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An exploratory study of the relationships between mobile data services business models and customer value

by

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This report is one of a series of papers and reports on telecommunication economics published by the Institute for Research in Economics and Business Administration (SNF) as part of its telecommunication economics program. The main focus of the research program is to study the deregulation process of the telecommunication industry, and the economic and organizational consequences of changes in markets, technology and regulation. Being started in 1992, the program is now in its fourth period ending in 2005/2006. The program is financed by Telenor AS.

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PREFACE

This report is part of a project funded by the Research Council of Norway, Telenor, Den Norske Bank, A-Pressen and Ericsson. The project is called "Mobile and channel integrating electronic commerce - Business models and end-user adoption". The main purpose of this part of the project is to integrate the supply and demand side models developed earlier in the project and to conduct a set of studies to test the integrated model. The report is the result of a joint effort by Leif Gressgård, Leif B. Methlie, Herbjørn Nysveen, Per E. Pedersen and Helge Thorbjørnsen. However, most of the text has been written by Per E. Pedersen, Leif B. Methlie and Leif Gressgård, in that order. The authors want to thank Telenor, Netcom, Eurobate, Inpoc, and TV2 for giving us access to data through their customers and employees.

Grimstad and Bergen, March 30, 2005

Leif Gressgård, Leif B. Methlie, Herbjørn Nysveen, Per E. Pedersen and Helge Thorbjørnsen

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ABSTRACT

Adoption of mobile data services may be analyzed within the framework of two-sided markets. Service or content providers should adopt platforms for developing, integrating and distributing mobile services and end-users should adopt the offered services as well as the user platform offered. These two markets are often analyzed separately using different theoretical perspectives and models. In this report, we propose a model for integrating the two sides of the mobile data services market. We suggest that end-users adopt services with high perceived customer value. Perceived customer value is obtained through intrinsic and extrinsic service attributes appreciated by end-users. Intrinsic attributes are the inherent attributes of the mobile data service itself whereas extrinsic attributes are attributes of the network of users and complementary services offered. However, end-users differ with respect to their ability to assess perceived value from offered service attributes. Furthermore, services differ with respect to which service attributes are most important to perceived value.

We suggest that intrinsic and extrinsic services attributes are determined by dominant actors' decisions along four dimensions of their business models. The proposed model is used to develop specific hypotheses on the relationships between dominant actors' choice of business models for individual services and the end-users' perceived value of these services.

The proposed hypotheses are tested in a survey of service provider professionals including representatives of service providers offering six different mobile data services. The services are believed to systematically differ in the degree to which extrinsic and intrinsic attributes contribute to perceived value. To obtain data on the relationship between service attributes and end-users'

perceived value, six individual surveys are conducted. These surveys enable us to test the hypotheses proposed on the demand side relationships of the proposed model. Finally, supply side and demand side results are integrated in a proposed path model corresponding to the suggested conceptual model.

The results show that relatively few of the hypotheses suggested for the supply side of the model are supported, whereas we find support for most of the hypotheses on the demand side. On the supply side of the model, mobile specificity of value propositions seems to be the business model dimension most influential to service attributes. On the demand side, a large set of service attributes significantly affects perceived value. We find that behavioral control only seem to moderate the value of complementary service variety, whereas service category moderates most of the relationships between service attributes and perceived value. We find that complementary service attributes are more important to services characterized by indirect network effects and network size is more important to services characterized by direct network effects. Intrinsic attributes are important to the perceived value of all services, but particularly to services not characterized by direct and indirect network effects. Finally, integrated analysis of the two sides of the mobile data service market shows that the relationship between business model dimensions and perceived value follow specific causal paths. Along these paths, mobile specificity and governance form influence perceived value mainly through intrinsic attributes.

The findings have implications for both mobile data service industry and further research. For the mobile data services, the individual findings reported here may be used to suggest which business models dimensions providers of specific services should pay most attention to. For research, the main implication is that the exploratory investigation reported here should be followed by more

confirmatory research. The most powerful paths of the research model developed here should be integrated in more parsimonious research models, and these models should be tested using more confirmatory research designs.

1 INTRODUCTION

Recent analyst reports and academic papers suggest that open, collaborative business models are required to obtain variety in service offerings and consequently adoption of service platforms as well as end-user services. The authors most often refer to the Nordic experience with the so called CPA-models (Content Provider Access) for SMS and MMS services (Strand Consult, 2002, Northstream, 2002). However, this open model has so far not been equally successful in providing WAP services in these countries. Furthermore, recent examples suggest that closed, vertically integrated business models have been successful when introducing the more advanced mobile data services likely to be expected in 3G networks. Examples are the semi-walled garden model of DoCoMo's I-mode services in Japan and the model applied by Vodafone to provide their "Live!" services. Thus, it seems that examples of both successful and less successful service introductions may be found applying both closed and open business models.

While the conceptual dimensions of business models have recently obtained considerable attention (Campanovo and Pigneur, 2003; Faber et al., 2003, Bouwman, 2003), dominant actors' choice of specific business models and the relationship between these decisions and firm or service performance have been less attended to. End-users' perception of intrinsic service attributes has also obtained considerable attention in resent research on the adoption of mobile data services. However, research on the perception of extrinsic service attributes, such as end-user network size and complementary service variety has mainly been focused in contexts of professional end-users and traditional computer contexts, such as operating systems.

The purpose of this report is to extend research on the conceptual dimensions of mobile services business models into explorations of the relationship between business model dimensions and performance. In this report, performance is discussed in the context of the perceived and anticipated value of the services offered. The relationships between business model dimensions and performance are investigated by testing theoretically well founded hypotheses in a rigorous, but explorative, research design. The purpose of this investigation is to provide a basis for further refinement of a parsimonious model with acceptable explanatory power that can be used by service providers to guide business model decisions for different categories of services. We also aim to use the findings of this investigation as a basis for further research on the mediated and moderated relationships between business model dimensions and perceived customer value.

This report is organized in the following way: In section 2, a brief review is given of relevant general theory on business model dimensions, mobile data service attributes and adoption of mobile services. In section 3, a conceptual model of the relationships between business model dimensions, service attributes and perceived customer value of mobile data services is proposed. Current research on these three relationships is summarized and used to develop a set of hypotheses on the direct, mediated and moderated relationships. In section 4, the research design of a rigorous empirical study that includes one supply side survey and six demand side surveys is presented. The results of this empirical effort are presented in section 4 along with summaries of the support found for the hypotheses proposed in section 3. In the final section, conclusions are summarized, the limitations of the study are discussed, and implications for the mobile data services industry as well as for further research are presented.

2 THEORY

Explanations of mobile data services success span from focusing specific factors, such as the choice of an appropriate revenue model (Foros et al., 2001) to general systemic explanations, such as the dynamics of industry ecosystems (Vesa, 2003). The most common approach, however, is to combine a set of technological, business strategic and behavioral or cultural factors. For example, Henten et al. (2003) suggested technology, economy, market development and structure, marketing, socio-cultural, policy intervention and regulation as the relevant explanatory factors. Pedersen (2001) suggested three general requirements for successful adoption of mobile data services; technology-, business strategic-, and end-users' behavioral requirements. These requirement dimensions correspond roughly to the dimensions of Henten et al. (2003), but business strategic requirements refer to more than marketing decisions, and behavioral requirements refer to more than socio-cultural factors. Some authors apply a comparative perspective analyzing differences in adoption between Asian and European markets. For example, Bohlin et al. (2003) compared the developments of mobile data services in Japan and Europe and opposed popular assumptions that differences in adoption rates could be explained by differences in technology, regulatory regimes, cultural differences, Internet penetration and differences in consumer segments. Instead, they suggest that the important differences are the coordinated and vertically integrated service concepts and the revenue models offered by Japanese operators.

Our focus is on the causal relationship between business model choices (strategic conduct) and end-users behavioral factors. We suggest that the choice of specific business model options by dominant actors is one of the most important explanations of mobile data services success. The

term business model has been used mostly in traditional electronic commerce to describe how the key components of a business can capture the economic values from the e-business technology (Timmers, 1998; Amit and Zott, 2001; Rayport and Jaworski, 2001; Weill and Vitale, 2001). One of the earliest contributions came from Timmers (1998) suggesting that a business model describes the architecture for the product, service and information flows, including a description of various business actors and their roles, a description of potential benefits for the various actors, and a description of the sources of revenue. Thus, it includes infrastructure, value proposition and financial dimensions. Similarly, Weill and Vitale suggest that a business model is the "*description of the roles and relationships among a firm's consumers, customers, allies and suppliers that identifies the major flows of products, information and money, and the major benefits to participants*" (Weill & Vitale, 2001, p. 34). Methlie and Pedersen (2002) included three operational dimensions in their business model concept; integration model, collaboration model and revenue model. They focus that individual providers' business model options are restricted by structural determinants and value network considerations because value creation in both traditional and mobile electronic commerce requires a shared understanding of the business model of each network member. In some industries the business model options of each value network member are indirectly determined by the business model of the dominant members (e.g. operators in some mobile services industries and operating system developers in the software industry).). Hedman and Kalling (2003) develop the business model dimensions from several strategy perspectives and include a discussion on causal inter-relations and longitudinal processes by which business models evolve.

Recently, several authors have applied the business model concept to mobile commerce and mobile data services contexts (Campanovo and Pigneur, 2003; Faber et al., 2003, Bouwman,

2003). With some variations in propositions, these authors mainly suggest four dimensions of business models; the product innovation, the customer relationship, the infrastructure and the financial dimensions, covering the product related value proposition, the customer related value proposition, the structural dimension and the revenue dimension, respectively[1] (e.g. Campanovo and Pigneur, 2003). The infrastructure dimension is treated in the strategy and marketing literature under the label of governance. A growing body of research addresses different aspects of firms' relationships with exchange partners from a variety of theoretical perspectives (Wathne and Heide, 2004).. Several studies have relied on the new institutional economics literature, including transaction cost economics, to examine how governance processes are carried out between firms (e.g. Gosh and John, 1999, Heide, 1994). Most of this research has studied bilateral relationships, that is, individual dyadic relationships. However there is a growing attention to network relationships where the relationships between actors in the network mutually impact on each other, i.e. are connected (Anderson, Håkansson and Johanson, 1994). A general theory of network governance is given by Jones, Hesterly and Borgatti. (1997)

However, the choice between specific options along these dimensions and the performance effects of choosing specific options under different structural conditions have been given less attention in the literature on the business model concept applied to mobile services. Instead, performance effects of the choice of options for product-, customer-, financial- and infrastructural business model dimensions are treated separately in individual research areas such as product innovation, industrial organization and strategic marketing research. In the industrial organization field, however, one acknowledge the causal relationships between structural market conditions

[1] Faber et al. (2003) and also Bouwman (2003) suggest technology design, service design, organization design and finance design as the corresponding dimensions.

and business model choices, and between these strategic choices and performance in the so-called "structure-conduct-performance paradigm" (Bain, 1951). In this framework, performance is measured by a firm's business values such as profitability. The mobile data service industry, however, is an emerging market of network services where performance must be measured on perceived and anticipated customer values. Thus, integration between business model choices and perceived customer values is necessary in the mobile data services industry. It is beyond the scope of this paper to integrate and apply the vast literature on the performance effects of business model options to the mobile data services industry. However, it is well documented in this literature that the choice of specific business model options affects the intrinsic and extrinsic attributes of the product or service developed and produced (Nicholls-Nixon and Woo, 2003; Zahra and Nielsen, 2002; Sengupta, 1998; Stuart, 2000).

Service attributes emerge from two different sources. Intrinsic attributes refer to the inherent attributes of the service itself, whereas for network goods, extrinsic attributes emerge from the networks that provide and use the service. This involves an extension of the traditional typology of intrinsic and extrinsic sources of value suggested by Holbrook (1996), and underlines how network services are different from traditional products and services where extrinsic attributes often originate from complementary supplier services and consumer investments (Mathwick, Malhotra and Rigdon, 2001). The two types of attributes represent the sources of intrinsic and extrinsic value unique to network effects products as suggested by Lee and O'Connor: "*extrinsic value… is unique to network effects products… is the set of benefits derived from outside the product itself, such as the size of the installed base and the availability of compatible and complementary products…"* (Lee and O'Connor, 2003a, p. 244).

Many unique intrinsic attributes have been mentioned characterizing mobile services. One of the most obvious characteristics of mobile services is the lack of constraints related to time and space (Balasubramanian, Peterson, and Jarvenpaa, 2002). Watson, Pitt, Berthon, and Zinkhan (2002) suggest the "u-commerce" construct to describe services characterized by ubiquitous-, universal-, and unison access as well as uniqueness. Doyle (2001) suggests the following key characteristics of SMS: personal, real time delivery, unobtrusive, low price, simple, supports two way communication, can be forwarded, and location based potential. Thus, being personal seems to be an additional intrinsic attribute of mobile data services (Siau, Lim, and Shen, 2001). This corresponds well to the suggestions by Kannan, Mei Chand, and Whinston (2001). They argue that wireless devices are accessible, personal and location aware, and thus, that these attributes are unique to mobile services.

A problem with considering accessibility and "being personal" as unique attributes of mobile services is that these attributes are general and may be unrelated to the content of the mobile service. Even though the lack of constraints related to time and space of mobile services has been suggested as the basis for their usefulness (Pedersen and Nysveen, 2003), usefulness is mainly determined by the content of the service – its functionality. Often, the usefulness of mobile services depends on other users using the same service rather than the accessibility or personalization attributes of the service. This is particularly true for communication or person-interactive services, where extrinsic attributes are more important for creating customer value than the intrinsic attributes of the service. Still, for information or machine-interactive services, the usefulness of the service is an important intrinsic attribute (Pedersen and Nysveen, 2003). Another unique intrinsic attribute found important in six studies of mobile service adoption by Nysveen, Pedersen and Thorbjørnsen (2005) was enjoyment. Even for services with functionality

that was believed to be unrelated to enjoyment, such as a mobile payment services, enjoyment was found to be a relevant intrinsic attribute (Pedersen and Nysveen, 2003). This finding corresponds well to studies of mobile services in uses and gratification research suggesting that gratifications of "relaxation" (Leung and Wei, 2000) and "nutz-spaz" (Höflich and Rössler, 2001) are important to the adoption and use of mobile services. Intrinsic attributes of a service may also be described by technical specifications, for example related to speed and capacity. It is difficult to determine such attributes for services in general, and mobile services are no exception. Still, attributes such as network bandwidth, dial-up speed, coverage and signal strength have been suggested. For example, in a service quality framework for mobile services, Nordman and Liljander (2003) suggested dial-up that speed and configuration settings were important components of service quality.

A study by Leung and Wei (1998) revealed that pagers were viewed as a marker of status and social identity. Pagers were used to show fashion and status and to integrate with peer social networks. A study by Ling (2001) also showed that mobile phones were used to express fashion and for presentation of the self. Other results also indicate that mobile devices and services are used to express and confirm the users' identity (Pedersen and Nysveen, 2003).

These symbolic and expressive attributes of mobile services may be considered extrinsic attributes because they result from the service being used in a network context. However, the two most often mentioned extrinsic attributes of network services are direct and indirect network effects. Direct network effects are the effects related to increasing value of a service as the size of the network increases (Liebowitz and Margolis, 1999). Network effects are typical of all communication and person-interactive mobile services and have been the basis for understanding

value propositions and the choice of governance forms in telecommunication networks (Brosseau and Quelin, 1996). In their study of 125 value added services, Brosseau and Quelin (1996) found that telecommunication communication services and information services were controlled by applying systematically different governance forms. Person-interactive services that are not typically categorized as communication services (e.g. discussion-, contact- and self- support services) have a somewhat more complex set of direct network effects, but these effects are nonetheless related to network size. Thus, network size is an important extrinsic attribute of many mobile data services. For example, social coordination, suggested as one of the most important gratifications of SMS usage (Ling, Julsrud and Yttri, in press), may not be exercised without sufficient network size.

While direct network effects are important extrinsic attributes of communication services, indirect network effects are more often focused in information, transaction or machine-interactive services. Indirect network effects originate from direct network effects when the networked good or service is a platform for complementary services and products (Gupta, Jain and Sawhney, 1999). Mobile data services differ with respect to their potential as a platform for complementary services. For example for information and machine-interactive services like premium SMS, MMS content services, mobile Internet access or game services, the potentials for generating indirect network effects are great. From the concept of indirect network effects, a set of operational extrinsic service attributes, such as complementary service variety, speed of complementary service development and complementary service quality may be derived. Basu, Mazumdar and Rai (2003) also suggest that the assessment of intrinsic attributes of a product or service may interact with indirect network effects. For example, they showed that the utility of CD-changer capacity, an intrinsic attribute of CD-players, increased with increasing number of CD-titles. For

mobile data services, compatibility with a set of content standards may be a similar intrinsic attribute that increase in importance as the number of providers offering content services (e.g. games, information services) increases. As for direct network effects, considerable attention has been given to the importance of indirect network effects in consumers' assessment of service or product value. For example, researchers in economics, marketing and information systems have concluded that the availability of complementary goods affects the prices that can be obtained for networked goods (Gandal, Kende and Rob, 2000; Basu et al., 2003; Brynjolfsson and Kemerer, 1996).

Recently, end-users perception of network effects has been given considerable attention. Studies of innovation adoption take sensitivity to network effects into consideration and argue that network size is more important when the network is small than when it is large. This suggests that adoption likelihood is sensitive to critical mass and anticipation of future network size (Shapiro and Varian, 1999). For example, the use of pre-announcement and commitment announcements are examples of strategies used to convince end-users that future network size is expected to be large and that it will increase quickly (Lee and O'Connor, 2003a; Montaguti, Kuester and Robertson, 2002). Perceptions and anticipation of direct network effects have also recently achieved considerable attention in information systems, strategy and marketing literature (Gallaugher and Wang, 2002; Schilling, 2003; Frels, Shervani and Srivastava, 2003). Most of these studies have been conducted in professional end-user markets suggesting that direct network effects are taken into consideration in professional end-users' value assessment process. We are unable to identify similar research in traditional consumer markets. However, economic theory on network effects assumes that consumers are somehow able to make such assessments and includes network size elements in consumers' utility functions (e.g. Katz and Shapiro, 1992;

Foros, 2003). For indirect network effects, end-users' appreciation of complementary service variety and innovativeness may also vary across user segments. In professional business markets, such as business software or server operating systems markets, it is likely that complementary service variety is assessed and appreciated (Frels et al., 2003). For simple consumer network goods where the complementary goods are content goods delivered on a content distribution platform such as a video game platform, this is also very likely (Schilling, 2003). However, for complex or radically new network goods and services, like mobile data services, the assessment and valuation of indirect network effects are much more difficult. In this case, consumers will often also have to assess the value of future indirect network effects resulting from adopting the network goods platform. This is an even more difficult task requiring considerable experience and cognitive capacity.

From this selective and brief review of some of the recent research on business models, service attributes and service adoption in mobile services markets we suggest that the relationships between these elements may be explained through a model where options along specific business model dimensions are operational, relevant intrinsic and extrinsic service attributes are specified, and knowledge of end-users' perceptions of service attributes are moderated.

3 RESEARCH MODEL AND HYPOTHESES

Our proposed conceptual model follows the structure-conduct-performance (SCP) framework often applied in empirical industrial organization (Kadiyali, Sudhir and Rao, 2001). Structural determinants, however, have been focused elsewhere (Gressgård, Methlie and Stensaker, 2003) and the conduct-performance relationship is focused here. The conceptual model is illustrated in figure 3.1.

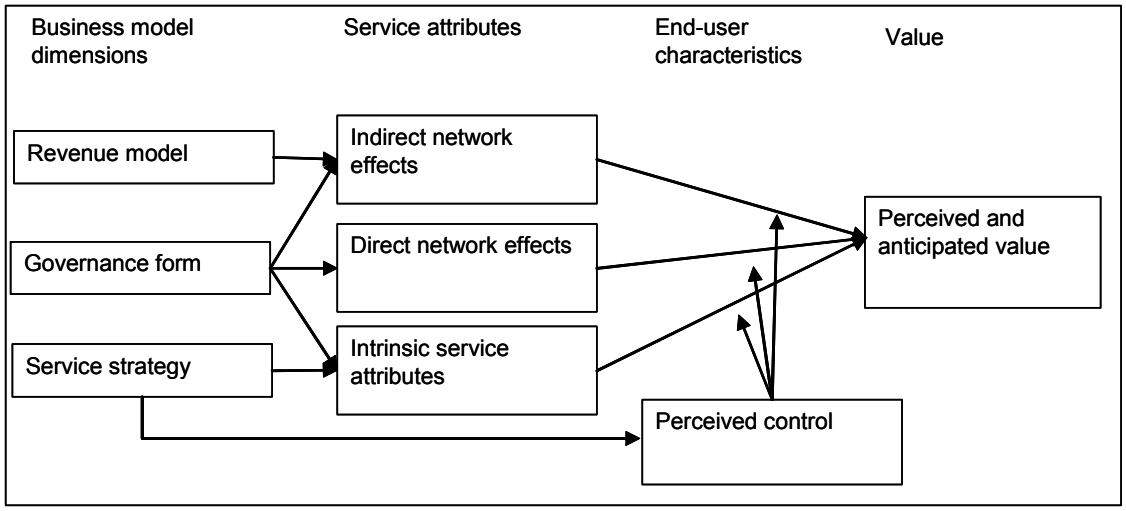

Figure 3.1. Conceptual model

In the conceptual model of figure 3.1, we propose that specific business model dimension options affect the intrinsic and extrinsic service attributes as well as end-user characteristics. Furthermore, we propose that the relationship between service attributes and perceived and anticipated value is moderated by end-user characteristics. While the literature cited in section 2 was general with respect to business model dimensions, service attributes and end-user value perceptions, a research model will have to be more operational for these concepts to be useful in hypothesis development.

The business model concept has been operationalized along three dimensions. For the financial arrangement dimension found in the business model ontology literature we focus on the *revenue model* including revenue valuation and sharing. Content based valuation means that end-users pay per unit of the service content delivered, whereas transport based valuation means that end-users pay for the amount of time online, packet charge or similar volume units. The revenue share element may have a complex option structure, but we simplify this to revenue shares favoring content rather than transport (Strand Consult, 2001). A content oriented revenue share involves a relatively larger proportion of revenue is redistributed to content providers, whereas a transport oriented revenue share involves a relatively larger proportion of revenue is redistributed or retained by network or transport providers. In almost all practical settings, the objects of revenue valuation and sharing are equivalent.

For the infrastructural arrangement dimension, we focus on *governance form* corresponding to governance form or mode as treated in new institutional economics and organization theory. Providers' options further correspond to the traditional categorization of governance forms as market, relational and hierarchy modes or forms (e.g. Ghosh and John, 1999). However, governance form is a complex element, and it may include several options. We have previously suggested that the relational form of governance includes so many options that it may be treated as a separate element in the infrastructure dimension of a providers business model (Pedersen, 2001). For example both network forms and alliance forms are relational forms, but there is little doubt that these forms may have quite distinct and different effects on service attributes and thus, performance.

The product innovation and customer relationship dimensions may be treated under the common term *service strategy* with two elements including service value proposition[2] and market focus elements corresponding to Porter's (1985) generic strategy elements. The options for the service value proposition element are service dependent and related to the specific gratifications sought by mobile data services. We have discussed some of these gratifications above but here we focus two important option issues. The first is to what degree the value proposition focuses the unique attributes of mobile services. Examples are accessibility that only may be obtained through the mobile device or personalization that is unique due to identification of the end-user. The second option issue is that of breadth in service attribute offerings. Examples are services that cover a large set of mobile service gratifications versus services that cover a focused set of gratification as part of their value proposition. Thus, we suggest the two options of mobile specificity (uniqueness) and proposition breadth (scope). For the market focus element we apply the focused versus undifferentiated options of Porter (1985).

In principle, all these options may be treated as continuous. For example, the choice of governance form is not a discrete choice between market, relational and hierarchy forms. Instead, the options vary with respect to the degree of hierarchical, relational and market oriented governance mechanisms are utilized. Thus, closed business models include governance mechanisms mainly of the hierarchical form whereas open models include governance mechanisms mainly of the relational and market forms. Similarly, revenue share options involve a choice of the revenue share redistributed to content providers rather than an absolute value above or below 50% indicating a content versus transport oriented model.

[2] The terms "positioning" and "positioning option" are often used in marketing strategy literature (e.g. Ghosh and John, 1999)

As suggested in section 2, mobile data services attributes are categorized as intrinsic reflecting inherent attributes of the service itself, or extrinsic reflecting attributes derived from direct and indirect network effects. For *indirect network effects* we suggest that the attributes of the complementary services network include complementary service variety, -quality and speed of development. For *direct network effects* we suggest that the attributes are related to end-user network size. While several *intrinsic attributes* were discussed in section 2, we suggest mobile specific ease of use, usefulness, compatibility[3], service quality and innovativeness. Intrinsic attributes may also be specific to the service category being investigated, and thus, other intrinsic service attributes may be focused for example for goal-oriented versus experiential service categories. For the moderating factor termed end-user characteristics in figure 3.1, we focus *perceived behavioral control*. The term is often used in information systems adoption literature (e.g. Taylor and Todd, 1995) to reflect the combination of end-users perceptions of their own resources (e.g. skills, experience, financial) and facilitation of the service provider.

The conceptual model is based on rationalistic assumptions suggesting that end-users adopt mobile data services because of high *perceived and anticipated value*. Value perceptions reflect the value assessments that are made from current intrinsic and extrinsic service attributes whereas anticipated value reflects expectations of further development of these attributes. In figure 3.1, intrinsic and extrinsic attributes are unrelated, but for many mobile services these attributes are related. For example, the usefulness of most communication services is strongly influenced by the size of the end-user network, but not all communication services share this interrelationship.

[3] Ease of use and compatibility may be included in the service quality concept if applying a framework similar to SERVQUAL for mobile services (Nordman and Liljander, 2003).

For example, the usefulness of mobile email in Japan may be strongly influenced by network size, but in Europe mobile email simply represents a new access point for an existing service. Thus, network size influences the usefulness of traditional email, but not necessarily the usefulness of a service giving mobile access to email. Also, because these relationships are service specific, the conceptual model in figure 3.1 assumed that intrinsic service attributes are unrelated. However, this assumption may be relaxed for service specific versions of the model.

From this discussion of the elements of each of the concepts in the general model illustrated in figure 3.1, a more operational research model is suggested. The research model is shown in figure 3.2.

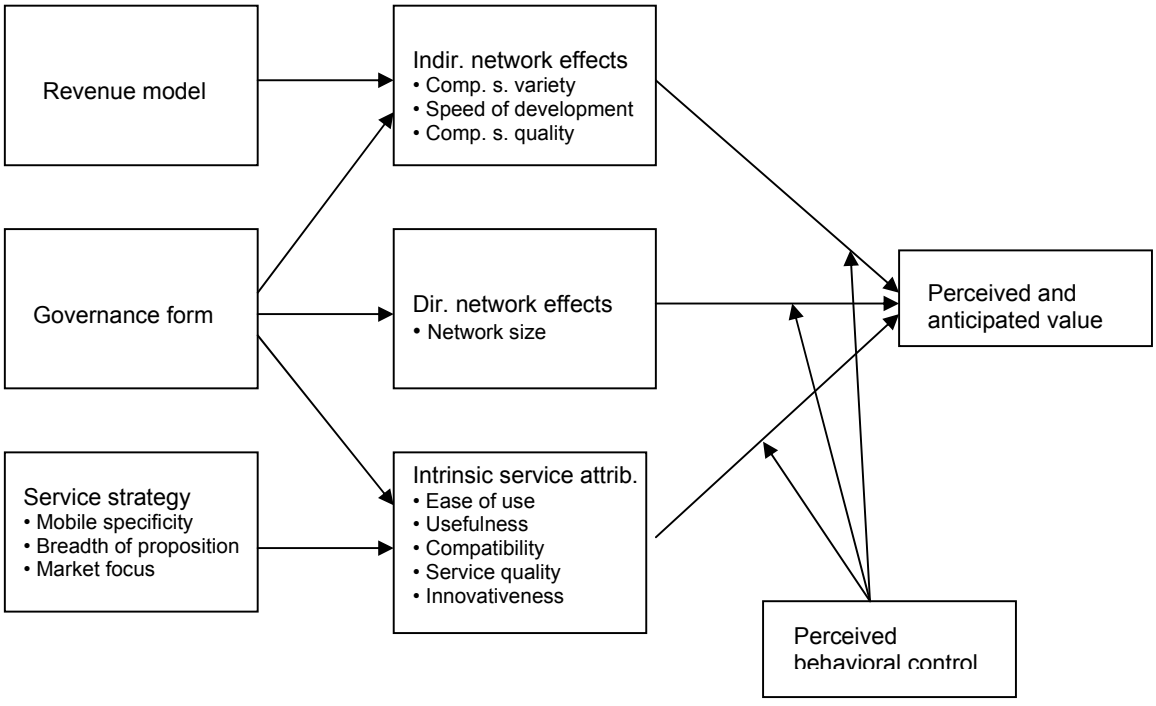

Figure 3.2. Research model

The relationships in the research model illustrate the main influences from the choice of business model options on service attributes and the main and moderated influences from these attributes on perceived and anticipated value. We suggest that the choice of revenue model primarily influences the complementary service attributes of mobile data services, in particular if the mobile data services offered represent service platforms such as SMS, MMS or WAP services. Governance form is expected to influence both extrinsic and intrinsic attributes. For example, hierarchical governance forms are likely to give service developers full control of the intrinsic attributes of a service and the attributes of its complementary services. Furthermore, if the firm applying this form is large, it may utilize its current user network to obtain speed of diffusion in new service domains. The choice of a particular service value proposition is the most influential factor determining the intrinsic attributes of a service, whereas the choice between a focused or an undifferentiated market strategy is likely to affect whether end-users have the necessary experience or skills to feel they have behavioral control of the mobile service being used.

The relationship between service attributes and end-user value includes two sets of influences. The first set is the main effects of service attributes on perceived and anticipated value. In the second set, we assume that these relationships are moderated by the perceived behavioral control of end-users. For example, one may propose that complementary service variety leads to high perceived value for all users, but one may also propose that this is only true for experienced end-users being able to utilize and choose among these services. Less experienced end-users may be confused by a great variety of complementary service offerings. Thus, the relationship of the research model provides the basis for developing hypotheses that may be tested empirically. In the next paragraphs, we elaborate on and develop further these hypotheses.

As can be seen from figure 3.2, two sets of hypotheses may be suggested: A) Hypotheses on the relationship between business model options and service attributes, and B) hypotheses on the relationship between service attributes and perceived and anticipated value. Above, we suggested the two most relevant financial dimension elements of the business model to be revenue share and valuation object. In almost all empirical settings, the objects of revenue valuation and sharing are equivalent. Thus, the same theoretical arguments may be given for both elements of the revenue model dimension. We suggest that revenue share models may be categorized according to their implicit appreciation of content versus transport. Because the value network for mobile data service involves complementary services, we assume that complementary service variety, quality and speed of development will be obtained by stimulating the providers of these services. Consequently, pricing and revenue sharing become parts of the innovation process of network and platform providers (Jonasson, 2001). There are many ways to design the revenue models that stimulate the providers of complementary services. For example, economists have discussed the use of different forms of subsidizing in two-sided markets to obtain profit in the base (e.g. platform) market and stimulate competition in the other (e.g. content provider) market (Armstrong, 2002). However, complementary service providers will be able to assess the degree of competition in the complementary service market making them reluctant to innovate if this strategy is used aggressively by the network or platform providers to obtain monopoly profits.

Another issue is that network or platform providers may use access costs as an instrument in regulating service providers' access to the network or platform (Rochet and Tirole, 2002; Foros, Kind and Sørgard, 2002). We assume that mobile data services markets have a two sided structure where platform or network providers recognize the need to stimulate innovation in complementary services and that revenue sharing in some form contributes to this. Thus, we

suggest that regardless of the use of subsidizing, access pricing or other strategy for regulating content or service providers access to the network or platform, complementary service providers will be stimulated better if platform providers' offer transparent and content oriented revenue models. For example, if a mobile operator uses a content based revenue object, the revenue sharing model will be based upon this revenue object and providers of complementary services will have a simple model that makes it easer for them to assess the potential revenue from accepting operators' business model and adopting their service provisioning platform. Thus, we propose:

A1a-c: Using content oriented revenue models increases complementary service variety, quality and speed of development

The element of the infrastructure dimension that we have focused is governance form. We suggested categorizing the governance form in market, relational and hierarchy forms. We also suggested that the hierarchy versus relational and market forms represent a continuum rather than a discrete categorization of governance forms. Still, we maintain the original option categorization here and propose:

A2a-b: Using relational and market governance forms increases complementary service variety and speed of development

The arguments behind this hypothesis were discussed in section 2 and in previous paragraphs of this section. In particular, literature on governance forms in network markets as well as resource based theory suggest that complementary service variety and diversity is better obtained using

open forms of collaboration (e.g. Schilling, 2003). Zahra and Nielsen (2002) found that relational forms increased development speed. In addition, when involvement and formal coordination were included as moderators, market forms of governance also increased development speed. Service quality on the other hand, may come out of the service integrator's control, or service quality may not be related to perceived quality elements when governance is left to market or relational forms (Dyer and Singh, 1998; Ghosh and John, 1999, p. 137). Thus, we propose:

A2c: Using hierarchical governance forms increases complementary service quality

Governance form is also expected to influence direct network effects. For example, Frels et al. (2003) found that professional consumers in business markets where able to assess direct network effects through the strength of the user network of operating systems. Gallaugher and Wang (2002) suggested mindshare was an important proxy used by professional consumers to assess future direct and indirect network effects. We suggest that firm size is a moderating variable in the relationship between governance form and direct network effects in that size is required to make the hierarchical governance forms trigger direct network effects in the form of end-user network size and speed of development of complementary services. Thus, we propose:

A3a: For larger firms hierarchical governance forms increase end-user network size

Finally, governance form is expected to influence intrinsic attributes of the individual service offered through a provider's business model. From the product innovation literature cited in section 2 we also suggest that innovativeness is promoted both in the complements and platform markets through the use of relational and market governance forms. Also, a study by Srinvasan,

Lillien and Rangaswarny (2002) found that a hierarchy culture was negative related to technological opportunism whereas an adhocracy culture was positively related to technological opportunism[4]. Because these culture forms were derived from governance forms, the findings support the following hypothesis:

A4a-b: Using relational and market forms of governance enable providers to offer more innovative, useful services than if using a hierarchical governance form

On the other hand, relying on relational and market forms of governance may make platform providers and individual service providers lose control of the production and distribution process of their service. Furthermore, compatibility and intrinsic quality may not be obtained by relying on standards that may be interpreted differently by different providers collaborating using relational and market forms of governance. For example, Sahay and Riley (2003) found that vertical integration lead to increased focus on customer interface standards, but they found no support for their hypothesis that vertical integration lead to less focus on compatibility standards. Thus, relying on transaction cost theory, we suggest:

A5a-c: Using hierarchical governance form increases the ease of use, compatibility and intrinsic quality of services

In section 3, we suggested two elements of relevance to value proposition; service value proposition and market focus. For the service value proposition element we suggested the issue of

[4] For opposite arguments, see the discussion on new product development in integrated firms and responsiveness (e.g. Richardson, 1996) and the "incumbent's curse" discussion (Chandy and Tellis, 2000)

mobile specificity (uniqueness) and breadth (scope) of offerings to be important. We suggest that the potential for creating higher value among end-users is greater when the service offerings are mobile specific. This means that the services are designed to meet the unique gratifications expected from mobile services. Thus, we propose that this will be reflected in the potential ease of use, usefulness and quality of the service. Thus, we propose:

A6a-c: Mobile-specific value propositions increase ease of use, usefulness and intrinsic service quality

Mobile specificity may require focusing the service offering, but research shows that a variety of gratifications is expected from mobile data services (Leung and Wei, 2000; Nysveen, Pedersen and Thorbjørnsen, 2005). However, trying to fulfill a variety of gratifications may result in more complex services with less mobile specific usefulness and service quality. Thus, we suggest:

A7b-c: Value propositions with greater breadth reduce service quality, ease of use and usefulness

For market focus, we suggested applying the traditional categorization of focused versus undifferentiated market strategies from Porter (1985). In general, a focused strategy makes it easier for the provider to adapt their services to the requirements and qualifications of end-users. We suggest that successful adaptation is reflected in the perceived behavioral control of end-users. Perceived control is assumed to be influenced by experience, resources and end-users' self-efficacy. In general, we suggest that due to a better adaptation of services to experience, resources and skills:

A8a: Using focused market strategies increases perceived behavioral control.

All hypotheses on the relationship between business model dimensions and service attributes have been formulated as direct relationships. However, it is likely that these relationships are moderated by service categories as well. For example, Brousseau and Quelin (1996) suggest that "*the success of an information-intensive service is based on its intrinsic quality… there are no network externalities … therefore, when possible, a single firm should seek to become a core firm*" (Brousseau and Quelin, 1996, p. 1223). Consequently, Brousseau and Quelin (1996) suggest a hierarchical governance form will be best suited for obtaining intrinsic quality of services that are not characterized by network effects. However, we have decided not to propose specific hypotheses on how relationships between business model dimensions and service attributes are moderated by service category, and suggest moderated relationships are investigated as exploratory research questions.

The next set of relationships in the research model illustrated in figure 3.2 is the set of relationships between service attributes and perceived and anticipated value of end-users. We first suggest a set of hypotheses on these direct relationships. Next, we suggest how perceived behavioral control is likely to moderate these relationships. While research in economics indirectly assumes network effects are perceived and anticipated, behavioral research in marketing and strategy is not so conclusive on this matter. While several studies have shown that the availability of complementary goods increases the perceived value of the platform good (e.g. Basu, Mazumdar and Raj, 2003), Cottrell and Kaput (1998) also showed that the variety of complementary goods increases platform value. However, research also suggests that consumers appreciate variety and quality differently, and that there may be differences in the appreciation of

variety versus quality across services. For example, Bohlman, Goldman and Mitra (2002) investigated the survival of pioneers and found that pioneers did better in product categories where variety was important and worse in categories where product quality was important. Still, for the complementary service attributes variety, quality and speed of development, we generally suggest:

B1a-c: Complementary service variety, quality and speed of development increase perceived value

and

B1d: Complementary service speed of development increases anticipated value

Direct network effects attributes are service dependent, complicating the assessment of the end-user value of these attributes. However, we assume a minimum degree of direct network effects and focus on attributes reflecting direct network effects that are not specific to any particular mobile data service category. In general, the rate of which a networked service is adopted by users is expected to increase end-user value because critical mass will be reached earlier. Also, when anticipating future value, end-users process information under the assumptions of bounded rationality. Using heuristic judgment, it is likely that current network size is used as a proxy for future network size (Tversky and Kahneman, 1974). Thus, we suggest:

B2a-b: Increasing network size increase perceived and anticipated value

Our proposed relationships between intrinsic attributes and perceived value are based on specificity and variety in gratifications sought by end-users of mobile data services. We argue that gratifications obtained should be mobile specific. In addition, because end-users seek a variety of gratifications from mobile services, richness in service attributes is also appreciated. Thus, we suggest the following hypotheses:

B3a-d: Mobile-specific usefulness, ease of use, compatibility and intrinsic service quality increase perceived value

While it may be argued that there are direct effects of service attributes on perceived and anticipated value of mobile data services, it is even more likely that this relationship is moderated by the perceived behavioral control of end-users. For example, resources in the form of both monetary resources and skills make it more likely that end-users having these resources have explored and tested a variety of data services, and that they are better qualified in making assessments of value based upon such trials. For example, Herpen and Pieters (2002) found that both preference awareness (negatively) and expertise (positively) moderated the relationship between assortment variety and preference. Thus, we suggest three hypotheses where perceived behavioral control positively moderates the relationship between service attributes and perceived value.

B4a-c: Perceived behavioral control positively moderates the effect of complementary service variety, speed of development and speed of diffusion on perceived value

The other hypotheses on moderating effects assume that the relationship between service attributes and value is moderated negatively by perceived behavioral control. For example, users with little experience in using mobile data services are expected to appreciate ease of use more than experienced users. The moderated influence of network size, on the other hand, is difficult to decide. Users with considerable perceived behavioral control are likely to be sensitive to network size, but these users may use other measures of current and future network size than currently observed size. Thus, we suggest five hypotheses on the moderated relationship between service attributes and value:

B5a-e: Perceived behavioral control negatively moderates the effect of complementary service quality, network size, ease of use, compatibility, and intrinsic service quality on perceived value

While all direct and moderated hypotheses suggested here were assumed to be general to all services, research indicates that services are different in the importance of extrinsic versus intrinsic attributes to perceived value (Frels et al., 2003). For example, it is likely that the perceived value of services that offer or depend on communication between members of a network will be more influenced by attributes related to direct network effects. Thus, the value of services like person to person MMS is expected to be more heavily influenced by network size than services like MMS content services or mobile payment services. Thus, we propose:

B6a-b: Network size influences perceived and anticipated value more for services characterized by direct network effect attributes than for services characterized by indirect or intrinsic service attributes.

Furthermore, research has also shown that customers value products that offer a large number of or variety of complementary products or services than products that offer a limited set of complementary products or services. For instance, Cottrell and Koput (1998) found that prices were higher for hardware complemented by greater software variety. Cottrell and Koput (1998) suggested that software variety was a signal of hardware quality and that customers perceive this quality difference. The reversed causal relationship was found by Gallauger and Wang (2002) showing that higher prices could be obtained for complements when the platform product reached a larger market share early. However, many products differ in being considered platform goods in the same way as hardware may be considered a platform good for software. Thus, we propose that the importance of indirect network effect attributes is greater for services that may be considered platform services. For example, MMS may be considered as a platform for offering person to person services, but also as a platform for offering a variety of MMS content services. For MMS as a person to person communication services, complementary services are considered to be off less importance to perceived value than they are for MMS as a content service. Thus, we propose:

B6c-e: Complementary service quality, variety and speed of development influence perceived value more for services characterized by indirect network effect attributes than for services characterized by direct or intrinsic service attributes.

While many products and services are characterized by direct and indirect network effect attributes, traditional services still exist. Also for mobile services, some services are better characterized by their intrinsic attributes, and direct and indirect network effect attributes are just less relevant. Thus, they are of less relevance to perceived value as well. For example, a mobile

payment service that only offers one single function, such as charging the cash card of the mobile phone, is mainly adopted for this functionality alone and the intrinsic attributes related to this functionality are the most important attributes contributing to perceived value. Thus, we propose:

B6f-j: Usefulness, ease of use, compatibility, innovativeness and intrinsic service quality influence perceived value more for services characterized by their intrinsic attributes than for services characterized by direct or indirect network effect attributes.

To investigate the last three hypotheses a comparison must be made between what influences perceived and anticipated value for different mobile services. These different services may be categorized according to their possibility for creating direct and indirect network effects. If this categorization can not be done independent of investigating whether these effects lead to perceived value, the hypotheses (B6) become tautological. Thus, empirical investigation of these hypotheses must be conducted for services where providers or other experts can categorize the services according to the potential for creating direct and indirect network effects. Consequently, provider categorization of services provides an important basis for testing the hypotheses B6a-j.

4 METHOD

In section 3, hypotheses have been suggested that relate to both sides of a two-sided market. Thus, a study investigating both sides is required. Furthermore, hypotheses are formulated independent of service category, whereas services vary widely with respect to how intrinsic and extrinsic attributes contribute to perceived and anticipated value. Thus, a multi service category study is required. A *research design* including six services using subjects on both sides of the two-sided market was developed. The research design of this study is presented in table 4.1 showing the six different services representing differences in the importance of intrinsic versus extrinsic attributes and the samples used in each survey.

Table 4.1. Two-sided, multi service research design

	Supply side survey	Demand side survey
Person to person MMS	N=8, Source: Operator MMS roaming professionals	N=280, Source: Students
SMS chat service	N=8, Source: Chat service provider professionals	N=187, Source: TV2 chatters
MMS content service	N=11, Source: MMS content service provider professionals	N=291, Source: MMS content websites
POS payment service	N=7, Source: Payment service provider professionals	N=140, Source: Payment service users
Java games	N=12, Source: Mobile gaming service provider professionals	N=130, Source : Java game websites
Cash card charging service	N=8, Source: Charging service provider professionals	N=221, Source: Cash card charging service users
Sum	N=54	N=1249

The services listed in table 4.1 were chosen due to presumed differences in intrinsic and extrinsic attributes. The value of person to person MMS and SMS chat services were presumed to be influenced by direct network effects related to network size, whereas the value of MMS content services and POS payment services were presumed to be influenced by indirect network effects related to service complementarity. Finally, the value of individual Java games and cash card charging services were presumed to be influenced mainly by intrinsic service attributes such as ease of use, usefulness and service quality. Manipulation checks showed that these presumptions were shared by service provider professionals, but that end-users not consistently shared the same perceptions of the service attribute differences.

As seen from table 4.1, subjects were recruited from a variety of sources. Thus, there are differences in sample characteristics across studies. Also, due to a combination of recruitment methods, comparable response rates may not be reported.

Supply side respondents for the person to person MMS study were recruited among the professionals responsible for roaming agreements of the two operators Telenor and Netcom. These subjects were believed to have extensive knowledge of which attributes are relevant when signing roaming agreements with national and foreign operators. Demand side respondents were recruited among students at the Norwegian School of Economics and Business Administration. Paper based survey instruments were handed out in a marketing research class and participation was voluntary. For SMS chat services, supply side respondents were recruited among content service providers offering chat services. All respondents were professionals working with providing chat services. For the demand side study, respondents were recruited by posting an

announcement requesting chatters on TV2's text-TV chat service to participate in the survey. Willingness to participate was indicated by subjects sending an SMS with their name and mail address to a dedicated short code phone number. Paper based survey instruments were then mailed to 324 registered addresses. The number of returned instrument forms was 187, representing a response rate of 58%.

Supply side respondents for MMS content services were recruited among MMS content service provider professionals. Examples of providers represented are Eurobate, Inpoc and Telitas. Demand side respondents were recruited through advertisements at the MMS content websites of Eurobate, TV2 (Micromania) and Inpoc. A total of 1107 potential respondents clicked on the advertisements. Of these, 291 completed the survey, representing a response rate of 26%. For the POS payment service, almost all professionals responsible for POS services at the provider of the payment service, Telenor MobilHandel, participated in the survey. For the demand side survey, respondents were recruited from an SMS-based account balance service at Telenor. Subjects having experience with the payment service could show an interest in participating in the survey by sending an SMS with email or mail address to a dedicated SMS short code number. From these responses, 132 emails and 280 regular mails were sent out. From these, 140 acceptable responses were received, representing a response rate of 34%.

For the Java game survey, supply side respondents were recruited among content provider professionals responsible for offering downloadable Java games. The demand side respondents in this survey were recruited from the Java game websites of Eurobate, TV2 (Micromania) and Inpoc. Advertisements similar to those used for MMS content services were used, and a total of 843 clicked on these advertisements, indicating their interest in taking the survey. Of these, a

total of 130 complete responses were received, representing a response rate of 15.5%. For the final cash card charging service, almost all professionals in the department of Telenor responsible for this service, participated in the survey. Demand side respondents were recruited in the same way as for the POS payment service the week after this survey was finished. A total of 158 emails and 272 regular mails were sent out. From these requests, 221 responses were received, representing a response rate of 51%.

Among the supply side respondents, 24.5% were female and 75.5% were male, 50% of the respondents were in the 30-39 age category and 39% were in the 40-49 year old category. When it comes to education 98.1 of the subjects had a university degree. The demographic characteristics of the demand side respondents are shown in table 4.2.

Table 4.2. Demographic characteristics

	Gender		Age (years)		Education	
Person to person MMS (N=280)	Female	37.1	13-19	29.7	Secondary	58.5
	Male	62.9	20-29	65.2	University L	38.2
			30-39	5.1	University H	3.3
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		
Cash card 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		

Because the respondents of the MMS person to person survey were recruited among students, these subjects showed little variance in age and education. Also, a relatively large proportion of

the subjects were male. For all other studies except the Java game study, a larger proportion of the subjects were female. For all studies except the MMS person-to person study, the age distribution was close to what may be termed the "Internet-population" in Norway. This means a higher proportion of younger subjects and a lower proportion of older subjects than the general population of Norwegians were recruited. For education, the distribution was closer to the general population, but for the Java games and MMS content studies, the number of subjects with a lower education was even higher than that found in the general population. This is mainly due to the high number of younger subjects in these studies. Except for the MMS person to person study, the demographics of each sample show that they reflect the population of users using the corresponding services. For the MMS person to person study, a somewhat larger proportion of younger subjects with a lower level education could have been preferred if the sample should properly reflect the population of MMS person to person users. However, the deviation from what was preferred is not very large and by controlling for age and education differences in this study, results should not be threatened by lack of internal validity due to sample bias. Thus, the samples reflect the purpose of the study which is to generalize results from the samples to the populations of service users, rather than generalizing results across user groups or to the general population.

The model shown in figure 3.2 should be understood as a research model. Thus, measures were not designed with a one-to one correspondence with measures reflecting items of latent constructs shown in the conceptual model of figure 3.1. Instead, most independent latent constructs, dependent latent constructs and moderating constructs were designed with corresponding measurement items, but mediating latent constructs reflecting extrinsic and intrinsic service attributes were designed with a component structure. In addition, three latent constructs reflecting

manipulation checks of perceived direct network effects, indirect network effects and intrinsic attributes were designed with corresponding measurement items. We present the manipulation check measurements first. Next, latent dependent constructs, the moderating construct of perceived behavioral control, and the component structure of the mediating latent constructs are presented. Finally, the independent latent construct variables are presented.

To measure how providers and consumers characterize a service, we focused two extrinsic attributes – indirect network effect attributes and direct network effect attributes as well as intrinsic attributes. The extent to which respondents perceive *direct network effect* attributes as characteristic of a service was measured with two items collected from the measure of direct network effects used by Sahay and Riley (2003). The items reflect perceptions of value as a function of network size. In the Sahay and Riley (2003) study, similar items were shown to have acceptable reliability and validity. For *indirect network effect* attributes, items were adapted from the same study by Sahay and Riley (2003). The items reflect perceptions of value as a function of the amount of complementary services available with the assessed service. Again, similar items were shown by Sahay and Riley (2003 to be reliable and valid. Several authors separate product attributes into extrinsic or "extrabrand" (Boyd and Mason, 1999) and intrinsic or experiential attributes (Mathwick, Malhotra and Rigdon, 2001). Rather than using the components of such *intrinsic attributes* (playfulness, service quality, ease of use etc.), the last manipulation check variable was designed to tap the perceived attributes of the "service itself" when contrasted with attributes related to direct and indirect network effects respectively. Thus, two items were designed to reflect these perceptions of the weight of attributes of the "service itself" relative to the weight of direct and indirect network effect attributes in creating service value.

Consumers' or customers' *perceived value* of a service or product has been investigated applying concepts such as perceived customer value (Chen and Dubinsky, 2003), consumer perceived value (Sweeney and Soutar, 2001), service value (Bolton and Drew, 1991), experiential value (Mathwick, Malhotra and Rigdon, 2001), perceived acquisition value (Grewal, Monroe and Krishnan, 1998) and perceived value of a service (Petrick, 2002), just to mention some examples. Our measures of perceived value and anticipated 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. *Anticipated value* was designed from the same three items, but rather than referring to current value, the three items referred to anticipations of future value, that is value as it was anticipated in 6 months. The time slot of six months was used because it is the time slot used in studies of behavioral intention in information systems research and marketing (e.g. Venkatesh et al., 2003, Battacherjee, 2000. Nysveen, Pedersen and Thorbjørnsen, 2005)

In general, perceived *behavioral control* is composed of elements of individual constraints that are related to the individual user's economy, experience, and skill in using a service. Our measure of behavioral control was almost identical to the measure applied by Battacherjee (2000) and Taylor and Todd (1995). The same items have also been applied in previous studies of mobile services showing acceptable reliability and validity (Nysveen, Pedersen and Thorbjørnsen, 2005).

Service quality has been extensively studied in marketing research and information systems research (Zetihaml, 1988; Zeithaml, Parasuraman and Malhotra, 2002). Recently, service quality of mobile services has also been given some attention (Nordman and Liljander, 2003). The main problem with these approaches is that they include complex, formative items of service quality. Such measures limit the possibilities for structural analysis and require large measurement instruments. Thus, the development of a reflective measure was prioritized in this study. A measure very similar to the reflective measure of Cronin, Brady and Hult (2000) was developed for both intrinsic service quality and *complementary service quality*. The items were designed as three bipolar adjectives covering reflective dimensions of service quality. Cronin, Brady and Hult (2000) also compared this reflective measure with a ten-item formative measure of service quality based upon Parasuraman, Zeithaml and Berry (1985) but the reflective measure was found to be both reliable and valid and thus, more parsimonious than the formative measure.

Several authors have measured variety-dimensions of complementary services, such as the current size of the complements network (Frels et al., 2003), the availability of complementary services or goods (Schilling, 2003) or the integration of complementary products (Nambisan, 2002). Both complements network size and availability are closely related to the variety of complementary goods studied in the network effects literature (Cottrell and Koput, 1998, Gallaugher and Wang, 2002). Our measure of *complementary service variety* was adapted from the measure of the size of the complements 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 a "variety of services" partly adapted from Shankar and Bayus (2003).

Authors have also focused the increase in available complementary services and products as a function of an increase in the sales of the platform product (Sahay and Riley, 2003), and the expectations of increasing availability of complementary services or products (Frels et al., 2003). We consider these elements as a third dimension of indirect network effects (in addition to complementary service quality and variety) related to the *speed of development in complementary services*. Reframing one of the items used by Sahay and Riley (2003) and adding and adapting two items related to the current and future expectations of the increase in availability of complementary services from Frels et al. (2003), we designed a reflective measure of speed of development in complementary services.

Shankar and Bayus (2003) suggest that direct network effects are a function of *network size* defined as the installed base and *network strength*, which is defined as the marginal impact of a unit increase in network size on demand. They suggest these two components are necessary to capture the direct network effects concept because network strength can partially compensate for network size in creating direct network effects. Network size in the form of installed base has been measured by several authors as market share, but also more perceived elements have been included, such as the "mindshare" concept used by Gallaugher and Wang (2002). Our measure of 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). Network strength was measured by using two items reflecting different components of strength. The first component was based upon the idea that well developed norms in a network make the network stronger than

without such norms. Thus, a norm item was included. The second item was designed from Shankar and Bayus' (2003) idea that members of strong networks have more in common than members of weak networks. Unfortunately, these items did not seem to represent a consistent construct and the variable network strength was excluded from further analysis.

Both usefulness and ease of use are well known constructs in the technology acceptance literature. Both constructs have been applied in numerous studies and their validity is well proven (Venkatesh et al., 2003). *Usefulness* was measured using three items covering the original dimensions of time saving, improvement and usefulness suggested by Davis (1989). *Ease of use* was measured using four items developed from adapting the original items of Davis et al. (1989) to our setting. Similar operations are found also in Taylor and Todd (1995) and in Battacherjee (2000).

Compatibility is one of the intrinsic attributes suggested by Rogers (1995). It has also been defined in information systems research as "*the degree to which an innovation is perceived as being consistent with existing values, needs, and past experiences of potential adopters*" (Chin and Gopal, 1995). It has been applied in numerous of technology adoption (Moore and Benbasat, 1991; Chin and Gopal, 1995). Our measure 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.

As discussed above, a reflective measure of service quality was preferred for *intrinsic service quality* as well as for complementary service quality. Thus, the same form of item including three bipolar adjectives of service quality was used for intrinsic service quality as well. Similar measures have been applied by Cronin, Brady and Hult (2000) with good results.

Innovativeness is used of both providers (Deshpande, Farley and Webster, 1993), end-users (Goldsmith, 2001), and products and services (Garcia and Calantone, 2002). Garcia and Calantone (2002) mentioned the three components newness to the industry, newness to the firm and newness to the customer, whereas Lee and O'Connor (2003b) suggested product newness to the firm, market newness to the firm, product superiority to the customer, and adoption difficulty for the customer as relevant components. A reflective measure can not be designed from such formative components. We were mainly interested in newness to the customer in this study and intended to design a reflective measure that discriminates from ease of use (adoption difficulty inverse) and superiority. Thus, innovativeness was seen as an intrinsic attribute of a service as perceived by the customer. The measure was designed with three reflective components collected from the product innovativeness literature (innovativeness (Garcia and Calantone, 2002), radicalness (Srinvasan. Lilien and Rangaswamy, 2004) and newness (Olson, Walker and Reukert, 1995), and was presented to the subjects through bipolar adjectives.

The term *revenue model* has primarily its basis in the e-commerce literature as part of the broader concept of a business model (Timmers, 1998; Amit and Zott, 2001, Rayport and Jaworski, 2001, Weill and Vitale, 2001). The literature on revenue models in particular is descriptive and definitional, almost ontological (Campanovo and Pigneur, 2003). A typical definition is by revenue sources: advertising; product, service, or information sales; transaction; and subscription

(Rayport and Jaworski, 2001). Thus, two items were created focusing content versus transport related revenue sources using revenue and price as the reflective terms in the items. In addition, we also have to look at how revenues are shared among partners, in particular between those who produce the services (the content providers) and those who mediate the services (telecom operators) (Bouwman, 2003). Thus, a final item was designed focusing content versus transport based revenue sharing. Even though this is one of the first attempts at defining a scale for measuring content oriented revenue models, the scale showed acceptable distribution and measurement quality.

The term *governance form* has been defined broadly as a "mode of organizing transactions" (Williamson, 1981) and was operationalized in transaction cost economics by Williamson (1985). A growing literature has been addressing governance forms in interfirm relationships (Ghosh and John 1999, Heide, 1994). Heide (1994) suggests governance forms are second order forms that must be identified through underlying mechanisms and processes. He applies a process view focusing on relationship initiation, maintenance and termination. Thus, two items in our governance form scale were adapted from his relationship maintenance dimensions, that of hierarchical versus relational or market oriented elements in role specification and in monitoring or control procedures. The final item was an adaptation of one of the most widely applied items of the relationalism scale developed by Boyle et al. (1992).

Nysveen, Pedersen and Thorbjørnsen (2005) suggest three characteristics can be used to develop *mobile-specific value propositions*. These are lack of accessibility constraints related to time and space (Balasubramanian, Peterson, and Jarvenpaa 2002), personalization of artefacts, applications and services (Watson et al., 2002) and ease and convenience of information dissemination (Siau,

Lim and Shen, 2001). These characteristics may be used to develop formative scales measuring mobile specificity in the same way as has been attempted for mobile-specific service quality (Nordman and Liljander, 2003). However, we choose to design a reflective scale designed around these characteristics including components like "unique characteristics of mobile services", "can only be successful if deployed as a mobile service", and "the service is unique because it uses the mobile as its platform". The items proved to form a simple scale of mobile specificity with good distribution and measurement qualities.

The concept *breadth of the value proposition* is related to Porter's first dimensions of competitive strategy (1985), but it has also been applied in strategic management studies as a separate concept related to the variety of product or service offerings and to the richness of product offerings (Nayyar, 1993). To cover these dimensions of the construct, we applied one of the differentiation items by Nayyar (1993) and designed an additional item adapted from this item with a slight variation in wording. Furthermore, one of the items measuring breadth of the product range (item 24) (Nayyar, 1993) was used, and again, an additional item with slight variation in the wording was designed as a fourth indicator.

The *market focus* concept is based on Porter's second dimension of competitive strategy – broad (industry wide, unsegmented) versus narrow (focused, segmented) market strategy (Porter, 1985). As the first item we used a generic item tapping this dimension that has been used by several other authors with good results (e.g. Slater and Narver, 1994). In addition, items no 17 and 18 from Nayyar (1993) designed to measure segmented or focused market strategy were adapted to our setting and used as two additional reflective items. Finally, a reversed item covering broad market strategy was adapted from Slater and Olson (2000).

Sample copies of the questionnaires used in the supply and demand side studies respectively are shown in appendix A (Norwegian only). The different variable categories, the individual variables and their corresponding reliability coefficient, Cronbach's α are shown in table 4.3 for aggregate data from both supply and demand side studies.

As seen from table 4.3, all reliability coefficients are above the critical value of 0.6 used for exploratory research except for network strength and compatibility (Hair et al., 1998, p. 118). However, the variable network strength has been excluded from further analysis. We choose to accept the current operation of compatibility, but special attention should be given to this variable when analyzing validity. We see that the low reliability values are found in the particularly explorative study conducted among service provider professionals whereas the values are much more satisfactory for the larger scale demand side studies.

Table 4.3 Variable categories, variables and the reliability coefficient α

Category	Variable	α Demand	α Supply.
Manipulation check variables	Direct network effects	0.83	0.81
	Indirect network effects	0.92	0.91
	Intrinsic attributes	0.71	0.74
Dependent variables	Perceived value	0.91	0.76
	Anticipated value	0.93	0.82
Moderating variable	Behavioral control	0.87	0.79
Mediating variables (independent in demand side surveys)	Ease of use	0.90	0.86
	Usefulness	0.90	0.84
	Compatibility	0.70	0.57
	Service quality	0.91	0.85
	Innovativeness	0.86	0.89
	Network size	0.76	0.75
	Network strength (excluded)	0.70	0.11
	Comp. service variety	0.88	0.82
	Speed of development	0.76	0.86
	Comp. service quality	0.91	0.94
Independent variables	Revenue model	n/a	0.68
	Governance form	n/a	0.61
	Mobile specificity	n/a	0.85
	Breadth of value proposition	n/a	0.84
	Market focus	n/a	0.75

In the supply side studies, the number of subjects is somewhat low for conducting regular analyses of measurement items. However, when conducting separate analyses of the structure of manipulation check variables, independent variables and mediating and dependent variables, the coefficient of items to respondents is acceptable. Exploratory factor analysis of the independent

variables extracted three factors with an eigenvalue above 1. This is as expected, and the results of the analysis are shown in table 4.4.

Table 4.4. Factor analysis, manipulation check variables, supply side study

	Components		
	1	2	3
Direct network effects 1	0.09	0.89	-0.18
Direct network effects 2	0.13	0.90	-0.12
Indirect network effects 1	0.95	0.15	-0.02
Indirect network effects 2	0.95	0.07	-0.03
Intrinsic attributes 1	-0.08	-0.24	0.84
Intrinsic attributes 2	0.02	-0.06	0.91

Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization. Values above 0.4 are marked grey. Eigenvalues (% of variance): 2.43 (40.5), 1.61 (26.9) and 1.05 (17.4).

As seen in table 4.4, the pattern of factor loadings corresponds very well with what was expected. Exploratory factor analysis of the independent variables extracted six factors with eigenvalue above 1. When restricting the number of factors to the hypothesized number - five, the results are consistent with the hypothesized structure of items. The results are shown in table 4.5

Table 4.5. Factor analysis, independent variables, supply side study

	Component				
	1	2	3	4	5
Revenue model 1	,048	-,123	-,118	,766	,022
Revenue model 2	-,142	-,106	-,034	,810	-,030
Revenue model 3	-,079	,168	,101	,637	-,063
Governance form 1	,143	-,161	-,116	-,328	,671
Governance form 2	,062	-,307	-,091	-,043	,738
Governance form 3	-,216	,092	,018	,185	,743
Mobile specificity 1	,126	,836	,149	,077	-,024
Mobile specificity 2	,218	,779	,051	,055	-,261
Mobile specificity 3	,089	,889	,018	-,217	-,082
Breadth 1	,700	-,371	-,035	-,335	-,047
Breadth 2	,882	,192	-,029	-,054	-,107
Breadth 3	,881	,197	,050	-,067	,159
Breadth 4	,806	,183	-,035	,064	-,048
Market focus 1	-,045	,097	,579	-,331	,002
Market focus 2	-,143	,138	,875	,154	-,160
Market focus 3	,072	,257	,831	,006	-,153
Market focus 5	,081	-,365	,674	,034	,133

Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization. Values above 0.4 are marked grey. Eigenvalues (% of variance): 3.61 (21.2), 2.99 (17.6), 2.12 (12.5), 1.73 (10.2) and 1.36 (8.0).

Exploratory factor analysis of the mediating variables extracted nine factors with eigenvalue above 1. This corresponds exactly with the hypothesized concept structure. The results are shown in table 4.6

Table 4.6. Factor analysis, mediating variables, supply side study

	Component								
	1	2	3	4	5	6	7	8	9
Ease of use 1	,281	,765	-,033	-,014	,226	-,137	,255	,050	,044
Ease of use 2	,086	,628	,363	,092	-,028	,160	,315	-,170	,160
Ease of use 3	,055	,861	-,137	,007	,083	,147	,208	,190	,074
Ease of use 4	,053	,900	-,100	,014	,215	,070	,035	-,002	,107
Usefulness 1	,178	,148	,016	,354	,756	,194	,137	-,018	,084
Usefulness 2	,122	,144	-,128	,066	,753	,118	,264	,243	,094
Usefulness 3	-,011	,157	-,132	,049	,793	-,032	,217	,026	-,127
Compatibility 2	,099	,113	,059	-,096	-,164	,096	,125	-,041	,841
Compatibility 3	-,060	,230	,024	-,041	,448	-,104	,056	,164	,680
Service quality 1	,268	,169	,054	,061	,350	-,052	,738	-,101	,047
Service quality 2	-,035	,225	-,021	-,082	,344	,135	,779	,124	-,112
Service quality 3	,044	,245	,106	-,027	,068	,064	,866	-,009	,281
Innovativeness 1	,057	,021	-,023	,885	,140	,129	-,133	,074	,113
Innovativeness 2	,251	,013	-,037	,838	,086	,047	,050	-,041	-,163
Innovativeness 3	,213	,003	-,213	,856	,066	,090	,045	,071	-,105
Network size 1	,229	,099	,050	,071	,103	,088	,012	,831	-,186
Network size 2	,151	,007	-,109	,026	,088	,045	-,013	,864	,236
Compl. variety 1	,190	,127	,098	,249	,289	,785	,020	-,026	,055
Compl. variety 2	,166	,068	-,025	,105	,038	,894	-,001	-,043	-,024
Compl. variety 3	-,115	-,008	,241	-,031	-,090	,776	,137	,306	,031
Speed of dev. 1	,014	-,048	,929	-,122	-,040	,081	-,021	-,079	,012
Speed of dev. 2	,034	-,094	,851	-,178	-,223	-,121	,045	,033	-,101
Speed of dev. 3	,022	,024	,829	,043	,048	,310	,089	,004	,178
Compl. quality 1	,901	,082	,007	,192	,067	,097	,085	,150	-,013
Compl. quality 2	,863	,119	-,073	,164	,137	,060	,097	,151	,060
Compl. quality 3	,920	,126	,142	,161	-,002	,085	,018	,092	,036

Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization. Values above 0.4 are marked grey. Eigenvalues (% of variance): 6.39 (24.6), 3.42 (13.2), 3.01 (11.8), 2.04 (7.8), 1.78 (6.8), 1.59 (6.1), 1.27 (4.9), 1.13 (4.3) and 0.94 (3.6).

As seen from table 4.6, the factor structure corresponds well with the hypothesized structure. With the exception of the second item for compatibility, convergence and discriminant validity also seem to be acceptable. As mentioned above, we identified reliability problems with the compatibility variable. Thus special attention should be paid to this variable in the analysis of validity of the demand side surveys. Despite this finding, we retain compatibility as a two-item measure.

For the demand side studies, we analyze the measurement model with data from all studies.

First, the discriminant and convergent validity of the manipulation check variables was investigated using exploratory factor analysis. The analysis extracted two factors indicating a lack of correspondence with the hypothesized pattern. When extracting the expected three factors, the results were as shown in table 4.7.

Table 4.7. Factor analysis, manipulation check variables, demand side study

	Components		
	1	2	3
Direct network effects 1	0.29	0.88	0.08
Direct network effects 2	0.30	0.85	0.17
Indirect network effects 1	0.87	0.36	0.19
Indirect network effects 2	0.89	0.30	0.20
Intrinsic attributes 1	0.24	0.01	0.85
Intrinsic attributes 2	0.08	0.21	0.86

Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization. Values above 0.4 are marked grey. Eigenvalues (% of variance): 3.31 (55.2), 1.16 (19.4) and 0.655 (10.8).

Even though the pattern of the factor loadings and the structure of eigenvalues are not as favorable as for the supply side study, it still seem that the hypothesized structure of three dimensions involved in these items is reasonable and validity seems acceptable. The large eigenvalue of the first factor, however, indicates that it may be a common method bias in these items.

The exploratory factor analysis of all other measured items for the demand side studies showed that seven factors were extracted. However, a considerably lower eigenvalue was found for factor 12 (0.54), indicating that a structure corresponding to the hypothesized structured could be used. Because the number of subjects is so large, both moderating and dependent variables could be included in this analysis.

The results of this analysis are shown in table 4.8. As seen from table 4.8, the structure of the items corresponds well with the hypothesized structure. As expected, perceived and anticipated value are found to belong to the same dimension. In addition, both convergence and discriminant validity seem to be very good. We also see that the reliability problems identified for the compatibility variable in the supply side data is not present in the demand side data. Consequently, the same structure for the mediating variables may be applied at both the supply and demand side. This means that we conclude that our items are well founded in the literature or have been developed with reference to empirically tested and well founded constructs. Furthermore, empirical analysis of the measurement models also support our assumption that the constructs are empirically valid and are well suited for further structural analysis.

Table 4.8. Factor analysis, mediating, moderating and dependent variables

	Component										
	1	2	3	4	5	6	7	8	9	10	11
Ease of use 1	.153	.810	.213	.073	.119	.101	.101	.122	.057	.084	.068
Ease of use 2	.136	.750	.186	.022	.128	.182	.038	.146	.059	.073	.127
Ease of use 3	.174	.809	.210	.071	.082	.225	.068	.110	.107	.026	.070
Ease of use 4	.171	.804	.229	.072	.062	.205	.074	.181	.060	.057	.097
Usefulness 1	.258	.352	.098	.050	.131	.741	.107	.152	.131	.066	.102
Usefulness 2	.254	.271	.151	.079	.127	.796	.137	.174	.095	.060	.086
Usefulness 3	.298	.232	.093	.131	.083	.763	.176	.155	.084	.028	.103
Compatibility 2	.260	.081	.307	.071	.064	.131	.173	.206	.169	.107	.671
Compatibility 3	.190	.276	.119	.172	.084	.127	.083	.051	.075	.090	.782
Service quality 1	.303	.271	.144	.203	.236	.195	.156	.698	.121	.039	.100
Service quality 2	.228	.255	.146	.211	.230	.169	.132	.751	.117	.075	.101
Service quality 3	.259	.251	.165	.174	.221	.213	.147	.747	.074	.068	.099
Innovativeness 1	.188	.109	.082	.132	.785	.102	.114	.180	.057	.106	.053
Innovativeness 2	.135	.114	.100	.167	.822	.125	.118	.122	.101	.075	.080
Innovativeness 3	.218	.114	.022	.184	.805	.041	.113	.130	.081	.079	.009
Network size 1	.185	.101	.136	.172	.169	.035	.117	.026	.103	.812	.037
Network size 2	.101	.079	.078	.110	.066	.064	.098	.076	.144	.863	.106
Compl. variety 1	.277	.091	.095	.174	.127	.130	.781	.168	.203	.083	.042
Compl. variety 2	.232	.107	.087	.192	.174	.083	.782	.079	.222	.128	.122
Compl. variety 3	.246	.086	.114	.189	.130	.203	.719	.109	.221	.096	.098
Speed of dev. 1	.013	.085	.093	.193	.048	.056	.208	.042	.785	.109	.070
Speed of dev. 2	.307	.078	.036	.108	.139	.114	.122	.059	.730	.021	-.024
Speed of dev. 3	.162	.093	.164	.165	.065	.082	.207	.131	.714	.192	.193
Compl. quality 1	.187	.065	.095	.816	.168	.068	.167	.152	.195	.122	.069
Compl. quality 2	.192	.070	.089	.822	.181	.076	.185	.126	.148	.109	.111
Compl. quality 3	.199	.080	.147	.798	.206	.093	.149	.151	.165	.130	.075
Behavioral control 1	.311	.358	.708	.025	.014	.072	.054	.138	.071	.099	.098
Behavioral control 2	.258	.260	.753	.082	.053	.155	.079	.103	.088	.126	.143
Behavioral control 3	.179	.167	.798	.163	.086	.025	.101	.058	.070	.031	.037
Behavioral control 4	.234	.336	.612	.089	.129	.157	.077	.135	.150	.096	.210
Perceived value 1	.678	.185	.273	.128	.147	.210	.206	.212	.062	.129	.168
Perceived value 2	.685	.202	.238	.151	.131	.243	.218	.210	.074	.107	.144
Perceived value 3	.744	.175	.177	.200	.156	.181	.186	.137	.097	.114	.126
Anticipated value 1	.819	.133	.200	.137	.172	.151	.134	.121	.152	.061	.082
Anticipated value 2	.802	.166	.175	.103	.146	.138	.144	.140	.137	.076	.072
Anticipated value 3	.811	.136	.170	.165	.160	.154	.153	.096	.158	.099	.099

Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization. Values above 0.4 are marked grey. Eigenvalues (% of variance): 15.47 (42.9), 2.88 (8.02), 1.82 (5.0), 1.72 (4.8), 1.5 (4.2), 1.18 (3.3), 1.07 (3.0), 0.93 (2.6), 0.88 (2.5), 0.84 (2.3) and 0.77 (2.1).

5 RESULTS

The results from our rigorous research design, including one survey of the supply side and one study of the demand side including six different surveys, are not easily presented in a simple and integrated way. Also, the complete research model illustrated in figure 3.2 may not be modeled in a simple and integrated way because it includes subjects form both sides of the two-sided market as well as variables that may only be measured at one of the two sides. Thus, the model should be interpreted as a research model in which results of separate analyses on the supply and demand sides may be structured. The results section is organized in three parts. First, we present results from separate analyses of the supply side data. Next, we present results from corresponding analyses at the demand side. In the last section, we compare and, to the extent possible, integrate our findings with reference to the research model presented in figure 3.2.

5.1 Supply side results

Six services were selected to represent differences in the importance of extrinsic versus intrinsic attributes in creating perceived customer value. A critical test of whether these services represented valid manipulation of relevance of service attributes is if the providers of these services perceive them as different with respect to how they are characterized by direct network effects attributes, indirect network effects attributes and intrinsic attributes. This test can be conducted as an analysis of variance in means of the service attributes when compared across three groups of services. MMS person to person and SMS chat services are joined in group number one representing services where direct network effects are believed to be important to customer value. MMS content and POS payment services are joined together in group number

two representing services believed to be characterized by indirect network effects and Java games and the Cash Card Charging service are joined together because they are believed to represent services where direct and indirect network effects are not thought to be the main value drivers. Here, the functionalities embedded in the service itself, the intrinsic attributes, are thought to be the primary value driver.

As shown in table 5.1, the mean score on direct network effects for service group number one is 4.19, while the score for groups two and three are 3.42 and 2.85 respectively. The hypothesis that all means are equal is thus rejected at the 1% level ($F=7.785$, d.f.=2, $p<0.05$). For direct network effects, t-tests show that the difference in means between groups 1 and 2 is significant at the 5% level ($t=2.733$, d.f.=32, $p<0.05$), and significant at the 1% level between groups 1 and 3 ($t=3.971$, d.f.=31, $p<0.01$).

For service group number two, the mean score on indirect network effects is 3.92, and for groups one and three, the corresponding mean scores are 3.50 and 3.00 respectively, and the hypothesis that all means are equal is rejected at the 5% level ($F=3.739$, d.f.=2, $p<0.01$) (see table 5.1 below). For indirect network effects, t-tests show that the difference in means between group number two and one is not significant ($t=1.444$, d.f.=26, $p=.161$, n.s.), but significant at the 5% level between group number two and three ($t=2.656$, d.f.=36, $p<0.05$).

For the last group representing services where intrinsic service attributes are believed to be important to value, group number three has a mean score of 3.93, and group number one and two have mean scores of 2.75 and 3.44 respectively. The hypothesis that all means are equal is rejected at the 1% level ($F=7.276$, d.f.=2, $p<0.01$) (see table 5.1 below). For intrinsic attributes,

the difference in means between group number three and one is significant at the 1% level ($t=3.661$, d.f.=34, $p<0.01$), but not significant between group number three and two ($t=1.646$, d.f.=36, $p=0.109$).

Table 5.1. Analysis of variance, manipulation check variables

Variable	Group(*)	N	Mean	St. dev.	F	Sig.
Direct network effects	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		
Indirect network effects	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		
Intrinsic attributes	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		

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

The manipulation checks reported above show that respondents in group number one perceive the services to be characterized by a significantly higher level of direct network effects than both group two and three. For indirect effects, group number two has a higher level than both group number one and three, but only the difference between group number two and three is significant. For intrinsic attributes, group number three has a higher score than both group one and two, but only the difference between group number three and one is significant. In sum, analysis of variance and t-tests show that the manipulations of service categories work quite well when viewed from the perspective of professionals on mobile services.

When data is investigated at the level of individual services, MMS person to person and SMS chat have a mean score of 4.50 and 3.88 on direct network effects. The mean scores of the respondents belonging to the other service groups are all lower than 3.88. MMS content, which is believed to be characterized by indirect network effects, has a mean score of 3.64 on direct effects. Analysis of variance testing whether there are differences between group mean scores on direct network effects shows that the hypotheses that all means are equal is rejected at the 1% level ($F=3.679$, d.f.=5, $p<0.01$). The mean score on indirect network effects for the two services in this group are 3.95 (MMS content) and 3.86 (POS payment). All mean scores of the respondents belonging to the other services are lower than 3.86 except for SMS chat, which has a mean score of 4.00 on this variable. Using analysis of variance to test the hypothesis that all means are equal, should be rejected at the 1% level ($F=3.979$, d.f.=5, $p<0.01$). The two services belonging to the third service group, intrinsic service attributes, have mean scores of 3.83 (Java games) and 4.10 on this variable. The mean score of POS payment on intrinsic service attributes are 3.86, and all other services have mean scores lower than 3.83. Analysis of variance shows that the hypothesis of equal mean scores should be rejected at the 5% level ($F=3.424$, d.f.=5, $p<0.05$).

In sum, both services in group one have higher scores on direct network effects than the other services. For indirect effects, the two services in group number two have higher levels than the other services, except for SMS chat. One of the services in group number three has a higher level of intrinsic attributes than all other services, and the last service in this group has a mean score higher than all other services, except for POS payment services. It should also be noticed that the group sizes are low when manipulation checks are conducted at the level of individual services. We will therefore investigate the data mainly at the service group level, as shown above.

5.1.1 Descriptive results and service comparisons

Descriptive information of variables is presented to illustrate some characteristics of the service groups (table 5.2) and individual services (table 5.3), and to make comparisons across groups and services regarding business model dimensions, service attributes, and perceived and anticipated value. As can be seen from table 5.2, perceived usefulness, intrinsic service quality, perceived value, anticipated value, and speed of development are higher for services with intrinsic attributes than for services with direct and indirect network effects. Behavioral control is lower for services with indirect network effects than for services with direct network effects and intrinsic attributes (significant at the 5% level ($t = 2.445$, d.f. = 52, $p<0.05$)), while the mean score on content oriented revenue model is higher for services with indirect network effects than for services with direct network effects and intrinsic attributes. Breadth of value propositions is higher for services with direct network effects than for services with indirect network effects and intrinsic attributes, and the network size is also, as expected, higher for services with direct network effects than for the other service groups, but it is rather low for this group as well (3.03).

Table 5.2. Description of service groups

Variable	Group	N	Mean	St. dev.	F	Sig
Direct network effects	Direct network effects	16	4.19	0.73		
	Indirect network effects	18	3.42	0.90	7.79	0.00
	Intrinsic attributes	20	2.85	1.27		
Indirect network effects	Direct network effects	16	3.50	0.97		
	Indirect network effects	18	3.92	0.67	3.74	0.03
	Intrinsic attributes	20	3.00	1.32		
Intrinsic attributes	Direct network effects	16	2.75	0.97		
	Indirect network effects	18	3.44	0.84	7.28	0.00
	Intrinsic attributes	20	3.93	0.95		
Ease of use	Direct network effects	16	3.92	0.75		
	Indirect network effects	18	3.72	0.66	1.23	0.30
	Intrinsic attributes	20	4.05	0.54		
Usefulness	Direct network effects	16	3.46	0.71		
	Indirect network effects	18	3.48	1.09	3.76	0.03
	Intrinsic attributes	20	4.17	0.85		
Compatibility	Direct network effects	16	3.22	1.06		
	Indirect network effects	18	2.80	0.96	0.72	0.49
	Intrinsic attributes	20	3.13	1.16		
Intrinsic service quality	Direct network effects	16	3.46	0.81		
	Indirect network effects	18	3.63	0.68	5.49	0.01
	Intrinsic attributes	20	4.15	0.50		
Innovativeness	Direct network effects	16	3.46	0.88		
	Indirect network effects	18	3.76	0.95	0.58	0.57
	Intrinsic attributes	20	3.70	0.76		
Network size	Direct network effects	16	3.03	1.06		
	Indirect network effects	18	2.47	0.83	2.84	0.07
	Intrinsic attributes	20	2.29	0.95		
Complementary service variety	Direct network effects	16	3.06	0.94		
	Indirect network effects	18	3.09	0.91	0.31	0.74
	Intrinsic attributes	20	3.32	1.30		
Speed of development	Direct network effects	16	3.04	0.85		
	Indirect network effects	18	2.80	1.24	1.40	0.26
	Intrinsic attributes	20	3.45	1.43		
Complementary service quality	Direct network effects	16	3.40	0.60		
	Indirect network effects	18	2.94	0.65	2.38	0.10
	Intrinsic attributes	20	3.23	0.58		

Table 5.2. Description of service groups, continued

Variable	Group	N	Mean	St. dev.	F	Sig
Behavioral control	Direct network effects	16	3.42	0.64		
	Indirect network effects	18	2.97	0.60	2.94	0.06
	Intrinsic attributes	20	3.45	0.74		
Perceived value	Direct network effects	16	3.65	0.63		
	Indirect network effects	18	3.46	0.64	6.40	0.00
	Intrinsic attributes	20	4.12	0.49		
Anticipated value	Direct network effects	16	3.67	0.50		
	Indirect network effects	18	3.52	0.61	3.68	0.03
	Intrinsic attributes	20	4.05	0.72		
Revenue model	Direct network effects	16	3.00	1.20		
	Indirect network effects	18	3.96	0.84	4.33	0.02
	Intrinsic attributes	20	3.37	0.86		
Governance form	Direct network effects	16	2.60	0.77		
	Indirect network effects	18	2.93	0.71	1.16	0.32
	Intrinsic attributes	20	2.97	0.79		
Mobile specific value propositions	Direct network effects	16	4.10	0.95		
	Indirect network effects	18	3.83	0.70	0.93	0.40
	Intrinsic attributes	20	3.63	1.31		
Breadth of value propositions	Direct network effects	16	3.52	0.72		
	Indirect network effects	18	2.86	0.88	4.59	0.02
	Intrinsic attributes	20	2.65	0.98		
Market focus	Direct network effects	16	3.13	0.86		
	Indirect network effects	18	3.24	0.81	0.12	0.88
	Intrinsic attributes	20	3.11	0.82		

The results also show that the mean score on governance form are below 3 (on a 5 point Likert scale) for all service groups. Compared with the responses to other variables (almost all variables have mean scores higher than the middle value), this may indicate that hierarchical governance forms are preferred over market and relational governance forms.

Table 5.3. Description of services

Variable	Service	N	Mean	St. dev.
Direct network effects	MMS p2p	8	4.50	0.65
	SMS chat	8	3.88	0.69
	MMS content	11	3.64	0.87
	POS payment	7	3.07	0.89
	Java games	12	2.83	1.17
	Cash card charging	8	2.88	1.48
	Total	54	3.44	1.13
Indirect network effects	MMS p2p	8	3.00	1.07
	SMS chat	8	4.00	0.53
	MMS content	11	3.95	0.65
	POS payment	7	3.86	0.75
	Java games	12	2.54	1.37
	Cash card charging	8	3.69	0.92
	Total	54	3.45	1.09
Intrinsic attributes	MMS p2p	8	2.69	1.10
	SMS chat	8	2.81	0.88
	MMS content	11	3.18	0.56
	POS payment	7	3.86	1.07
	Java games	12	3.83	1.09
	Cash card charging	8	4.06	0.73
	Total	54	3.42	1.02
Ease of use	MMS p2p	8	3.84	0.63
	SMS chat	8	4.00	0.90
	MMS content	11	3.55	0.63
	POS payment	7	4.00	0.58
	Java games	12	4.00	0.56
	Cash card charging	8	4.13	0.52
	Total	54	3.90	0.65
Usefulness	MMS p2p	8	3.42	0.64
	SMS chat	8	3.50	0.82
	MMS content	11	3.15	1.13
	POS payment	7	4.00	0.86
	Java games	12	3.78	0.82
	Cash card charging	8	4.75	0.50
	Total	54	3.73	0.95

Table 5.3. Description of services, continued

Variable	Service	N	Mean	St. dev.
Compatibility	MMS p2p	8	2.56	0.98
	SMS chat	8	3.88	0.69
	MMS content	11	2.59	1.07
	POS payment	7	3.14	0.69
	Java games	12	3.04	0.92
	Cash card charging	8	3.25	1.51
	Total	54	3.05	1.06
Intrinsic service quality	MMS p2p	8	3.62	0.55
	SMS chat	8	3.29	1.01
	MMS content	11	3.39	0.51
	POS payment	7	4.00	0.77
	Java games	12	4.19	0.39
	Cash card charging	8	4.08	0.66
	Total	54	3.77	0.71
Innovativeness	MMS p2p	8	3.92	0.56
	SMS chat	8	3.00	0.93
	MMS content	11	3.45	1.08
	POS payment	7	4.24	0.46
	Java games	12	3.31	0.58
	Cash card charging	8	4.29	0.60
	Total	54	3.65	0.85
Network size	MMS p2p	8	3.25	1.20
	SMS chat	8	2.81	0.92
	MMS content	11	2.50	0.67
	POS payment	7	2.43	1.10
	Java games	12	2.21	1.10
	Cash card charging	8	2.43	0.67
	Total	54	2.58	0.98

Table 5.3. Description of services, continued

Variable	Service	N	Mean	St. dev.
Complementary service variety	MMS p2p	8	2.71	1.10
	SMS chat	8	3.42	0.64
	MMS content	11	3.12	0.86
	POS payment	7	3.05	1.04
	Java games	12	3.33	1.39
	Cash card charging	8	3.29	1.25
	Total	54	3.17	1.07
Speed of development	MMS p2p	8	2.63	0.65
	SMS chat	8	3.46	0.85
	MMS content	11	3.45	1.06
	POS payment	7	1.76	0.66
	Java games	12	4.50	0.54
	Cash card charging	8	1.88	0.60
	Total	54	3.11	1.23
Complementary service quality	MMS p2p	8	3.33	0.47
	SMS chat	8	3.46	0.73
	MMS content	11	2.70	0.71
	POS payment	7	3.29	0.36
	Java games	12	3.22	0.69
	Cash card charging	8	3.24	0.37
	Total	54	3.19	0.62
Behavioral control	MMS p2p	8	3.22	0.57
	SMS chat	8	3.63	0.67
	MMS content	11	2.93	0.67
	POS payment	7	3.04	0.53
	Java games	12	3.67	0.73
	Cash card charging	8	3.13	0.67
	Total	54	3.28	0.69
Perceived value	MMS p2p	8	3.58	0.68
	SMS chat	8	3.71	0.60
	MMS content	11	3.21	0.54
	POS payment	7	3.86	0.60
	Java games	12	3.83	0.33
	Cash card charging	8	4.54	0.35
	Total	54	3.76	0.64
Anticipated value	MMS p2p	8	3.63	0.52
	SMS chat	8	3.71	0.52
	MMS content	11	3.36	0.59
	POS payment	7	3.76	0.60
	Java games	12	3.75	0.74
	Cash card charging	8	4.50	0.40
	Total	54	3.76	0.66

Table 5.3. Description of services, continued

Variable	Service	N	Mean	St. dev.
Revenue model	MMS p2p	8	2.21	1.15
	SMS chat	8	3.79	0.56
	MMS content	11	3.73	0.57
	POS payment	7	4.33	1.09
	Java games	12	3.33	1.01
	Cash card charging	8	3.42	0.66
	Total	54	3.46	1.03
Governance form	MMS p2p	8	2.71	0.52
	SMS chat	8	2.50	0.99
	MMS content	11	2.79	0.76
	POS payment	7	3.14	0.60
	Java games	12	3.22	0.81
	Cash card charging	8	2.58	0.64
	Total	54	2.85	0.76
Mobile specific value propositions	MMS p2p	8	4.46	0.80
	SMS chat	8	3.75	1.00
	MMS content	11	3.55	0.65
	POS payment	7	4.29	0.52
	Java games	12	2.78	0.97
	Cash card charging	8	4.92	0.15
	Total	54	3.84	1.03
Breadth of value propositions	MMS p2p	8	3.84	0.55
	SMS chat	8	3.19	0.74
	MMS content	11	2.95	1.04
	POS payment	7	2.71	0.57
	Java games	12	2.52	0.79
	Cash card charging	8	2.84	1.25
	Total	54	2.98	0.93
Market focus	MMS p2p	8	3.06	0.86
	SMS chat	8	3.19	0.90
	MMS content	11	3.14	0.83
	POS payment	7	3.39	0.80
	Java games	12	3.02	0.94
	Cash card charging	8	3.25	0.61
	Total	54	3.16	0.81

Results for the cash card charging service show a high level of perceived usefulness, perceived value and anticipated value. For SMS chat, table 5.3 shows a relatively high level of compatibility compared to the other services. The results for MMS person to person show a high

mean value of network size and breadth of value propositions, and a low mean value of complementary service variety when compared to the other services. Both services in group number two (MMS content and POS payment) have a relatively low mean scores on behavioral control (2.93 and 3.04 respectively), and none of the services show a noteworthy difference between mean perceived value and mean anticipated value. Only MMS content and MMS person to person services have higher levels of anticipated value than perceived value. For SMS chat, the levels are equal, while anticipated value gets a lower mean score than perceived value for POS payment, Java games, and the card charging service.

Results for POS payment and card charging services show a very low score on speed of development. The Java games service, on the other hand, has a high score on this variable. MMS content has a lower mean score on complementary service quality than the other services. MMS person to person has a low score on revenue model when compared to the other services. The score on governance form is rather low for all services (except for the Java games service, which has a mean score of 3.22). The overall mean score is 2.85, and governance is one of three variables that have lower mean scores than the middle value (Network size = 2.56, Breadth = 2.98.).

5.1.2 Tests of hypotheses

The specific relationships between independent variables of the research model in figure 3.2 and the mediating variables are proposed in hypotheses A1-8. These suggest that revenue model, governance form and value proposition variables influence extrinsic and intrinsic attributes of services. All these hypotheses are proposed in section 3 as direct relationships between

independent and mediating variables. Even though no moderated hypotheses were explicitly suggested, the discussion in section 3 indicated that the relationships between independent and mediating variables may be moderated by service category. Thus, potential moderations of direct relationships are also explored in this section without referring to explicit hypotheses on the form of moderation.

In addition, we have measured the service providers' assessments of customer perceptions for behavioral control and perceived and anticipated value, making it possible to investigate hypotheses B1-5 regarding the relationship between service attributes and perceived value for service provider professionals also. These hypotheses are investigated in section 5.3. All variables have been measured as provider professionals' perceptions, so that all hypothesis tests are tests of provider professionals' beliefs, not tests of relationships in the mobile data services industry. However, provider professionals' beliefs are expected to reflect true industry variable relationships. In table 5.4, bivariate correlations of all independent variables are shown.

Table 5.4. Correlation matrix, independent variables

	1	2	3	4
Revenue model (1)				
Governance form (2)	-0.01			
Mobile specific value propositions (3)	-0.10	-0.29*		
Breadth of value propositions (4)	-0.23	-0.02	0.25	
Market focus (5)	0.04	-0.13	0.09	0.08

* Correlation is significantly different from 0 at the 0.05 level.

As seen from table Table 5.4, multicolinearity is not a problem. Thus, the individual relationships hypothesized in A1-8 are tested using multiple regressions including all independent variables and one mediating variable at the time. This represents a rather strong test of the hypotheses because relationships must be significant within the context of all other possible relationships between all independent variables and each mediating variable for us to reject the null hypotheses.

Table 5.5. Regression analysis, independent variables - complementary service variety

Dependent is complementary service variety Adjusted $R^{2 =}$ -0.042.	B	Std.err.	β	t
Revenue model	0.04	0.15	0.04	0.29
Governance form	0.01	0.21	0.01	0.07
Mobile specific value propositions	-0.06	0.16	-0.06	-0.39
Breadth of value propositions	0.27	0.17	0.23	1.57
Market focus	0.14	0.19	0.11	0.74

Table 5.5 above shows that the hypotheses that content based revenue models and relational and market based governance forms increase complementary service variety (A1a and A2a respectively) are not supported. We also see that explained variance is very low. Individual analyses of covariance controlling for service category differences for each of the relationships included in this regression were conducted. None of the individual analyses showed any significant influence of the interaction terms between individual independent variables and service category on complementary service variety.

Table 5.6. Regression analysis, independent variables - complementary service quality

Dependent is complementary service quality Adjusted $R^2 = 0.14$.	B	Std.err.	β	t
Revenue model	-0.04	0.08	-0.06	-0.47
Governance form	0.03	0.11	0.04	0.25
Mobile specific value propositions	0.16	0.09	0.27	1.89
Breadth of value propositions	0.10	0.10	0.14	0.98
Market focus	0.25	0.10	0.32	2.46*

* Indicate significance at $p<0.05$.

From table 5.6 we see that this model explains a considerably larger proportion of the variance in the dependent variable than the previous model. Also, we see that the hypothesis that content based revenue models increase complementary service quality (A1b) in general is not supported. However, analysis of covariance shows a significant interaction effect of revenue model and service category on complementary service quality at the 10% level (F=2.61, d.f.=2, p=0.08), and regression analyses of the respective service groups show that there is a significant negative relationship between revenue model and complementary service quality for service group three (intrinsic attributes category) at the 5% level (R^2=0.17, B=-0.47, t=-2.28). There are no significant relationships for the other two groups (R^2=-0.02, B=0.22, t=0.83, n.s. for group one and R^2=0.02, B=0.21, t=0.82, n.s. for group two). In other words, use of content based revenue models decreases complementary service quality for services where intrinsic attributes are believed to be important to service value.

The analysis also shows that, even though this was not hypothesized, use of focused strategies seems to increase complementary service quality. Regression analysis split on service groups turns out significant only for services with indirect network effects (R^2=0.28, B=0.57, t=2.68,

$p<0.05$), but covariance analysis shows no significant interaction effect between service group and market focus ($F=0.87$, d.f.=2, $p=0.43$), and the null hypothesis that there are no differences between service groups can therefore not be rejected. Thus, provider professionals believe that applying a focused market strategy is a way to increase the quality of complementary services.

Table 5.7. Regression analysis, independent variables - speed of development

Dependent is speed of development Adjusted $R^2 = 0.24$.	B	Std.err.	β	t
Revenue model	-0.24	0.15	-0.20	-1.65
Governance form	0.05	0.20	0.03	0.26
Mobile specific value propositions	-0.65	0.16	-0.54	-4.17**
Breadth of value propositions	0.07	0.17	0.06	0.44
Market focus	0.16	0.18	0.10	0.40

** Indicates significance at $p<0.01$.

Table 5.7 shows that explained variance in speed of development is even larger than for complementary service quality. We see that the hypotheses that content based revenue models and relational and market based governance forms increase speed of development (A1c and A2b) are not supported. Covariance analysis controlling for differences across service groups showed no significant interaction effects. However, we see that mobile specific value propositions decrease speed of development. Split on groups, regression analysis is only significant (at the 1% level) for services in group three ($R^2=0.49$, B=-0.72, t=-4.39). Thus, mobile specific value propositions seem particularly to decrease speed of development for services with intrinsic attributes. However, covariance analysis shows no significant interaction effect between service groups and mobile specific value propositions ($F=1.33$, d.f.=2, $p=0.27$), and the null hypothesis that no differences between groups exist can not be rejected. Still, we can conclude that providers

of mobile services believe that trying to provide services that are specific to the mobile context (accessibility, personalization and ease of information dissemination) will require longer time to develop.

For direct network effects attributes, we only suggested one hypothesis on the relationship between the independent variables and network size. However, this hypothesis proposed that the relationship was moderated by firm size. Our data do not allow analysis using firm size as the moderator. The regression results for testing the unmoderated version of hypothesis A3a is shown in table 5.8.

Table 5.8. Regression analysis, independent variables - network size

Dependent is network size Adjusted $R^{2 =}$ 0.08.	B	Std.err.	β	t
Revenue model	0.03	0.13	0.03	0.22
Governance form	-0.03	0.18	-0.02	-0.15
Mobile specific value propositions	0.22	0.14	0.23	1.60
Breadth of value propositions	0.28	0.15	0.26	1.84
Market focus	0.08	0.16	0.07	0.49

The general hypothesis that hierarchical governance forms increase end-user network size (A3a) is not supported. Separate covariance analysis controlling for potential interaction effects between the independent variables and service groups showed no significant effects of the interaction terms. No other significant general relationships between independent variables and network size were found.

Turning to the relationships between independent variables and intrinsic service attributes, the relationship between independent variables and intrinsic service quality is shown in table 5.9.

Table 5.9. Regression analysis, independent variables - service quality

Dependent is service quality Adjusted $R^{2 =}$ 0.06.	B	Std.err.	β	t
Revenue model	0.10	0.10	0.15	1.08
Governance form	0.14	0.13	0.15	1.08
Mobile specific value propositions	0.20	0.10	0.29	2.08*
Breadth of value propositions	-0.19	0.11	-0.25	-1.79
Market focus	-0.13	0.12	-0.15	-1.09

* Indicate significance at $p<0.05$.

The model in table 5.9 explains only 6% of the variance in service quality, and the hypotheses that hierarchical governance forms increase intrinsic service quality (A5c) and that value propositions with greater breadth reduce intrinsic service quality (A7a), are not supported. However, covariance analysis testing the potential influence of an interaction effect between governance form and service group on service quality turns out significant at the 1% level ($F=5.18$, d.f.=2, $p<0.01$), and the null hypothesis that there is no relationship between governance form and intrinsic service quality regardless of service group should be rejected. Thus, moderated support for hypothesis A5c has been found. In further analysis it seems that the relationship is strongest for services were indirect network effects are believed to be important to perceived value. This means that for services characterized by indirect network effects, relational and market forms of governance are believed to increase service quality.

Also, analysis of covariance revealed that a moderated relationship could be identified between revenue model and service quality. It seems that the relationship is strongest (R^2=0.40, B=-0.34, t=1.91) for indirect network effects services. Thus, content based revenue models seem to increase service quality, but only for services characterized by indirect network effects.

As hypothesized (A6c), mobile specific value propositions increases intrinsic service quality. Covariance analysis also shows a significant interaction effect at the 5% level of the interaction term between mobile specific value propositions and service group on service quality (F = 4.54, d.f. = 2, $p<0.05$). Regression analysis split on groups shows a significant relationship between mobile specific value propositions and service quality only for services with direct network effects (R^2=0.38, B=0.65, t=3.20, $p<0.01$). Thus, mobile specific value propositions increase intrinsic service quality, in particular for services where perceived value is believed to be determined by direct network effects.

Regression analysis results of the effect of all independent variables on service innovativeness are presented in table 5.10, showing that the independent variables explain 27% of the variance in service innovativeness.

Table 5.10. Regression analysis, independent variables - innovativeness

Dependent is innovativeness Adjusted $R^2 = 0.27$.	B	Std.err.	β	t
Revenue model	-0.06	0.10	-0.07	-0.57
Governance form	0.12	0.14	0.11	0.85
Mobile specific value propositions	0.43	0.11	0.52	4.02**
Breadth of value propositions	0.07	0.11	0.09	0.76
Market focus	0.19	0.13	0.18	1.52

** Indicates significance at $p<0.01$.

Table 5.10 shows that the hypothesis that relational and market based governance forms increase innovativeness (A4a) is not supported. There are no effects of the interaction between service group and governance form on service innovativeness ($F=0.53$, d.f.=2, $p=0.59$, n.s.).

However, mobile specific value propositions seem to increase innovativeness. This relationship is significant at the 1% level in general, and it is also significant at the 1% level for services with indirect network effects and intrinsic attributes ($R^2=0.32$, B=0.60, t=2.98 and $R^2=0.39$, B=0.65, t=3.65 respectively), and at the 5% level for services with direct network effects ($R^2=0.25$, B=0.55, t=2.43) in individual analyses of each service category. Thus, the relationship between mobile specific value propositions and service innovativeness is independent of service category indicating that for all services paying attention to what is specific to mobile services (accessibility, personalization and ease of information dissemination) will create services that are perceived as being more innovative.

Regression analysis results of the effect of all independent variables on service usefulness are presented in table 5.11, showing that the independent variables explain 19% of the variance in service usefulness.

Table 5.11. Regression analysis, independent variables - usefulness

Dependent is usefulness Adjusted $R^{2} = 0.19$.	B	Std.err.	β	t
Revenue model	0.17	0.12	0.19	1.48
Governance form	0.35	0.16	0.28	2.15*
Mobile specific value propositions	0.45	0.12	0.48	3.60**
Breadth of value propositions	-0.03	0.13	-0.03	-0.21
Market focus	0.16	0.15	0.14	1.09

* and ** indicate a significance at $p<0.05$ and $p<0.01$ respectively.

Table 5.11 indicates that both governance form and mobile specific value propositions increase perceived usefulness. Thus, relational and market forms of governance seem to increase service usefulness. This is consistent with hypothesis A4b. Furthermore, mobile specific value propositions increase service usefulness. Thus, hypothesis A6b is also supported. Even though the relationship between breadth of value propositions and usefulness is in the proposed direction of hypothesis A7c, it is far from significant. Thus, we conclude that relational and market forms of governance seem to increase service usefulness. Furthermore, fulfilling value propositions that focuses what is unique to mobile contexts (accessibility, personalization and ease of information dissemination) will increase service usefulness.

Investigating whether there are service category differences in these relationships, we find that there are no significant interaction effects of governance form and service category on service

usefulness ((F=2.35, d.f.=2, p=0.11). Thus, the finding that governance form is important to service usefulness is universal for all service categories. For mobile specific value propositions, we do, however, find a significant interaction effect (F=12.06, d.f.=2, p<0.01). Investigating the effect further, we find that the relationship between mobile specific value propositions and usefulness is positive for all service categories, but particularly strong for services where intrinsic attributes are believed to be important to perceived value (B=0.51, t=5.40, p<0.01). Thus, we find that even though it seemed that paying specific attention to mobile specificity when developing mobile services would delay development, it seem to be extremely important when trying to develop services where intrinsic attributes are important to perceived value.

Simple regression analysis shows that service quality positively influences perceived usefulness. The relationship is significant at the 1% level (R^2=0.30, B=0.56, t=4.87). There is also a significant interaction effect of service quality and service group on perceived usefulness of services (F=3.90, d.f.=2, p<0.05). Separate analysis of the three service groups shows that service quality increases usefulness for services characterized by indirect network effect attributes (R^2 = 0.58; B = 0.78, t = 4.97), while this is not the case for services characterized by intrinsic service attributes (R^2 = -0.04, B = 0.10, t = 0.40, n.s.) and direct network effect attributes (R^2 = 0.19, B = 0.49, t = 2.10, n.s.). Thus, there is a general positive relationship between service quality and usefulness, but this relationship seems to be particularly strong for services characterized by indirect network effects.

In table 5.12, regression analysis results when using ease of use as the dependent variable is shown. Unfortunately explained variance is very low.

Table 5.12. Regression analysis, independent variables - ease of use

Dependent is ease of use Adjusted R^2 = -0.01.	B	Std.err.	β	t
Revenue model	0.02	0.09	0.03	0.20
Governance form	-0.01	0.12	-0.01	-0.07
Mobile specific value propositions	0.15	0.09	0.23	1.56
Breadth of value propositions	-0.15	0.10	-0.22	-1.47
Market focus	0.05	0.11	0.06	0.45

The hypotheses that use of hierarchical governance forms and mobile specific value propositions increase ease of use (A5a and A6a), and that value propositions with greater breadth decrease ease of use (A7b), are not supported. Covariance analysis, however, shows that there is a significant effect of the interaction term of service group and mobile specific value propositions on ease of use ($F=3.36$, d.f.=2, $p<0.05$), and regression analysis split on service groups shows a significant relationship at the 1% level between mobile specific value propositions and ease of use for services with direct network effects ($R^2=0.36$, $B=0.64$, $t=3.08$, $p<0.01$), but not for the other two groups ($R^2=-0.06$, $B=0.00$, $t=0.00$, n.s. for group two and $R^2=-0.06$, $B=0.02$, $t=0.09$, n.s. for group three). This means that for services with direct network effects, mobile specific value propositions increase perceived ease of use of the services. Thus, partial support is found for hypothesis A6a.

As for perceived usefulness, simple regression analysis shows that service quality positively influences perceived ease of use. This relationship is significant at the 1% level ($R^2=0.27$, $B=0.54$, $t=4.56$). Covariance analysis aiming at testing the potential existence of an interaction effect of service groups and service quality on ease of use shows no significant effects, and the

null hypothesis that there are no differences between service groups can not be rejected. In other words, an increase in perceived service quality leads to an increase in perceived ease of use for all categories of services.

In table 5.13, regression analysis results for the compatibility variable are shown. Again, explained variance is very low.

Table 5.13. Regression analysis, independent variables - compatibility

Dependent is compatibility Adjusted $R^{2 =}$ -0.02.	B	Std.err.	β	t
Revenue model	0.17	0.15	0.17	1.17
Governance form	0.04	0.20	0.03	0.18
Mobile specific value propositions	0.06	0.16	0.05	0.35
Breadth of value propositions	-0.13	0.17	-0.12	-0.78
Market focus	-0.26	0.18	-0.20	-1.40

The hypothesis that use of hierarchical governance forms increase compatibility (A6b) is not supported. Individual analyses of covariance controlling for service differences for each of the relationships included in this regression were conducted. None of the individual analyses showed any significant effects of the interaction terms between the individual independent variables and service category on compatibility. Finally, regression analysis results for the variable perceived behavioural control are shown in table 5.14. Once more, explained variance is very low.

Table 5.14. Regression analysis, independent variables - behavioral control

Dependent is behavioral control Adjusted $R^{2 =}$ -0.07.	B	Std.err.	β	t
Revenue model	-0.08	0.10	-0.11	-0.78
Governance form	0.01	0.14	0.01	0.06
Mobile specific value propositions	-0.07	0.10	-0.11	-0.70
Breadth of value propositions	0.08	0.11	0.11	0.75
Market focus	0.03	0.12	0.04	0.28

The hypothesis that use of focused market strategies increase perceived control (A8a) is not supported. No significant interaction effects were found for the interaction of revenue model, governance form, breadth of proposition or market focus and service category on behavioral control. For mobile specific value propositions, however, a significant effect of the interaction term was identified ($F=3.27$, d.f.=2, $p<0.05$). Separate regression analyses for the groups show that the relationship between mobile specificity and behavioral control is positive for services in category one and two, but negative for services characterized by intrinsic attributes. Interpretation of this finding is difficult, but as shown above, providers believe that mobile specificity is important to service quality and innovativeness. However, they also believe that in particular for services where most value is supposed to lie in the intrinsic attributes of service, paying much attention to mobile specificity may also lead to loss in behavioral control, perhaps due to services being too innovative for regular end-users.

To summarize supply side study findings, we concentrate first on the findings of relevance to the hypotheses in section 3. In table 5.15, a summary of the findings is shown.

Table 5.15. Summary of findings related to hypotheses - supply side

No	Independent	Mediating	Supp	Moderation
A1a	Revenue model	Comp. s. variety	n.s.	
A1b	Revenue model	Comp. s. quality	*	Only if mod. by service category
A1c	Revenue model	Speed of dev.	n.s.	
A2a	Governance form	Comp. s. variety	n.s.	
A2b	Governance form	Speed of dev.	n.s.	
A2c	Governance form	Comp. s. quality	n.s.	
A3a	Governance form	Network size	n.s.	
A4a	Governance form	Innovativeness	n.s.	
A4b	Governance form	Usefulness	**	Universal
A5a	Governance form	Ease of use	n.s.	
A5b	Governance form	Compatibility	n.s.	
A5c	Governance form	Intrinsic s. quality	***	Only if mod. by service category
A6a	Mobile specificity	Ease of use	**	Only if mod. by service category
A6b	Mobile specificity	Usefulness	***	Also if mod. by service category
A6c	Mobile specificity	Intrinsic s. quality	**	Also if mod. by service category
A7a	Prop. breadth	Intrinsic s. quality	n.s.	
A7b	Prop. breadth	Ease of use	n.s.	
A7c	Prop. breadth	Usefulness	n.s.	
A8a	Focused strat.	Behav. control	n.s.	

*, ** and *** indicate support for the hypotheses at $p<0.10$, $p<0.05$ and $p<0.01$ levels, respectively

From table 5.15 we see that only six of the original 19 hypotheses on the relationships between independent variables on the supply side and service attributes were supported. Three of the hypotheses received partial support because the hypotheses were only supported when controlling for the moderating effect of service category, whereas two hypotheses were supported in general

despite service differences being revealed. Finally, one of the hypotheses received universal support with universal effects across service categories.

In addition to the findings related directly to proposed hypotheses, a number of other interesting findings were made on the relationship between independent and mediating variables in our research model shown in section 3. These findings are summarized in table 5.16.

Table 5.16. Summary of other findings - supply side

Independent	Mediating	Supp	Moderation
Market focus	Comp. s. quality	**	Also if mod. by service category
Mobile specificity	Speed of dev.	***	Also if mod. by service category
Mobile specificity	Innovativeness	***	Universal
Mobile specificity	Behav. control	**	Only if mod. by service category

*, ** and *** indicate support for the hypotheses at $p<0.10$, $p<0.05$ and $p<0.01$ levels, respectively

From table 5.16 we see that it may be interesting to put particular attention to the providers' attempts at offering mobile specific services. For example, we found that providers believed offering such services was important to innovativeness and service quality, but would require longer development time. We now also see that they consider another problem with offering mobile specific services, that of reduced behavioral control. These relationships should be given attention in further research.

5.2 Demand side results

As for the supply side study, six services were selected as a basis for investigating both direct and moderated effects of service attributes on perceived value. In section 5.1, we documented that providers of these six services characterized them as systematically belonging to three categories. Two services were characterized for their potential in creating direct network effects, two services were characterized by their potential for creating indirect network effects through complementary service offerings. Finally, three services were believed to have only a minor potential for creating these two types of network effects. Consequently, using intrinsic attributes were believed to be the best way to describe and assess the value creating potential of these services. Even though the services were selected because of these differences in their bases for value creation, and the providers' categorization of the services corresponded to these differences, we have no guarantee that end-users will conduct the categorization of services in the same way. A lack of such correspondence could be attributed to lack of consideration for network effects in their value assessments or to lack of explicit knowledge of network effects. In this study, we are able to investigate the correspondence between providers' and end-users' categorization of mobile services as well as if any lack of correspondence between the two may be attributed to limitations in value assessment or lack of explicit knowledge.

To investigate if end-users' and provider professionals' categorizations match, we analyzed the three manipulation check variables in the same way as in section 5.1. As shown in section 4, end-user categorizations have been made by different samples of end-users. Consequently, there may be systematic biases that make traditional analysis of variance of less relevance. For example, the MMS person to person study included subjects that may have felt a pressure to participate in the

study whereas the other subjects were recruited voluntarily. Thus, positive and negative affectivity (Podsakoff et al., 2003) may be a source of bias that should be considered in these comparisons. With this limitation in mind, analysis of variance results for the manipulation check variables are shown in table 5.17.

Table 5.17. Analysis of variance, manipulation check variables

Variable	Group(*)	N	Mean	St. dev.	F	Sig.
Direct network effects	1	464	3.56	0.95	3.62	0.03
	2	429	3.74	1.01		
	3	350	3.64	1.04		
	Total	1243	3.65	1.00		
Indirect network effects	1	464	3.52	0.90	19.14	0.00
	2	427	3.90	0.99		
	3	348	3.85	1.06		
	Total	1239	3.74	0.99		
Intrinsic attributes	1	464	3.21	0.92	54.23	0.00
	2	428	3.76	0.88		
	3	350	3.75	0.91		
	Total	1242	3.55	0.94		

(*) 1=MMS person to person and SMS chat services, 2=MMS content and POS payment services, 3=Java games and cash card charging services

As seen from table 5.17, for all three categorizations, the hypothesis that all means are equal is rejected at the 1% level. When investigating the differences in means, however, the categorizations do not match the categorizations of the provider professionals. We find that for direct network effects, the highest mean is found for MMS content and POS payment services. For indirect network effects, the highest mean is also found for MMS content and POS payment

services, but the difference between this mean and the mean for Java games and the cash card charging service is not significant at the 5% level ($t_{2\text{-}3}$=0.63, d.f. 773, n.s.). For intrinsic attributes, the highest mean again is found for MMS content and POS payment services. When adjusting for affectivity by computing a general affectivity scale based upon all items except the manipulation check variables, the categorization still does not match the categorization of the provider professionals. In this case, the highest means are for MMS person to person and SMS chat services, regardless of which variable is being investigated. Thus, two options seem possible. Either, the customers do not explicitly consider network effects in their value assessments, or they lack self-insight into their own value assessment process. To identify which of the two options is most likely, further analysis is reported below.

5.2.2 Descriptive results and service comparisons

The limitations with respect to possible affectivity are also relevant when comparing the other variables of the demand side studies. Thus, the results should be interpreted with care. Also due to these limitations, we report descriptive results at the level of each individual service rather than grouping them according to their hypothesized category of extrinsic versus intrinsic attributes. Still, some systematic results were revealed for the mediating variables shown in table 5.18.

Table 5.18. Analysis of variance, mediating variables

Variable	Service	N	Mean	St. dev.	F	Sig.
Ease of use	MMS p2p	280	3.58	0.88		
	SMS chat	187	4.37	0.71		
	MMS content	291	4.01	0.83		
	POS payment	140	3.84	0.90	30.77	0.00
	Java games	130	3.99	0.81		
	Cash card charging	221	4.35	0.81		
	Total	1249	4.01	0.87		
Useful-ness	MMS p2p	278	2.90	0.88		
	SMS chat	187	3.76	0.99		
	MMS content	291	3.79	0.99		
	POS payment	140	3.91	0.98	75.67	0.00
	Java games	130	4.02	0.89		
	Cash card charging	221	4.48	0.89		
	Total	1247	3.75	1.07		
Com-pati-bility	MMS p2p	280	2.40	0.84		
	SMS chat	186	4.01	0.89		
	MMS content	291	3.55	1.02		
	POS payment	139	3.45	0.91	78.75	0.00
	Java games	130	3.38	1.11		
	Cash card charging	219	3.69	1.06		
	Total	1245	3.36	1.11		
Service quality	MMS p2p	277	3.18	0.66		
	SMS chat	187	3.84	0.77		
	MMS content	291	3.93	0.77		
	POS payment	139	4.00	0.84	57.00	0.00
	Java games	130	3.76	0.91		
	Cash card charging	220	4.29	0.81		
	Total	1244	3.80	0.86		
Innova-tiveness	MMS p2p	278	3.46	0.73		
	SMS chat	187	3.49	0.91		
	MMS content	290	3.77	0.87		
	POS payment	140	4.04	0.85	18.83	0.00
	Java games	129	3.44	1.06		
	Cash card charging	220	4.01	0.89		
	Total	1244	3.70	0.90		
Network size	MMS p2p	280	2.97	0.96		
	SMS chat	185	3.51	1.06		
	MMS content	291	3.82	1.04		
	POS payment	140	2.92	1.01	28.66	0.00
	Java games	130	3.17	1.20		
	Cash card charging	221	3.05	1.00		
	Total	1247	3.28	1.09		

Table 5.18. Analysis of variance, mediating variables, continued

Variable	Group(*)	N	Mean	St. dev.	F	Sig.
Comp. service variety	MMS p2p	279	2.75	0.76		
	SMS chat	184	3.23	1.05		
	MMS content	291	3.89	0.82		
	POS payment	140	3.70	0.95	63.25	0.00
	Java games	130	3.64	1.03		
	Cash card charging	221	3.87	0.87		
	Total	1245	3.49	1.00		
Speed of dev.	MMS p2p	278	3.17	0.78		
	SMS chat	185	3.68	0.83		
	MMS content	291	4.02	0.81		
	POS payment	140	3.64	0.92	40.16	0.00
	Java games	130	4.18	0.83		
	Cash card charging	220	3.59	0.88		
	Total	1244	3.68	0.90		
Comp. service quality	MMS p2p	274	3.23	0.61		
	SMS chat	183	3.32	0.90		
	MMS content	289	3.92	0.77		
	POS payment	140	3.67	0.89	24.16	0.00
	Java games	130	3.67	0.94		
	Cash card charging	218	3.58	0.89		
	Total	1234	3.56	0.85		

In table 5.18 we see that for all variables, the hypothesis that all means are equal should be rejected at the 1% level. This is also the case if we leave the affectivity-biased MMS person to person service out of the analyses. We also observe that there is no consistent pattern indicating that the means for one particular service is always highest or lowest. This means that even though there may be sample differences and affectivity bias in the MMS person to person study, there are some important descriptive findings in the material. We see that the services considered most easy to use are the MMS chat and cash card charging services. Leaving the MMS person to person service out of these comparisons, we see that the service found the least easy to use is POS payment. This is interesting because it is the same service architecture that is used for this service and the cash card charging service. For usefulness, the highest mean is found for the charging service and the lowest for SMS chat. This probably reflects that the gratifications of

using SMS chat are not utilitarian, but hedonic. For compatibility it is also interesting to observe that the lowest mean is found for Java games, a service that should be very well standardized but does not seem to be so when seen from the perspective of the end-users.

For service quality, both services from MobilHandel (POS payment and charging services) have the highest means, whereas the lowest is found for Java games. A further indication of problems with Java games may be observed for innovativeness where we find that Java games score even lower then MMS person to person services despite the affectivity bias in the latter study. For network size, MMS content and SMS chat has the highest means. One may easily confuse this finding with suggesting that network size influences perceived value for these services, but this finding only refers to how users perceive the number of other users using the service. The lowest mean is found for POS payment services which users seem to perceive as a rarely used service. For complementary service variety, it is not surprising that users see MMS content services as having the greatest variety. Charging service comes out second highest, but in this case, all complementary services that may be used with MobilHandel are used as the reference point in the measurement scale. Not surprisingly, speed of development has its highest means for Java games and MMS content services. Finally, complementary service quality is also considered highest for MMS content and lowest for SMS chat if the affectivity-influenced MMS person to person service is left out of the analysis.

More interesting, maybe, are the findings for the moderating and dependent variables shown in table 5.19.

Table 5.19. Analysis of variance, moderating and dependent variables

Variable	Group(*)	N	Mean	St. dev.	F	Sig.
Behav-ioral control	MMS p2p	280	2.99	1.04		
	SMS chat	186	4.30	0.76		
	MMS content	291	4.02	0.88		
	POS payment	140	3.69	1.06	55.05	0.00
	Java games	130	3.87	0.93		
	Cash card charging	220	3.92	1.02		
	Total	1247	3.76	1.05		
Perceiv-ed value	MMS p2p	280	2.16	0.84		
	SMS chat	186	3.32	1.07		
	MMS content	291	3.66	0.92		
	POS payment	139	3.51	0.95	116.86	0.00
	Java games	130	3.36	1.07		
	Cash card charging	221	4.07	0.97		
	Total	1247	3.30	1.16		
Antici-pated value	MMS p2p	280	2.31	0.91		
	SMS chat	186	3.23	1.14		
	MMS content	290	3.73	0.97		
	POS payment	139	3.75	0.93	98.91	0.00
	Java games	130	3.50	1.09		
	Cash card charging	221	4.08	0.99		
	Total	1246	3.37	1.18		

We find that affectivity also influences the results for these variables. In particular, perceived value for the MMS person to person service is very low. Still, if leaving this service out of the analysis, the hypothesis that all means are equal must be rejected at the 1% level ($F=9.91$, d.f.=4, $p<0.01$, $F=18.38$, d.f.=4, $p<0.01$ and $F=19.34$, d.f.=4, $p<0.01$). Thus, there are differences in behavioral control and customer value across these services. We find the highest mean for perceived behavioral control for the SMS chat service. This is due to experienced chatters participating in the study and due to the service being is perceived as easy to use. None of the services except SMS person to person services is perceived as something the users feel they are unable to cope with. The most interesting findings are for perceived value where we see that despite affectivity bias, perceived value of the SMS person to person service is very low when compared to the mean score of this service for the other variables. No other service has such a

large difference between, for example, usefulness and perceived value (t_{diff}=12.99, d.f.=277, p<0.01). This indicates a lack of customer value for the MMS person to person service among regular mobile users that can not be attributed to affectivity. For the other services, we see that the cash card charging service has the highest mean perceived value followed by MMS content services.

The lowest perceived value is found for SMS chat and Java games. An interesting comparison is between perceived and anticipated value indicating which services users expect will increase in perceived value the next six months. The largest difference is found for the POS payment service where users seem to expect a future value. The second largest differences are found for Java games and the MMS person to person service. All these differences are significant at the 5% level. The only service that is expected to decrease in value is the SMS chat service, but this difference is only significant at the 10% level.

5.2.2 Tests of hypotheses

The specific relationships between mediating variables of the model in figure 3.2 and the dependent variable are proposed in hypotheses B1-3. These suggest that indirect effect attributes, direct effect attributes and intrinsic attributes influence perceived and anticipated value. In the analysis of the measurement model we found that perceived and anticipated value could not be discriminated. Thus, we focus on perceived value in the following analyses. In table 5.19, bivariate correlations of all mediating variables are shown.

Table 5.19. Correlation matrix (*)

	1	2	3	4	5	6	7	8
Ease of use (1)								
Usefulness (2)	0.59							
Compatibility (3)	0.45	0.35						
Service quality (4)	0.53	0.53	0.38					
Innovativeness (5)	0.31	0.39	0.31	0.59				
Network size (6)	0.25	0.22	0.34	0.28	0.30			
Comp. service variety (7)	0.27	0.38	0.34	0.41	0.45	0.35		
Speed of dev. (8)	0.24	0.25	0.30	0.30	0.34	0.38	0.51	
Comp. service quality (9)	0.26	0.28	0.34	0.46	0.46	0.39	0.50	0.46

(*) All correlation coefficients are significantly different from 0 ($p<0.01$)

The table shows that none of the mediating variables have correlations above 0.6, a conservative value for assessing multicollinearity problems. However, correlations at the level of 0.59 are found indicating that multicollinearity should be paid attention to during analyses. Assuming multicollinearity is not a big problem, all hypotheses of direct effects on perceived value (B1-B3) may be tested in a linear regression including all nine mediating variables of the research model in figure 3.2 as independent variables in the analysis. The results of this analysis are shown in table 5.20

Table 5.20. Regression analysis, mediating variables

Dependent is Perceived value Adjusted R^2=0.53	B	Std.err.	β	t
Ease of use	0.09	0.04	0.07	2.30*
Usefulness	0.23	0.03	0.23	7.46**
Compatibility	0.16	0.03	0.16	5.85**
Service quality	0.18	0.04	0.15	4.47**
Innovativeness	0.14	0.03	0.12	4.19**
Network size	0.07	0.02	0.08	3.01**
Comp. service variety	0.16	0.03	0.15	5.07**
Speed of dev.	-0.03	0.03	-0.03	-0.98
Comp. service quality	0.14	0.03	0.12	4.04**

* and ** indicate significance at $p<0.05$ and $p<0.01$, respectively, all R^2 in this report refer to adjusted R^2

From table 5.20 we find that perceived value is explained by eight of the nine mediating variables. All intrinsic attributes are found significant. Furthermore, the direct network effect attribute network size significantly influences perceived value and two of the indirect network effect attributes, complementary service variety and quality, affect perceived value. Thus, seven of the eight hypotheses in section 3 on the relationships between mediating variables and perceived value are supported. In addition to the relationships suggested by the hypotheses, innovativeness is also found to affect perceived value. However, speed of development does not seem to influence perceived value.

To better integrate the structural and measurement models of the relationship between the mediating variables and perceived value of the research model in figure 3.2, a path model may be used. When using Amos 5.0 to design and estimate such a model, results show that the significant

path between ease of use and perceived value is insignificant whereas the path between speed of development and perceived value is significant. Thus, multicollinearity, as well as the simplifications made in the measurement model from aggregating composite variables based upon equal weights in the regression model above, may cause some problems. However, for the purpose of this exploratory investigation, these problems are not considered substantial enough to replace the linear regression analyses with path model analyses (structural equations modeling).

To investigate the hypotheses suggesting that the relationship between mediating variables and perceived value are moderated by behavioral control (B4-B5), regression analysis including behavioral control and interaction terms between behavioral control and the nine mediating variables may be used. To report this analysis in a comprehensible way, the regression analyses are reported with standardized coefficients and t-values only. The results are shown in table 5.21.

Table 5.21. Regression analysis, moderating effects, all data

Dependent is Perceived value	R^2=0.63 β	t	R^2=0.64 β	t
Ease of use	-0.04	-1.72	-0.10	-1.17
Usefulness	0.24	9.96**	0.32	3.40**
Compatibility	0.11	4.92**	0.22	2.60**
Service quality	0.16	5.96**	0.15	1.59
Innovativeness	0.08	3.63**	-0.06	-0.80
Network size	0.04	2.02*	0.02	0.21
Comp. service variety	0.17	7.06**	0.02	0.26
Speed of dev.	-0.02	-0.80	0.08	1.00
Comp. service quality	0.07	2.95**	-0.07	-0.88
Behavioral control (BC)	0.27	10.79**	-0.01	-0.06
Ease of use * BC			0.12	0.73
Usefulness * BC			-0.14	-0.91
Compatibility * BC			-0.18	-1.36
Service quality * BC			0.04	0.21
Innovativeness * BC			0.23	1.77
Network size * BC			0.03	0.32
Comp. service variety * BC			0.23	1.68
Speed of dev. * BC			-0.16	-1.21
Comp. service quality * BC			0.24	1.66

* and ** indicate significance at $p<0.05$ and $p<0.01$, respectively

The analyses shown in table 5.21 indicate that R^2 changes only marginally from 63% to 64%. However, the increase in R^2 from the model shown in the previous regression table excluding behavioral control is considerable (from R^2=0.53 to R^2=0.63). This indicates that, even though this has not been suggested in our hypotheses, including a direct effect of behavioral control seems plausible (B=0.30, t=10.79, $p<0.01$). Thus, we conclude that there are no moderating effects of behavioral control once the direct effect of behavioral control has been included. Due to problems with affectivity in the MMS person to person study, we also conducted this analysis with all services except the MMS person to person service included. The comparable results are shown in table 5.22.

Table 5.22. Regression analysis, moderating effects, MMS P2P excluded

Dependent is Perceived value	R^2=0.54 β	t	R^2=0.55 β	t
Ease of use	-0.01	-0.29	-0.02	-0.19
Usefulness	0.23	7.63**	0.31	2.37*
Compatibility	0.10	3.65**	0.22	2.03*
Service quality	0.14	4.37**	0.06	0.48
Innovativeness	0.12	4.28**	0.05	0.39
Network size	0.05	2.01*	0.09	0.76
Comp. service variety	0.16	5.38**	-0.24	-2.06*
Speed of dev.	-0.04	-1.56	0.03	0.28
Comp. service quality	0.11	3.72**	0.01	0.12
Behavioral control (BC)	0.20	6.42**	-0.13	-1.16
Ease of use * BC			0.03	0.12
Usefulness * BC			-0.15	-0.72
Compatibility * BC			-0.20	-1.18
Service quality * BC			0.17	0.76
Innovativeness * BC			0.11	0.58
Network size * BC			-0.06	-0.38
Comp. service variety * BC			0.60	3.42**
Speed of dev. * BC			-0.11	-0.65
Comp. service quality * BC			0.13	0.70

* and ** indicate significance at $p<0.05$ and $p<0.01$, respectively

From table 5.22 wee see that including the interaction terms representing the moderating variable behavioral control does not improve model fit. Still, the pattern of significant coefficients in the analysis is interesting. We see that the pattern of significant variables in the interaction model includes significant positive influences of usefulness and compatibility. Significant negative direct effects of complementary service variety and a significant positive interaction term of complementary service variety and behavioral control. This leaves us with a very simple and powerful model shown in table 5.23.

Table 5.23 Regression analysis, moderating effects, MMS P2P excluded

Dependent is Perceived value Adjusted R^2=0.51	B	Std.err.	β	t
Usefulness	0.35	0.10	0.34	3.50***
Compatibility	0.23	0.10	0.23	2.23**
Comp. service variety	-0.19	0.11	-0.18	-1.72*
Behavioral control (BC)	-0.02	0.11	-0.02	-0.21
Usefulness * BC	-0.01	0.03	-0.06	-0.41
Compatibility * BC	-0.02	0.03	-0.14	-0.92
Comp. service variety * BC	0.12	0.03	0.67	4.39***

*, ** and *** indicate significance at $p<0.10$ $p<0.05$ and $p<0.01$, respectively

This model is simple, it explains much of the variance in perceived value, and it shows a very interesting relationship between usefulness, compatibility, behavioral control and complementary service variety. From this model it seems that end-users' perceived value decreases as complementary service variety increases if we control for the effect of behavioral control. However, behavioral control positively moderates the relationship between complementary service variety and perceived value. Summarizing these analyses of interaction terms, we find support for only one of the eight hypotheses (B4a, b, c and B5a, b, c, d, e) on how behavioral control moderates the relationships between the mediating variables and perceived value.

The final hypotheses (B6a-c) of section 3 suggest moderating effects of services on the relationship between the mediating variables and perceived value. Now that we have found behavioral control to influence perceived value and only a limited way to moderate the relationship between mediating variables and perceived value, we suggest including behavioral control in the model and compare individual service models to identify service differences.

In tests of moderating effects of service category on the relationship between the mediating variables and perceived value, we have two problems. First, we have found that the categorization of end-users does not correspond to that of service provider professionals. We treat this problem by conducting analysis of the moderating effects of service category at the service level. Second, affectivity bias in the data from one of the services makes analysis of covariance less well suited for an integrated analysis of moderating effects. Thus, individual regression analyses for each service is more suited because we may then compare the pattern of significant regression coefficients across service categories rather than relying on tests of differences in individual regression coefficients that may be influenced differently by affectivity bias. However, analysis of variance including mediating variables as covariates has also been conducted, and is reported in table 5.31.

For all services, we first investigate the correlation matrix to reveal any multicollinearity problems. If these problems are not considered too serious, the model is estimated and the results commented. We start with the MMS person to person services. The largest correlation coefficient of 0.53 is found between ease of use and behavioral control indicating few multicollinearity problems for this model. The results of the regression analysis are shown in table 5.24.

Table 5.24. Regression analysis, mediating variables, MMS person to person service

Dependent is Perceived value Adjusted R^2=0.44	B	Std.err.	β	t
Ease of use	-0.01	0.06	-0.01	-0.19
Usefulness	0.18	0.05	0.18	3.45***
Compatibility	-0.01	0.05	-0.01	-0.12
Service quality	0.09	0.07	0.07	1.21
Innovativeness	0.13	0.06	0.11	2.24**
Network size	0.10	0.04	0.11	2.31**
Comp. service variety	0.12	0.06	0.11	1.95**
Speed of dev.	0.02	0.06	0.02	0.39
Comp. service quality	0.10	0.07	0.07	1.33
Behavioral control	0.35	0.04	0.43	7.92***

*, ** and *** indicate significance at $p<0.10$ $p<0.05$ and $p<0.01$, respectively

From table 5.24 we find that usefulness, innovativeness, network size, complementary service variety and behavioral control all influence perceived value significantly.

For the SMS chat service, the largest correlation coefficient of 0.45 is found between ease of use and behavioral control indicating few multicollinearity problems. The results of the regression analysis are shown in table 5.25.

Table 5.25 Regression analysis, mediating variables, SMS chat service

Dependent is Perceived value Adjusted R^2=0.50	B	Std.err.	β	t
Ease of use	-0.04	0.10	-0.02	-0.34
Usefulness	0.28	0.07	0.26	4.11***
Compatibility	0.16	0.07	0.13	2.17**
Service quality	0.30	0.10	0.21	3.05***
Innovativeness	0.00	0.08	0.00	0.03
Network size	0.12	0.06	0.12	1.82*
Comp. service variety	0.28	0.08	0.27	3.69***
Speed of dev.	0.08	0.08	0.06	0.95
Comp. service quality	0.06	0.08	0.05	0.83
Behavioral control	-0.01	0.09	-0.01	-0.15

*, ** and *** indicate significance at $p<0.10$ $p<0.05$ and $p<0.01$, respectively

From table 5.25 we see that usefulness, compatibility, service quality, network size and complementary service variety influence perceived value. Thus, common to perceived value of both services believed to be characterized by direct network effects are significant influences of usefulness, network size and complementary service variety.

For the MMS content service, the largest correlation coefficient of 0.64 is found between ease of use and usefulness indicating that multicollinearity may be a minor problem. The results of the regression analysis are shown in table 5.26.

Table 5.26. Regression analysis, mediating variables, MMS content service

Dependent is Perceived value Adjusted R^2=0.58	B	Std.err.	β	t
Ease of use	0.00	0.06	0.00	0.07
Usefulness	0.01	0.05	0.01	0.17
Compatibility	0.20	0.05	0.22	4.27***
Service quality	-0.07	0.08	-0.06	-0.87
Innovativeness	0.22	0.06	0.21	3.91***
Network size	0.12	0.04	0.13	2.78***
Comp. service variety	0.08	0.06	0.07	1.32
Speed of dev.	0.02	0.06	0.02	0.32
Comp. service quality	0.19	0.07	0.16	2.69***
Behavioral control	0.28	0.06	0.26	4.63***

*, ** and *** indicate significance at $p<0.10$ $p<0.05$ and $p<0.01$, respectively

From table 5.26 we see that compatibility, innovativeness, network size, complementary service quality and behavioral control influence perceived value.

For the POS payment service, the largest correlation coefficient of 0.72 is found between ease of use and usefulness indicating that multicollinearity may be a problem. Also, the large correlation between ease of use and usefulness seem to be typical for the two services believed to be characterized by indirect network effects. The results of the regression analysis are shown in table 5.27.

Table 5.27. Regression analysis, mediating variables, POS payment service

Dependent is Perceived value Adjusted R^2=0.58	B	Std.err.	β	t
Ease of use	0.02	0.10	0.02	0.17
Usefulness	0.17	0.08	0.18	2.08**
Compatibility	0.18	0.08	0.17	2.16**
Service quality	0.13	0.10	0.11	1.28
Innovativeness	-0.06	0.08	-0.05	-0.71
Network size	0.02	0.06	0.02	0.28
Comp. service variety	0.10	0.07	0.10	1.35
Speed of dev.	-0.10	0.08	-0.09	-1.22
Comp. service quality	0.20	0.08	0.19	2.66***
Behavioral control	0.31	0.07	0.34	4.15***

*, ** and *** indicate significance at $p<0.10$ $p<0.05$ and $p<0.01$, respectively

From table 5.27 we see that usefulness, compatibility, complementary service quality and behavioral control influence perceived value. Thus, compatibility, complementary service quality and behavioral control seem to influence perceived value for both the services believed to be characterized by indirect network effects. Most interesting of these findings is that complementary service quality was found not to influence perceived value for MMS person to person and chat services. However, it seems to consistently influence perceived value for both MMS content and POS payment services.

For the Java game service, the largest correlation coefficient of 0.63 is found between compatibility and behavioral control indicating that multicollinearity may be a minor problem. The results of the regression analysis for this service are shown in table 5.28.

Table 5.28. Regression analysis, mediating variables, Java games

Dependent is Perceived value Adjusted R^2=0.61	B	Std.err.	β	t
Ease of use	0.07	0.11	0.05	0.64
Usefulness	0.07	0.09	0.06	0.80
Compatibility	0.08	0.07	0.08	1.07
Service quality	0.09	0.10	0.07	0.85
Innovativeness	0.16	0.09	0.16	1.80*
Network size	0.00	0.07	0.00	-0.02
Comp. service variety	0.17	0.07	0.16	2.29**
Speed of dev.	0.00	0.09	0.00	0.05
Comp. service quality	0.19	0.10	0.17	1.97**
Behavioral control	0.34	0.10	0.29	3.45***

*, ** and *** indicate significance at $p<0.10$ $p<0.05$ and $p<0.01$, respectively

From table 5.28 we see that innovativeness, complementary service variety, complementary service quality and behavioral control significantly influence perceived value. It is somewhat surprising that innovativeness is the only intrinsic attribute that influences perceived value for this service.

When looking at the card charging service we find that the largest correlation coefficient of 0.64 is found between ease of use and behavioral control indicating that multicollinearity may be a problem. The results of the regression analysis for this service are shown in table 5.29.

Table 5.29. Regression analysis, mediating variables, card charging service

Dependent is Perceived value Adjusted R^2=0.59	B	Std.err.	β	t
Ease of use	0.05	0.08	0.04	0.55
Usefulness	0.34	0.07	0.32	4.97***
Compatibility	0.02	0.05	0.03	0.49
Service quality	0.08	0.08	0.06	1.01
Innovativeness	0.12	0.06	0.11	2.02**
Network size	0.08	0.05	0.08	1.64
Comp. service variety	-0.06	0.06	-0.05	-0.97
Speed of dev.	0.12	0.06	0.11	1.85*
Comp. service quality	0.02	0.06	0.02	0.27
Behavioral control	0.34	0.06	0.36	5.56***

*, ** and *** indicate significance at $p<0.10$ $p<0.05$ and $p<0.01$, respectively

From table 5.29 we see that usefulness, innovativeness, speed of development and behavioral control influence perceived value for this service. Thus, innovativeness and behavioral control both significantly influence perceived value of the services believed to be characterized primarily by intrinsic attributes. An overview of these results is shown in table 5.30.

Table 5.30 Variables with significant regression coefficients for both services in each category

	Direct network effects	Indirect network effects	Intrinsic attributes
Ease of use			
Usefulness	***		
Compatibility		***	
Service quality			
Innovativeness			***
Network size	***		
Comp. service variety	***		
Speed of dev.			
Comp. service quality		***	
Behavioral control		***	***

*** indicates that significant regression coefficients are found for both services in the category

To sum up the results shown in table 5.30, we find that the direct network effect attribute - network size only influences perceived value for the two services believed to be characterized by direct network effects. This is consistent with hypothesis B6a. Furthermore, we find that complementary service quality only consistently influences perceived value for the two services believed to be characterized by indirect network effects. This is consistent with hypothesis B6b, but similar support was not found for the other two indirect network effect attributes – complementary service variety and speed of development. Thus, support is only partial for B6b. Finally, we find that none of the variables reflecting direct or indirect network effect attributes consistently influences the two services believed to be characterized primarily by intrinsic attributes. This finding support what was proposed above in hypothesis B6c.

We discussed above that lack of correspondence between end-users' and service provider professionals' categorization of services could also be attributed to limitations in the ability of end-users to conduct complex assessments of service attributes. Thus, a further test of the hypotheses B6a-c could be based upon this assumption being correct. Thus, our own and the service provider professionals' categorization could be used as the basis for analysis of variance using mediating variables and their interaction terms with service category as covariates. Due to the possibility of affectivity bias, data from the MMS person to person survey are excluded. Table 5.31 shows the results of this analysis.

Table 5.31. Analysis of variance, moderating effects, all services except MMS person to person included

Dependent is Perceived value R^2=0.58	Sum of squares	d.f.	Mean square	F
Ease of use	0.10	1	0.10	0.24
Usefulness	18.48	1	18.48	42.03***
Compatibility	10.13	1	10.13	23.03***
Service quality	6.27	1	6.27	14.27***
Innovativeness	5.11	1	5.11	11.62***
Network size	3.85	1	3.85	8.75***
Comp. service variety	8.49	1	8.49	19.32***
Speed of dev.	0.06	1	0.06	0.14
Comp. service quality	4.39	1	4.39	9.98***
Behavioral control	13.73	1	13.73	31.22***
Service category (SC)	2.10	2	1.05	2.39*
Ease of use * SC	0.66	2	0.33	0.75
Usefulness * SC	3.61	2	1.80	4.10**
Compatibility * SC	2.13	2	1.07	2.42*
Service quality * SC	3.26	2	1.63	3.71**
Innovativeness * SC	2.25	2	1.13	2.56**
Network size * SC	0.46	2	0.23	0.53
Comp. service variety * SC	3.40	2	1.70	3.87**
Speed of dev. * SC	1.35	2	0.67	1.53
Comp. service quality * SC	2.04	2	1.02	2.32*
Behavioral control * SC	5.96	2	2.98	6.78***

*, ** and *** indicate significance at $p<0.1$, $p<0.05$ and $p<0.01$, respectively

From table 5.31 we recognize the main effects of all mediating variables on perceived value except speed of development and ease of use. This corresponds to what was found in the corresponding regression analysis above when including behavioral control in the model. Thus, including interaction effects did not alter the direct effects of the mediating variables on perceived value. We also find that there is a significant effect of service category on perceived value. Thus, there are differences in perceived value across the three categories of services ($F=2.38$, d.f.=2, $p=0.09$). This effect is significant at the 1% level when including the MMS person to person service survey in the analysis ($F=9.82$, d.f.=2, $p<0.01$). Furthermore, we see that as in the analyses of individual services above, significant interaction effects are found for usefulness, compatibility, innovativeness, complementary service variety and complementary service quality. However, we also find a significant interaction effect of service quality that was not identified in the individual analysis of each service. We also find that the interaction effect of network size and service category on perceived value in this analysis is not significant. However, this may be due to problems with a relatively low number of subjects in the direct network effects service category due to leaving the MMS person to person service out of the analysis. Thus, we conclude that the findings based upon individual service category analysis correspond well with the findings from the analysis of variance reported in table 5.31.

In addition, other important findings were also made that oppose the idea that *either* extrinsic or intrinsic attributes are important to particular services. For example, we found that intrinsic attributes like usefulness or indirect network effect attributes like complementary service variety may be important to services characterized by direct network effects attributes also. Furthermore, we found that, even though the influence varied across service categories, behavioral control is

important to services of most categories. Consequently, most hypotheses proposed above on systematic differences in the importance of extrinsic and intrinsic attributes to perceived value for different categories of services were supported. However, a more nuanced picture could also be drawn on how service attributes influence perceived value.

To summarize the demand side study findings, we concentrate first on the findings of relevance to the hypotheses in section 3. In table 5.32, a summary of the findings is shown.

From table 5.32 we see that seven of the eight hypotheses of direct effects of mediating variables on the dependent variable perceived value were supported. Furthermore, we see that only one of the eight hypotheses that behavioral control moderates the relationship between service attributes and perceived value was supported. Finally, it shows that six of the nine hypotheses that the relationship between service attributes and perceived value differ by service category were supported. Three of the hypotheses could not be tested due to lack of discriminant validity in the anticipated value construct.

Table 5.32. Summary of findings related to hypotheses, demand side

No	Mediating	Dependent	Supp	Moderation
B1a	Comp. s. variety	Perceived value	***	
B1b	Comp. s. quality	Perceived value	***	
B1c	Speed of dev.	Perceived value	n.s.	
B1d	Speed of dev.	Anticipated value	n/a	
B2a	Network size	Perceived value	***	
B2b	Network size	Anticipated value	n/a	
B3a	Usefulness	Perceived value	***	
B3b	Ease of use	Perceived value	**	
B3c	Compatibility	Perceived value	***	
B3d	Intrinsic s. quality	Perceived value	***	
B4a	Comp. s. variety	Perceived value	***	Behavioral control
B4b	Comp. s. quality	Perceived value	n.s.	Behavioral control
B4c	Speed of dev.	Perceived value	n.s.	Behavioral control
B5a	Comp. s. quality	Perceived value	n.s.	Behavioral control
B5b	Network size	Perceived value	n.s.	Behavioral control
B5c	Ease of use	Perceived value	n.s.	Behavioral control
B5d	Compatibility	Perceived value	n.s.	Behavioral control
B5e	Intrinsic s. quality	Perceived value	n.s.	Behavioral control
B6a	Network size	Perceived value	supp	Service category (n.s.)[5]
B6b	Network size	Anticipated value	n/a	Service category (n/a)
B6c	Comp. s. quality	Perceived value	supp	Service category (*)
B6d	Comp. s. variety	Perceived value	supp	Service category (**)
B6e	Speed of dev.	Perceived value	n.s.	Service category (n.s.)
B6f	Usefulness	Perceived value	supp	Service category (**)
B6g	Ease of use	Perceived value	n.s.	Service category (n.s.)
B6h	Compatibility	Perceived value	supp	Service category (*)
B6i	Innovativeness	Perceived value	supp	Service category (**)
B6j	Intrinsic s. quality	Perceived value	n.s.	Service category (**)

*, ** and *** indicate significant at $p<0.1$, $p<0.05$ and $p<0.01$, respectively. "n/a" indicates that the hypothesis could not be tested. "supp" indicates support for the hypothesis based upon service comparison analyses.

The study also revealed some other findings that were not hypothesized a priori. These are summarized in table 5.33.

[5] Brackets indicate level of significance in analysis of variance reported in table 5.31.

Table 5.33. Summary table of other findings, demand side

Mediating	Dependent	Supp	Moderation
Innovativeness	Perceived value	**	Also, if mod. by service category
Behav.control	Perceived value	**	Also, if mod. by service category (**)[6]

** indicate p<0.01, respectively.

Table 5.33 shows that even though it was not hypothesized, innovativeness and behavioral control influence perceived value directly. The results also show that the relationships between innovativeness and behavioral control and perceived value differ by service category

5.3 Comparisons and integrated results

In principle, two forms of syntheses may be conducted with our data. First, data may be used to compare service provider perceptions with end-user perceptions. Second, results may be synthesized along the relationships of the research model shown in figure 3.2. In this section, we attempt to conduct both forms of syntheses.

5.3.1 Comparisons of provider and consumer perceptions

Data have been collected for the independent variables at the supply side only. However, data for mediating, moderating and dependent variables have been collected in both supply side and demand side surveys. Thus, two comparisons are possible using these data; comparisons of mean

[6] Indicates level of significance in separate analysis of covariance.

values and comparisons of effects. We first report and discuss comparisons of mean values. Next, effect differences are investigated at the aggregate level and at the service category level.

First, mean values of mediating, moderating and dependent variables may be compared between service provider professionals and end-users. However, several problems make such comparisons less valid. The number of observations in the supply side survey is relatively low when compared to demand side surveys. This makes analysis of variance less suited for mean value comparisons. Also, data from the demand side was collected through six individual surveys with different sampling techniques and potential biases. We have already identified an affectivity bias in the MMS person to person survey illustrating this problem. Affectivity or other common method bias adjustments may be made before comparison is done, but the problem with large differences in variance still remains. Thus, this form of comparison is probably less valid if conducted at the service category level. Thus, we conduct these comparisons at the aggregate level only.

In table 5.34, mean values and standard deviations of the mediating, moderating and dependent variables are shown with corresponding analyses of variance. All services have been included in the analysis.

Table 5.34. Analyses of variance, mediating, moderating and dependent variables

Variable	Service	N	Mean	St. dev.	F
Ease of use	Providers	54	3.90	0.65	0.74
	End-users	1249	4.01	0.87	
Usefulness	Providers	54	3.73	0.95	0.02
	End-users	1247	3.75	1.07	
Compatibility	Providers	54	3.05	1.06	4.05*
	End-users	1245	3.36	1.11	
Service quality	Providers	54	3.77	0.71	0.08
	End-users	1244	3.80	0.86	
Innovativeness	Providers	54	3.65	0.85	0.16
	End-users	1244	3.70	0.90	
Network size	Providers	53	2.58	0.98	21.20**
	End-users	1247	3.28	1.09	
Comp. service variety	Providers	54	3.17	1.07	5.28*
	End-users	1245	3.49	1.00	
Speed of dev.	Providers	54	3.11	1.23	19.77**
	End-users	1244	3.68	0.90	
Comp. service quality	Providers	52	3.19	0.62	9.95**
	End-users	1234	3.56	0.85	
Behavioral control	Providers	54	3.28	0.69	10.87**
	End-users	1247	3.76	1.05	
Perceived value	Providers	54	3.76	0.64	8.53**
	End-users	1247	3.30	1.16	

* and ** indicate significance at $p<0.05$ and $p<0.01$, respectively

From table 5.34 we see that there are several variables where the mean values of service providers' perceptions significantly differ from those of end-users. We also see that despite the small number of service provider professionals, standard deviations are acceptable and differences may be identified. We also see that while most mean values are highest for end-users, the opposite is found for perceived value indicating that means may fruitfully be compared at the aggregate level.

There seem to be differences in mean values of service providers' and end-users' perceptions for compatibility, network size, complementary service variety, speed of development,

complementary service quality, behavioral control and perceived value. Anticipated value was excluded from the analysis due to lack of discriminant validity.

We find that end-users perceive the mobile services as more compatible than service providers ($F=4.05$, d.f.=1, $p<0.05$). End-users perceive network size as larger ($F=21.20$, d.f.=1, $p<0.01$), complementary service variety as greater ($F=5.28$, d.f.=1, $p<0.05$), speed of development as quicker ($F=19.77$, d.f.=1, $p<0.01$), complementary service quality as better ($F=9.95$, d.f.=1, $p<0.01$) and behavioral control as better ($F=10.87$, d.f.=1, $p<0.01$) than service provider professionals. On the other hand, service provider professionals consider perceived value of mobile services to be greater than end-users do ($F=8.53$, d.f.=1, $p<0.01$). It is important to remember that service provider professionals express their judgments of end-users perceptions for behavioral control and perceived value. Thus, end-users feel more in control of these services than service providers think they feel. Not surprisingly, service providers think end-users perceive these services as more valuable then end-users actually do.

The second form of comparison is a comparison in the differences in direct and moderated effects of mediating variables on the dependent variable perceived value between service provider professionals and end-users. Because sample differences, variance differences and affectivity biases are more likely to affect the mean values of service attributes more than relationships, we prefer this form of comparison to mean level comparisons. The comparisons are first conducted for the direct relationships between mediating variables and perceived value. Next, comparisons are made at the level of different service categories using service providers' categorizations as a basis.

In table 5.35, regression analyses are shown for aggregate data of the supply and demand side studies for the direct relationship between mediating variables and perceived value. To ease comparisons, only standardized regression coefficients and their t-values are shown.

Table 5.35 Regression analysis, supply and demand side data

Dependent is Perceived value	Supply side (N=50) Adjusted R^2=0.30		Demand side (N=1222) Adjusted R^2=0.63	
	β	t	β	t
Ease of use	0.07	0.49	0.06	2.53***
Usefulness	0.31	2.02**	0.24	9.55***
Compatibility	0.15	1.16	0.19	8.10***
Service quality	0.05	0.29	0.18	6.46***
Innovativeness	0.24	1.69*	0.08	3.27***
Network size	0.14	1.07	0.07	3.15***
Comp. service variety	-0.06	-0.49	0.17	6.96***
Speed of dev.	-0.01	-0.08	0.00	-0.06
Comp. service quality	0.12	0.86	0.08	3.23***

*, ** and *** indicate significance at $p<0.10$ $p<0.05$ and $p<0.01$, respectively

Demand side analysis was also conducted eliminating MMS person to person services. The results were very similar to those shown in table 5.20 except for ease of use being insignificant. Thus, we use data from all services in further analyses.

From table 5.35 we find that due to huge variance in how each individual service provider professional perceive the relationships between service attributes and value and a small number of observations, only usefulness and innovativeness are found to significantly influence perceived value in the supply side analysis. For the demand side analysis, the results are equal to those

shown in section 5.2 that did not include behavioral control. From these findings we cannot conclude much else than there seem to be much more diversity among service provider professionals in how service attributes contribute to perceived value than among end-users. This is also confirmed in analysis of variance using mediating variables as covariates. This also shows that usefulness and innovativeness is significant regardless of which side of the two-sided market the subjects represent. However, it shows a significant interaction effect of side and complementary service variety ($F=4.69$, d.f.=1, $p<0.05$). Thus, complementary service variety seems to be more appreciated by end-users than by service providers. However, this finding should be interpreted with care due to huge differences in sample size.

Conducting the analysis at the level of each service category, we rely on service provider professionals' categorization of the services. Thus, MMS person to person and SMS chat services are categorized in group number one, MMS content and POS payment services are categorized in group number two, and finally, Java games and cash card charging services are categorized in group number three.

In table 5.36 the results of regression analyses are shown for services categorized by service provider professionals as being particularly characterized by direct network effects.

Table 5.36. Regression analysis, supply and demand side data, service category 1

Dependent is Perceived value	Supply side (N=15) Adjusted R^2=0.30		Demand side (N=454) Adjusted R^2=0.63	
	β	t	β	t
Ease of use	0.81	1.74	0.10	2.40**
Usefulness	0.08	0.22	0.21	5.23***
Compatibility	0.04	0.11	0.17	4.31***
Service quality	-0.98	-1.62	0.17	3.95***
Innovativeness	1.52	2.56**	0.04	1.18
Network size	-0.35	-0.94	0.12	3.50***
Comp. service variety	0.36	0.98	0.19	4.49***
Speed of dev.	0.43	1.25	0.04	0.94
Comp. service quality	-0.24	-0.46	0.03	0.80

*, ** and *** indicate significance at $p<0.10$ $p<0.05$ and $p<0.01$, respectively

One should be very careful when interpreting these results. Mainly because the number of observations in the supply side survey at the service category level is very small. However, some interesting findings can still be made. Again, we see that variation among service provider professionals' perceptions results in few significant relationships in the supply side model. Innovativeness seems to be the only variable where service provider professionals consistently agree that has an influence on perceived value. This perception, however, is not shared by the end-users. This is rather surprising because the result is very consistent for end-users.

In table 5.37 the results of regression analyses are shown for the services believed to be characterized by indirect network effects.

Table 5.37. Regression analysis, supply and demand side data, service category 2

Dependent is Perceived value	Supply side (N=16) Adjusted R^2=0.30		Demand side (N=425) Adjusted R^2=0.63	
	β	t	β	t
Ease of use	0.22	0.78	0.12	2.42**
Usefulness	0.12	0.21	0.09	1.80*
Compatibility	-0.08	-0.22	0.29	6.78***
Service quality	0.35	0.68	0.05	0.92
Innovativeness	0.16	0.44	0.12	2.83***
Network size	0.25	0.81	0.09	2.28**
Comp. service variety	0.03	0.09	0.08	1.71*
Speed of dev.	-0.17	-0.56	-0.01	-0.31
Comp. service quality	0.09	0.23	0.18	3.85

*, ** and *** indicate significance at $p<0.10$ $p<0.05$ and $p<0.01$, respectively

Again, care should be taken when interpreting results, and we see that for this service there is even less agreement among service providers in what influences perceived value.

In table 5.38 the results of regression analyses are shown for services primarily being characterized by intrinsic service attributes.

Table 5.38. Regression analysis, supply and demand side data, service category 3

Dependent is Perceived value	Supply side (N=17) Adjusted R^2=0.30		Demand side (N=341) Adjusted R^2=0.63	
	β	t	β	t
Ease of use	0.08	0.38	0.19	3.74***
Usefulness	-0.20	-0.86	0.21	4.22***
Compatibility	0.04	0.21	0.14	3.17***
Service quality	-0.16	-0.87	0.13	2.49***
Innovativeness	0.44	2.40**	0.19	3.91***
Network size	0.40	2.38**	0.08	2.03**
Comp. service variety	0.06	0.24	0.06	1.45
Speed of dev.	-0.48	-2.53**	-0.04	-1.04
Comp. service quality	0.15	0.86	0.08	1.77*

*, ** and *** indicate significance at $p<0.10$ $p<0.05$ and $p<0.01$, respectively

Even though the number of observations is still low, we see some interesting results in table 5.38. For the other service categories, there seemed to be large variation in the perceptions of what contributes to perceived value among service provider professionals. For this category of services, however, there is much better agreement. Innovativeness and network size seem to contribute to perceived value. This corresponds with end-users perceptions. However, for speed of development, service providers seem to believe that end-users require a long time to get used to services, to adopt them, and to perceive them as valuable. This opinion is not shared by the end-users who do not seem to agree on such a relationship.

Thus, three interesting observations were made from these comparisons. First, there seemed to be very little agreement among service provider professionals on what affected perceived value of mobile services in general. Second, for services with direct network effects there seemed to be a

discrepancy between how service providers and end-users valued innovativeness of services. End-users did not seem to pay much attention to innovativeness for mobile services with direct network effects. Finally, there seemed to be a discrepancy between how service providers and end-users valued speed of development for the category of intrinsic attribute services. While this was not something that end-users considered at all, providers seem to think that speed of development reduced perceived value, probably because services would then not get enough time to be adopted before new versions and developments were introduced.

5.3.2. Integrated results

Due to limitations in data at the supply side, the research model in figure 3.2 may not be estimated and modeled as a path model directly. However, integrated analysis of the research model may be conducted using supply side data for the relationship between independent and mediating variables and demand side data for the relationship between mediating and dependent variables. Also, such analyses are limited to using aggregate data for all service categories. One way to conduct the analysis is to illustrate significant paths along the model illustrated in figure 3.2. We have already conducted the necessary analyses to illustrate significant paths. This form of "path" analysis is entirely explorative in nature and should not be restricted to showing hypothesized relationships. In figure 5.1, the significant paths revealed through our analyses of the supply and demand sides are shown. The path model is illustrated at the construct level.

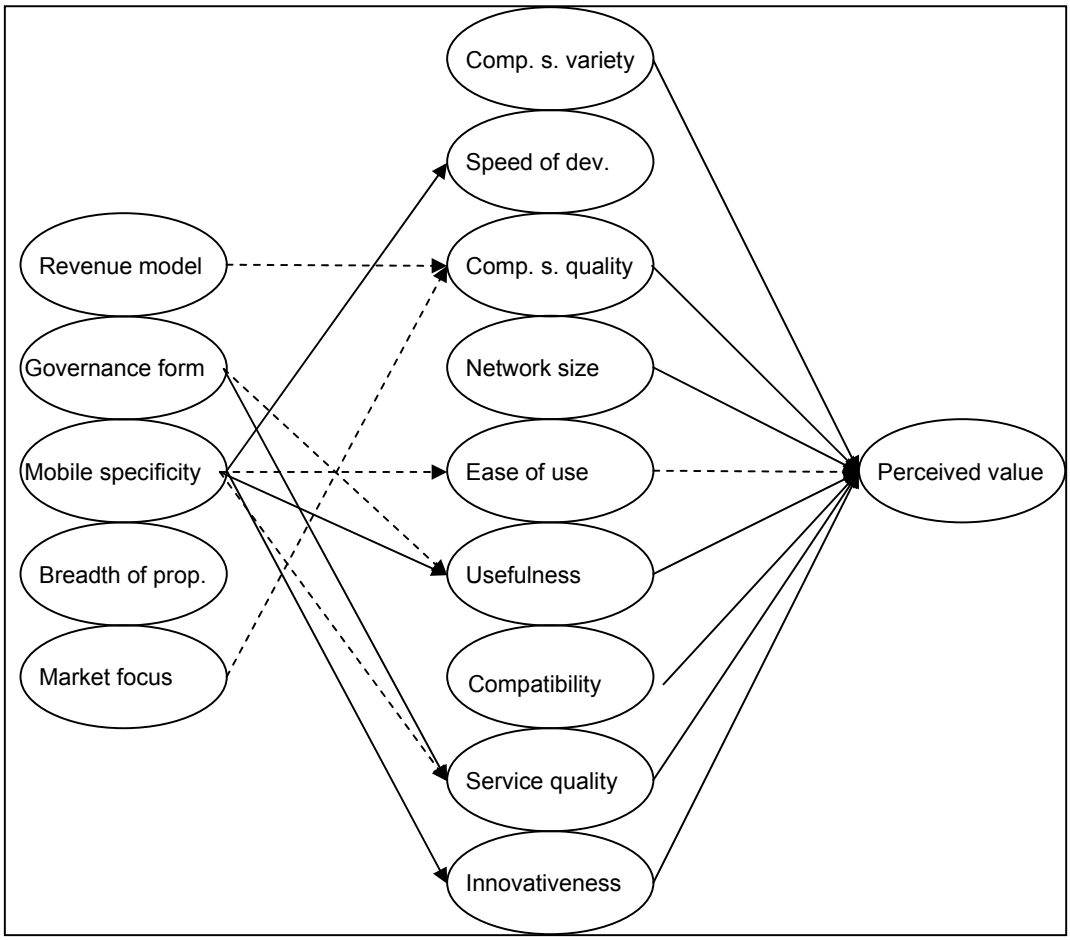

Figure 5.1. Significant paths from combining studies (dashed lines indicate significance at $p<0.05$, and bold lines indicate significance at $p<0.01$)

From figure 5.1 we see that the most significant paths are between governance form and service quality, between mobile specific value propositions and usefulness and innovativeness, and between all service attributes except ease of use and perceived value. We may interpret the integrated findings by starting with the independent variables.

First, we see that content oriented revenue models influence complementary service quality which again influences perceived value. However, this relationship is only significant, and negative, for services characterized by intrinsic attributes. Thus, revenue models are a source of

perceived value, particularly to avoid content based revenue models for services characterized by intrinsic attributes that require high complementary service quality seems to be important.

Second, we find that relational or market oriented governance forms influence usefulness and intrinsic service quality, which again influences perceived value. Thus, relational and market oriented governance forms are sources of perceived value.

Third, we see that mobile specific value propositions influence ease of use, usefulness, service quality and innovativeness positively and speed of development negatively. The negative influence does not seem to be all that important because end-users doe not seem to value speed of development very much. Thus, the most influential part of a mobile service provider's business model is offering mobile specific value propositions. Mobile specific value propositions influence four of the service attributes most important to end-users' perceived value.

Finally, market focus seems to influence complementary service quality, which further influences perceived value. Thus, focused market strategies seem to be the third way that service providers can make business model decisions that enhance end-user value.

We also see that three important determinants of perceived value seem not to be influenced significantly by service providers' business model decisions. Thus, necessary complementary service variety must be obtained through other means than those discussed in this report. The same is the case for network size and compatibility. Suggesting how these attributes may be influences is left to speculation or further research. Of these, we suggest further research, but trying to speculate, complementary service variety and compatibility may be obtained by

standardization and open API's, and network effects may be obtained by horizontal collaboration rather than the vertical forms discussed in this report. Thus, the role of standardization and open application interfaces as well as horizontal integration and horizontal relational agreements may be keys to better understanding of these key influences of perceived value. Thus, further research is required on these topics.

6 CONCLUSIONS, IMPLICATIONS AND DISCUSSION

We have presented a research model suggesting that business model decisions influence end-users' perceived and anticipated service value through the intrinsic and extrinsic service attributes they facilitate. From the research model, a set of hypotheses has been proposed that was investigated empirically through a supply side survey and six demand side surveys covering six different mobile data services. Investigations of validity and reliability of the data from these studies proved that the data could be used to describe perceptions of service differences, test the hypotheses proposed and reveal further relationships between business model dimensions, service attributes and perceived value. In section 5, the results from these three types of investigations (service descriptions, hypotheses tests, revealed relationships) were documented. The complexity of the research model as well as the large number of findings made us summarize these results through hypothesis tables, tables showing revealed relationships not originally hypothesized, and through an integrated path model.

6.1 Conclusions

Because the main focus of this report has been on exploratory investigations the relationships between business model dimensions, service attributes and perceived value, we summarize the most important *significant* findings on these relationships here, whether they were not originally hypothesized or not. Thus, non-significant findings, even though they may be surprising and interesting, are not summarized. First, the supply side study revealed that:

- Provider professionals' perceptions of systematic *differences in service attributes* correspond to the hypothesized categorization. Thus, service providers seem able to categorize services according to direct effects-, indirect effects- and intrinsic service attributes.
- Content oriented *revenue models* decrease complementary service quality for services characterized mainly by intrinsic service attributes, but not for other service categories.
- For services characterized by indirect network effects, relational and market *forms of governance* are believed to increase service quality.
- Relational and market *forms of governance* increase service usefulness regardless of service category.
- *Mobile specificity* of value proposition (accessibility, personalization and ease of information dissemination) increases ease of use for services characterized by direct network effects.
- *Mobile specificity* of value proposition (accessibility, personalization and ease of information dissemination) increases service usefulness regardless of service category, but the relationship is particularly strong for services characterized by intrinsic service attributes.
- *Mobile specificity* of value proposition (accessibility, personalization and ease of information dissemination) increases service quality regardless of service category, but the relationship is particularly strong for services characterized by direct network effects.
- *Mobile specificity* of value proposition (accessibility, personalization and ease of information dissemination) increases service innovativeness regardless of service category.

- *Mobile specificity* of value propositions (accessibility, personalization and ease of information dissemination) increases behavioral control for services characterized by direct and indirect network effects and decreases behavioral control for services characterized mainly by intrinsic attributes.
- *Mobile specificity* of value propositions (accessibility, personalization and ease of information dissemination) requires longer time for services to be developed.
- *Focused market strategies* increase complementary service quality.

As shown in the listing of findings, providers' categorizations corresponded well with our proposed categorization. Even though the relationships between business model dimensions and service attributes were found to be rather different from those proposed in our hypotheses, business model dimensions significantly influenced service attributes. In particular, mobile specificity of value proposition was found more influential than originally proposed. Governance form, revenue model and market focus, however, also influence service attributes significantly.

The demand side study included six individual surveys. Data from these surveys were partly integrated and partly contrasted revealing that:

- End-users' perceptions of systematic *differences in service attributes* do not correspond to the hypothesized categorization. Thus, service providers seem unable to categorize services according to direct network effects, indirect network effects and intrinsic service attributes. This influences their value assessments.

- *Complementary service variety* influences perceived value in general, but most for end-users with a high level of behavioral control and for services characterized by indirect network effects and intrinsic attributes.
- *Complementary service quality* influences perceived value in general, but most for services characterized by indirect network effects.
- *Network size* influences perceived value in general, but most for services characterized by direct network effects.
- *Usefulness* influences perceived value in general, but particularly for services characterized by direct network effects.
- *Compatibility* influences perceived value in general, but particularly for services characterized by indirect network effects.
- *Intrinsic service quality* influences perceived value in general.
- *Innovativeness* influences perceived value in general, but particularly for services characterized mainly by intrinsic attributes.
- *Behavioral control* influences perceived value, but particularly for services that are not characterized by direct network effects.

As seen from the listing of findings, end-users did not seem to perceive services as being different in the same way as service provider professionals. We also found strong support for most of our direct relationships hypotheses in the demand side study. However, behavioral control was not as influential as a moderator as hypothesized, and was only found to moderate the effect of complementary service variety on perceived value. Even though end-users did not seem to grasp the systematic variation in service attributes across service categories, we found strong

support that service category moderated the relationship between service attributes and perceived value. Thus, end-users seemed to perceive service category differences more indirectly or implicitly. For example, even though they were unable to systematically identify services that was characterized by indirect network effects, they seemed to put more weight on the quality of complementary services when assessing the value of such services than when assessing the value of other mobile data services. This finding supports the suggestion that differences in categorization of services between service provider professionals and end-users should be attributed to end-users' *lack of explicit knowledge* of extrinsic attributes (network effects) rather than lack of attention to extrinsic attributes in the value assessment process.

The final set of analyses conducted was integrated analyses of data from both the supply and demand side studies. Two approaches were used. One compared the value perceptions of service provider professionals and end-users. This approach showed considerable discrepancy in the value assessments that service provider professionals believed end-users did and what the end-users actually did. The other approach integrated the supply side model of relationships between business model dimensions and service attributes with the corresponding demand side model of the relationships between these service attributes and perceived value. The identification of *significant paths* in this model showed that:

- Content oriented *revenue models* affect complementary *service quality* – an important source of perceived value.
- Relational and market *forms of governance* influence *usefulness* and intrinsic service *quality*, which are important sources of perceived value.

- *Mobile specific value propositions* influence *ease of use, usefulness, service quality and innovativeness* positively and *speed of development* negatively. Speed of development has no affect on perceive value, whereas, all the other mediating variables affected are important to perceived value.
- *Market focus* influences complementary service *quality* which is an important source of perceived value, particularly for services characterized by indirect network effects.

From the listing of important finding, mobile specificity of value propositions stands out as the most important of all business model dimensions. It affects perceived value through a number of significant paths. Thus, of all business model dimensions, mobile specificity seems the one that should be paid most attention to in both the mobile data services industry and in future research.

6.2 Limitations

Several limitations in the design of this study have already been commented. Particular attention has been given to affectivity bias in one of the demand side surveys and the small number of subjects participating in the supply side study. In a more general framework of threats to validity, attention should be paid to limitations in both internal and external validity.

Internal validity is the main methodological objective of this study. Attention has been given to guarantee the validity of applied constructs. However, some of the constructs have not been applied in this context and some have never been operationalized at all or have not been operationalized with parsimonious instruments and reflective items. Thus, there are limitations in the construct validity of some constructs, but much attention has been given to document and

show acceptable convergence and discriminant validity as well as reliability. Construct validity is also relevant for what is usually termed the manipulation variable. Even though service category is not manipulated in a traditional sense, service category comparisons are important and service category was treated as though it represented a manipulated variable. Manipulation checks showed that end-users did not comprehend the manipulation in the expected way. However, careful analysis of service provider professionals' perception of the manipulation variable showed that these skilled subjects' categorization corresponded very well with the manipulation scheme of the study.

All variables have been measured as service provider professionals and end-users perceptions. For the demand side study, subjects are first hand sources of these perceptions. However, for the supply side study, we are interested in revealing true industry relationships. This means we would like to reveal the structural relationships between business model dimensions and service attributes. One usually accepts that service attributes are perceived attributes, but business model dimensions are, in principle, industrial dimensions. One may argue that service provider professionals are only second hand sources of information about these relationships. However, our study shares this problem with a considerable number of industrial organization studies (Nayyar, 1993, Cannon and Perreault, 1999, Sahay and Riley, 2003, Frels et al., 2003). Thus, it seems unlikely that this threat to measurement validity is any greater in this study than in other industrial organizations studies.

Voluntary participation of subjects is important to obtain recruitment of motivated subjects. However, mixing voluntary and almost compulsory recruitment methods created differences in affectivity bias between otherwise comparable survey data. Particular attention was, however,

given to control for this in analyses. Recruitment of subjects with experience from each of the services surveyed may have given us subjects with more positive attitudes towards the services. However, it is not likely that positive attitudes influence relationships in the same way as they do for levels of perceived value. Consequently, this report has focused relationship findings rather than presenting and comparing levels of perceived value as its main findings.

A large number of hypotheses could be used as an argument that this study was bound to identify significant relationships of one kind or another. However, this is hardly a valid argument against an exploratory investigation of the kind conducted in this study. Instead of expressing exploratory research questions that could easily lead to even more "fishing" for significant relationships, this study has proposed theoretically well founded hypotheses and investigated these through a rigorous research design. We have documented significant findings that have not been hypothesized, but most attention was given to the tests of hypotheses. Partly as a result of differences in the maturity of research on supply side issues versus demand side issues, more null hypotheses were rejected in the demand side study than in the supply side study. This is only logical, given the exploratory status of research on business model dimensions in general and in mobile data services in particular.

Even though external validity is not the main methodological objective of this study, attention has been paid to the most usual threats to external validity as well. For example, attention has been given to show that subjects are representative of the category of potential end-users of each mobile data service. Our service provider professionals have been recruited from a variety of mobile data service provider companies, representing different professional functions and interests. Still, care must be taken in generalizing the findings of this study to current non-users

of mobile data services. The finding that end-users did not seem to comprehend the differences in network effects across service categories may also be explained by lack of validity or representativeness in the chosen service categories. Thus, service categories may have been chosen that were more obviously reflected the role of direct or indirect network effects in creating customer value. This is a topic for further research.

New mobile data services are constantly being developed and introduced. Thus, a limited time slot is open in which customers perceive specific services as innovative and of high value. Services were chosen particularly for their relevance and were believed to vary mainly with respect to differences in direct, indirect ad intrinsic attributes, not in attributes within these attribute categories. Still, care should be taken in generalizing our findings from services categorized here to other services believed to fall in one of the same categories. Differences within service category attributes may prove more important than shown here in providing perceived value and end-user adoption (Nysveen, Pedersen and Thorbjørnsen, 2005).

6.3 Implications

The findings presented in this report have implications for the mobile data service industry and further research. We first focus on industry related implications. To create a better overview of what the findings may imply, a summary of implications is presented from the supply side study first, the demand side study next, and finally, from the integrated analyses conducted in section 5.3. The summary follows the order of findings presented in section 6.1. The main implications of the supply side study are:

- *Open business models* should be used to obtain *service quality* for services characterized by indirect network effects (complementarity).
- *Open business models* should be used to offer more *useful* mobile services.
- For communication services and other services characterized by direct network effects, providers should focus *mobile specificity to improve ease of use*.
- Providers should focus *mobile specificity* to create *useful* services, particularly for services characterized by intrinsic service attributes.
- Providers should focus *mobile specificity* to improve *intrinsic service quality*, particularly for communication services and other mobile data services characterized by direct network effects.
- Providers should focus *mobile specificity* to obtain service *innovativeness*.
- Even though offering *mobile specific* services seem to be critical to service *usefulness, quality, innovativeness and service value*, it may also lead to loss in *behavioral control* for services characterized by intrinsic service attributes.
- Even though offering *mobile specific* services seem to be critical to service *usefulness, quality, innovativeness and service value*, prolonged *development time* is perceived as a barrier that providers have to overcome to offer such services.
- *Focused market strategies* rather than undifferentiated market strategies should be used by providers if *complementary service quality* is important to the value of the service.

Summarizing the listing of implications, providers should pay specific attention to the mobile specificity of their value propositions. Mobile specificity is the key to perceived usefulness, service quality and innovativeness and is the dominant dimension of providers' business models.

In addition, focused market strategies and open business models using relational and market forms of governance also add to service quality and usefulness.

The implications that may be derived from the demand side study are:

- Lack of correspondence between providers' and end-users' attribute models is likely to influence adoption (offerings, value assessments and effectiveness of marketing communication).
- Providers should strive to obtain *variety of complementary services*, particularly if addressing experienced and capable end-users.
- Providers should strive to obtain *quality of complementary services*.
- Providers should pay attention to *network size* for all services, but particularly for communication services and other services characterized by direct network effects.
- Providers should strive to obtain mobile specific *usefulness*, particularly for communication services and other services characterized by direct network effects.
- Providers should offer *compatible* services, particularly for services that are provided in bundles of complementary services.
- Providers should strive for *intrinsic service quality* regardless of service category.
- Providers should strive for *innovativeness*, but particularly for services that are not characterized by network effects.
- Providers should *facilitate* use and help customer gain *control* of the service, particularly for mobile data services not directed at communication.

Due to moderating effects of service category, this list of implications may be used to provide specific advice on which service attributes should be facilitated to obtain perceived value for each service category. However, lack of correspondence between service provider perceptions and end-user perceptions of service attributes suggest that service providers should study the service attribute *perceptions* of their end-users and use these perceptions as a means to continuously offer services with high perceived value.

From the integrated analysis of the supply and demand side studies we suggest the following implications are relevant:

- Providers should avoid content based *revenue models* for services characterized by intrinsic attributes that require high *complementary service quality*.
- To provide services that are perceived as *useful and of good intrinsic quality*, providers should use *open business models*.
- *Mobile specificity* of value propositions is by far the most important business model dimension. No other element in providers' business models affect perceived value more. The element particularly influences perceived value through *usefulness and innovativeness.*
- Providers should follow a *focused market strategy* to create perceived *quality of complementary services*. It follows naturally that this is particularly important for offerings of bundles of complementary services based on a service platform.

Again, summarizing the implications, we advice that service providers pay particular attention to the mobile specificity of their value propositions. The reason is that mobile specificity leads to service characteristics that are valued by end-users. Other dimensions of the business model also affect service attributes, but some of the attributes affected are of no or little importance to end-users' value. Identifying such paths of influence from business model decisions through service attributes to perceived value is a key for service providers trying to develop a better understanding of their own value creation process. In addition, the choice of the right governance form and market focus is also an important determinant of service providers' value creation.

The two findings from this study that have the greatest implications for further research are the importance of mobile specific value propositions and the lack of significant paths from business model dimensions through mediating variables to perceived value. The first of these findings imply that more research should be conducted on the supply side to uncover how mobile specificity is focused in providers innovations processes, how customers are used in the service development process to design mobile specific propositions, what resources are required to develop such propositions and how mobile specific service development is and should be organized.

The second finding indicates that only fragments of the paths from business model dimensions to service attributes have been uncovered in this study. This may be due to lack of sophistication in business model dimensions and the fact that determinants of service attributes not related to business model dimensions have not been included here. An example of the first category of explanations is the lack of a business model dimension specifying the direction that relational or market based governance forms take. We have previously investigated this dimension as

"integration direction" (Methlie and Pedersen, 2002). It is not unlikely that for services characterized by direct network effects, horizontal forms of relational governance are more important in facilitating network size and service compatibility than vertical relational forms. An example of the second category of explanations is external determinants of service attributes that are only partly influenced through providers' business model decisions. Many authors have focused the importance of standardization as an example of this type of external influence (Shapiro and Varian, 1999). Both these explanations would require further research. However, the findings reported here provide a new foundation for conducting such research within the context of mobile services rather than traditional online services.

There are also a number of specific research questions that could be raised from the findings reported here, and that requires further research. One is the lack of correspondence between service provider professionals' and end-users' categorization of services. An important question is whether this difference can be attributed to knowledge and experience differences between provider professionals and end-users, or to more fundamental differences service attribute and value perceptions. If the last attribution is correct, it would imply that service providers should more systematically collect and use end-user perceptions as a basis for their service development, perhaps even include end-users more actively in their service development process (Kristensson, Gustafsson and Archer, 2004). Service provider professionals' seem to better assess the value of extrinsic attributes. An interesting research question is if this also is correct for other professionals, suggesting that the business market for mobile data services is more sensitive to extrinsic attributes than the traditional consumer market.

Another research question is if the service categorization used here applies to more mobile data services, and if the way the categories moderate the relationships in the research model illustrated in figure 3.2 generalize to other services and subjects not studied here. All this calls for larger scale studies both on the demand and supply side. The small number of supply side subjects and the industrial context investigated in a Norwegian setting call for a larger scale study at the supply side. Finally, an exploratory investigation of the kind reported here calls for more thorough investigation of some of the most powerful relationships identified. For example, explanatory power of the different regression analyses conducted at the supply side varied considerably. Combining some of the most powerful models on the supply and demand side to design a more parsimonious model that could be investigated in more detail seems to be an interesting path to follow.

A set of methodological issues could be raised that are relevant in further research. Problems with external validity mentioned above also suggest more parsimonious models should be investigated in larger scale studies. Also, how supply side and demand side data may be combined in research on two-sided markets represents a methodological challenge. Finally, the measures developed and applied in this study require further refinement, including both refinements in the service categorization methodologies applied here and traditional measurement scale refinements.

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APPENDIX A. SAMPLE QUESTIONNAIRES

Side **1** av 4

Konsentrer deg først om **en MMS-innholdstjeneste dere utvikler, videredistribuerer eller tilbyr sluttbrukere**. Du velger selv hvilken innholdstjeneste du skal tenke på. Bruk den som utgangspunkt gjennom hele undersøkelsen.

Svar på spørsmålene ut fra dine **erfaringer**. Hvis du ikke har erfaringer vil vi likevel at du svarer på spørsmålene ut fra det du **vet** eller **tror** om **MMS-innholdstjenesten.**

Vennligst ta stilling til følgende utsagn om **MMS-innholdstjenesten** på en **skala** fra 1 til 5 der **1 er svært uenig** og **5 er svært enig**:	Svært uenig 1	2	3	4	Svært enig 5
Det er lett å lære å bruke MMS-innholdstjenesten	☐	☐	☐	☐	☐
Det er lett å få MMS-innholdstjenesten til å fungere slik man vil	☐	☐	☐	☐	☐
Bruken av MMS-innholdstjenesten er enkel og forståelig	☐	☐	☐	☐	☐
Det er lett å bruke MMS-innholdstjenesten	☐	☐	☐	☐	☐
MMS-innholdstjenesten gjør at man raskt kan få tak i eller formidle det man ønsker	☐	☐	☐	☐	☐
MMS-innholdstjenesten gjør det enklere å få tak i eller formidle det man ønsker	☐	☐	☐	☐	☐
MMS-innholdstjenesten er nyttig når man skal få tak i eller formidle noe	☐	☐	☐	☐	☐
Vennligst ta stilling til følgende utsagn om **bruken** av denne **MMS-innholdstjenesten** på en **skala** fra 1 til 5 der **1 er svært uenig** og **5 er svært enig**:	Svært uenig 1	2	3	4	Svært enig 5
MMS-innholdstjenesten fungerer fint sammen med de andre mobiltjenestene man bruker	☐	☐	☐	☐	☐
MMS-innholdstjenesten fungerer fint uansett hvilket brukersted som leverer innholdet	☐	☐	☐	☐	☐
MMS-innholdstjenesten fungerer fint på alle mobiler som kan håndtere MMS	☐	☐	☐	☐	☐
Brukerne føler at de behersker bruken av MMS-innholdstjenesten	☐	☐	☐	☐	☐
Brukerne har fullstendig kontroll over bruken av mobiltjenester som MMS	☐	☐	☐	☐	☐
Generelt sett har brukerne de midler og ressurser de trenger for å bruke MMS-tjenesten	☐	☐	☐	☐	☐
Slik MMS-tjenesten er tilrettelagt føler brukerne det uproblematisk å velge å ta den i bruk	☐	☐	☐	☐	☐

Hvordan vil du, på en skala fra 1 til 5, vurdere **kvaliteten** på **MMS-innholdstjenesten**?

Elendig	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	Perfekt
Lav standard	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	Høy standard
Svært dårlig	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	Svært god

Hvordan vil du, på en skala fra 1 til 5, vurdere hvor **innovativ** (nyskapende) **MMS-innholdstjenesten** er?

Lite innovativ	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	Svært innovativ
Omtrent som tidligere mobiltjenester	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	Radikalt ny
Tradisjonell	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	Noe helt nytt

Fortsett på neste side når du er klar.....

Side **2** av 4

Konsentrer deg fortsatt om **den samme MMS-innholdstjenesten**.

Svar på spørsmålene ut fra dine **erfaringer**. Hvis du ikke har erfaringer vil vi likevel at du svarer på spørsmålene ut fra det du **vet** eller **tror** om **MMS-innholdstjenesten.**

Vennligst ta stilling til hvordan du oppfatter **verdien** av denne **MMS-innholdstjenesten** på en **skala** fra 1 til 5 der **1 er svært liten** og **5 er svært stor**:	Svært liten 1	2	3	4	Svært stor 5
Totalt sett er verdien av MMS-innholdstjenesten for brukerne:	☐	☐	☐	☐	☐
Når det gjelder innholdstjenester, er MMS-tjenestens evne til å tilfredsstille brukernes behov og ønsker:	☐	☐	☐	☐	☐
Sammenlignet med det som må ofres for å bruke MMS-innholdstjenesten vil jeg si verdien den gir brukerne er:	☐	☐	☐	☐	☐
Jeg forventer at verdien av MMS-innholdstjenesten for brukerne de neste seks månedene vil være:	☐	☐	☐	☐	☐
Når det gjelder innholdstjenester, forventer jeg at MMS-tjenestens evne til å tilfredsstille brukernes behov og ønsker de neste seks månedene vil være:	☐	☐	☐	☐	☐
Sammenlignet med det som må ofres for å bruke MMS-innholdstjenesten vil jeg si verdien jeg forventer den vil gi brukerne de neste seks månedene er:	☐	☐	☐	☐	☐

Vennligst ta stilling til følgende utsagn om **brukernettverket** til denne MMS-innholdstjenesten på en **skala** fra 1 til 5 der **1 er svært uenig** og **5 er svært enig**:	Svært uenig 1	2	3	4	Svært enig 5
Svært mange av mobilbrukerne jeg har kjennskap til bruker MMS-innholdstjenesten	☐	☐	☐	☐	☐
Svært mange, også ut over mobilbrukerne jeg har kjennskap til, bruker MMS-innholdstjenesten	☐	☐	☐	☐	☐
Det å bruke MMS-tjenester er en svært vanlig måte å skaffe seg innhold på mobilen blant de mobilbrukerne jeg kjenner til	☐	☐	☐	☐	☐
Folk som bruker MMS-innholdstjenesten har mye mer til felles enn de som ikke gjør det	☐	☐	☐	☐	☐

Vennligst ta stilling til følgende utsagn om de andre **innholdstjenestene som baserer seg på MMS** (f. eks. andre bilde-, lyd- og nyttetjenester) på en **skala** fra 1 til 5 der **1 er svært uenig** og **5 er svært enig**:	Svært uenig 1	2	3	4	Svært enig 5
Med MMS får man adgang til svært mange forskjellige innholdstjenester også	☐	☐	☐	☐	☐
Bruker man MMS får man samtidig adgang til mange andre innholdstjenester	☐	☐	☐	☐	☐
Noe av det unike med MMS er at det kan brukes til å formidle mange forskjellige typer innhold	☐	☐	☐	☐	☐
En egenskap ved MMS er at man kan velge blant mange forskjellige leverandører av samme type innhold	☐	☐	☐	☐	☐
Antallet nye innholdstjenester basert på MMS har økt kraftig det siste året	☐	☐	☐	☐	☐
Jeg forventer at antallet nye innholdstjenester basert på MMS vil øke kraftig de neste seks månedene	☐	☐	☐	☐	☐
Siden MMS ble introdusert som en måte å formidle innhold på har innholdet som leveres på denne måten økt svært hurtig	☐	☐	☐	☐	☐

Hvordan vil du, på en skala fra 1 til 5, vurdere **kvaliteten på de andre innholdstjenestene** som baserer seg på MMS?

Elendig	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	Perfekt
Lav standard	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	Høy standard
Svært dårlig	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	Svært god

Fortsett på neste side når du er klar.....

Side **3** av 4

Konsentrer deg nå om **organiseringen** og **tilbudet** av **MMS-innholdstjenesten.**

Svar på spørsmålene ut fra dine **erfaringer**. Hvis du ikke har erfaringer vil vi likevel at du svarer på spørsmålene ut fra det du **vet** eller **tror** om **MMS-innholdstjenesten.**

Vennligst ta stilling til følgende utsagn om **organiseringen** av **MMS-innholdstjenesten** på en **skala** fra 1 til 5 der **1 er svært uenig** og **5 er svært enig**:	Svært uenig 1	2	3	4	Svært enig 5
Prisen kunden betaler for MMS-innholdstjenesten avhenger av innholdet i det som sendes og mottas og ikke hva det koster å transportere innholdet	☐	☐	☐	☐	☐
Inntektene som skapes fra MMS-innholdstjenesten avhenger av innholdet i det som sendes og mottas, og ikke fra transporten	☐	☐	☐	☐	☐
Fordelingen av inntekter fra bruk av MMS-innholdstjenesten er slik at en stor andel tilfaller de som leverer innholdet i tjenesten og ikke transporten av innholdet	☐	☐	☐	☐	☐
Vi ønsker et åpent forhold til dem vi samarbeider med for å tilby MMS-innholdstjenester og stiller ingen bestemte funksjonelle krav til tjenesteutformingen	☐	☐	☐	☐	☐
Vi ser ikke behovet for omfattende kvalitetssikring av dem vi samarbeider med for å tilby MMS-innholdstjenester	☐	☐	☐	☐	☐
Vårt forhold til dem vi samarbeider med for å tilby MMS-innholdstjenester er bedre karakterisert som åpent og gjensidig enn kontrollerende og styrende	☐	☐	☐	☐	☐
Avtalene med dem vi samarbeider med for å tilby MMS-innholdstjenester er relativt enkle og lite formalisert	☐	☐	☐	☐	☐
Mobiltjenester har en del unike **egenskaper**, for eksempel ved at de er tilgjengelige når som helst og hvor som helst, at de kan gjøres personlige for brukeren eller at de kan gjøres avhengige av hvor brukeren er. Ta utgangspunkt i dette og angi hvor enig eller uenig du er i følgende utsagn om **MMS-innholdstjenesten** på en **skala** fra 1 til 5 der **1 er svært uenig** og **5 er svært enig**:	Svært uenig 1	2	3	4	Svært enig 5
Denne MMS-innholdstjenesten er en tjeneste som utnytter det unike ved mobilen som plattform	☐	☐	☐	☐	☐
Denne MMS-innholdstjenesten har noen særskilte egenskaper som bare kan realiseres fordi den bruker mobilen som plattform	☐	☐	☐	☐	☐
Denne MMS-innholdstjenesten er spesiell fordi den utnytter mobilens unike egenskaper	☐	☐	☐	☐	☐
Mobiltjenester kan dekke mange behov. Eksempler på slike behov er nytte, behovet for å være tilgjengelig uavhengig av tid og sted, behovet for underholdning, behovet for sosial kontakt eller behovet for å uttrykke hvem man er. Ta utgangspunkt i dette og ta angi hvor enig eller uenig du er i følgende utsagn om **MMS-innholdstjenesten** på en **skala** fra 1 til 5 der **1 er svært uenig** og **5 er svært enig**:	Svært uenig 1	2	3	4	Svært enig 5
Denne MMS-innholdstjenesten retter seg spesielt mot ett eller et fåtall bruksbehov	☐	☐	☐	☐	☐
Denne MMS-innholdstjenesten dekker mange ulike behov	☐	☐	☐	☐	☐
Det er meningen at denne MMS-innholdstjenesten skal møte mange forskjellige behov hos brukeren	☐	☐	☐	☐	☐
Denne MMS-innholdstjenesten tilbys som en tjeneste med et stort mangfold av funksjoner rettet mot mange forskjellige behov	☐	☐	☐	☐	☐
Vi tilbyr denne MMS-innholdstjenesten som en del av et tjenestetilbud med stor bredde	☐	☐	☐	☐	☐

Fortsett på siste side når du er klar.....

Side **4** av 4

Konsentrer deg fortsatt om **MMS-innholdstjenesten**.

Svar på spørsmålene ut fra dine **erfaringer**. Hvis du ikke har erfaringer vil vi likevel at du svarer på spørsmålene ut fra det du **vet** eller **tror** om **MMS-innholdstjenesten.**

Vennligst ta stilling til følgende utsagn om **MMS-innholdstjenesten** på en **skala** fra 1 til 5 der **1 er svært uenig** og **5 er svært enig**:	Svært uenig 1	2	3	4	Svært enig 5
Det er strategisk viktig at markedsføringen av denne MMS-innholdstjenesten skjer mot bestemte kundegrupper eller segmenter	☐	☐	☐	☐	☐
Denne MMS-innholdstjenesten er rettet mot ett eller noen få kundesegmenter/kundegrupper	☐	☐	☐	☐	☐
Markedsføringen av denne MMS-innholdstjenesten er rettet mot en eller noen få spesielle kundegrupper	☐	☐	☐	☐	☐
Denne MMS-innholdstjenesten tilbys eller produseres med spesielle egenskaper for bestemte kundegrupper	☐	☐	☐	☐	☐
Denne MMS-innholdstjenesten har bred markedsappell	☐	☐	☐	☐	☐

Vennligst ta stilling til følgende utsagn om **MMS-innholdstjenesten** på en **skala** fra 1 til 5 der **1 er svært uenig** og **5 er svært enig**:	Svært uenig 1	2	3	4	Svært enig 5
En økning i antall brukere av denne MMS-tjenesten øker verdien av den for den enkelte bruker	☐	☐	☐	☐	☐
Når antall brukere av denne MMS-tjenesten er stort, gir tjenesten mer verdi enn sammenlignbare tjenester	☐	☐	☐	☐	☐
Verdien av MMS-tjenesten øker når det er mye annet innhold som baseres på MMS	☐	☐	☐	☐	☐
Hvis det finnes mye annet innhold på mobilen som baseres på MMS, er verdien av å bruke MMS-tjenesten stor	☐	☐	☐	☐	☐
Verdien av MMS-tjenesten er mer avhengig av hvordan innholdstjenesten er utformet enn om mange bruker den	☐	☐	☐	☐	☐
Verdien av MMS-tjenesten er mer avhengig av hvordan tjenesten i seg selv er utformet enn at det finnes mye annet innhold på mobilen basert på MMS	☐	☐	☐	☐	☐

Vennligst **besvar følgende spørsmål**:	
Er du kvinne eller mann?	☐ Kvinne ☐ Mann
Hva er din alder?	☐ 0-19 ☐ 20-29 ☐ 30-39 ☐ 40-49 ☐ 50-59 ☐ 60 og over
Hva er din høyeste utdanning?	☐ Grunnskole ☐ Videregående skole ☐ Universitet/høyskole 1-3 år ☐ Universitet/høyskole 4 år eller mer
Hvilken type selskap representerer du?	☐ Operatør ☐ Annen tjenestetilbyder

Husk å fylle ut kontaktinformasjon på første side av undersøkelsen og returner dine svar i vedlagte svarkonvolutt!