are always present.

User network attributes pertain to qualities of the physical or social network providing the service. The perhaps most salient and important attribute of the network is size. *Network size* is an extrinsic attribute that is fairly easy to estimate and that also has well-documented effects on perceived value for network goods. Direct network effects occur when the perceived benefit of using a service increases with the number of users. Such direct network effects are frequently used in both industrial economics and social network theory to explain the well-documented "bandwagon effect": The more existing users of a service, the more attractive the service becomes also for potential users (Katz and Shapiro, 1986; Frels et al, 2003). In addition to the fact that the value of network goods (such as fax, phone or MSN Messenger) per definition increases with the number of users, Shapiro and Varian (1999) also argue that there is a strong perception of safety in numbers: Few people are willing to use a technology or service on their own or in small numbers. By the same token, Lou, Luo and Strong (2000) argue that adoption of information systems requires the participation of many individuals to create a sense of collective action.

Other essential user network attributes include *network strength*, defined as the marginal impact of a unit increase in network size on demand. For instance, Shankar and Bayus (2002) suggest that it is necessary to measure both network size and network strength in order to capture direct network effects because network strength can partially compensate for network size in creating service value.

Complement network attributes pertain to attributes associated with other goods serving as complements to the service or product in question. For instance, attributes of software are considered to complement network attributes for personal computers. If, say, the availability of software for Apple Computers is limited, this complement network attribute may impact

the decision of whether to buy an Apple computer or not. This example illustrates an indirect network effect which predicts that the greater the availability of complementary products or services, the more attractive the relevant network service will become. Such effects of complement network attributes are also called market-mediated network effects, because the demand for the service is indirectly affected by the increased supply of complementary services (Gupta, Jain and Sawhney, 1999). Important complement network attributes are thus *complementary service quality* and *complementary service variety.* Complementary service quality and variety are particularly important for platform services, where multiple services are offered on the same technological platform or portal. By the same token, *compatibility* is another complement network attribute that is important for the creation of value in network markets. Compatibility pertains to whether the service is believed to be compatible with other services and on other platforms, and whether the service is consistent with the user's needs and his/her experience with similar services. When evaluating a particular service, a central criterion might be whether the service is compatible with complementary services and platforms, for instance, whether a mobile payment service is compatible with the payment options on a Coca-Cola vending machine.

CATEGORIZING MOBILE SERVICES

Various existing classification schemes may be applied in categorizing mobile services. Service technologies are classified according to, e.g. process characteristics, type of interactivity, possibility for transaction and self-help, and level of customer service (Meuter et al, 2000; Nysveen et al., 2005). In the context of mobile services, Nysveen et al. (2005) utilize Hoffman and Novak's (1996) distinction between person and machine interactivity and between goal-related and experiential services. Most of the readily available categorization schemes emanate primarily from intrinsic attributes of the service and/or pertain to the

consumers' motives for use. However, as the literature on direct and indirect network effects illustrates, categorization schemes that go beyond the intrinsic properties of the services are required to capture a wider array of relevant service attributes. Moreover, for service categories to have true managerial value, categorization schemes should also guide managers regarding the kinds of consequences to be expected under certain conditions. Is ease of use, for instance, a more important driver of intention to use experiential or goal-directed mobile services (cf. Nysveen et al., 2005)?

We argue that the concepts of *intrinsic attributes*, *user network attributes* and *complement network attributes* constitute a meaningful and interesting point of departure for categorizing mobile services. These three concepts all have their origin in previous research and pertain to three fundamentally different sources of consumer perceived value. By categorizing services based on their dominant source of value, we argue that the categorization scheme also will provide practical value for managers and industry players. The three concepts or categories are elaborated below:

First, mobile services driven by *intrinsic attribute*s are denoted by the fact that the inherent attributes of the services per se are most important for perceived value. For these services, few direct or indirect network effects exist, and it is rather the inherent features of the services that make them valuable to consumers. For instance, a mobile prepayment charging service that only offers a single feature – such as charging the mobile phone cash card – is primarily adopted and valued for this functionality alone, and the intrinsic attributes of the service are thus most important for perceived value. By the same token, mobile downloadable games (i.e. single-player games downloaded to a mobile phone) are also valued primarily for the entertainment and recreation they provide the user. Mobile gaming services and mobile

prepayment charging services are thus used and consumed in relative isolation from other users and other services. The perceived value of these services is thus little affected by either the perceived number of users or the perceived number of complementary services.

Second, mobile services driven by *user network attributes* are defined as services where the perceived value increases as the installed base/network size and network strength increases. Examples of such services are person-to-person SMS, person-to-person MMS and various chat services. For instance, the value of MMS messaging is much higher when the majority of your friends are able to receive MMS messages than if only one friend's mobile phone can receive MMS.

Lastly, mobile services driven by *complement network attributes* are defined as services where the perceived value increases with the perceived number and quality of complementary services. Indirect network effects are particularly salient for platform goods. For content services (e.g. news downloads, stock-quotes, games, sports), MMS may be considered a platform offering a variety of services. The perceived value of a given MMS content service will thus increase as the number of other services available on the same platform increases. Consumers are likely to be less willing to buy a platform-dependent service if very few complementary services are (or will be) available on the same platform. At the same time, customers' perceived value of a POS[2] payment service, which allows users to pay for products and services via their mobile phone, is also dependent on the availability of other services on the same payment platform. We argue that MMS content services and POS payment services are good examples of mobile services where the value is driven by complement network attributes.

[2] Point-of-sale

The above proposed categorization scheme is in many ways analogous to the integrated networks model by Frels et al (2003), where resource allocation in professional business markets is explained by the relative strength of user network, complement network and producer network. However, for consumer markets, very little empirical research has been conducted for conceptualizing and categorizing the intrinsic and extrinsic attributes that drive customer value. In the following, we report on two studies designed to illustrate and test this categorization scheme. For the categorization scheme to have practical significance for managers, the three categories must not only be understood and accepted by industry experts, it should also be reflected in the perceptions and intentions of end-consumers. Study 1 is aimed at testing the above service allocation through consulting a panel of industry experts. The reasons for conducting study 1 are twofold. First, and foremost, to test whether six different services, which based on the suggested categorization scheme are defined as driven by either intrinsic-, user network- or complement network attributes also are categorized in the same manner by industry experts. Second, to identify a set of services for use in study 2 in which are correctly categorized by experts. The key aim of study 2 is to further illustrate and test the categorization scheme on end-users through conducting a cross-service study of drivers of perceived customer value.

STUDY 1: CATEGORIZATION BY INDUSTRY PROFESSIONALS

Above, we suggested three broad categories of mobile services based on the types of attributes that drive customer value. Within each category we have suggested two mobile services. Mobile services driven by *intrinsic attributes* include cash card charging services and Java games. Mobile services driven by *user network attributes* include SMS chatting and person-to-person MMS services. Mobile services driven by *complement network attributes*

include MMS content services and POS payment services. The allocation of these services to their respective categories is based on the authors' subjective evaluation of service attributes. Consequently, in order to validate this service allocation, we conducted a study among industry professionals.

Method

The purpose of this survey of industry experts was to evaluate whether the services chosen were allocated to the correct service category. Service provider professionals were interviewed on the importance of intrinsic attributes, user network attributes and complement network attributes in creating customer value for each of the six different mobile services. For each of the six services, highly skilled service provider professionals were identified and recruited in order to validate our up-front categorization of the six services. Table 1 shows the number and type of categorization validators.

Insert table 1

Categorization validators for the person-to-person MMS study were recruited among the professionals responsible for roaming agreements of two large nationwide mobile operators. These professionals were believed to have extensive knowledge of which attributes are relevant when signing roaming agreements with national and foreign operators. For SMS chat services, categorization validators were recruited among content service providers offering chat services. All were professionals working in companies providing chat services. Categorization validators for MMS content services were recruited among MMS content service provider professionals. For the POS payment service, almost all professionals responsible for POS services at the provider of the payment service were used as

categorization validators. Categorization validators for the Java game survey were recruited among content provider professionals responsible for offering downloadable Java games. Finally, for the cash card charging service, almost all the professionals in the relevant department of the service provider participated.

Results

To validate the categorization of services, service provider professionals' responses to six items regarding the relationship between service value drivers and customer value were analyzed. Two of the items tapped the importance of intrinsic attributes, two tapped the importance of the user network and two items tapped the importance of the complement network to customer value for the service categorized by the professional. Exploratory factor analysis of the items using principal component analysis extracted three factors with eigenvalues higher than 1. The first showed an eigenvalue of 2.43 and explained 40.5 % of the variance. The corresponding values for factor 2 were 1.61 and 26.9%, and the values were 1.05 and 17.4%. for factor 3. Using varimax rotation, the pattern of factor loadings showed a maximum cross loading of 0.24 and a minimum inter-item loading of 0.84. The pattern of factor loadings corresponded to the expected relationship between items. Thus, composite scores for these items were used as variables indicating the professionals' perception of the importance of intrinsic attributes, user network and complement network in creating customer value. Results from the analyses of variance for these variables are shown in table 2.

Insert table 2

Table 2 shows that Java games and the prepayment account charging services were categorized as services where intrinsic attributes were believed to be of particular importance

to customer value. MMS person-to-person services and SMS chat services were categorized as services were the characteristics of the user network were particularly important to customer value, and MMS content services and POS payment services were categorized as services where characteristics of the complement network were of particular importance to customer value. Thus, our proposed categorization of services according to the sources of customer value appears valid.

STUDY 2: CROSS-SERVICE STUDY OF END-USERS

In order to have managerial significance and also to be theoretically valid, the services in the proposed categories should also prove to have different antecedents of perceived value among end-users. Consequently, we tested the proposed categorization scheme on end-users by conducting a cross-service study on drivers of perceived customer value.

In the following section, we propose a conceptual model for explaining the perceived value of mobile services among consumers. This model serves as a framework for postulating hypotheses regarding cross-service differences that test the underlying rationale of the service categorization scheme.

Conceptual Model and Cross-Service Hypotheses

Whereas traditional adoption studies typically apply "intention to adopt" as the dependent variable, we focus on consumers' perceived value of the service. Perceived customer value has come in for much attention in marketing (cf. Chen and Dubinsky, 2003; Zeithaml, 1988; Cronin, Brady and Hult, 2000) and concepts related to perceived service value have been investigated by a large number of scholars. The concepts used include service value (Bolton and Drew, 1991), experiential value (Matwick, Malhotra and Rigdon, 2001), perceived

acquisition value (Grewal, Monroe and Krishnan, 1998), and perceived value of a service (Petrick, 2002). The reasons for focusing on perceived value as opposed to intention to adopt are twofold. First, perceived customer value plays an important role not only in predicting consumer behavior, but also sustained competitive advantage (Chen and Dubinsky, 2003). Direct and indirect network externalities are believed to give corporations and brands competitive advantages through "bandwagon-effects", and theories of network effects also presume that consumers are able to take into account network effects when evaluating the perceived value of a given service. Second, and related to this point, perceived value constitutes the consumers' *overall* assessment of the (current and future) utility of a service and is influenced not only by prior experience with the same product, but also experience with other similar services and complementary services. Thus, value perceptions are formed partly by direct comparisons with other services and can also be generated without the service being bought or used.

With the notable exception of e.g. Wang et al. (2005), most existing adoption models and models of perceived service quality primarily include antecedents that pertain to *intrinsic* properties of the relevant technologies/services. As many mobile services are denoted by strong direct and indirect network externalities, our conceptual model is selectively designed to also integrate antecedents that are important for services with such network externalities.

Below, we present a *sub-set* of the previously discussed service attributes that may influence perceived service quality both for services with and without network externalities. This set of variables is carefully selected with the purpose of identifying variables that discriminate between the proposed service categories. Also, the chosen variables should explain large portions of the variance in perceived value.

Intrinsic Value Drivers

Previous research on technology and service adoption has identified a wide array of determinants of perceived value and behavioral intentions. Traditional adoption models, primarily designed to predict the adoption of technologies and services *without* network externalities, suggest determinants such as *ease of use* and *usefulness* as key drivers of value. The technology adoption model (Davis, 1989) has been successfully applied to contexts such as e-mail (Davis, 1989; Gefen and Straub, 1997), voice-mail (Adams et al, 1992); Karahanna and Limayem; 2000), the Internet (Gefen, 2003; Lederer et al, 2000), mobile phones (Kwon and Chidambram, 2000) and mobile services (Fang et al, 2006). Although the TAM model has been extended in a number of ways by including other intrinsic attributes such as enjoyment (Nysveen et al, 2005), playfulness and security (Fang et al, 2006), the original concepts of perceived ease of use and perceived usefulness continue to explain large portions of the variance in intention to use technologies and services.

Of course, perceived ease of use and usefulness may also be important for services with network externalities (as demonstrated by Wang, Hsu and Fang, 2005), but these two antecedents are generally more important for services driven by intrinsic attributes. Ease of use and usefulness have in numerous studies proven to be important determinants of attitudes and behavior towards technology-based services, particularly for professional services. We argue that ease of use and usefulness constitute important determinants of perceived value of mobile services, particularly for services where value is primarily intrinsically driven. Consequently, we propose the following hypotheses:

Hypothesis 1: Perceived ease of use will positively influence consumers' perceived value of mobile services.

Hypothesis 1a: Perceived ease of use is a more influential determinant of perceived value for services driven by intrinsic attributes as compared to services driven by user network attributes and complement network attributes.

Hypothesis 2: Perceived usefulness will positively influence consumers' perceived value of mobile services.

Hypothesis 2a: Perceived usefulness is a more influential determinant of perceived value for services driven by intrinsic attributes as compared to services driven by user network attributes and complement network attributes.

User Network Value Drivers

Wang et al. (2005) argue that the technology acceptance model needs to be complemented to also take into account effects of direct network externalities, that is, network attributes. For communication- and networked services, much of perceived customer value stem from benefits associated with other service users, not just the services' intrinsic attributes (Birke and Swann, 2006). The perceived number of users may prove as an important driver of customer value, especially for communication services such as messaging services. Telecommunication services are often described as having strong direct network effects (Suarez, 2005; Wang et al, 2005). The value a user derives from consuming the service should thus increase as the number of users using the same product also increases (Katz and Shapiro, 1986). However, the notion of a positive network effect rests upon several premises: First,

that the additional value of adding a new member to the network always increases at a higher rate than the costs of the network. This is not always the case, as Asvansund et al (2004) demonstrate in the context of peer-to-peer music sharing networks. Negative network externalities may also arise due to increased consumption of limited network resources or increased propensity for person-to-person users to free-ride in larger networks (Asvansund et al, 2004). Second, that all users have an equal effect on and equal importance for other users. Social network theory suggests that direct network effects will vary depending on the strength of ties between members. Findings by Suarez (2005) in the context of wireless telecommunication give support to the notion that small networks characterized by strong ties tend to be more valuable for members than larger networks with weak ties. Third, the notion of positive, linear network effects also assumes that members are actually capable of seeing and discounting these effects when evaluating the value of the service. Often, consumers may have limited opportunities and resources to actually evaluate potential direct network effects. Moreover, even if consumers, when prompted, acknowledge that direct network effects exist for a particular service, this may not necessarily influence their perceived value of the service significantly.

Predicting the effect of network size on perceived service value is thus not necessarily as straight forward as one may intuitively expect. However, for mobile services in general, limited network resources and network free-riding are thus far not considered large problems. The main challenge for consumers is rather to actually be capable of appreciating and discounting direct network externalities when evaluating perceived value. Still, Wang et al's (2005) recent study of instant messaging services, found significant effects of the perceived number of users on behavioral intentions. In line with these findings, and previous research on direct network effects, we propose the following hypotheses:

Hypothesis 3: Network size will positively influence consumers' perceived value of mobile services.

Hypothesis 3a: Network size is a more influential determinant of perceived value for services driven by user network attributes as compared to services driven by complement network attributes and intrinsic attributes.

Complement Network Value Drivers

Previous research has shown that consumers value products that offer a large number of, or a variety of, complementary products or services (Basu, Mazumdar, and Raj, 2003; Gupta, Jain, and Sawhney, 1999; Stremersch, Tellis, Frances and Binken, 2007). For instance, the expected utility of high-definition television (HDTV) sets to consumers increase as more HD broadcasting becomes available, and vice versa. Complementary products and services are thus mutually dependent on each others' success, which often leads to a "chicken-and-egg" paradox (Farrell et al, 1992; Stremersch et al, 2007). Although there are controversies on the temporal pattern and general persuasiveness of indirect network effects (cf. Stremersch et al, 2007), numerous studies suggest a positive correlation between complementary service variety and perceived quality and willingness to pay (Cottrell and Koput, 1998; Gallaugher and Wang, 2002; Schilling, 2003). Still, as most of the studies on the effects of complementary service variety apply secondary and aggregated data, these effects are still not well documented on the individual and perceived level.

Taken together though, the theories and empirical studies on indirect network effects strongly suggest that if, say, an MMS weather forecast service is launched on an MMS-content

platform, consumers will perceive this service as being of higher value than if the same service was launched on a proprietary (non-MMS) platform where fewer complementary services are available. Anecdotal support for this claim can also be found in industry cases where, for instance, the continued success of services based on the Japanese i-mode mobile Internet Platform often is explained by the great variety of complementary services available (e.g. Baldi and Thaung, 2002). Consequently, we propose the following hypotheses:

Hypothesis 4: Complementary service variety will positively influence consumers' perceived value of mobile services.

Hypothesis 4a: Complementary service variety is a more influential determinant of perceived value for the services driven by complement network attributes as compared to services driven by user network attributes and intrinsic attributes.

Compatibility is suggested by Rogers (1995) as a key driver of diffusion of innovations. The concept has also been applied in numerous studies of technology adoptions (cf. Moore and Benbasat, 1991; Chin and Gopal, 1995), including the adoption of mobile technologies (Schwartz et al, 2004). Compatibility is defined as "the degree to which an innovation is perceived as being consistent with the user's existing values, needs, and past experiences" (Moore and Benbasat, 1991). Most studies applying this concept to technology adoption seem to focus on the match between consumer needs and technology (e.g. compatibility with work-related tasks or work-style) and/or between consumer's past experiences and technology (e.g. compatibility with existing knowledge and expertise). According to Schwartz et al. (2004) the user's prior experience with systems or platforms (such as MMS-services) will create a baseline within the user's cognition that is used as a standard for comparison with all future

technology encounters. Thus, compatibility between the relevant mobile service and the consumer's prior experiences with similar services will be essential for consumer evaluation of the service. In line with Schwartz et al (2004), we argue that the higher the consistency and compatibility of the new service with existing ones, the higher the adoption-rate and perceived value of the new service.

Moreover, we argue that compatibility is particularly important for services where the value is driven by complement network attributes. Although compatibility per se may be regarded an intrinsic attribute of the service itself, the effect of compatibility on perceived value of the service will most likely be stronger when indirect network externalities are salient. Services driven by complement network attributes are denoted by the fact that the perceived value of using the service increases with the number of complementary services. Most often these complementary services are based on the same technological platform (e.g. Wap, MMS, or Java) and compatibility will thus most likely be more valued by consumers for services dominated by indirect network properties than for services dominated by intrinsic properties. The notion that intrinsic attributes in a product may interact with indirect network effects is not new. Basu, Mazumdar and Raj (2003) showed, for instance, that the utility of CD-changer capacity, an intrinsic attribute of CD-players, increased with increasing number of CD titles. By the same token, for mobile services, compatibility with a set of content standards may be an intrinsic attribute that increases in importance as the number of providers offering content services (via e.g. Java or MMS) increases. Based on the arguments above, we suggest the following hypotheses:

Hypothesis 5: Compatibility will positively influence consumers' perceived value of mobile services.

Hypothesis 5a: Compatibility is a more influential determinant of perceived value for services driven by complement network attributes as compared to services driven by user network attributes or intrinsic attributes.

Based on the hypotheses presented above, the conceptual model guiding the cross-service study may be depicted as follows:

Insert figure 1

In the following, we present the research design and methodology used to test the model and the proposed mobile service categorization scheme.

METHOD

Design, Procedure, and Sample Characteristics

Six individual end-user surveys were conducted to investigate differences in the effects of service attributes on customer value. The six services scrutinized where the same as in study 1. All studies were conducted in Norway and we designed all surveys as one-group post-test designs. A quasi-experimental setting was applied by giving subjects a stimulus text that focused on one particular mobile service that was relevant in the context in which they were recruited. For example, after checking their prepayment account balance, subjects were asked to review a mobile payment service used to fill up their prepaid mobile account. In this case, the following stimulus text was used: "We now want you to focus on the payment service that

you use to charge your prepaid mobile account. Using the payment service for other purposes, such as paying for other goods and services (if possible) is not relevant here. Please focus on this specific use of the payment service throughout this questionnaire".

Insert table 3

Table 3 shows the numbers and types of survey respondents for each study. Survey respondents (consumers) were recruited through collaborating with the leading nationwide providers in each of the six service categories. Active service users were recruited by either approaching them by SMS via the vendor CRM database (Person-to-person MMS, Cash Card charging service and POS payment service), by announcements on the vendor text-TV pages, (SMS chat services), or by announcements on the vendors' website (MMS content service and Java gaming). Sample demographics of all four studies are shown in Table 4.

Insert table 4

As Table 4 shows, there are systematic differences in sample demographics among the six surveys. Because of these differences, the data should be controlled for age, gender, and education differences before cross-population generalization is recommended. In particular, we control for age and gender differences in all hypothesis tests reported throughout this study.

Survey Measures

The model presented in Figure 1 includes six concepts, most of which are well founded in the information systems or marketing literature. We measured usefulness using three items and

ease of use using four items adapted from Davis et al's (1989) original items. Similar operations can be found in Taylor and Todd's (1995) and Battacherjee's (2000) work. The items were adapted to the current service context of each survey. The adaptation and final measures correspond to the measures applied by Nysveen et al (2005).

Our measure of *compatibility* is based on adapting the items of Moore and Benbasat (1991) to the mobile context of our services. They were also modified to fit the compatibility factor of interoperability typical for mobile services. Originally, three items were suggested, corresponding to the first three items used by Moore and Benbasat (1991). The final measure, however, was composed of two items only.

User network size in the form of installed base has been taken by several authors as equal to market share, but also more perceived elements have been included, such as the "mindshare" concept used by Gallaugher and Wang (2002). Our measure of user network size is based on similar ideas and consists of two items reflecting perceived size of the user base. Similar items have been used by e.g. Frels at al (2003).

Our measure of *complementary service variety* was adapted from the measure of the size of the complement network used by Frels et al (2003) with good results. However, the measure focuses somewhat more directly on complementary service variety. It was designed with three items, reflecting the dimensions of complementarity as consisting of "other services", "different services" and "variety of services" partly adapted from Shankar and Bayus (2002).

The measures of *perceived service value* were founded in the literature on perceived customer value (Zeithaml, 1988). Rather than using a formative scale like Sweeney and Soutar (2001),

perceived value was measured using three items, reflecting perceived total value (acquisition value), perceived value relative to offer, and perceived value relative to requirements. The items constitute a reflective scale with the two first items being used in previous studies of service value. Cronin, Brady and Hult (2000) found these items to constitute a reliable scale of service value (α =0.88). The final item has been used in studies of acquisition value (Grewal, Monroe and Krishnan, 1998) with good results.

All concepts were measured using items tapping subjects' agreement with a set of statements, using a five-point scale that ranged from *strongly disagree* to *strongly agree*, or the indication of levels on a similar five-point scale ranging from *very low* to *very high*. For each study, we adapted the items to the service studied so that the wording of the items referred to different contexts and different purposes of use for each service. However, the wording was kept as similar as possible across studies. Example wording (originally in Norwegian), means, standard deviations, and reliabilities of the variables across all six mobile services studied are shown in Table 5.

Insert table 5

In table 5 we find coefficient alpha to be higher than the recommended .7 limit suggested by Nunnally (1978) for all scales except for the compatibility scale. Although Hair, Anderson, Tatham, and Black (1998) suggest accepting alphas as low as .60 for exploratory research of the kind reported here, further investigation of the reliability of this scale is conducted and reported under measurement model analyses below.

To investigate the discriminant and convergence validity of the variables in our model, we included all items in a factor analysis (principal components) that included five factors. The analysis showed that the factors explained 79% of the variance in the material (see table 5). We also see that the highest factor loading on items not included in a corresponding scale is .33 and the lowest factor loading of an item in a scale is .77, suggesting acceptable discriminant and convergence validity of the scales. With the first factor explaining 41% of the variance, indicative results of the Harmon-test suggested by Podsakoff et al (2003) indicate that common method bias is not a problem.

To further analyze the reliability and validity of our variables, we applied the procedures suggested by Agarwal and Karahanna (2000) and Hair et al (1998). We estimated our complete measurement model using AMOS 6. We also calculated intervariable correlations, shared variances, and composite reliability, which we illustrate in table 6.

Insert table 6

We show the composite reliability for each variable in table 6. All values are well above the recommended level of .50 suggested by Hair et al (1998). Thus, the reliability of the compatibility scale is also considered acceptable. According to Agarwal and Karahanna (2000), all variables should share more variance with their indicators than with other variables. To test this, we show the square root of the average shared variance between items and scale variables on the diagonal of table 5. Off-diagonal elements are correlations among variables. We find that all variables share more variance with their indicators than with the other variables in the study. Because we calculated these values on the basis of the combined data from the six surveys, the results should be considered an indication of the lowest level of

reliability and validity of our measurement model. We also estimated the measurement model fit based on data from all six studies showing $\chi 2/df = 2.37$, normed fit index (NFI) = .98, Tucker-Lewis index (TLI) = .98, and root mean square error of approximation (RMSEA) = .033. Thus, the fit of the measurement model is considered acceptable.[1]

RESULTS

In the path diagram of figure 2, we show fit indexes, standardized path coefficients, and explained variances for the suggested full structural model using composite data from all six studies. The model explains 60% of the variance in customer value, which is considered high. It is, however, likely that both fit and explained variance vary across models applying data from each of the six studies individually.

Insert figure 2

As can be seen in figure 2 and table 7, hypotheses 1, 3, 4, and 5 are all supported. However, the effect of ease of use on customer value is not significant. Thus, hypothesis 2 is rejected. The reason for this may be the high correlation between ease of use and usefulness. However, as evident in numerous applications of the technology acceptance model (cf. Davis, 1989), it has been suggested that the effect of ease of use is mediated via usefulness rather than vice versa.

The hypotheses proposed above may be tested as hypotheses of cross-service differences in structural models. Ideally, all subjects should have participated in all service studies because sample characteristics may interact with service categories. Due to the applied sampling method, the demographic characteristics of our respondents vary across the six studies. To

control for this situation, we applied service category comparisons while controlling for age and gender as the most important variables indicating sample differences. The analyses follow the procedures of multigroup SEM used by Sujan, Weitz, and Kumar (1994). We first test the cross-service hypotheses by investigating differences in structural paths between services in each category (value driven by intrinsic, user network and complement network effects respectively) and the rest of the services correspondingly. We then report the results of multigroup analyses for corresponding tests controlling for age and gender. The results of the five tests of differences in structural paths are shown in table 7.

Insert table 7

Table 7 shows the results for each of the five hypotheses on cross-service differences. The columns show the proposed service category of the service investigated, the variable proposed to differ in effects between service categories, path coefficients for the constrained and unconstrained models and the $\chi 2$ difference in fit between constrained and unconstrained models. From table 7 we find that usefulness is more important to services whose value was categorized as being driven by intrinsic attributes. Because the level of significance is as low as 10% for this test, we consider the support for hypothesis 1a to be weak. Although ease of use was not in general found to significantly influence customer value when investigating all mobile services collectively, we see from table 7 that it is significant for services whose value was categorized as being driven by intrinsic attributes. Thus the difference in influence between categories of services is also significant, strongly supporting hypothesis 2a. For network size we also find strong support for hypothesis 3a suggesting that this variable more strongly influences the customer value of services whose value was categorized as being driven by direct network effects. For hypothesis 4a we see that there are significant differences in the influence of complementary service variety across service categories, but

the finding is in the opposite direction to that proposed. This is rather surprising and the results indicate that customer value is unaffected by complementary service variety for services whose value was categorized as being driven by indirect network effects. Thus, customer value of payment services and MMS content services does not seem to be driven by greater variety of complementary services. Rather, this seems to be the case for MMS services used for peer-to-peer communication, SMS chat services, game services, and prepayment account charging services. Finally, we see from table 7 that hypothesis 5a is strongly supported, indicating that compatibility may be very important for services whose value is categorized as being driven by indirect network effects.

Due to differences in sample demographics across the six services investigated in this study, the hypothesis tests should also be controlled for age and gender differences. The procedure applied in this analysis corresponds to the procedure applied above, but the service category differences are investigated for four individual sub-samples, corresponding to younger and older subjects (using a median split of the sample) and male and female subjects. The results show that when controlling for age and gender, service category differences vary across sub-samples. However, in the majority of sub-sample/hypotheses combinations the pattern of significant findings shown in table 7 is consistent. Moreover, the pattern of interaction effects is not directionally consistent. Thus, we conclude that even though age and gender has an effect on the direct relationships between service attributes and customer value, the service category differences identified in table 7 are largely consistent when controlling for age and gender. Still, future research should investigate potential moderators and interaction effects with all the variable relationships shown in table 7.

DISCUSSION AND IMPLICATIONS

The present paper proposes three basic categories of mobile- and networked services: Services driven by intrinsic attributes, services driven by user network attributes, and services driven by complement network attributes. Relying on an expert panel consisting of 54 service provider professionals, six different mobile services were investigated and categorized as either driven by intrinsic attributes, user network attributes or complement network attributes. Subsequently, a set of cross-service studies of mobile end-users was conducted in order to test the applicability and validity of the categorization scheme. The same six mobile services were used in these end-user studies. For the categorization scheme to be valid and have true managerial impact, mobile services in each category should have different antecedents of perceived value. Specifically, we expected that for services driven by intrinsic attributes, usefulness (H1a) and ease of use (H2a) would be particularly strong drivers, whereas for services driven by user network attributes, network size (H3a) would be a more important driver than for the remaining service categories. By the same token, the perceived value of services driven by complement network attributes was expected to be more strongly influenced by compatibility (H5a) and complementary service variety (H4a). The cross-service hypotheses were largely supported (although support for H1a failed to reach the 5% significance level), however, H4a was directionally opposed to what was hypothesized. The variety of complementary services was found to have no effect on perceived value for services driven by complement network attributes, but surprisingly so for the two other service categories. This particular finding may have several potential explanations. First, the services selected by our expert panel may not represent "true" services driven by complement network attributes. Second, and related to the first point, the categorization scheme may in

itself be invalid, or it may not sufficiently discriminate between the different mobile services. That is, either the industry experts might be "wrong", or the categorization scheme might be "wrong". We cannot, of course, rule out these two potential explanations, but given the homogeneous expert categorization of all six services to the corresponding three service categories, this appears somewhat less likely. Also, the remaining antecedents and categories proposed in the paper behave according to the hypotheses set forth. A third potential explanation might be that the conceptualization or, even more likely, the measures of complementary service variety are invalid and capture something other than the perceived variety of complementary services. Although similar measures have been used successfully by Frels et al (2003) and Shankar and Bayus (2002), one might suspect consumer market end-users to have trouble understanding the meaning of the term "complementary", and rather interpret the question as e.g. "similar" services. This may, in part, explain why this variable in the present study is a stronger antecedent of perceived value for services driven by intrinsic attributes and user network attributes. In hindsight, we see that the questionnaire items representing "complementary service variety" should have been phrased differently.

The external validity of our findings may be limited by our sampling principles as well as the uniqueness of the investigated mobile services. To generalize our findings to other populations and networked services, more research and replications are required. On the other hand, telephony services are among the services that where early acknowledged to be characterized by network effects. Also, to ensure external validity, internal validity in the form of respondents with sufficient understanding and experience with the investigated services must be present. By showing that these findings are consistent when controlling for age and gender, the limitations stemming from our sampling principles are proven not to seriously threaten the external validity of the study.

In sum, the present study offers a tentative, yet promising categorization scheme for mobile- and networked services based on their dominant source of value. It extends and refines previous categorizations of value driving attributes of IT-based services (Davis, Bagozzi and Warshaw, 1992; Shang, Chen and Shen, 2005) to better fit the fact that most such services are now provided and consumed in complements- and user networks. As direct and indirect network effects are salient for many services offered by both traditional firms and "new economy" firms, the developed categorization scheme may offer new insights for a wide array of contexts, not just for mobile services. The perceived value of services, distribution and marketing communication via Internet, mobile phones, communities and social networks is heavily influenced by both extrinsic and intrinsic attributes. Consequently, managers may get important hints in how to develop and market new services based on a preliminary in-house investigation of whether the value of the relevant service stems primarily from intrinsic attributes, user network attributes, or complement network attributes. Say, for instance, brand X is planning to launch a new Internet-based service for communicating with its customers and allowing customers to interact with each other. By thoroughly evaluating the intrinsic attributes, user network attributes and complement network attributes of the service, marketing managers can gain important insights into what attributes (most likely) makes the service valuable to consumers and, consequently, which determinants to focus in marketing communication. Most likely, user network attributes will be more important for this particular service, than for a brand website simply aimed at providing consumer with product information. Moreover, by drawing a distinction between user network attributes and complement network attributes, firms will get a more fine-grained understanding of the extrinsic value drivers of their products and services. The fictitious brand/customer community software of brand X described above may be driven primarily by user network

attributes, but it may also be heavily contingent on complement network attributes, depending on the software/technological platform used.

The present study also suggests some managerial implications in terms of business model design. Previous research on the relationship between business model dimensions and mobile service attributes reveal that e.g. relational and market forms of governance enable providers to offer more useful services and that hierarchical governance forms increase the intrinsic quality of services (Methlie and Pedersen, 2007). Thus, linking the categorization scheme presented above with the documented effects of business model dimensions on networked service attributes may provide managers with important guidelines as to the kinds of business models that will work best for the three different categories of services.

Lastly, the current categorization scheme will have much stronger and clearer managerial implications when the full array of antecedents and the consequences of intrinsic, user attribute, and complement network attributes have been investigated. Future studies should investigate how other documented drivers of network service usage, such as network strength and complementary service quality, relate to consumers' perceived value of the different categories of mobile services proposed here. Moreover, future research should also investigate how intrinsic, user attribute, and complement network attributes relate to other crucial dependent variables, such as adoption likelihood, willingness to pay, and actual service usage.

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TABLES

Table 1. Sample: Industry professionals

Service	Categorization validators
Person-to-person MMS	N=8, Source: Operator MMS roaming professionals
SMS chat service	N=8, Source: Chat service provider professionals
MMS content service	N=11, Source: MMS content service provider professionals
POS payment service	N=7, Source: Payment service provider professionals
Java games	N=12, Source: Mobile gaming service provider professionals
Cash card charging service	N=8, Source: Charging service provider professionals
Sum	N=54

Table 2. Analysis of variance, categorization validation

Variable	Group(*)	N	Mean	St. dev.	F	Sig.
Intrinsic attribute importance	1	16	2.75	0.97	7.28	0.00
	2	18	3.44	0.84		
	3	20	3.93	0.95		
	Total	54	3.42	1.02		
User network importance	1	16	4.19	0.73	7.79	0.00
	2	18	3.42	0.90		
	3	20	2.85	1.27		
	Total	54	3.44	1.13		
Complement network importance	1	16	3.50	0.97	3.74	0.03
	2	18	3.92	0.67		
	3	20	3.00	1.32		
	Total	54	3.45	1.09		

(*) 1=MMS person-to-person and SMS chat service, 2=MMS content and POS payment service, 3=Java games and prepayment charging service)

Table 3. Sample: End-user respondents

Service	Survey respondents
Person-to-person MMS	N=299, Source: Prepayment plan users
SMS chat service	N=187, Source: TV-based SMS chatters
MMS content service	N=291, Source: MMS content website users
POS payment service	N=140, Source: Payment service users
Java games	N=130, Source : Mobile Java game website users
Cash card charging service	N=221, Source: Cash card charging service users
Sum	N=1268

Table 4. Sample Demographics

	Gender		Age (years)		Education	
Person-to-person MMS (N=280)	Female	64.3	0-12	4.1	Primary	39.8
	Male	35.7	13-19	31.1	Secondary	49.3
			20-29	25.3	University L	6.8
			30-39	25.0	University H	4.1
			40-49	10.8		
			50-59	2.7		
			60+	1.0		
SMS chat service (N=187)	Female	59.9	13-19	5.4	Primary	30.3
	Male	40.1	20-29	30.4	Secondary	55.1
			30-39	31.5	University L	11.9
			40-49	23.4	University H	2.7
			50-59	7.1		
			60+	2.2		
MMS content service (N=291)	Female	64.4	0-12	11.4	Primary	53.4
	Male	35.6	13-19	55.7	Secondary	32.2
			20-29	15.6	University L	8.1
			30-39	9.0	University H	6.4
			40-49	6.2		
			50-59	1.4		
			60+	0.7		
POS payment service N=140)	Female	60.4	0-12	1.4	Primary	16.5
	Male	39.6	13-19	10.7	Secondary	56.8
			20-29	27.9	University L	17.3
			30-39	27.9	University H	9.4
			40-49	25.0		
			50-59	4.3		
			60+	2.9		
Java games (N=130)	Female	31.4	0-12	11.5	Primary	45.0
	Male	68.6	13-19	44.6	Secondary	34.9
			20-29	22.3	University L	9.3
			30-39	16.9	University H	10.9
			40-49	2.3		
			50-59	1.5		
			60+	0.8		
Prepayment charging service (N=221)	Female	59.5	0-12	0.9	Primary	20.8
	Male	39.5	13-19	11.3	Secondary	56.3
			20-29	32.1	University L	14.4
			30-39	28.5	University H	8.5
			40-49	20.4		
			50-59	4.1		
			60+	2.7		

Table 5. Principal Components Analysis of all Measurement Items (Varimax Rotation)

Variables / Communalities (C) and loadings	C	1	2	3	4	5	6
3 Usefulness							
Using "service" saves me time	.80	.33	.12	.80	.16	.06	.09
Using "service" improves my efficiency	.84	.32	.15	.81	.20	.07	.11
"Service" is useful to me	.79	.20	.17	.81	.22	.05	.09
1 Ease of Use							
Learning to use "service" is easy for me	.75	.82	.09	.14	.17	.10	.10
It is easy to make "service" do what I want it to	.68	.77	.09	.19	.12	.11	.15
My interaction with "service" is clear and understandable	.78	.83	.09	.24	.12	.06	.10
It is easy to use "service"	.78	.81	.05	.27	.14	.07	.13
6 Compatibility							
Using "service is compatible with all aspects of my mobile service use	.76	.16	.17	.07	.20	.11	.81
"Service" is completely compatible across all my mobile service providers	.76	.20	.10	.15	.18	.11	.81
5 Network size							
Today this "service" is used by a large number of users I know of	.79	.11	.16	.03	.23	.83	.09
A large number of users, also beyond those I know of, use "service"	.82	.13	.13	.09	.06	.87	.12
2 Complementary service variety							
Using "service" makes a great deal of "complementary services" available	.81	.09	.85	.15	.21	.10	.05
"Service" has a large amount of "complementary services" available	.82	.09	.85	.09	.18	.16	.15
One of the unique attributes of "service" is the great variety of "complementary services" available	.76	.08	.82	.15	.18	.09	.10
4 Customer value							
Overall, the value of "service" to me is	.80	.19	.21	.18	.80	.14	.16
The overall ability of "service" to satisfy my wants and needs is	.82	.20	.23	.25	.79	.11	.18
Compared to what I had to give up, the overall value of "service" is	.80	.17	.26	.19	.79	.15	.18
Eigenvalues		6.95	2.12	1.36	1.10	1.00	.84
Variance explained		40.90	12.46	7.99	6.49	5.90	4.95
Mean (n=1262)		4.13	3.67	3.97	3.60	3.46	3.57
Standard deviation (n=1262)		.81	.95	.97	.99	1.10	1.04
Cronbach's alpha		.88	.86	.88	.87	.75	.68

Table 6. Intervariable Correlations, Root Average Shared Variances*, and Composite Reliability**

	Usefulness	Ease of use	Compati-bility	Network size	Comp. serv. variety	Customer value
Composite reliability	.88	.88	.68	.76	.86	.87
Usefulness	.84					
Ease of use	.66	.81				
Compatibility	.46	.52	.76			
Network size	.29	.33	.45	.80		
Comp. serv. variety	.43	.30	.41	.45	.82	
Customer value	.60	.51	.47	.58	.63	.83

*Root Average Shared Variances on the diagonal, **Composite reliability for all measures in row 1.

Table 7. Differences in Antecedents of Customer Value

Hyp .	Service category	Variable	Constrained	Service in proposed category	Other services	$\chi 2$ difference (df = 1)
1a (+)	Driven by intrinsic attributes	Usefulness	.24*** (5.66)	.38*** (4.35)	.20*** (4.73)	3.37*
2a (+)	Driven by intrinsic attributes	Ease of use	.04 (.76)	.35*** (3.40)	-.04 (-.80)	11.10***
3a (+)	Driven by user network attributes	Network size	.13*** (4.70)	.23*** (4.13)	.09*** (2.81)	4.73**
4a (-)	Driven by complement network attributes	Comp. serv. variety	.26*** (7.81)	.10 (1.36)	.29*** (7.94)	5.01**
5a (+)	Driven by complement network attributes	Compatibility	.35*** (7.57)	.62*** (5.73)	.24*** (4.84)	12.65***

*p < .10 **p < .05. ***p < .01.

Note: + indicates support for the proposed hypothesis; – indicates significant findings in the opposite direction to the proposed hypothesis. Columns 4-6 include path coefficients (regression weights); t-values are in parentheses.

FIGURES

Figure 1. Conceptual model

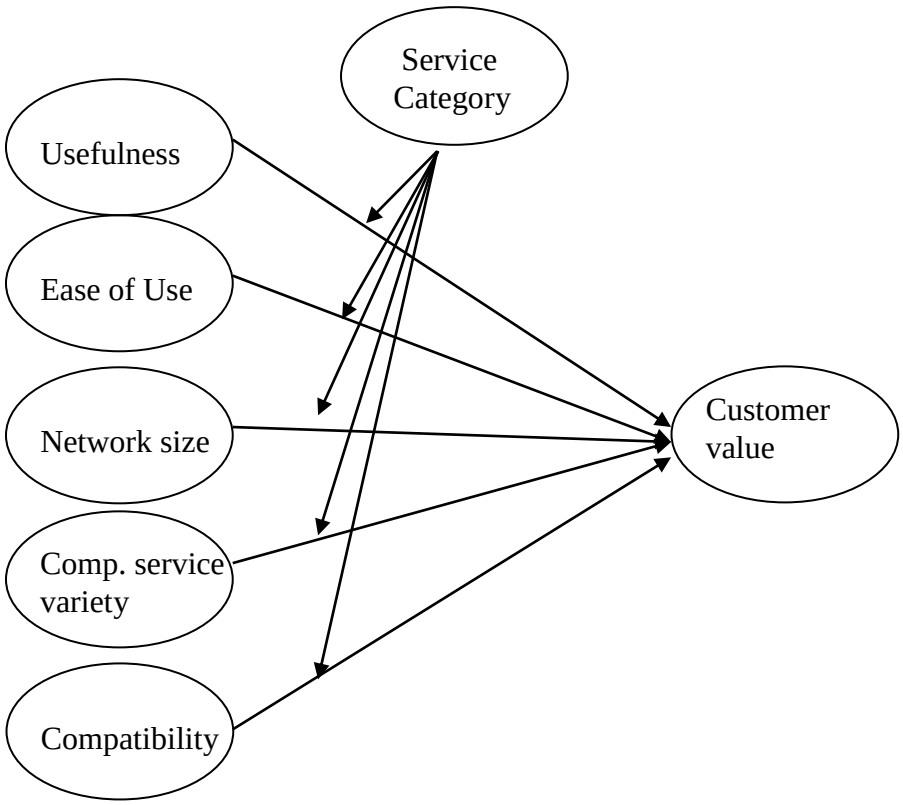
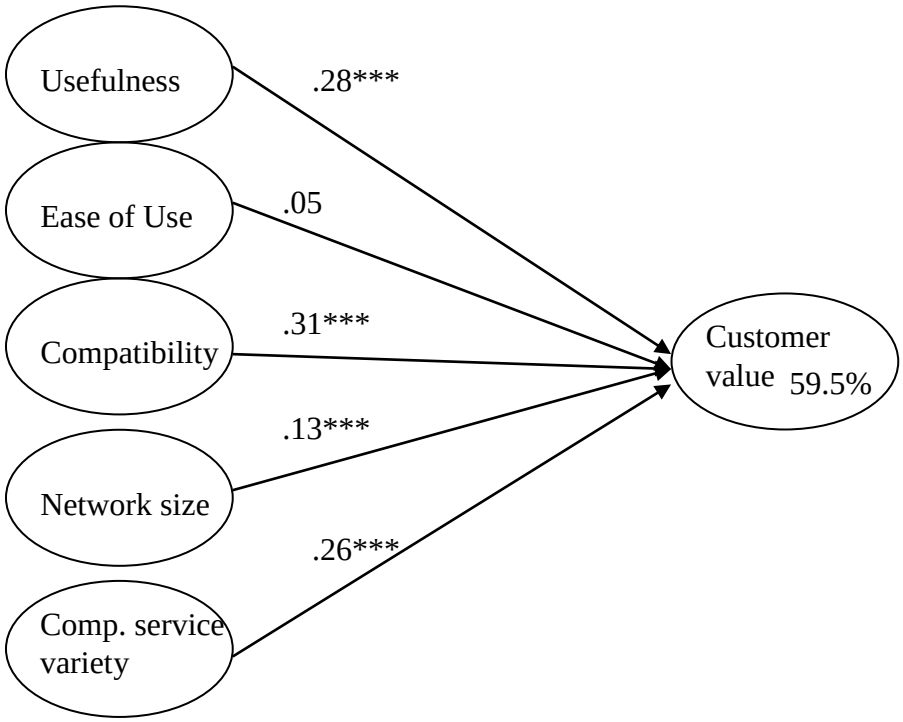


Figure 2. Structural model



*** indicate significance at p<0.01