

# **DEVELOPING NETWORKED BUSINESS MODELS FOR EMERGING TECHNOLOGY-BASED SERVICES – UNDERLYING CHALLENGES**

Teea Palo

*Department of Marketing, Oulu Business School, University of Oulu, P.O. Box 4600, 90014  
University of Oulu, Finland, teea.palo@oulu.fi*

Developing commercially successful technology-based services has proved to be challenging. Companies are facing a frustrating problem of how to develop new business models for the services. For the business model to succeed, it needs to exploit a viable business opportunity. In addition, it needs to be developed in a net of actors since the development, production, and commercialization of the services require a diversity of activities and resources. Yet there is a lack of studies on the dynamics of business models, and empirical research on networked business models is scarce. To fill in this gap, this study aims to elaborate the development of networked business models, and identify the underlying challenges in this. This will be done by analysing the emergence of the business net and business opportunities in the specific field of novel technology-based services which are still at the development and testing phase. The empirical data has been collected in a real-life experiment among experts in the fields of developing, testing, and commercializing new ubiquitous services. As a result, the key phases in networked business model development are presented, and challenges regarding this development are identified.

Keywords: Networked business model, business net, business opportunity, technology-based service

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# DEVELOPING NETWORKED BUSINESS MODELS FOR EMERGING TECHNOLOGY-BASED SERVICES – UNDERLYING CHALLENGES

## INTRODUCTION

Many companies increasingly engage in research and testing activities which aim at creating new technological applications in order to cope with threats and leverage possible market opportunities posed by emerging technologies (Srinivasan, 2008). However, translating the results from scientific research into industrial innovation (Lundgren, 1995) and further into commercially successful technology-based services that create value for the customer as well as the network actors has proved to be problematic and challenging. A key challenge is how to innovate business models for emerging technology-based services. It is common to see technological innovations fail commercially since there is a lack of studies on business model design and implementation (Teece, 2010; Osterwalder et al., 2005). There is also a failure in the way scholars account for the use and operations of business models (Doganova & Eyquem-Renault, 2009) and only a little formal research has been done into the dynamics and processes of business model development (Johnson et al., 2008). Hence there is strong need to elaborate the development of business models.

An essential prerequisite for developing future business models for emerging technology-based services is the identification and exploitation of business opportunities; the overall objective of a business model is to exploit an opportunity (Zott & Amit, 2010). Another key feature to be considered in developing business models for novel technology-based services is the networked nature of the development, production, and commercialization of such services. The development of technology requires a network of actors connecting the supply and demand sides and facilitating the development, production and application of new technology (Lundgren, 1995). A diversity of activities and resources are needed from various actors (see e.g. Kalakota & Robinson, 2002; Lundgren, 1995; Möller & Svahn, 2009), such as application provider, technology providers, infrastructure providers, network operators, device producers, and content and service providers. Hence, this study focuses on the level of company actors instead of analysing the individuals. To create commercially viable services out of the new technology, these different actors need to form strategic business nets with radical changes in their value systems or completely new value activities (Möller & Rajala, 2007; Möller et al., 2005). Hence, this study adopts a network perspective on business models and uses the term networked business model to describe the various actors coordinating and combining their activities and resources to create value from the emerging technology-based services.

For the above mentioned reasons, *this study aims to elaborate the development of networked business models, and identify the underlying challenges in this.* This will be done by analysing the emerging business nets and business opportunities in the specific field of novel technology-based services which are still at the development and testing phase but yet their business potential and future commercialization need to be planned. Hence in this specific context, the importance of examining the networked business model development is emphasized since the commercialization of technology-based services needs to be done by potential new and existing actors, and due to the future perspective, there are various challenges in this. The paper builds on research on business models (see e.g. Shafer et al., 2005, Osterwalder et al., 2005) from the strategic business net perspective (e.g. Möller et al., 2005; Jarillo, 1988; Parolini, 1999), and explores literature on entrepreneurial opportunities to understand the development of networked business models for novel technology-based

services. The study aims to contribute to business model research by integrating notions from strategic networks and entrepreneurial opportunities as interpretive lenses in developing future business models. The study is qualitative and the empirical data consists of interviews and observation on the potential business net actors' expectations and views on future business creation for the services.

Next, the theoretical background of the study is discussed, and a conceptual framework will be developed. Following this, the methodology of the study is presented more thoroughly. After illustrating the findings of data analysis, the implications of this study and future research to be done are discussed.

## IDENTIFICATION OF BUSINESS OPPORTUNITIES

The creation of new, successful businesses follows a successful opportunity development process (Ardichvili et al., 2003). Before technological change results in new processes, products, and markets, entrepreneurs must discover opportunities in which to use the new technologies (Shane, 2000). Hence, to create business of an invention, either the inventor or entrepreneur must recognise the opportunity and evaluate it (Ardichvili et al., 2003), and furthermore to exploit it in a business model. Identifying business opportunities is thus highly important in the specific context of emerging technology-based services, whose business potential and commercialization are yet to be planned and realized.

Research on opportunity recognition is based on entrepreneurship literature (Park, 2005). In fact, Shane and Venkataraman (2000) state that the field of entrepreneurship is concerned with the sources of opportunities, the processes of discovery, evaluation, and exploitation of opportunities, and the set of individuals who discover, evaluate, and exploit them. An entrepreneurial opportunity consists of 1) new ideas or inventions that may or may not lead to the achievement of economic end(s) made possible by such ideas or inventions, 2) beliefs about things favourable to the achievements of such ends, and 3) actions that implement those ends through specific new economic artefacts that may be products and services, and/or firms and markets, and/or standards and norms (Sarasvathy et al., 2003). Singh (2001) defines entrepreneurial opportunity as a feasible, profit-seeking, potential venture that provides an innovative new product or a service to market, improves an existing product/service, or imitates a profitable product/service in a less-than-saturated market. Entrepreneurial opportunities can be conceived as situations in which new goods, services, material, markets, and organizing methods can be introduced through the formation of new means, ends, or means-ends relationships (Eckhardt & Shane, 2003; Shane & Venkataraman, 2000).

Sarasvathy et al. (2003) distinguish different views on entrepreneurial opportunity; as a function, a process, or a set of decisions. In opportunity recognition both sources of supply and demand exist rather obviously, and the opportunity for bringing them together has to be recognised. In opportunity discovery only one side exists, demand or supply, and the non-existent side has to be discovered. In opportunity creation neither supply or demand exist in an obvious manner, but they have to be created and several economic inventions e.g. in marketing, financing, etc. have to be made for the opportunity to come into existence. There is a difference when certain entrepreneurial actions will be effective in enabling entrepreneurs to form opportunities (Alvarez & Barney, 2007). For example the development of business model can be seen different in the discovery and creation theories. In the discovery view on entrepreneurial opportunities as objective phenomenon, entrepreneurs would spend a lot of

time and effort on developing a single and comprehensive business plan, whereas in the creation view, business plan can be written after an opportunity has been created (Alvarez & Barney, 2007). This study focuses on the actions and functions in opportunity identification and exploitation, where each view can provide additional insights into the phenomenon of business opportunities.

Park (2005) identifies three components of the opportunity recognition process; the founding entrepreneur, collective knowledge and experience of the firm, and the technology on which new venture is based. New product innovation results as an interaction and combination between these components. According to Eckhardt and Shane (2003) opportunity discovery process describes how individuals perceive of a previously unknown way to create a new means-ends framework. Here, the individual must attempt to foresee the characteristics of future markets to determine whether the opportunity has potential value. Shane (2000) emphasizes the role of prior knowledge in entrepreneurial opportunity discovery. Although information about a technological change is disseminated broadly, only a certain subset of people possesses prior knowledge that triggers the discovery of a particular opportunity. Three dimensions of prior knowledge are essential in entrepreneurial discovery; knowledge of markets, ways to serve markets, and customer problems.

According to Ardichvili et al. (2003) opportunity development process includes recognition of an opportunity, its evaluation, and development. They identify some major factors affecting the process of opportunity recognition and development, such as entrepreneurial alertness, information asymmetry and prior knowledge, social networks, personality traits, and the type of opportunity itself. Entrepreneur needs to investigate and be sensitive to market needs, as well as be able to spot suboptimal deployment of resources to develop an opportunity. In the process of opportunity exploitation, individuals acquire resources and engage in activities that change prices and provide information to others (Eckhardt & Shane, 2003). The opportunity development processes may differ between individuals, teams, and institutions; e.g. some individuals may excel at invention while others at creating business models (Ardichvili et al., 2003).

Much of the focus of entrepreneurial opportunity discussion is on the individual level. The characteristics of individuals, such as entrepreneurial alertness to market needs are essential. The knowledge possessed by the entrepreneur is important in identifying the opportunities, and the exploitation of the opportunity requires specific resources and activities. This study perceives that the identification and exploitation of the opportunities can take place both at the individual and corporate levels, and even in networks of business actors. There is a need for entrepreneurial actions in the network, which facilitate the business model development.

## NETWORK PERSPECTIVE ON BUSINESS MODELS

Networks have been identified as a key element of business models (Shafer et al., 2005; Westerlund et al., 2008). Various definitions of business models highlight the notion of actors and relations (e.g. Timmers, 1998; Weill & Vitale, 2001) as well as the role or the position of a company in a network (e.g. Chesbrough & Rosenbloom, 2002; Westerlund et al., 2008). A business model is seen as a crucial source of value creation for the firm and its suppliers, partners and customers (Amit & Zott, 2001) and as the firm's logic for creating and capturing value in a value network (Shafer et al., 2005). The boundary-spanning nature of business models emphasizes the need to consider activities performed outside the boundaries of the focal firm, allowing the firm to rely on resources and capabilities of third parties (Zott &

Amit, 2010). Cooperating with partners in the research and development of a new product or a service creates business model options with many benefits, such as reducing expenses and opening new markets (Chesbrough & Schwartz, 2007). As can be seen from the above, previous studies consider business models to be centred on a particular actor (Amit & Zott, 2001) and examine the network through the central actor.

Yet, often in new service development, and especially in the emergence of technology-based services, a single firm cannot master all the relevant competencies and resources but various actors are needed (e.g. Komulainen et al., 2006; Lundgren, 1995; Möller & Svahn, 2009). Relationships with customers, suppliers, research institutions, and competitors can share the burden of innovation (Ritter & Gemünden, 2003). Business model can provide a broader conceptualization for capturing this kind of evolution of value creation from individual firms to networks (Nenonen & Storbacka, 2009; Zott & Amit, 2008). Hence, business models need to be attractive to the multiple actors (Bouwman & Fiel 2008) involved in developing and producing the new service. Business model describes the way the whole network of companies creates customer and network value, and thus changes in a business model lead to changes in value creation in the network (Kijl et al., 2005). The current study considers the business model to be centred on the emerging technology-based service, and uses the term networked business model to describe the various actors coordinating and combining their activities and resources to create value from the service.

Networks in the field of emerging technology-based services are dynamic and complex with new actors from different industries (Kijl et al., 2005). Hence, the actors and roles need to be identified and formed into strategic business nets to develop and commercialize new technology-based services (Möller et al., 2005). Such strategic networks are purposeful arrangements to gain or sustain competitive advantage by outsourcing activities and focusing on the key ones (Jarillo, 1988). Strategic networks are composed of enduring interorganizational ties and provide companies the access to information, resources, markets and technologies (Gulati et al., 2000). Companies with superior network structures are also able to better exploit their own internal capabilities (Zaheer & Bell, 2005). Strategizing means for a single company that the heterogeneity of resources and interdependencies between activities, and the organised cooperation among the companies, needs to be considered simultaneously (Gadde et al., 2003). Jarillo (1988) sees a hub firm as essential in setting up the network and taking a pro-active role in it. In the business net of the service or the product, there are often one or more leading actors, which can influence the business model development greatly; such actors have usually critical roles performing many activities, such as the telecom operators, but also the service and content providers may have the opportunity to be the leading firm in the network (Kijl et al., 2005).

Value creation logic and management mechanisms are central in understanding strategic business nets (Möller & Rajala, 2007; Möller et al., 2005) and their evolution. Value creating systems can be defined as sets of activities that create value and that are connected to each other by flows of information, material, money and influence relationships (Parolini, 1999). Different value creation logics require different management mechanisms (Möller & Rajala, 2007). Although there are differing views on the manageability of organizations and networks (Achrol, 1997; Håkansson & Snehota, 2006; Möller & Rajala, 2007), the key issue is what kinds of management mechanisms are suitable for different types of nets (Möller & Rajala, 2007) and in business models as well (Westerlund, 2009). Möller and Rajala (2007) identify three types of nets in the domain of emerging business nets which concern radical and discontinuous change and are characterized by vaguely identifiable ideas about the future

involving great uncertainty. Firstly, there are innovation nets which are mainly loose science and technology-based research networks consisting of universities, research institutions and research organizations of corporations. Secondly, there are dominant design nets in which companies try to create dominant technological designs in order to favour their positions in the field. The third type is application nets which are formed in order to achieve commercially viable business applications of the evolving technology. These nets can overlap with dominant design nets. The specific features of technology and technology-based services affect the structure of the net including the actors and their roles. Technological development in terms of standards is important, and has direct and indirect impact on the possible actors in the market (Nyström, 2008). The types of nets are included in the networked business model development since the service is developed and further commercialized by an evolving net of actors.

## REVIEW ON BUSINESS MODELS

### Defining and using business models

The overall objective of a business model is to exploit a business opportunity by creating value for the parties involved (Zott & Amit, 2010). In fact, business model “depicts the content, structure, and governance of transactions designed so as to create value through the exploitation of business opportunities” (Amit & Zott, 2001, 511). Business models allow entrepreneurs to explore the market and to bring their innovation into existence (Doganova & Eyquem-Renault, 2009) and hence, the business model design is a key decision for new entrepreneurs (Zott & Amit, 2010).

How can business models be used then to exploit the business opportunities and to create value of new technology-based services? Baden-Fuller and Morgan (2010) see that business models have a multifaceted character as models. Business models enable us to classify businesses in a taxonomy, they may function as models in the scientific sense, and specific business models may function as recipes that provide managers and scholars a way to describe and distinguish the variety of types of business behaviour. Demil and Lecocq (2010) identify static and transformational uses of the business model concept. In the static view, business model is a blueprint, enabling description and classification. In the transformational view, business model is considered as a tool to address change and focus on innovation. Since the field of new technology is very knowledge-intensive and often difficult to understand by investors, customers, and partners, the business model gives an explanation of complex processes by telling what kind of value is created and shared (Doganova & Eyquem-Renault, 2009). Hence, the business model can be used in future business planning and creation.

Doganova and Eyquem-Renault (2009) identify three approaches to business models; essentialist, functionalist, and pragmatic. They conceive that the extant literature has focused on providing simplified descriptions of companies, and then such broad definitions have been elaborated through identifying the elements or components of the business model. Such definitions share a common view of the business model; a description, or a representation of reality beyond the firm. However, they continue that the entrepreneurship scholars have viewed business models differently and shifted the view to a functionalist, or instrumental perspective. Business models are prospective; they envisage a future venture and its value creation logic, and are part of a planning activity that relies on writing the business plan. However, the authors propose a pragmatic stance on business models, and examine them as

intelligent collective devices in contexts of uncertainty. This paper applies this kind of view on business models, which are thus perceived as demonstrations aiming to provide evidence for the feasibility of an innovative project and to facilitate the development of the business net for the emerging services.

### Developing the business model – choices and phases

Technological innovation often triggers business model development because of the need to bring new discoveries to market and the chance to satisfy novel customer needs (Teece, 2010). However, despite the presence of market opportunities and novel business ideas, ventures often fail because of the underlying model driving the business (Morris et al., 2005), and therefore we need to focus on the critical phases in business model development.

New and potential configurations of the elements of a business model to probe nascent markets and hence learn ahead of the rest of the market are ways to business model innovation (Chesbrough, 2010). Creativity, insight, as well as customer, competitor, and supplier information and intelligence are needed in developing new business models (Teece, 2010). Defining the type of innovation (e.g. radical or disruptive vs. incremental or sustainable technological innovation) can also be helpful in business model development since it can facilitate the development of suitable business models and networks to capitalize on a technological innovation (Kijl et al., 2005). Also organizational processes must change; companies need to adopt an effectual attitude toward business model experimentation, identify internal leaders for business model change, as well as adjust the culture to embrace the new model (Chesbrough, 2010). Companies should take into account the external factors that influence business models such as market, technological, and regulatory influences (Kijl et al., 2005). Key decisions in developing business models to a large extent concern the core elements of a business model. For example Teece (2010) has recognised the following elements that need to be determined in a business model design: selection of technologies to be embedded in a product/service, determining the benefit of the product/service to the customer, identification of market segments, confirmation of available revenue streams, and design of mechanisms to capture value.

Only a few studies have focused on the specific phases or shifts in developing the business model. Such phases may include e.g. specification, refinement, adaptation, revision, and reformulation (Morris et al., 2005); the technology/R&D phase, the implementation/roll-out phase, and the market phase (Kijl et al., 2005); or in the light of the technology life cycle the emerging or fluid phase, growth or transitional phase, and the mature or stable phase (Afuah & Tucci, 2001).

During the initial phases the focus is on technology, investments, and the development of service concepts, following the service concept testing, field experiments, first introduction and small scale roll-out services (Kijl et al., 2005). The business model is fairly informal and implicit, a process of trial and error follows, and a number of decisions need to be made to delimit the directions (Morris et al., 2005). According to the technology life cycle model, there is a lot of product and market uncertainty at first; different actors interact with each other and make the initial decisions concerning their network positions (Afuah & Tucci, 2001).

As Doganova and Eyquem-Renault (2009) notice in their study, the development of business model can start from “overflowing” situation, with multiple possible but uncertain

applications of the technology, and the actors need to choose a path to follow, limit the possibilities and allow calculations. Also defining the actors to be involved is important, which is followed by the search for potential partners. It is important to define the business objectives for partnering (Chesbrough & Schwartz, 2007). In the early phases, actors such as research institutes, entrepreneurs, and venture capitalists have an important role (Kijl et al., 2005).

The shift to the market phase is a shift to commercial exploitation, where big companies such as telecom operators usually become the leading actors (Kijl et al., 2005). Standardisation of components, market needs, and product design features take place; a standard or a dominant design emerges (Afuah & Tucci, 2001). Finally, when a fairly definite and formal model has been developed, adjustments and ongoing experiments are made (Morris et al., 2005).

Doganova and Eyquem-Renault (2009) view the transformation of a business model from a model into a business as a series of trials in the market creation path of entrepreneurs. These consist of encounters with potential partners, and such encounters transform the network being built by the entrepreneur's innovation. Each encounter puts the business model to a test and may lead to changes in the technology and the network. Co-development partnerships are an increasingly effective way to innovate business models while these partnerships represent a mutual working relationship between two or more parties aiming to create and deliver a new product, technology, or a service (Chesbrough & Schwartz, 2007).

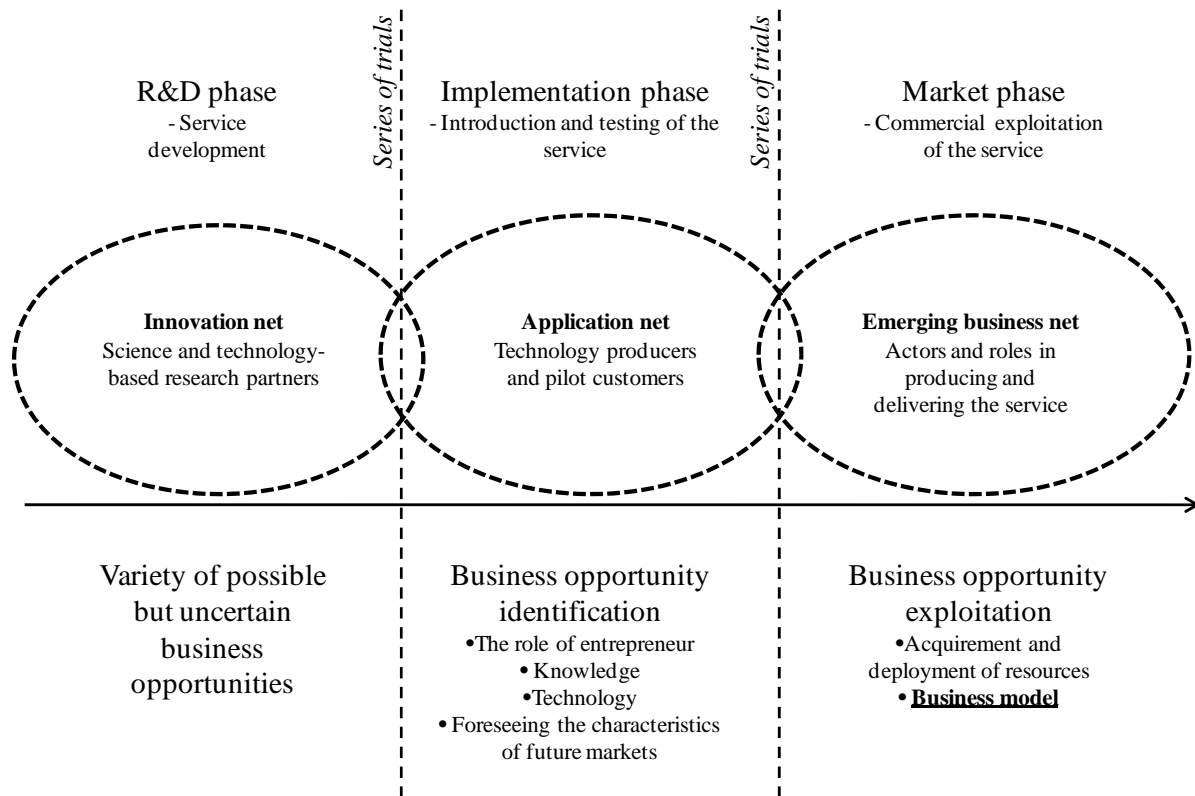
Essential problem in developing new business models is that they often look unattractive to internal and external stakeholders at the outset (Johnson et al., 2008). The success of established business models influence the information routed into or filtered out of corporate decision process – this represents a cognitive barrier to business model experimentation leading firms to miss potentially valuable uses of new technology when they do not fit into their current business models (Chesbrough, 2010). Potential risks in co-development business models is the mis-assessment of the business objectives for the partnerships, the misjudging of the criticality of particular capabilities, and the potential lack of alignment between the business models of co-development partners (Chesbrough & Schwartz, 2007).

### Networked business model development

The conceptual framework of the networked business model development is presented in Figure 1. Based on existing literature, the development phases are divided into the R&D phase, implementation phase, and market phase. During these phases, the service is developed and commercialized, as well as the net of actors evolves into a viable business net.

In the first phase of the development, the technology itself and potential technology-based applications are developed in an innovation net including mainly science and technology-based research organisations. In the second phase, the services are introduced and tested, e.g. in the form of pilots. An application net aims to develop services that can be commercialized. Pilot customers are essential actors in the net, since their experiences and needs influence the development of the services. In the final phase, the services are commercially exploited with a viable networked business model. The emerging business net includes the actors in producing and delivering the service. The net becomes more stable aiming to do business of the service, with possible modifications on the business model.

In the bottom of the figure, the business opportunity identification and exploitation are described. In the early stage of the development, there are various possible but uncertain business opportunities to be realized in the business model. The potential opportunities need to be identified based on prior knowledge, and the possibilities provided by technology itself. The role of the entrepreneur is essential, and the ability to see the characteristics of the future markets possessed by the actors. Finally, the business opportunity needs to be exploited by acquiring and deploying the right resources, in a viable business model.



**Figure 1. Conceptual framework of networked business model development**

The development phases including the types of nets are ideal types or situations making sense of the networked business model development. Hence in reality there cannot be found such clear phases or types but they are overlapping and iterative. A set of trials take place in shifting to different phases, and affect the development of networked business model with possible changes in the business net and the model itself.

## RESEARCH APPROACH

This study employs qualitative methods in studying the networked business model development. The data is presented in Table 1. The primary empirical data consists of semi-structured expert interviews. Access to the data was available through a university-based research project developing an ubiquitous service infrastructure in the city centre. The empirical setting is a real-life experiment, the UBI pilot organised in summer 2009, in which new ubiquitous service infrastructure and service applications were tested by real end users. During and after the real-life experiment, altogether 12 experts in the fields of developing, testing, and commercializing new technology-based services were interviewed. Hence, the experiment provided a possibility to collect unique data in an emerging business field.

The interviews lasted approximately one hour each. The interviews covered the following central themes: 1) the nature and business potential of ubiquitous technology, 2) elements of the ubiquitous infrastructure and possible actors operating it, 3) the role/experience in the service production, business potential, possible actors and cooperation in commercializing the services, and 4) future expectations and views concerning the ubiquitous infrastructure and services. Discussion on issues that the experts felt important was also allowed. The exact questions presented in the interviews differed to some extent, according to the experiences of the interviewer gained in the process of data collection, and some of the questions were also spontaneous reactions to the answers.

All the interviews adopted a future time dimension by examining expectations of the future evolution (see Halinen and Törnroos, 1995, p.518) since the infrastructure and services were still at the development and testing phase and the focus was on examining the business potential of the services. The future perspective is also justified by the focus on business opportunities. Retrospective case studies or archival data in empirical studies for business opportunities has been seen problematic since bias can result when outcomes are known, and on the other hand, there is no historical data from which to make financial projections or to estimate potential market size, since the market has not yet been created (Singh, 2001).

**Table 1. Empirical data**

<b>Types of data</b>	<b>Data collection method</b>	<b>Use of data</b>
Interviews	13 interviews	Construction of the phenomenon
Participant observation	Participation in 2 business meetings on the commercialization of the infrastructure	Construction and increasing understanding on the phenomenon
Archival material	Working group meetings and seminars	Increasing understanding of the phenomenon and the technology

In addition to the interviews, complementary data was collected prior and after the UBI pilot. An interview of a company in the field of mobile solutions and information management was conducted to gain pre-understanding of the phenomenon of commercializing new technology-based services. Participant observation was done in two business meetings in which the future commercialization of ubiquitous service infrastructure was discussed. In addition, memos of project meetings of the research consortium and other internal documents have been used to complement the data, and the researcher has also participated in seminars in which the preliminary research results were presented to the company partners.

All the interviews and the observed business meetings were audio-taped and transcribed. The data was analysed with the help of content coding, theme-based categorization, and mind mapping. Any exact limits for the analysis were not predefined, but issues relevant considering the specific field were allowed to be raised. In the data analysis it became clear, that the data emphasized two key themes; the challenges and opportunities related to developing future business models for the technology-based services. These included discussion on the identification and exploitation of business opportunities, and the role of the network in the business model. In the following, the empirical context of the study, the UBI pilot, is shortly introduced, continuing with the analysis of the data.

## EXPERT PERSPECTIVES ON NETWORKED BUSINESS MODEL DEVELOPMENT

The interviewed experts represented altogether eight different actors, both commercial companies as well as non-business organizations included in the service development net (see Table 2). The interviewees represent actors that are part of the service development. Therefore, although not all the actors come from a technology-based industry, they have important roles in developing and producing the services (e.g. content providers). In addition, a complementary interview was made before the pilot concerning a university spin-off, the commercialization of a technology-based service developed in a prior university-based research project. The interviewees were selected to include a wide range of expertise on developing, producing and commercializing technology-based services to get rich and diverse data and perspectives on the phenomenon. The research project in which the pilot was conducted provided access to the service development net and its actors, who are involved in the service development and testing via the project. The interviewees represent the company actors in the service development net instead of analysing them as individuals forming an informal network.

**Table 2. Selected actors and experts in the study**

<b>Actors</b>	<b>Roles</b>	<b>Experts</b>
<b>Device manufacturer</b>	Manufacturer of mobile devices	Senior technology manager
<b>Municipality</b>	Provider of the space for the infrastructure	Project manager Information management expert
<b>Media broker</b>	Supplier of electronic information channel services	CEO
<b>Research project (university)</b>	Facilitator of the development and testing of the ubi services	Project manager Account manager
<b>Operator</b>	Well-established telecommunications company	R&D manager R&D manager Business development manager
<b>Non-profit development organisation</b>	Focuses on regional economic development in high technology	Project manager
<b>Development and testing network</b>	Offers a testing environment for mobile technologies and services	Manager
<b>Media house</b>	Publisher of a major newspaper	Manager, digital business
<i>Complementary interview:</i>		
<b>Company in the field of mobile solutions and information management</b>	Mobile solutions provider	CEO

### The UBI pilot

The specific technological field that this study focuses on is called ubiquitous computing, which commonly combines the advances of information and networking technologies (Shin & Lee, 2005) as well as mobile and pervasive computing (Lyytinen & Yoo, 2002). Mark

Weiser (1991) created a vision of ubiquitous computing of people and environments augmented with computational resources providing information and services whenever and where-ever. In order to realize this vision, there are several goals to address, such as understanding the everyday practices of people, augmenting the world through the provisioning of heterogeneous devices and finally orchestrating the networked devices in order to provide for a holistic user experience (Abowd et al., 2002). As ubiquitous computing changes the way people access and use services, it causes new classes of services embedded in the environment leading us to a world of ubiquitous commerce (Fano & Gershman, 2002). However, the appropriate business models that would provide value as a new ubiquitous business or as converged with traditional businesses are yet to be found (Lee & Lee, 2005).

The ubiquitous services which are under focus in the present study have been developed and tested within a multidisciplinary research project. Hence, they have not been commercialized yet but their business potential is to be explored. The project combines basic research of ubiquitous computing with different angles on the phenomenon. The project focuses on fundamental research problems of ubiquitous computing, deploys a new ubiquitous service infrastructure, and develops novel ubi-service applications. The developed technologies are integrated into a software platform, which supports the creation of novel and innovative service applications for mobile users. A Living Lab approach is used, so that users can participate in the design of the proof of concept pilots, which are then empirically evaluated by conducting field trials in real-life settings and with real end users. Assorted services are integrated into large-scale pilots to the general public. The first UBI pilot was organized during summer 2009 in a city centre.

The ubiquitous service infrastructure and service applications developed and tested in the UBI pilot are seen to represent a potential new business, since it provides a new kind of urban computing infrastructure and the possibility to provide new kinds of services atop the infrastructure as well as new service interfaces. In the pilot the city centre represented a smart urban space where a new computing infrastructure was built consisting of ubi-hotspots (interactive displays which provide interaction between physical, virtual and social spaces), open network, WPAN hotspots (Bluetooth), wireless sensor network, ubi-middleware software, ubi-mobile software, and different kinds of service applications atop the infrastructure. Smart phones were used as interaction devices in addition to touch-screen displays. The service applications tested in the pilot can be divided into three main categories: ubi-channel (for commercial use as well as non-commercial communication), ubi-portal (web-portal browsed with a touch screen), and mobile applications. The project and the UBI pilot are the first steps towards a commercial, ubiquitous city, but yet the business potential is debated among various actors.

Hence, an essential feature of the empirical setting and the data is that the emerging technology is in between the R&D and the implementation phases of business model development, and the data focuses on the shift to the market phase (Kijl et al., 2005). The current net of actors involved in the infrastructure and service development represents an innovation net (Möller & Rajala, 2007) but needs to evolve into a viable business net producing and selling the services. The empirical setting compares to a situation, characterized by a variety of possible but uncertain applications of technology (see Doganova & Eyquem-Renault, 2009) where the business opportunities need to be identified and exploited in a networked business model. The views and perceptions of the experts are examined and analysed in the following.

## Identifying and exploiting business opportunities

The developed technology and services serve as a first step for developing business opportunities and a viable business model based on them. The experts see ubiquitous technology as a new wave of technological development in the interaction between people and computing. A phased development of such an emerging technology is seen as an integral feature in this context; the current infrastructure is one of the first steps towards a world in which technology is embedded in the surroundings. A crucial element in the early phases of the development is the research and testing activities to see how potential customers react and use the services, and to learn and develop the technological solutions further.

Overall the experts viewed the infrastructure and the services potential, and identified various kinds of opportunities related to the technology, infrastructure, and service applications. The possible opportunities identified by the experts relate to research potential and learning, technology integration and standardisation, the change of mental models, and new ways to use existing technology.

”Well in sum, it is good to have all these kinds of visions for which to reach, but if we know how to be sensible and exchange our views about things and change opinions, and turn to new directions, then we are strong.” (Expert4)

The research project provides an important way to learn about and identify potential business opportunities. Value is seen in the opportunity for companies to develop business, learn, and do research. The pilot provides valuable data about user experiences and needs. It also provides them a platform for testing e.g. new applications and solutions.

”for those actors who are looking for new business in that sector, have been at least provided the possibility to go and try service production in that kind of environment. To see what could be their business.” (Expert4)

The interactive displays in the city centre can be comprehended as one layer or step towards an ubiquitous city enabling further development steps in technology and in business. The value of ubiquitous computing to be exploited in business models are mobility, context-awareness, and interactivity. Additional value emphasized in the empirical data is the change in people’s behavior and processes; the innovation is seen to take place in people’s mindsets, including mental changes, instead of radically new technological development. People need to change their behavior in terms of how to use services, and need guidance in this.

”Yeah, I see the added value in the changing world, it becomes more technology-oriented, but at the same time the new technologies need to be harnessed for them to stay alive, as a new way to live this life. “ (Expert7)

To be able to develop the networked business model for the services, an understanding and vision of the business opportunities and their exploitation is needed. Business opportunities are mostly identified and evaluated based on the actor’s current business and services. However, risk-taking, courage, and future-visioning may be the keys for finding and exploiting valuable business opportunities. Also creativity and open-mindedness are necessary in developing the services and business models. Overall, competences and know-how are emphasized as important resources in the business model development. Hence, the role of individuals is essential in developing and commercializing the services.

Ubiquitous computing provides ways to integrate and exploit existing technology in new, innovative ways and hence creates novel ways to use services. Opportunities can be developed by integrating new technology into existing services and business. Ubiquitous computing covers and employs different technologies; such disconnected and separate technologies used in an urban environment need to be integrated. Hence, actors need to cooperate to create standards e.g. in the fields of mobile devices, sensor networks, and wireless networks.

”...it is integrated into existing opportunities, existing services. And the aim is then to gain, kind of increase the efficiency, increase speed, bring easiness into the services so that, the business potential in this phase is, it seems to be indirect, but for sure potential exists.” (Expert6)

The experts identified various different ways to use the ubiquitous technology and infrastructure which can mainly be divided into two parts; namely public/non-commercial or commercial use, which are not exclusionary but can be combined. The potential ways to use the infrastructure and the perceived value of the technology clearly differ between the actors: device manufacturer emphasized the potential ways to use the terminal devices, whereas the media house saw the infrastructure as a new communication channel, and the provider of the development and testing network saw it as an important platform for research and testing purposes. Hence, there was no clear, unified vision among the various actors, which in turn complicates the development of the service production net and the networked business model.

The research project has developed the infrastructure and service applications with a lot of effort and resources, and the different actors see enormous potential in the pilot. Yet, no-one really knows what is the main vision or the ownership of the infrastructure, but this kind of an entrepreneurial actor is clearly needed. In addition, the experts saw there is a need for a success story or one killer application for the business model to succeed. This kind of a service innovation would be the basis for the business model and business creation in general. However, at the phase of the pilot, the service innovation had not yet been developed, although the service concepts development had been done in prior phases. This implies that the business model development is an iterative process, with a series of trials and errors.

”...supporting business life, so that if new innovations rise, that can be commerc-[ialized], well innovation is generally directly linked to commercialization, but based on those innovations we are able to create new entrepreneurs, entrepreneurship and then of course get new export products” (Expert3)

### Towards a viable business net

The emergence of the business net is important in developing the future business model. The net clearly needs to evolve from the service development or innovation net towards a viable business net, in which the business model is developed and implemented for the service. The right actors and roles need to be identified and determined already in the R&D phase of the business model development. Commercial actors are naturally necessary in the business model, and the dialog between the companies and the research organizations is essential already in the early phases. Many actors perceive the research project as a way to create and attain contacts, and to be ahead of competitors. However, without identifying the actors and forming the business net, there are problems in developing a viable business model for the service infrastructure and the services.

”the kinds of roles and responsibilities need to be defined, that is, who is responsible for the infrastructure, and in what kinds of principles the actors can continue the development work, and in what kinds of roles or agreements they can produce their own services.” (Expert3)

It is clear that the business model involves a net of actors, and the service development net needs to evolve to a viable business net. Various possible actors and roles were identified by the experts. Based on the data, the role of the service infrastructure is essential in the business model. The infrastructure needs an operator; it is responsible for the maintenance, devices (technical elements) and updates, and acts as an interface for the service providers. The possible actor for the operator may be an existing actor with a new role (e.g. telecom operator) or a completely new actor. Furthermore, it may be a business operator or a non-profit one, e.g. the municipality. However, there is essential difference in the business model whether the operator is the municipality or a private actor. This influences the revenue model in the way the customers pay for the services (e.g. via taxes or to the operator). The infrastructure operator is also the focal actor in the net.

”...if we talk about ubi-infrastructure, it means that the ubi-infrastructure is build by the municipality or the government. Private sector will not build the infrastructure, and if they do, they are gonna ask a price for it. And for them to be able to build it, the public sector needs to give them permission for it.” (Expert4)

Also more traditional roles can be identified, such as the content and service providers, device manufacturers, and a media broker. The content is a central issue in the commercial success of the infrastructure, and hence the content and service providers are key actors in the business model. The service providers create content atop the infrastructure, whereas the infrastructure operator provides the tools for service providers to create the content.

The emergence of new roles is also possible, e.g. in creating the tools for service providers to use the infrastructure, coordinating the infrastructure, and integrating/intermediating between the various actors such as the service providers. The media broker is an alternative actor responsible for the content production if the infrastructure is used for advertising purposes. The infrastructure is a potential new channel with interactivity and the possibility to react fast to changing customer needs and environmental changes. Also the traditional roles may be integrated to some extent, such as service production and device manufacturing. Overall, the roles are seen as more flexible and dynamic in the potential business models.

“Sometime when the [mobile] phone operations started, there was quite a clear division that each and everyone had their own territories and that was it. It has been kind of a sacred thing that everyone stays in their own land and doesn’t go to the neighbor’s territory. But now it has changed, that this kind of division will not be so clear in the future, but the same actors can act at every level, and at least for the bigger actors it is probably more possible, and then you don’t have to think so carefully where the line is, it is a bit more blurred.” (Expert10)

The municipality is emphasized as a central actor as well, either as an alternative infrastructure operator, and at least as providing access to the city premises by controlling and coordinating the space. The role of the customer is seen by most experts essential in the development of future business; user experience and target groups as a basis for service development are highly important. However, the role of the customer as an actor in the business net is not so much discussed.

An interesting finding concerning the service production net is the clear need for an entrepreneurial actor who identifies the business opportunities to be exploited in the

networked business model. In addition, this kind of actor can facilitate the development of the business model and the business net. However, the main problem seen in the experts' answers is that any of the actors in the service development net is not willing to take this role, or feels unable to be this kind of an actor. The experts were waiting for an entrepreneurial actor, a saviour, outside the current net. Based on the complementary interview on a prior project, the net and its actors may need to change completely from the R&D phase to market phase, and hence the development of net often fails.

The entrepreneurial role can also be discussed in terms of network management which is also essential in the business model. Without the focal actor with a clear vision, the emergence of the net as well as the business model development is difficult.

"But yeah, of course there has to be this kind of a strong, focal actor, whether it is from a private sector or this kind of a research group for example, or any other actor who coordinates and has the vision of what has to be done, and has some kinds of special skills and know-how for doing this."  
(Expert2)

### Business model development

The development of the business model in this specific case is distinguished between the business model for the service infrastructure and the business model for the services. Hence, the role of the infrastructure is important in the business model development, and affects the business model of the services. Overall, visioning the business model was challenging for the experts since there is great uncertainty and only vague ideas about the future business potential. However, the business model development is emphasized by the experts as a central issue in developing and producing the services after the research project ends.

"you have kind of learned to understand the problem, that although there are the technologies, there are the devices and even the infrastructure, inventing the business models atop this kind of a platform, it is hard, hard work, then how to make them interesting for real, and how to make the [value] chain to work so that there could be various actors doing business" (Expert3)

Mostly, the development of the business model is done through the key elements of the business model and choices concerning these elements. Essential issues to be solved in the business model are the value offering and the technology itself. The value constellation is dependent on the technology and the service. The offering needs to be developed based on the customer needs and the content instead of the possibilities the technology offers. Hence, the content of the services should steer the technological development instead of the other way around.

"You know, the starting point should be different, the technology comes only after the customer needs and other things have been [determined], only after that comes the technology. The content and needs come always first." (Expert11)

Another important question in developing the business model is to define the added value that the service offers compared to existing technology-based services. The customer needs and the value of the services are emphasized as the cornerstone in the business models. The analysis shows that business potential exists, but only if the services are easy to use and create value for both the consumers and the business customers. In addition, the benefits of the services need to be skillfully marketed to the users, and they need guidance in using the new services.

In addition, the markets and customer segments need to be analyzed in developing the business model. What are potential markets and where are they? It is not obvious that the market for the infrastructure and the services are in the local city or even in the country, but international markets should be considered as well. However, the markets can be explored in a pilot like this, and this way the consciousness among the market increases and the industry can be developed further. In parallel with analysing the potential markets, identification of different customer segments is important: routines and activities as well as needs differ among different target groups.

In relation to the the markets and customer segments, the development of the offering is an important decision on developing the business model. It was clear in the experts' views that the offering needs to be limited and provide a clear and simple value proposition to the customers. Hence, developing focused service offerings atop the infrastructure facilitate commercial success.

”...then after the research project fades out and is finished, then we need to decrease, simplify, focus on some interactive services, so that people could perceive what is available, now they may not necessarily know, there are rather too many things in a single display now” (Expert7)

An important issue in the business model is the revenue logic: it has to be determined who pays for the service, and who collects the money, that is who is the service provider. The revenue logic of the service infrastructure needs to be similarly determined, which is related to the infrastructure operator. The role of advertising can be an important source of revenues in the business model of the service infrastructure. However, during the research project, there are certain limitations of making revenues with the infrastructure and the services, which in turn challenges the development of the business model.

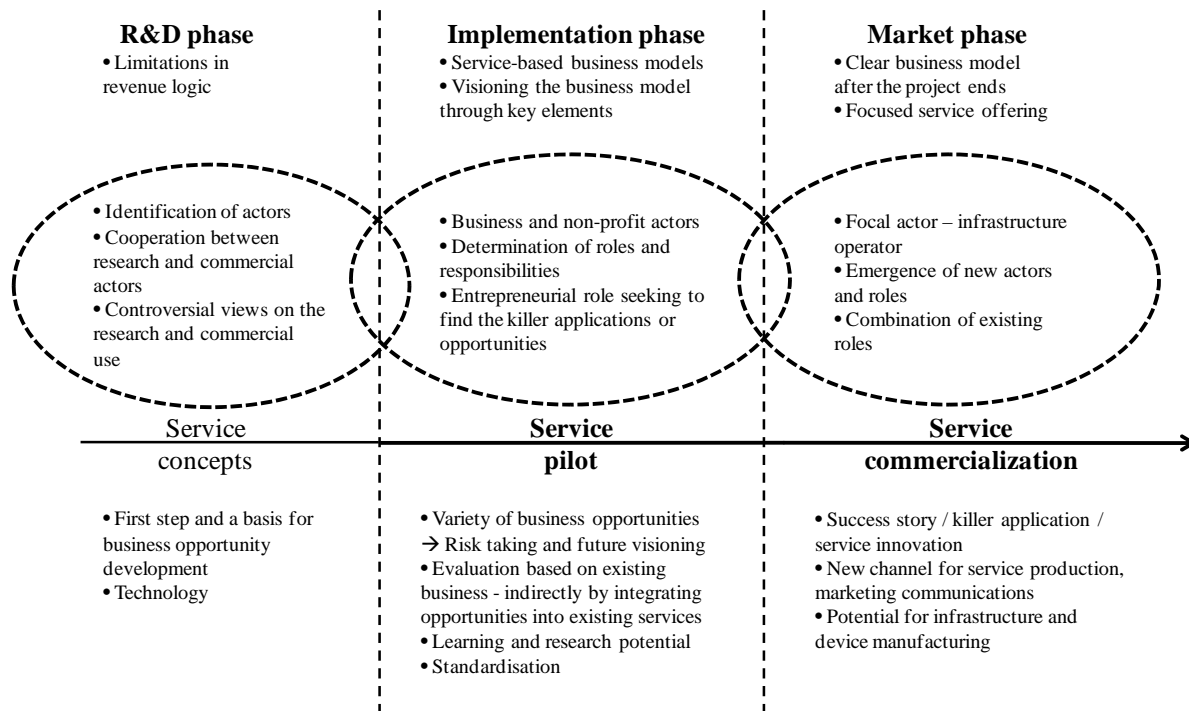
## Discussion

The results of the empirical data analysis are summarized in Figure 2. The empirical setting of the study is currently at the phase of implementation, but the empirical data mainly explores future perspectives and expectations on the market phase. However, experiences and perspectives on the R&D phase are also provided by the additional data collected to gain pre-understanding on the phenomenon, as well as in the experts' answers.

The visioning of the business model needs to be started already in the R&D phase, but it is very challenging due to the research project's possible limitations in producing revenues. Also the active actors innovating and developing the service concepts are at this stage mainly research-based partners. Cooperation with commercial actors already in this early phase is important, however, the challenge is in the controversial views on the use of the service infrastructure.

The key challenge and a stumbling stone focuses on the shift from the implementation phase to the market phase. In the implementation phase the service concepts are tested by real end users in the form of a pilot which includes both business and non-profit actors. The experts visioned the business model through key elements, such as the value offering, markets and customer segments. There is a variety of potential yet quite abstract business opportunities identified at this phase. The identification of opportunities is mainly done on the basis on actors' existing business and services. The main opportunities at the implementation phase concern learning and research potential for the companies, and the need for creating standards

or dominant technological designs. Therefore risk-taking and future visioning are important capabilities for the actors to possess.



**Figure 2. Networked business model development - empirical results**

The experts identified possible actors and roles for the business model in the market phase, and saw a clear focal actor would be needed in the business net. The opportunities to be exploited in the business model concern mainly content production, as well as infrastructure and device manufacturing. Yet there is a clear challenge in visioning the specific service innovation. The service offering needs to be limited and focused with a clear value proposition for the customers. Other challenges concern the determination of the roles and responsibilities in the networked business model, since there is a need for completely new actors or combinations of existing actors. Specifically, there is clear need for an entrepreneurial actor who would identify the opportunity for the service innovation and see the networked business model to exploit the opportunity.

## CONCLUSIONS

### Theoretical implications

Emerging technologies such as ubiquitous computing represent a dynamic and complex business environment. In parallel to developing novel services out of the technology, it is important to focus on developing the business model for the service to create and capture value of the technology. By emphasizing the network perspective on business models and discussing the business opportunities, this study provides novel insights into the development of networked business models. The study adds to our knowledge of the phenomenon of networked business model development in three central ways.

Firstly, the current study contributes to the understanding of dynamics of business models. Previous studies have examined the development of business models to lesser extent (Tece, 2010; Osterwalder et al., 2005). This study identifies emerging business nets and the notion

of business opportunities as key elements in understanding the development of networked business models, and presents the key phases in this development. By applying a future perspective, the study identifies the challenges in developing networked business models for services that are still at the development and testing stage. The challenges concentrate on the shift from an implementation phase to a market phase, where the networked business model needs to be developed to exploit the business opportunity.

Secondly, the study emphasizes the role of the service in the business model, and hence adopts a business net perspective on business models. The concept of networked business model is defined and used in examining the future business planning for emerging technology-based services. Business models are traditionally examined from a single actor's perspective or centred on a focal actor (e.g. Amit & Zott, 2001), and the network is examined as a key element of business model (Westerlund et al., 2008) or through the focal actor (e.g. Shafer et al., 2005). This study takes the perspective of the service as a central element of the business model, and hence examines the business model for the net of actors in producing and delivering the service. Thus, the concept of networked business model is used to distinguish the term from a more traditional use of the concept.

Thirdly, in developing a networked business model for emerging technology-based services, there is a need for an entrepreneurial actor, who identifies the business opportunities and acts as a facilitator of the business net. Prior studies have examined the types and evolution of business nets (Möller & Rajala, 2007), and entrepreneurial opportunity literature has emphasized the role of the individual in identifying and exploiting the business opportunities (e.g. Shane & Venkataraman, 2000). However, the current study sees this kind of an actor essential in the evolving business net and development of the networked business model.

The networked business model development was examined in the specific context of emerging technology-based services since the networked nature of this specific business field. Single companies rarely master all the necessary competencies, and such a business environment is also rather dynamic including rapid changes and emerging business opportunities. However, the elements and challenges identified in the study could be central also in other emerging business fields with new innovations and rapid change. Still, the business net of actors as well as the business opportunities elaborated in the study are strongly related to the field of technology-based services.

#### Managerial implications

Developing business models is a challenging issue for many companies in the field of technology. Especially moving towards service-oriented business is a current question, which requires the development of new and innovative business models for the services. Hence this study provides valuable knowledge concerning the development of future business models for technology-based services, and the impact of the networked nature of the business on this development.

The knowledge created can facilitate companies in their strategic business planning – especially in the development, production and commercialization of emerging technology-based services. The framework of networked business model development provides companies a means to focus on the key phases in developing the business model in cooperation with other actors. This can help companies in the early phases of service

development to better identify and structure the necessary actors and resources needed in the networked business model for the services.

Overall, it can be seen from the current study, that different actors may have similar but also very differing views concerning e.g. the service development, which needs special attention in developing the networked business model. Companies and other actors can already in the R&D phase outline what kinds of actors and resources are needed to develop commercial services of new technology. Specifically the need for an entrepreneurial actor is essential in setting up the network and the business model itself.

#### Limitations and future research

There are certain limitations in this study that need to be addressed. Firstly, the empirical setting of the current study is strongly connected to a research project and the real-life experiment conducted in the project. Hence, the results and conclusions mainly address the development of networked business models for services that are developed in a research or an r&d project. In addition, the study is strongly based on services in the field of technology, and does not discuss the business model development in other industries. Secondly, although the future time dimension is justified in this specific empirical setting and contributes to the future business planning, it also sets some limitations for studying the development of networked business models. The data collection has not followed a process of developing a specific business model, but it has been analysed through the framework of the phases. The future expectations and views on the final phase are thus subjective interpretations of the experts, which cannot be proofed to be right or wrong. Another limitation concerning the theoretical background on business opportunities concerns the level of the actors. Much of the existing literature on entrepreneurial opportunities focus on the individual levels, however, the current study does not examine the individuals but focuses on the level of the companies.

However, the limitations of the study offer several future research avenues to explore. Further empirical research on networked business model development needs be made. Follow-up or retrospective studies by observing the development of an existing networked business model would provide additional insights on the phenomenon. Also other kinds of empirical settings and industries would be very interesting to examine. In the current study, the future time dimension would enable the creation of possible scenarios of the networked business models by identifying the alternative actors and roles, and business opportunities. Future studies on the identification of business opportunities as part of the business model development would also be beneficial. Empirical research on the individuals could provide additional insights into the emerging role of the entrepreneur.

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## REFERENCES

- Abowd, G. D., Mynatt, E. D. & Rodden, T. (2002) "The human experience – reaching for Weiser's vision", *Pervasive Computing*, January-March, pp. 48-57.
- Achrol, R. (1997) "Changes in the theory of interorganizational relations in marketing: Toward a network paradigm", *Journal of the Academy of Marketing Science*, Vol 25 No 1, pp. 56-71.
- Afuah, A. & Tucci, C. (2001), *Internet business models and strategies*. New York: McGraw-Hill Companies, Inc.
- Alvarez, S. and Barney, J. (2007), "Discovery and creation: Alternative theories of entrepreneurial action", *Strategic Entrepreneurship Journal*, Vol. 1 No. 1–2, pp. 11–26.
- Amit, R. & Zott, C. (2001) "Value creation in e-business", *Strategic Management Journal*, Vol 22, pp. 493-520.
- Ardichvili, A., Cardozo, R. and Ray, S. (2003), "A theory of entrepreneurial opportunity identification and development", *Journal of Business Venturing*, Vol. 18 No. 1, pp. 105–123.
- Baden-Fuller, C. & Morgan, M. (2010) "Business models as models", *Long Range Planning*, Vol 43, pp. 156-171.
- Bouwman, H. & Fiel, E. (2008) "Service innovation and business models", in Bouwman, H., De Vos, H. & Haaker, T. (eds.), *Mobile Service Innovation and Business Models*. Berlin: Springer, pp. 9-30.
- Chesbrough, H. (2010) "Business model innovation: opportunities and barriers", *Long Range Planning*, Vol 43, pp. 354-363.
- Chesbrough, H. & Rosenbloom R. (2002) "The role of the business model in capturing value from innovation: evidence from Xerox Corporation's technology spin-off companies", *Industrial and Corporate Change*, Vol 11 No 3, pp. 529-555.
- Chesbrough, H. & Schwartz, K. (2007) "Innovating business models with co-development partnerships", *Research Technology Management*, Vol 50 No 1, pp. 55-59.
- Demil, B. & Lecocq, X. (2010) "Business model evolution: in search of dynamic consistency", *Long Range Planning*, Vol 43, pp. 227-246.
- Doganova, L. and Eyquem-Renault, M. (2009), "What do business models do? Innovation devices in technology entrepreneurship", *Research Policy*, Vol. 38, pp. 1559-1570.
- Eckhardt, J. and Shane, S. (2003), "Opportunities and entrepreneurship", *Journal of Management*, Vol. 29 No. 3, pp. 333–349.
- Fano, A. & Gershman, A. (2002) "The future of business services in the age of ubiquitous computing", *Communications of the ACM*, Vol 45 No 12, pp. 83-87.
- Gadde, L-E., Huemer, L. & Håkansson, H. (2003) "Strategizing in industrial networks", *Industrial Marketing Management*, Vol 32, pp. 357-364.
- Gulati, R., Nohria, N. & Zaheer, A. (2000) "Strategic networks", *Strategic Management Journal*, Vol 21, pp. 203-215.
- Håkansson, H. & Snehota, I. (2006) "No business is an island: the network concept of business strategy", *Scandinavian Journal of Management*, Vol 22, pp. 256-270.
- Halinen, A. & Törnroos, J-Å. (1995), "The meaning of time in the study of industrial buyer-seller relationships", in Möller, K. & Wilson, D. (eds.), *Business Marketing: An Interaction and Network Perspective*, Massachusetts: Kluwer Academic Publishers, pp. 493-529.
- Jarillo, J. C. (1988) "On strategic networks", *Strategic Management Journal*, Vol 9, pp- 31-41.
- Johnson, M., Christensen C. & Kagermann, H. (2008) "Reinventing your business model", *Harvard Business Review*, December 2008, pp. 57-68.

- Kalakota, R. & Robinson, M. (2002), *M-Business. The Race to Mobility*. New York: McGraw-Hill.
- Kallio, P. (2004), *Emergence of Wireless Services, Business Actors and Their Roles in Networked Component-Based Development*. Doctoral dissertation, University of Oulu: VTT Publications 534.
- Kijl, B., Bouwman, H., Haaker, T. & Faber, E. (2005) "Developing a dynamic business model framework for emerging mobile services", *ITS 16<sup>th</sup> European Regional Conference*, Porto, Portugal, 4-6 September, 2005.
- Komulainen, H., Mainela, T., Sinisalo, J., Tähtinen J. & Ulkuniemi P. (2006) "Business model scenarios in mobile advertising", *International Journal of Internet Marketing and Advertising*, Vol 3 No 3, pp. 254-270.
- Lee, J. & Lee, S. (2005) "Developing business models in ubiquitous era: exploring contradictions in demand and supply perspectives", in *Lecture Notes in Computer Science: Computational Science and Its Applications – ICCSA 2005*, Vol 3483, Heidelberg: Springer Berlin, pp. 96-102.
- Lundgren, A. (1995), *Technological Innovation and Network Evolution*. London: Routledge.
- Lyytinen, K. & Yoo, Y. (2002) "Issues and challenges in ubiquitous computing", *Communications of the ACM*, Vol 45 No 12, pp. 62-65.
- Morris, M., Schindehutte, M. and Allen, J. (2005) "The entrepreneur's business model: toward a unified perspective", *Journal of Business Research*, Vol. 58, pp. 726-735.
- Möller, K. & Rajala, A. (2007) "Rise of strategic nets – New modes of value creation", *Industrial Marketing Management*, Vol 36, pp. 895-908.
- Möller, K., Rajala, A. & Svahn, S. (2005) "Strategic business nets – their type and management", *Journal of Business Research*, Vol 58, pp. 1274-1284.
- Möller K. & Svahn, S. (2009) "How to influence the birth of new business fields – Network perspective", *Industrial Marketing Management*, Vol 38, pp. 450-458.
- Nenonen, S. & Storbacka, K. (2009) "Business model design: conceptualizing networked value creation", *The 2009 Naples Forum on Services: Service Dominant Logic, Service Science, and Network Theory*.
- Nyström, A-G. (2008), *Understanding Change Processes in Business Networks*, Doctoral dissertation. Turku: Åbo Akademi University Press.
- Osterwalder, A., Pigneur, Y. & Tucci, C. (2005) "Clarifying business models: origins, present, and future of the concept", *Communications of the Association for Information Systems*, Vol 15.
- Park, J.S. (2005) "Opportunity recognition and product innovation in entrepreneurial hi-tech start-ups: A new perspective and supporting case study", *Technovation*, Vol 25 No 7, pp. 739–752.
- Parolini, C. (1999), *The Value Net. A Tool for Competitive Strategy*, Great Britain: John Wiley & Sons Ltd.
- Ritter, T. & Gemünden, H. (2003) "Network competence: its impact on innovation success and its antecedents", *Journal of Business Research*, Vol 56, pp. 745-755.
- Sarasvathy, S., Dew, N., Velamuri, R. & Venkataraman, S. (2003) "Three views of entrepreneurial opportunity. A testable typology of entrepreneurial opportunity", in Acs, Z. J. and Audretsch, D. B. (Eds.), *Handbook of Entrepreneurship Research*, Dordrecht, NL: Kluwer.
- Shafer, S., Smith, H. & Linder, J. (2005) "The power of business models", *Business Horizons*, Vol 48, pp. 199-207.
- Shane, S. (2000) "Prior knowledge and the discovery of entrepreneurial opportunities", *Organization Science*, Vol 11 No 4, pp. 448–469.

- Shane, S. and Venkataraman, S. (2000) “The promise of entrepreneurship as a field of research”, *Academy of Management Review*, Vol 25 No 1, pp. 217–226.
- Shin, B. & Lee, H.G. (2005) “Ubiquitous computing-driven business models: A case of SK Telecom’s financial services”, *Electronic Markets*, Vol 15 No 1, pp. 4-12.
- Singh, R. (2001) “A comment on developing the field of entrepreneurship through the study of opportunity recognition and exploitation”, *Academy of Management Review*, Vol 26 No 1, pp. 10-12.
- Srinivasan, R. (2008) “Sources, characteristics and effects of emerging technologies: Research opportunities in innovation”, *Industrial Marketing Management*, Vol 37, pp. 633-640.
- Teece, D. J. (2010) “Business models, business strategy and innovation”, *Long Range Planning*, Vol 43, pp. 172-194.
- Timmers, P. (1998) “Business models for electronic markets”, *Electronic Markets*, Vol 8 No 2, pp. 3-8.
- Weill, P. & Vitale, M. (2001), *Place to Space: Migrating to E-Business Models*. Boston: Harvard Business School Press.
- Weiser, M. (1991) “The computer for the 21st century”, *Scientific American*, Vol 265 No 3, pp. 66-75.
- Westerlund, M. (2009), *Managing Networked Business Models: Essays in the Software Industry*. Doctoral dissertation, Helsinki School of Economics, Helsinki.
- Westerlund, M., Rajala, R. & Leminen, S. (2008) ”SME business models in global competition: a net work perspective”, *International Journal of Globalisation and Small Business*, Vol 2 No 3, pp. 342-358.
- Zaheer, A. & Bell, G. (2005) “Benefiting from network position: firm capabilities, structural holes, and performance”, *Strategic Management Journal*, Vol 25, pp. 809-825.
- Zott, C. & Amit, R. (2008) “The fit between product market strategy and business model: implications for firm performance”, *Strategic Management Journal*, Vol 26, pp. 1-26.
- Zott, C. & Amit, R. (2010) “Business model design: an activity system perspective”, *Long Range Planning*, Vol 43, pp. 216-226.