

The Capability to Commercialize Network Products in Telecommunication

by

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BI Norwegian School of Management
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The Capability to Commercialize Network Products in Telecommunication

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*“It is not the strongest of the species that survive nor
the most intelligent, but the one most responsive to
change”*

CHARLES DARWIN

Acknowledgement

The choice of topic was very much influenced by my personal interest and experience with commercialization activities as a business manager where developing new products was an important issue. Some of these products exhibited characteristics giving strong network effects. During that period, I often wondered whether it would be possible to identify specific success criteria for commercializing these kinds of products, something I assumed was feasible. Such know-how would have been very helpful for me in developing distribution strategies. My conviction was strengthened after I was introduced to Rogers' (2003) work, where he describes the negative influence of network effects when distributing network products in a phase when critical mass in users had not been obtained, and its positive influence on distribution afterwards. This insight, which was new to me, encouraged me to take a break from my industrial career and go deeper into this matter.

I have to admit that it has been a challenge to go back to "school" after several years of working life. As a manager you have to read up quickly on various problems and issues in order to make rapid decisions. Very often you only have time to obtain a superficial insight and must rely on others' expertises to make decisions. Working with a thesis is a totally different case. You need a great deal of time to read, reflect, gather data, discuss, and write in an iterative manner. Moreover, the work needs to be performed with a thoroughness that is not so common in commercial work. I had to slow down my tempo and accept that doing comprehensive work required an abundance of time. However, these years in school have given me valuable insights. One is a new theoretical and empirical insight important to my further career, but a more personal insight is how important it is to alternate between work and leisure time in order to be inspired.

I have not been alone on this journey. I have been blessed with senior experts as discussion partners and supervisors. I acknowledge Professor Torger Reve for having faith in me. His attitude is that it is fruitful for both the industrial and academic world that some PhD-candidates come from the industry. Torger Reve has continuously assured me that he had faith in this project and has inspired me during the periods when the uphill was quite steep; a quality that should not be underestimated. I will also thank Professor Kjell Grønhaug, a much demanded expert in his field, for being willing to discuss with me various approaches and methods. Last but not least, I will thank Professor Øystein Fjeldstad for our introductory discussion, where I

really had to work hard to be able to follow him in his suggestions and to make my own professional platform.

Finally, I will thank family and friends for being patient with me during a period when I often gave priority to work instead of leisure activities. Particularly, I want to mention my children, Frida and Bror, who also have inspired me in my work.

Haugesund 29.03.07

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1. Introduction

When we consider buying food, clothes or furniture we normally appraise the goods based upon our personal needs independent of the number of other people who have bought or use the same type of item. Some types of goods, however, have a quality that makes them more valuable to us as the number of other users' increases. Classical examples are telephone and fax-machine; a more recent one is video phone. These goods were of little value to the first individual who acquired them. The value increased with the total number of items in the network, because the total number of people with whom you could talk to or send and receive documents to, increased.

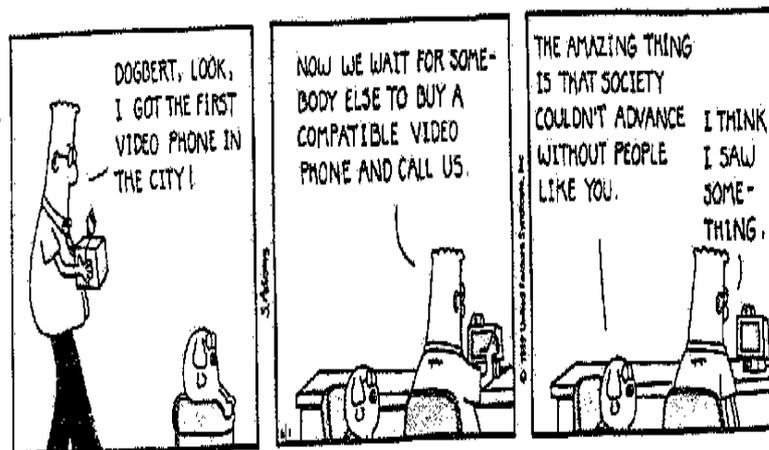


Figure 1. *It's hard to sell new network services (Source; Scott Adams)*

This phenomenon raises some questions relevant for the providers of these goods or services. Are the commercial and/or organizational challenges different when commercializing goods, which value depend on the amount of users, compared to when commercializing goods with an intrinsic value independent of other users? The theory of positive network effect has revealed that commercialization of network products can present difficulties that are specific for these types of products. The strong impact of direct network effects from inter-customer communication accentuates the

importance of distribution rate, i.e. a rapid rollout, and reaching critical mass in order for customers to experience value. The question is whether these challenges require peculiar capabilities. Operational capabilities enabling product innovation in general have been identified, but the capability to commercialize network products and the dynamics of resources and new products in telecommunication contexts have not been examined. The main concern of this thesis is capabilities fostering commercialization of network products.

The remaining chapters are organized as follows. In Chapter 2 we present theories and concepts relevant for the investigation of commercialization of network products. Relevant theories with central concepts are network effects theory and diffusion of innovations theory. Moreover, the concepts of operational and dynamic capabilities, dealing with the firm's routines or patterns of current practice in strategic and management processes relevant to achieving competitive advantages, enables us to identify capabilities important to successfully commercializing network products. From the theoretical part of chapter 2 we derive some research questions and a conceptual research model, proposing some operational capabilities enabling commercialization of network products. In Chapter 3, methods and research design are presented, followed by a discussion of the choices made to test theories and concept basis for the conceptual research model. The next four chapters, Chapter 4, 5, 6 and 7, describe the four commercialization processes, where each chapter is followed by a single case analysis. These four commercialization processes vary as regards successfulness and degree of direct network effects in the commercialized product. The four cases are cross-analyzed and discussed in Chapter 8. We conclude the work in Chapter 9 and the conceptual model, presented in Chapter 2, is refined based on the empirical data in the four cases. The theoretical and managerial implications of the findings are discussed in this chapter and close with a discussion of the limitations and makes suggestions for future research.

2. Central Concepts and Theories

The purpose of the theory chapter is threefold. First, to present the theory of positive network effect relevant for introduction and commercialization of new network products¹. Second, to present some central concepts related to diffusion of innovations and to commercialization. Third, to discuss the notion of operational capabilities and dynamic capabilities and its application to commercialization of network products. These discussions and descriptions will be used as a basis for the conceptual model in this study.

Network effects and network products

When we consider buying food, clothes or furniture we normally appraise the goods based upon our personal needs independent of the number of other people who have bought or use the same type of item². Some types of goods, however, have a quality that makes them more valuable to us as the number of other users' increases (Rohlfs, 1974; Katz and Shapiro, 1985; Farrell and Saloner, 1985). Classical examples are telephone and fax-machine; a more recent one is electronic mail. These goods were of little value to the first individual who acquired them. The value increased with the total number of items in the network, because the total number of people with whom you could talk to or send and receive documents to, increased. This type of side effect in a transaction, as when one market actor affects other market actors, is known as an externality in economics. Externalities arising from network effect, i.e. the size of the user-network, are known as network externalities (Katz and Shapiro, 1985). A market has network effects when, everything else being equal, the consumer's willingness to pay increases with the number of units sold or expected to be sold (Economides, 1996).

Economides (1996) explains network externalities with complementarities between the components of a network. Networks are composed of

¹ A network product, or more precisely, a networking service, is defined as a service for which a mediating technology is used to link customers who are, or wish to be, interdependent, and for which there are direct network effects (Thompson, 1967; Stabell and Fjeldstad, 1998).

² Here, we ignore a brand effect, i.e. that people we would like to identify with have bought the item.

links that connect nodes. A service delivered over a network requires the use of two or more network components. Thus, network components are complementary to each other. A well-used example is a telephone network (see Figure 1). If customer A calls customer B, the service is composed of AS (access to the switch of customer A), BS (access to the switch of customer B), and switching services at S. The service AS can then be seen as a complement service to BS, and vice versa (Economides, 1996). Network externalities arise from this dependency between the complementary components. A single star network as in Figure 1 can illustrate this.

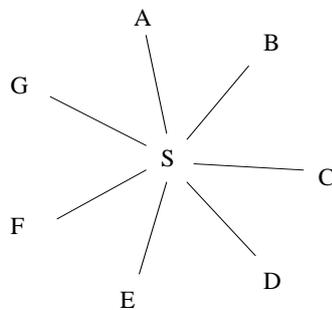


Figure 2. Star network (Economides, 1996)

In a network presented in Figure 1, there are $n(n-1)$ potential goods or services. An additional customer provides direct externalities to all customers in the network by adding $2n$ potential new goods through the provision of a complementary link to the existing links. In other words, adding one more customer to the communication network *directly* affects the value of the service to other customers (Katz and Shapiro, 1985). The service or product then has a utilitarian value that to a great extent is dependent on whom you can reach. This characteristic of a network was first pointed out in telecommunication networks by Rohlfs (1974), but is also relevant for networks such as various transport networks and Internet where the purpose of the connection is largely to interact with people or businesses at the other end (Shy, 2001).

Networks where services AB and BA are distinct, implying that the service can be performed in both directions in the network, are named “two-way” networks in Economides and White (1994). This categorizing is done in order to distinguish “two-way” network from “one-way” network. In a typical “one-way” network, there are two types of components, and composite goods are formed only by combining one component of each type. The customers are not identified as components; they are concerned with their own consumption of the network goods. Examples of this may be gas or electricity support, or radio and TV broadcasting. In “one-way” networks the externalities are only *indirect*, where a customer can experience consumption externalities only indirectly if increasing numbers of other consumers lead the network provider to increase the varieties or spatial availability of service at a special price.

Network effects are not confined to physical networks as in “two-way” or “one-way” networks. They are also powerful in “virtual” networks, such as network of users of hardware/software products. Katz and Shapiro (1985) show an example where an individual purchasing a personal computer will be concerned with the number of other individuals purchasing similar hardware because the amount and variety of software that will be supplied for use with a given computer will be increasing as a function of the number of hardware units that have been sold. A virtual network can be seen as a collection of compatible goods that share a common technical platform (Shapiro and Varian, 1999). For example, all computers running Windows 95 can be thought of as a virtual network, and correspondingly for VHS video players. One user adoption of compatible goods, i.e. a hardware/software system, will have no direct impact on other users, but may have lagged, *indirect* effects arising from increased variety of complementary goods produced by other firms (Katz and Shapiro, 1985).

Indirect network effects are then caused by supply side user externalities (Shapiro and Varian, 1999). Positive indirect network effects occur from the realization of returns to scale, i.e. falling unit costs in mass production, learning by doing and learning by using. These are passed on to users in the form of price cuts or quality increases. In the case of products or services in a “two-way” network one new user will result in an immediate utility gain for the established users³. Direct network effects are then caused by demand side user externalities (Shapiro and Varian, 1999).

³ Direct network effects occur only with use, purchasing the relevant good is not sufficient.

The extensive literature related to theories of positive network effects examines and analyzes the specific characteristics of markets for network goods. Much of the discussion concerns compatibility, standardization and its implications for governmental and policy regulations (see, for example, Katz and Shapiro, 1985; 1986; 1992; Farrell and Saloner, 1985; 1986; 1992; Economides, 1989; Matutes and Regibeau, 1992). This discussion is not included here. The thesis concerns commercialization and distribution of network products exhibiting direct network effects. Telecommunication is the empirical context and the service provider operates in a regulated market.

Commercialization and distribution of network products

The value of a product or service exhibiting direct network effects lies in the connection among users and, hence, has little or no value when introduced to the first user. *The question is then how can network services be commercialized and thus create value for the users and new rents for the service provider?* Before I describe some challenges that may arise when commercializing network products I will specify my interpretation of what “commercialization” implies.

Commercialization process

Commercialization is the process of transforming a new idea, i.e. innovation, from research or from other entrepreneurial activities, into a profitable product or service for sale in the market place. Furthermore, to call it a successful commercialization it must result in new profitable income, or, in other words, it must return the original investment in the innovation development process plus some additional gains (Burgelman et al., 2004). An innovation can be defined as new development or essential improvements of goods and services, and as production and distribution methods (processes) (Christensen, 1997). The innovation-development process often begins with recognition of a problem or need, which may stimulate research and/or development activities designed to create an innovation to solve the problem or need (Rogers, 2003). What remains when the innovation is created, is to realize the value potential embedded in the innovation. The innovation-development process can then, somewhat simplified, be divided into three phases; (1) discover; (2) create; and (3) realize.

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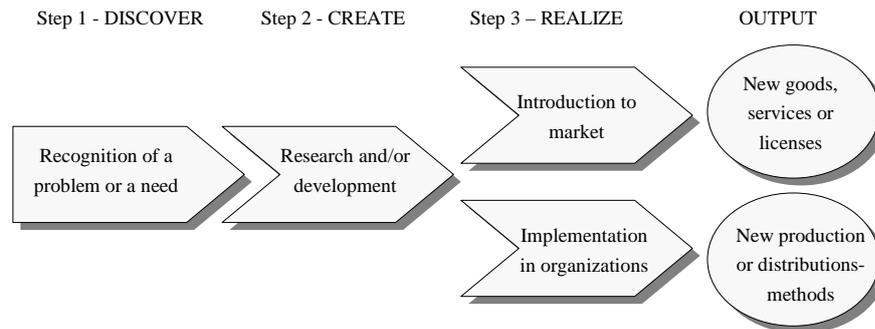


Figure 3. Different steps in an innovation process

In what way an innovation creates value depends on whether it appears as a product or as a process⁴. A new product or service must be introduced to a market that is willing to pay for the newcomer, and the measure of value realization is a new income. A new production method must be implemented in an organization and can be measured on increased efficiency. The reason why it is important to separate these two realization categories is that they require different types of activities to be fulfilled. In this study, the focus will be on products and services brought to the market, i.e. commercialization activities.

Rogers (2003) defines commercialization as the production, manufacturing, packaging, marketing and distribution of a product that embodies an innovation. Activities involved in production and in manufacturing can both be related to assembling components and technology for the product to function properly. Production and manufacturing will therefore be used as synonyms in this study. That leaves us with four

⁴ A process can, for that matter, be commercialized through sale or license-agreement in a market. Typical processes here are techniques or methods for attaining various targets like, for example, improving business results.

important main activities in a commercialization process: production, packaging, marketing and distribution.

The production, as already mentioned, deals with activities related to assembling components and technology. In manufacturing industries, these activities would deal with the transformation of raw materials into finished goods for sale, by means of tools and processing media. In mediating industries, as in telecommunication, a network product first becomes valuable to a customer when it can be used to communicate with other customers of the same product. Production related to commercialization processes of network products would then involve construction of a synchronized functionality of all components and technologies vital to the customer to experience its value.

Packaging involves activities related to development of the product concept. How the “package is wrapped”, i.e. what does it comprise and what other potential benefits, for example other services, comes with the “package”, are of value to the customer. Packaging can also be seen in connection with some of the tasks in marketing such as how to promote the product and encourage potential buyers to purchase it. Important activities in marketing are, according to the Chartered Institute of Marketing, related to the “management process of anticipating, identifying and satisfying customer requirements profitably”. Marketing is then a management tool to ensure that products and services are developed according to market requirements, and that they are profitable. Operative marketing is a wide concept and may involve market research, product development, product life cycle management, pricing, channel management, as well as promotion, covering almost all activities defined in a commercialization process. Distribution involves activities dealing with logistics: how to get the product or services to the customer, i.e. sales channels, methods and timing. There is, as described above, no watertight compartments between these commercialization activities. They can both be overlapping in their meanings and be performed partly in parallel. In this study, we divide these activities in two main ones: (1) production, meaning vital components and technology where technology is in main focus, and (2) packaging, marketing, and distribution where market is in the driver’s seat.

Distribution and the significance of critical mass

A network service that is new for individuals or for organizations will be perceived as an innovation (Mahler and Rogers, 1999). Diffusion

related to innovation is in diffusion literature defined as “the process in which an innovation is communicated through certain channels over time among the members of a social system” (Rogers, 2003). The individual consumer may accept or reject to adopt the innovation. Adoption deals with the psychological processes an individual goes through (Rogers, 2003) and adoption research attempts to explain diffusion processes at the individual level. These micro-level analyses are used to explain the resulting pattern of diffusion at a macro level. The rate of diffusion or, more precisely, the rate of adoption is defined as the relative speed with which members in a social system⁵ adopt an innovation.

Innovation can also be adopted or rejected by a social system like an organization or a department. The decision to adopt the innovation is then made by a collective or an authority decision. In this manner, Rogers (2003) distinguishes among three main types of innovation-decisions: (1) optional innovation decisions, choices that are made by an individual independent of the decision of other members of the system to adopt or reject an innovation; (2) collective innovation-decisions, choices that are made by consensus among the members of a system to adopt or reject an innovation; and (3) authority innovation-decisions, choices that are made by relatively few individuals in a system who possess power, status or technical expertise to adopt or reject an innovation. A fourth category consists of a sequential combination of two or more of these three types of innovation-decisions.

A few individuals called early adopters, with an adoption threshold of almost zero, may adopt a new idea or technology before anyone else in their system has. Adoption threshold is the number of other individuals who must have adopted before a given individual will adopt the new idea (Granovetter, 1978). Thus, the threshold indicates the degree to which an individual or an organization/department is resistant to adopting. Positive messages are then spread interpersonally from satisfied adopters to potential adopters who are thus persuaded to adopt (Rogers, 2003). As the number of satisfied adopters in a system gradually increases, and as the volume of positive messages about the innovation being communicated increases accordingly, the rate of adoption takes off after an initial period of relatively slow diffusion. Eventually, fewer and fewer individuals with a strong resistance to adoption remain, and the rate of adoption gradually levels off. The cumulative number of adopters of an innovation over time forms an S-shaped diffusion curve (Rogers, 2003) (see Figure 3 below). The adoption

⁵ A social system is defined as a set of interrelated units that are engaged in joint problem solving to accomplish a common goal. The members or units of a social system may be individuals, informal groups, organizations and/or subsystems.

rate, and by then the slope of the “S”, depend on several factors. The perceived attributes of an innovation are one important explanation of the rate of adoption of an innovation. Most of the variance in the rate of adoption of innovations, from 49 to 87 percent, is explained by five attributes: relative advantage, compatibility, complexity, “trialability” and observability (Rogers, 2003).

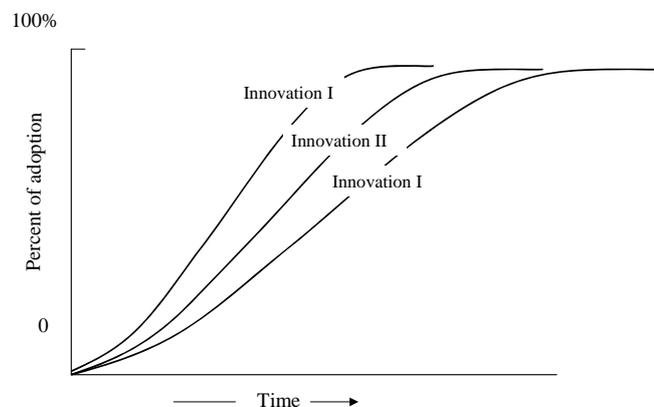


Figure 4. The rate of adoption for an innovation Source: Based on Rogers (2003)

The adoption rate for a network service, empirically observed for telecom services (Allen, 1988; Schmitz et al., 1995; Mahler and Rogers, 1999; Schoder, 2000), has a different course than the S-shaped curve. The diffusion curve is characterized by an almost straight line with a long tail to the left for a relative long period. Figure 4 below shows the cumulative rate of adoption for an innovation exhibiting direct network effects. The reason for the late take-off phenomenon in the diffusion of communication technologies is, according to Williams et al. (1988), the interactive nature of these services. It has been verified that network effects caused this late take-off phenomenon in diffusion of an interactive innovation such as fax (Lim et al., 2003). When a certain number of adopters with which prospective

adopters wish to communicate is achieved, a *turning point* arises in the adoption rate. This point is called critical mass⁶ in the diffusion literature.

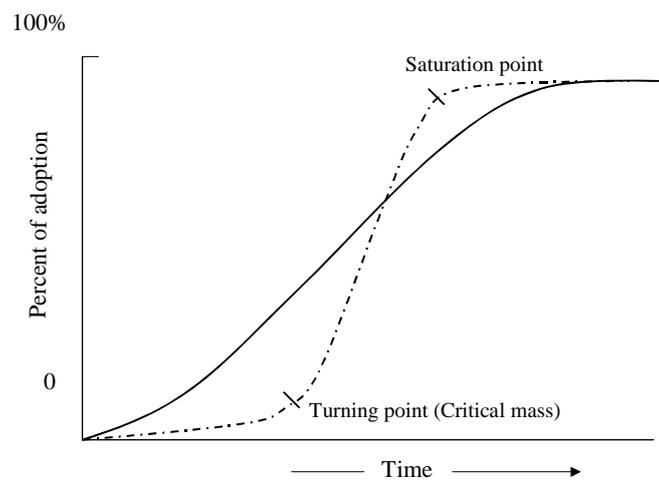


Figure 5. *The rate of adoption for a non-interactive product (solid line) and for an interactive innovation (dotted line) Source: Based on Williams et al. (1988)*

Critical mass in diffusion of interactive innovations occurs at the point when enough individuals in a system have adopted so that the innovation's further rate of adoption becomes self-sustaining (Rogers, 2003). The critical mass or the critical mass point has been interpreted as the *turning point* between positive and negative return to adoption, where a small deviation from this value can cause a transition from an unstable to a stable diffusion phase (Markus, 1990). As long as the critical mass point is not exceeded, demand synergies can only develop to a limited extent (Schoder, 2000), but after reaching critical mass demand pushes itself to maturity, which can be defined as a *saturation point*. The network effect that acts to slow the rate of

⁶ The idea of this critical mass originated in nuclear physics, where it referred to the amount of radioactive material needed for a pile to "go critical" in a self-sustaining reaction.

adoption of an interactive innovation before the critical mass is reached, serves to speed the adoption rate after the critical mass is attained (Liebowitz and Margolis, 1994). This way the network effect acts as a catalyst for the diffusion given that the critical mass is reached (Allen, 1988).

However, whether critical mass is crucial for commercialization of telecommunication services depends on the degree of externalities (Mahler and Rogers, 1999). Past literature on the diffusion of telecommunications innovation has not clearly distinguished between new services that are highly interactive in nature and have a high degree of direct network effects, versus those that are not interactive. The critical mass is more directly involved in the former and less in the latter. Fax, e-mail and video conferencing seem to have been characterized by a critical mass in their rate of adoption, while voice-mail was not (Mahler and Rogers, 1999). Nevertheless, for some new interactive services achieving critical mass is not crucial. This was the case when mobile telephones were introduced because of their compatibility with the installed base of telephone subscribers. Had mobile phones been designed so that each adopter could only talk with other mobile phone users, a critical mass would have been more important in the diffusion of this innovation.

Strategies for reaching critical mass

Why would anyone in the first place adopt a network service at the initial roll out when they experience low benefits and high costs relative to those potentially obtainable? Markus (1987) argued that adopters decide to adopt on the basis of an anticipation that the innovation is likely to take off. The individuals base their choice on what they expect the others in a group decide to do and watch the group to discern what the group choice may be. Allen (1988) described this reciprocal observation as everybody “watching while being watched”. Eventually, when many individuals in the system perceive that “everybody is doing it” the general perceptions of a new service change, from a view that “sees novelty” to “one that sees necessity”. Critical mass is being linked to consumer’s expectations regarding the performance of a technology and the final size of the network users (Mahler and Rogers, 1999). Reaching critical mass may then depend less on the objective number of adopters of an interactive innovation than on the perceived number of other adopters (Allen, 1988).

Getting to critical mass is not a fixed impediment to diffusion, but rather a special quality of interactive innovations that demands the use of particular strategies by the service provider. A service provider may employ several

means to implant such expectations. A prize incentive to early adopters is a well-used strategy (Rohlf, 1974; Allen 1988; Schmitz et al., 1995). A large portion of the network effects in telecommunication can also be captured if the operator initially recruits the customers that are more connected to others. That means to identify communities that wish to be connected (Fjeldstad, 1999). Gaining initial adoption of a high-status individual in the community who will support the new service (Rogers, 2003) and sequential introductions to communities where potential users are most receptive, increase the likelihood of reaching critical mass (Hohn and Schneider, 1991). When the French PTT introduced Minitel service, they used a strategy of sequential introduction (Allen, 1988) when they did this in regional steps and started where the prospects were strongest. This way, they built nationwide expectations for critical mass step-by-step.

When you cannot achieve network effect within your own network, you can seek alliances that allow interconnection with other networks. This “horizontal” compatibility, which is compatibility between two comparable rival systems, implies that a subscriber of one network can communicate with those on the other network (Katz and Shapiro, 1994). Bundling, or combining complementary goods in one “package”, may increase the perception of relative advantage. Introducing a new service layer, like, for example, Short Message Service (SMS) text messaging, to the mobile telephone service complements the underlying service and thus increases the value of subscribing to it (Milgrom and Roberts, 1995; Farrell and Katz, 2000). In this manner, a new network product or service on top of an existing network (product) will have an indirect network effect on the value of the underlying product. This may increase the adoption of the network service after the first saturation level.

Adoption dynamics previous to critical mass

In accordance to past diffusion research on innovations, summarized by Rogers (2003), there are five characteristics of an innovation that affect its rate of adoption. The first is the *relative advantage*, which is the degree to which an innovation is perceived as better than the idea it supersedes. Second, *compatibility*: the degree to which an innovation is perceived as being consistent with the existing values, past experience, and needs of potential adopters. Third, *complexity*: the degree to which an innovation is perceived as difficult to understand and use. New ideas that are simpler to understand are adopted more rapidly than innovations that require the adopter to develop new skills and understandings. Fourth, “*trialability*”, which is the degree to which an innovation may be experimented within a

limited base. An innovation that is trialable represents less uncertainty to the individual who is considering it for adoption, as it is possible to learn by doing. *Observability* is the fifth characteristic that affects the rate of adoption and is connected to the degree to which the result of an innovation is visible to others. The easier it is for individuals to see the results of an innovation, the more likely they are to adopt.

Network effects create utility for an individual user of a network product as other users adopt the product (Katz and Shapiro, 1985). Later adopters then influence earlier adopters and vice versa (Markus, 1987, Thompson, 1967). Such a reciprocal interdependence increases the relative advantage of the network product for both past and future adopters. Because of this interdependency between the users in valuing the product, Weiber (1992) called them “experienced goods”⁷. However, adopters perceived that the relative advantage of a telecommunication service might also be influenced by the degree to which all of the components (such as terminal, infrastructure, content, etc) work together. Until they do, a potential adopter cannot accurately evaluate the relative advantage for the new service.

Early adopters of network product, i.e. interactive innovations, require a lengthy period of use before the adopter can accurately perceive the innovation’s *relative advantage* (Mahler and Rogers, 1999; Markus 1987). Furthermore, if early users are not reinforced by reciprocity from new communication partners, they are very likely to discontinue using a communication medium (Rice, 1982). As users defect, the benefits to the remaining users will decrease and the cost increase, thus stimulation further defection (see Figure 5). Consequently, in the unsuccessful case, use of the communication medium will be extinguished (Rice, 1982).

⁷ Nelson (1970) introduced the concept of “experienced” goods when he made a distinction between qualities of a brand that the consumer can determine by inspection prior to purchase of the brand - “search qualities” - and qualities that are not determined prior to purchase - “experience qualities”.

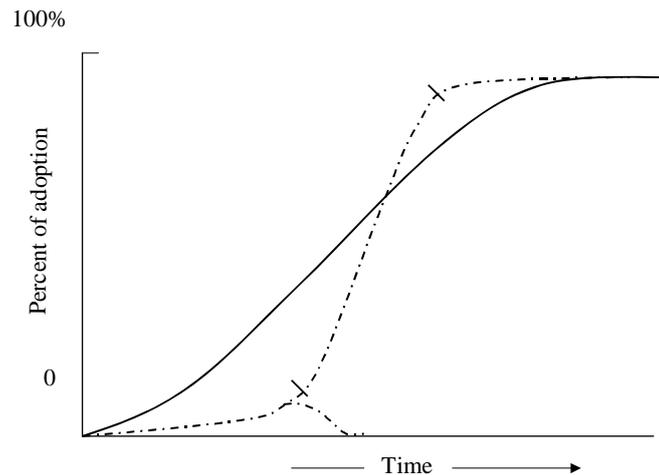


Figure 6. *Idealized successful and flop-like diffusion with network effects, compared to the typical S-shaped diffusion pattern. Adopted from Williams et al, 1988.*

Reaching critical mass of adopters where the turning point in adoption rate occurs, is seen the as a decisive measure or target when telecommunication services are commercialized (Allen, 1988; Schmitz et al., 1995; Schoder, 2000). Allen (1988) and Schmitz et al. (1995) argue that how quickly the critical mass is reached is also an important success factor of new telecommunications services. Strategies which make the distribution curve at the turning point move to the left (i.e. a rapid roll-out) will increase the probability of adopting the service earlier. In other words, the service would be valuable earlier than it would otherwise be. Whether a rapid roll-out also reduces the chance for the user to collect negative experiences with the service (cf. experience goods) and then discontinue to use the service before the turning point is reached is not mentioned here. However, based on the earlier discussion I would assume that this is a relevant issue.

Operational and dynamic capabilities

Development of new products with a following successful commercialization is important for renewal at the corporate level (Bowen et al., 1994; Covin and Miles, 1999; Dougherty, 1992) and thus sustains competitive advantage in markets with rapid changes (Cooper and Smith, 1992; Eisenhardt and Martin, 2000; Danneels, 2002). This theme is highly relevant in the strategic management literature where the fundamental question is how firms achieve and sustain competitive advantages through value creation (Schumpeter, 1934; Penrose, 1959; Wernerfelt, 1984; Prahalad and Hamel, 1990; Barney, 1991; Nelson, 1991; Peteraf, 1993). However, the debate regarding strategy has in recent years shifted from the sustainability of competitive advantage to the capacity to manage innovation and change (Brown and Eisenhardt, 1997; Tushman and O'Really, 1997; Christensen, 1998). This shift has been followed by a change of focus from the resource based view to a more “dynamic” resource based view (Teece et al., 1997; Eisenhardt and Martin, 2000).

Toward a “dynamic” resource based view

Different perspectives and theoretical streams of literature in strategic management are relevant for understanding how firms deploy their resources to create value. The activity-based perspective concentrates on what the firm does (Porter, 1985; 1991); the resource-based perspective concentrates on what the firm has (Wernerfelt, 1984; Barney, 1991), while other perspectives concentrate on ability to achieve new valuable resource configurations in dynamic business environment (Teece et al., 1997; Eisenhardt and Martin, 2002).

The activity-based perspective is focusing on how a firm can achieve competitive advantages through strategic activities (Porter, 1985). The activity-based perspective was, for a long time, mainly concerned with seeing firms as a value chain, i.e. as a system where value is created by transforming a set of inputs into more refined outputs (Porter, 1985). Stabell and Fjeldstad (1998) introduced two additional value configurations: value shop and value network. A value shop is modelling problem-solving firms as hospitals, law firms and architecture firms. They create value by solving their client's unique problems through core activities with a cyclical course. A value network is modelling network firms as telecommunication operators, retail banks and postal services. They create value by linking customer through core activities that have to be performed in parallel.

However, independent of value creation logic, the activity-based analysis framework postulates that competitive advantage is understood by disaggregating the value creation process of the firm into discrete activities that contribute differently to the valuable characteristics of the product (Stabell and Fjeldstad, 1998). The basic assumption is that activities are the building blocks with which a firm creates a product that is valuable to its customers. This disaggregating enables the firm to identify those activities that are strategically important where opportunities and improvement needs are present. The primary activities are characterizing the main value creation process of established products and services and, hence, do not involve innovation and commercialization processes. In addition to viewing these processes as a support activity to the value creation, this approach or framework has a disproportionately large “mesh width” for catching relevant characteristics in the process of commercialization.

Value creation results from activities in which resources are applied (Penrose, 1959; Porter, 1991). The resource-based view, therefore, represents a perspective going beyond the levels of activities. The resource-based view assumes that firms can be conceptualized as bundles of resources, that those resources are heterogeneously distributed across firms, and that resource differences persist over time (Mahoney and Pandian, 1992; Penrose, 1959; Wernerfelt, 1984). These resources are, however, “sticky” or difficult to modify (Amit and Schoemaker, 1993; Barney, 1991; Wernerfelt, 1984). Because of this stickiness, the resource-based view claims that any firm’s competitive advantage lies in developing strategies for effectively exploiting firm-based assets. However, over time, scholars have recognized that having a stock of assets, and to perform an old set of activities better than competitors, are not enough to maintain leadership or competitive advantage in situations of rapid or unpredictable change. When the business environment changes rapidly, static competitive advantages erode and firms unable to adapt fail (Teece et al., 1997). Both the resource-based view and the activity-based view appear to reach boundary conditions under these circumstances. The main essence of the critics is that the resource-based perspective has not adequately explained how and why certain firms have a competitive advantage in situations of rapid and unpredictable changes in the business environment (Henderson and Cockburn, 1994; Iansiti and Clark, 1994; Teece et al., 1997; Eisenhardt and Martin, 2000).

Teece et al., (1997) introduced the concept of “dynamic capabilities” which, according to the authors, incorporates the recognition that competitive advantage in situations of rapid changes in the business environment requires both the exploitation of existing internal and external firm-specific resources, and the development of new ones. The concept of

dynamic capabilities was defined as the firm's ability to integrate, build and reconfigure internal and external competences to address rapidly changing environments (Teece et al., 1997). Some authors criticized the definition to be tautological, recursive, non-operational and lack empirical grounding (Mosakowski and McKelvey, 1997; Williamson, 1999). Eisenhardt and Martin (2000), however, utilized prior empirical findings to examine dynamic capabilities associated with specific activities such as product innovation or the formation of alliances and acquisitions. Based on their findings, they claimed that dynamic capabilities consist of identifiable and specific routines that have extensive empirical research bases and management applicability.

Product development is, according to Eisenhardt and Martin (2000), a dynamic capability of the firm because this activity is one of the mechanisms by which firms create, integrate, recombine and shed resources. This resource handling is accomplished through learning from small failures and feedback from the external environment (e.g., customers, competitors) (Helfat, 2000; Helfat and Raubitschek, 2000). How product innovation generates organizational renewal or what the dynamic nature of capabilities really is, have been the subjects of a great deal of discussion (Helfat, 2000). Before I go deeper into this matter, I will first describe the origin of the notion of capability in strategic management literature.

Operational capability

Capabilities' constituent parts, their nature and strategic significance have been discussed since Selznick (1957) introduced the concept of distinctive competencies that were associated with organizations' ability to cope with environmental demands. This concept was later defined as the combined technological and organizational knowledge and skills that together are most important in determining the ability of an organization to survive (Nelson and Winter, 1982). Nelson and Winter describe them as embedded "routines" resulting from long time practice and organizational learning. A variety of the concept has been used to describe these types of knowledge and skills. Itamin (1987) used the concept of "invisible assets", Prahalad and Hamel (1990) used "core competencies", Pavitt (1991) "firm-specific competence" and Leonard-Barton (1992) "core capabilities". More recently, a concept like "operational capabilities" has been used (Winter, 2000; 2003; Helfat and Peteraf, 2003). Winter (2000; 2003) defines an operational capability as a high-level routine (or collection of routines) that together with its implementing input flows, confers upon an organizations management a set of decision options for producing significant outputs of a

particular type. In this definition the term routine refers to a “repetitive pattern of activity (Nelson and Winter, 1982). Similar, Helfat and Peteraf (2003) refer to the ability of an organization to perform a coordinated set of tasks, utilizing organizational resources, for the purpose of achieving a particular end result.

Several studies have used the concept of capabilities to illuminate and explain why some firms succeed more than others in developing new products and processes (Prahalad and Hamel, 1990; Leonard-Barton, 1992; Dougherty, 1992, 1995). Leonard-Barton (1992) defines a core capability as the knowledge set that distinguishes and provides a competitive advantage. The content of the knowledge set is, according to Leonard-Barton, embodied in (1) employee knowledge and skills and embedded in (2) technical systems. The processes of knowledge creation and control are guided by (3) managerial systems. The fourth dimension is (4) the value and norms associated with the various types of embodied and embedded knowledge and with the processes of knowledge creation and control. The values of an organization can then be seen as the criteria by which decisions about priorities are made (Garvin, 1988). According to Garvin (1988), processes are the pattern of interaction, coordination, communication, and decision-making through which they accomplish these transformations. Some processes are “formal”, in the sense that they are explicitly defined, visibly documented and consciously followed. Other processes are “informal”, in that they are habitual routines or ways of working that have evolved over time, which people follow simply because they work – or because “that’s the way we do thing around here”.

Leonard-Barton (1992) argued that core capabilities could, under some circumstances, become core rigidity and thus impede product innovation. She found that core capabilities facilitated the development of projects closely aligned with the four dimensions of a firm’s core capability (employee knowledge and skills, technical systems, administrative systems, values and norms). In contrast, projects lacking alignment with those capabilities were inhibited. In other words, new products with a closer fit to firm competences tended to be more successful. Similarly, Dougherty (1995) found that, over time, “core incompetence’s” grow around the firm’s core competences. The reason for this core rigidity is, according to Leonard-Barton (1992) that processes are, by their nature, established so that employees perform recurrent task in a consistent way, and to ensure consistency they are not meant to change. In other words, the mechanisms through which organizations create value are then intrinsically irreconcilable to change (Christensen, 2002). This implies that a process that defines a capability in executing a certain task concurrently defines disabilities in

executing other tasks. Leonard-Barton (1992) argued that firms are faced with the dilemma of both utilizing and maintaining their core capabilities, and yet avoiding the core rigidity by renewing the core capabilities.

The capabilities' "dysfunctional flip side" (Leonard-Barton, 1992) is a more pronounced problem in well-established firms (Burgelman et al., 2004). The locus of the organizations' capabilities shifts from resources (here people) toward process and values as a function of time (Burgelman et al., 2004). In the start-up stages of an organization, much of what gets done is attributable to its people. Hence, the location of the most powerful factors that define the capabilities of organizations migrates over time, from resources toward visible, conscious processes and values, and then toward culture. However, when the capabilities have come to reside in processes and values changes become more difficult (Leonard-Barton, 1992).

Environmental changes will make previously acquired competences obsolete and call for new competences to be built (Danneels, 2002; Dougherty, 1995; Leonard-Barton, 1992). For the firm, this implies that competences have to be renewed continuously in the face of change. The challenge, then, is that operational capabilities in well-established firms may be rigid and, as a result difficult to change. In this connection, the dynamic resource based view, or dynamic capability view, calls attention to the need for renewal of firm's competence and core capabilities when the business environment changes. Teece et al., (1997) identified dynamic capabilities as the main source of sustainable competitive advantage in a changing competitive landscape. The term "dynamic" here refers to the capacity to renew competence so as to achieve congruence with the changing business environment.

Dynamic capability

In the wake of the "dynamic capability" introduction, many studies have been theorizing on the dynamic nature of capabilities on a relatively high abstraction level (Helfat, 2000; Eisenhardt and Martin, 2000; Winter 2000; 2003; Makadok 2001; Zollo and Winter, 2002; Helfat and Peteraf, 2003). Few studies base their discussion on direct empirical observations, and the empirical evidence that links these firm-based processes to market and technology adaptation is then at an early stage (Dosi et al., 2002; Verona and Ravasi, 2003).

There is a broad consensus in the literature that dynamic capabilities contrast with "ordinary" or operational capabilities by being concerned with

change (Collis, 1994; Teece et al., 1997; Eisenhardt and Martin, 2000; Helfat and Peteraf, 2003; Winter, 2003). The dynamic capability view is based on the existence of some higher-order capabilities (Collins, 1994) that can deploy and re-deploy resources and “ordinary” capabilities to match market and/or technological change. An operational capability generally involves performing an activity using a collection of routines to execute and coordinate the variety of tasks required to perform the activity. Dynamic capabilities do not involve activities associated with production of goods or product innovation; they build, integrate or reconfigure operational capabilities (Helfat and Peteraf, 2003; Winter, 2003). Therefore, dynamic capabilities do not directly affect output for the firm in which they reside, but indirectly contribute to the output of the firm through an impact on operational capabilities. (Helfat and Peteraf, 2003).

Some authors exemplify dynamic capabilities as the result of a combination of resources, such as entry into a new product market (Danneels, 2002), the development of a new technology (Helfat, 1997) or the successful completion of an acquisition, such that a new form of competitive advantage is achieved (Teece et al., 1997). Viewing dynamic capabilities as the result would imply that a successful commercialization manifested, either in the form of new products or new firms, would bring new competencies to the firm supporting development of dynamic capabilities. Others describe dynamic capabilities as the development of a new process, such as the development of a systems integration process (Helfat and Raubitschek, 2000), an acquisition process, a new product development process (Eisenhardt and Martin, 2000), or a new manufacturing technique (Winter 2000). When relating to the theme of this study, the critical issue is not what a new product or service brings to the company in terms of new competencies, but how to develop and sustain a process for commercialization.

Dynamic capabilities are also described as mechanisms to create new knowledge (Henderson and Cockburn, 1994), to continuously improve processes (Zollo and Winter, 2002), or to ‘learn how to learn’. Zollo and Winter (2002) describe codifiable processes, repeatability and generalizability as the fundamental building blocks of developing a new dynamic capability. They define the construct as “a learned and stable pattern of collective activity through which the organization systematically generates and modifies its operating routines in pursuit of improved effectiveness”. In these words, dynamic capabilities are process improvement techniques. They constitute the firm’s systematic methods for modifying operating routines. The generation of capabilities requires enough experience that “tacit production and organizational knowledge become

stored in new patterns of activity, in routines” (Teece et al., 1997). These routines help the firm integrate (Helfat and Raubitschek, 2000), reconfigure (Hargadon and Sutton, 1997), or develop and release new resources (Henderson and Cockburn, 1994). Viewed in this way, competitive advantage is not based on the result of successful commercialization processes, or on building a business process to attain successful commercialization’s, but, rather, in the learning efforts of reflecting on the commercialization process as executed in the firm as well as its objectives, reconfiguring it, and re-institutionalizing that process for the purpose of improving it, or in accordance with new objectives. Most scholars agree that this third element, “learn how to learn”, is required for any dynamic capability to provide long run competitive advantage for the company (Eisenhardt and Martin, 2000; King and Tucci, 2002; Winter, 2003). To the extent that the learning mechanisms are themselves systematic, they could be regarded as “higher-order” or “second-order” capabilities (Collis, 1994; Zollo and Winter, 2002).

Building on the notion of second-order capabilities, Danneels (2002) views a second-order capability as the ability to acquire and develop vital operational capabilities. He studied the reciprocal relation between a firm’s product innovation efforts and its competence use and development over time. In line with the product innovation literature, Danneels (2002) assumes that new product development is, in essence, about making linkages between technological and customer competences (e.g., Cooper, 1993; Dougherty, 1992; Song and Parry, 1997) and that the key resources needed to accomplish them can be classified as market-related and technically related (Danneels and Kleinschmidt, 2001; Mitchell, 1992; Moorman and Slotegraaf, 1999). Based on his findings Danneels (2002) presents a new product typology which shows how technologies and customer as firm competences impact new product development and how competences are themselves impacted by new product development. Moreover, he further describes how these resource dynamics influence what type of product a firm pursues. In other words, product innovation activities not only draw on, but also serve to develop firm competences, and thus contribute to firm renewal over time.

Danneels’ portrayal of renewal of firm competences draws on organizational learning concepts where he applies March’s (1991) distinction between exploitative and explorative modes of learning to the product innovation context. The major components of any effort to improve organizational performance and strengthen competitive advantage are, according to March (1991), learning, analysis, imitation regeneration, and technological change. Furthermore, each of them involves adaptation and a

delicate trade-off between exploration and exploitation. The two types of competences required for product innovation in this matter constitute two learning dimensions along which products can be new to the firm (Danneels, 2002). A new product may draw on existing technological competences (exploitation technology competence) or require new technological competences (exploration technology competence). A new product may draw on customer competences that the firm already has (exploitation customer competence) or require a new type of customer competence (exploration customer competence). In pure exploitation, a firm uses both existing technological and existing customer competences. Product development, in that case, according to Danneels (2002), involves making new linkages among existing competences. In pure exploration, a firm must build both technological and customer competence which involves making new linkages among new competences.

However, as Danneels (2002) argues, both technologies and customers are firm competences that can be leveraged, which involve drawing on an existing competence, while using it as a stepping-stone to build a new competence. Leveraging technology competence implies appealing to additional customers through developing products based on an already achieved technological competence (exploiting technology competences/exploring customer competences). Leveraging customer competence involves building additional technological competences to appeal to a greater share of existing customers' needs (exploiting customer competence/exploring technological competence). Based on this, Danneels suggests that rather than trapping the firm (cf., Leonard-Barton's "core rigidity"), current competence may be used as a leverage point to add new competences, which he refers to as "competence leveraging".

The skill of the firm of combining and recombining both existing and new customer and technological competences could be thought of as its integrative capability (Henderson and Cockburn, 1994). Based on Teece et al.'s (1997) definition of the term "dynamic" (which relates to the "renewal of resources to address changing environments"), Danneels (2002) argues that the "dynamics" in this product innovation portrayal relates to the ability to learn new domains. He names this ability a second-order competence and defines it as the ability to identify, evaluate and incorporate new technological and/or customer competences into the firm. In that, second-order competences⁸ enable a company to renew itself through building new first-order competences. As Danneels (2002: 1115) expresses it: "*Some companies may have excellent first-order competences (e.g., they know their*

⁸ Danneels (2002) uses the term competence interchangeably with capability

customers very well and have great relations with them, and they deeply master their technologies), but may falter when faced with the renewal challenge. The presence of second-order competences may explain the relative success of firms in the face of environmental change". Product innovation is then not a dynamic capability per se, as Eisenhardt and Martin (2000) argue, but rather a potential avenue for a firm's renewal, or a vehicle for the firm to learn new domains of activity. This is in line with Leonard-Barton (1992:111) who characterizes development projects as a critical strategic activity because "*development projects become the focal point for tension between innovation and status quo*" in responding to environmental and market change, and by then act as a "*microcosm of the paradoxical organizational struggle to maintain, yet renew or replace core capabilities*". Danneels' (2002) additional point here is that a second-order competence, i.e. dynamic capability, is needed to fulfill a renewal. Based on this, I would argue that for a first-order capability, i.e. operational capability, to be vital and viable in a changing environment, it has to be seen in context with the dynamic capability to innovate and commercialize new products.

The literature has used terms like resources, assets, skills, capabilities, and competences to express something that is valuable to the firm in order to cope with environmental demands and changes. These terms are often used interchangeably and have, to a great extent, an overlapping meaning. For the present analysis I will use the term capability interchangeably with competences (Danneels, 2002) and knowledge-set (Leonard-Barton, 1992) to express the ability of an organization to utilize resources for "the purpose of achieving a particular result" (Helfat and Peteraf, 2003) or "producing significant output of a particular type" (Winter, 2003).

The capability to commercialize network products

The main concern of this thesis is capabilities fostering commercialization of network products. The theory of positive network effect has revealed that commercialization of network products can present difficulties that are specific for these types of products. The strong impact of direct network effects from inter-customer communication accentuates the importance of distribution rate, i.e. a rapid rollout, and reaching critical mass in order for customers to experience value. The question is whether these challenges require peculiar capabilities. Operational capabilities enabling product innovation in general have been identified, but the capability to commercialize network products and the dynamics of resources and new products in telecommunication contexts have not been examined.

Teece (1986) introduced the concept of complementary assets as being vital to attain a successful commercialization. These complementary assets could be generic or specialized (Teece, 2004), where generic assets are general-purpose assets not needed to be tailored to the innovation, and specialized assets are those where there is unilateral dependence between the innovation and the complementary asset, i.e. marketing, competitive manufacturing, and after-sales support. Teece (1986) argued that the ownership of complementary assets, particularly when they are specialized, determines who will benefit from that innovation. Mitchell and Singh (1996) showed that development-oriented and market-oriented collaborative relationships appeared to help firms acquire needed commercialization capabilities in order to commercialize complex goods in the software system industry. The dependency of several components in the telecommunication industry like terminals, infrastructure, applications and content for the product's functionality, and the impact of indirect network effects associated with a multitude of complement services, imply a strong role of coordination with other actors in the commercialization of network products. Access to resources through both development and market-oriented collaborative relationships can then be crucial and may require a firm-specific alliance capability⁹ (equal to technological and customer capabilities). Building on Danneels' (2002) framework, we argue that integration between technological, customer and alliance capabilities competence is important to innovate and commercialize new products effectively in the telecommunication industry. To empirically link the three proposed operational capabilities to commercialize network products successfully, our first question is: *how do technological, customer and alliance capabilities enable commercialization of new products in telecommunication industries?*

One of Danneels' (2002) key points is that for a viable new product to be developed and commercialized, technological and customer competences must have to come together. In other words, there have to be some linkages between them. The question is what these linkages comprise or require. Who knows, inside the firm, which technological, customer and alliance competence the firm possesses? Does linking require an in-depth understanding of the competences, i.e. do the competences have to be represented cognitively in the same mind or is an awareness of their existence sufficient? An additional factor is that different products will vary in their construction, the technical systems they comprise and commercial actors involved. Each new commercialization process may, in this manner, need different combinations of these operational capabilities. The next

⁹ We define alliance capability as the ability to handle external actors possessing vital resources for the network product to be commercialized

question is then: *in which way will linkages between the three operational capabilities enable the commercialization process?*

The main topic in this study is commercialization of network products in telecommunication where the impact of direct network effects accentuates the importance of distribution rate and reaching critical mass. Network products in telecommunication are used for communication between various nodes in a network, i.e. between individuals, organizations and terminals. With few nodes in a network, which means few nodes to communicate with, it is difficult for the individual user to perceive a new network product's relative advantage. The general perceptions of a new product change, from a view that "sees novelty" to "one that sees necessity" when a certain number of users are attained. The diffusion phase before this turning point, i.e. critical mass, is thus an unstable phase. For early users to persist in this early phase of diffusion, they have to experience the advantage through an inrush of new users. For the same reason, it is likely to assume that early users will lose their patience if this phase is long and drawn out and, hence, discontinue using the service before critical mass is reached. Operational capabilities enabling attainment of critical mass in users of the new network product, and at a high rate, will, accordingly, be a vital capability when commercializing network products. Our third research question is then: *are some of the proposed operational capabilities important for reaching critical mass and a rapid rollout?*

The progress in a commercialization process may vary, not only due to different product construction, but also because challenges and opportunities related to market and technology change. Product development and the appurtenant commercialization process in a changing business environment in that case require both exploitation of existing competences and exploration of new competences. The capability to innovate and commercialize network products in a changing market has to co-evolve over time to match emerging opportunities. In other words, to be vital and viable in a changing environment the operational capabilities needed to successfully commercialize network products have to absorb new erudition. This ability to learn through exploration and adding the new competence to current stock are called dynamic capability (Helfat and Peteraf, 2003; Winter, 2003) or second-order capability (Zollo and Winter, 2002; Dannels, 2002). The question is what kind of knowledge, organizational mechanisms and structures facilitate transfer and storage of knowledge learned through commercialization. In other words, what is the nature of a capability to add new competence to current stock? The fourth research question is then: *how do dynamic capabilities enable the proposed operational capabilities to evolve to match the changing environment?*

Conceptual model

The conceptual model is based on the literature review, and we will use the empirical data of this study to sharpen and refine this model. The conceptual model deals with the commercialization process and the operational capabilities important for reaching a large number of users; a critical factor for network products. The conceptual model is illustrated in Figure 6.

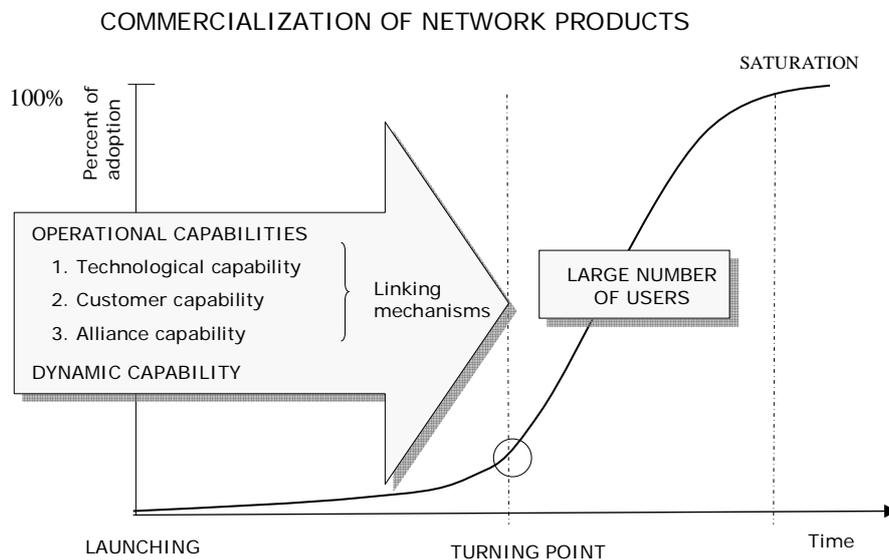


Figure 7. Conceptual model

This model illustrates, from left to the right, a progress during commercialization of a network product. At the launching point, when the product is introduced to the market, there might be some pilot customers involved but no commercially based customers. The solid line represents adoption to a new network product as a function of time. Network products in telecommunication are used in communication between individuals, organizations and terminals. With few nodes to communicate with, it is difficult for the individual user to perceive a new network product's relative

advantage. The general perceptions of a new product change, from a view that “sees novelty” to “one that sees necessity” when a certain number of users is reached. The diffusion phase before this *turning point*, i.e. critical mass, is thus an unstable phase. For early users to persist in this early phase of diffusion, they have to experience the advantage through an inrush of new users. For the same reason, one may assume that early users will lose their patience if this phase is long and drawn out and, therefore, discontinue using the service before critical mass is reached. The solid line representing adoption as a function of time, hence has a low gradient from launching point towards the turning point where the gradient increases significantly before a saturation point in adoption is reached and further adoption levels off. At the turning point, enough individuals have adopted the new product so that the further rate of adoption becomes self-sustaining (Rogers, 2003). Accordingly, this turning point represents a transition from an unstable to a stable diffusion phase (Markus, 1990).

An *operational capability* refers to the ability of an organization to perform a coordinated set of tasks, utilizing organizational resources, for the purpose of achieving a particular end result (Helfat and Peteraf, 2003), for producing significant outputs of a particular type (Winter, 2003), or as a knowledge set that distinguishes and provides a competitive advantage (Leonard-Barton, 1992). In this thesis, “a particular end result” will mean a successful commercialization of a product in telecommunication industries in general and network products¹⁰ in particular. Handling relevant technology underlying the firm’s major products and handling its customers and markets are indicated to be vital operational capabilities in a successful commercialization (Danneels and Kleinschmidt, 2001; Dougherty, 1992; Mitchell, 1992; Moorman and Slotegraaf, 1999). We assume that this claim include telecommunication industries. We propose that a (1) *technological capability* and a (2) *customer capability* will be to important operational capabilities for attaining successful network products (see conceptual model in figure 6). A technological capability can in this context be defined as an in-depth know-how about the technology underlying the new network product and the organizational routines and structure supporting both acquirement of this know-how, and employment in such a way that the turning point¹¹ is reached during distribution. In the same way, a customer

¹⁰ A network product, or more precisely a networking service, is defined as a service for which a mediating technology is used to link customers who are or wish to be interdependent, and for which there are direct networks effects (Thompson, 1967; Stabell and Fjeldstad, 1998).

¹¹ The point at which enough individuals in a system have adopted the innovation so that the further rate of adoption becomes self-sustaining.

capability can be defined as an in-depth know-how about customers' needs and preferences and the organizational routines and structure supporting both acquirement and employment of this know-how. Mitchell and Singh (1996) have shown that development-oriented and market-oriented collaborative relationships appeared to help firms acquire needed commercialization capabilities in order to commercialize complex goods in the software system industry. For that reason, we find the concept "knowledge acquirement" more appropriate than the concept of "knowledge creation" used by Leonard-Barton (1992) when describing the content of "knowledge set that distinguishes and provides a competitive advantage". For the same reason, we also propose a third capability (3) *alliance capability* as sketched in the conceptual model (figure 6). The dependency of several components in the telecommunication industry, such as terminals, infrastructure, applications and content for the product's functionality, and the impact of indirect network effects associated with a multitude of complementary services, implies a strong role of coordination with other actors in the commercialization of network products. Access to resources through both development and market-oriented collaborative relationships can, therefore, be crucial and may require a firm-specific alliance capability equal to technological and customer capabilities. An alliance capability can be defined as the ability to handle external actors possessing vital resources for the network product to be commercialized.

One of Danneels' (2002) key points is that for viable new products to be developed and commercialized, technological and customer competences must come together. In other words, there have to be some linkages between them. Linking the three abovementioned organizational capabilities is proposed to be decisive in reaching the turning point. We will, at this stage, define "*linking mechanism*" (see conceptual model) as routines and structures supporting employment of the aforementioned important know-how's in a combination that enables the commercialization process.

According to several authors, the capability to innovate in a changing market has to co-evolve over time to match emerging opportunities (Teece et al., 1997; Dougherty, 1992). In our context, that means the operational capabilities needed to successfully commercialize network products have to absorb new erudition in order to be vital and viable in a changing environment. This ability to learn through exploration and adding the new competence to current stock are called dynamic capability (Helfat and Peteraf, 2003; Winter, 2003) or second-order capability (Zollo and Winter, 2002; Danneels, 2002). A *dynamic capability* can, in this situation, be defined as mechanisms that facilitate transfer and storage of knowledge learned through the commercialization process.

The Capability to Commercialize Network Products in Telecommunication

In summary, the model illustrates that the three proposed *operational capabilities*; (1) *technological*, (2) *customer* and (3) *alliance capabilities*, and the way they are *linked* will enable the firm to introduce and commercialize network products. An important point is that these capabilities are involved in the commercialization processes until *turning point* is reached, where enough individuals have adopted the network product so that the further rate of adoption becomes self-sustaining (Rogers, 2003). The model further illustrates that a dynamic capability will enable the operational capabilities to evolve and, in this manner, assist the dynamic nature of the capability to commercialize network products in a changing business environment.

3. Research Method

The purpose of this chapter is to present and discuss the research methodology underlying the empirical part of the study. The research design is the result of the requirements, which are given by the nature of the research question and the substance of study (Yin, 1994). The research design involves the choice of methods and procedures for data collection and analysis. The chapters is closed with a reflection upon the validity and reliability of the conducted research, involving a discussion of the process for data collection and data analysis with respect to procedures and challenges in gathering and analysing data.

Research design

The research questions of this thesis deal with how commercialization processes take place in telecommunication industries and how various operational capabilities enable commercialization of new network products. To gain insights into these issues there were certain requirements that the research design had to fulfil. The following requirements were; (1) access to real-life successful and not successful commercialization processes in telecommunication which could be followed from the beginning to an end; (2) exploration of how routines, structures and systems restricted or promoted commercialization of network products and by then affect the outcome, i.e. successful or not.

Selection of cases and units of analysis

Yin (1994) emphasizes the importance of clearly defining the unit of analysis. Among the practical reasons for defining a particular unit of analysis is that results can be compared with previous research literature. For the purpose of the present study, a commercialization process was considered to be the unit of analysis.

Yin (1994) recommends the use of three conditions in distinguishing the most appropriate research strategy; the type of research questions, the degree of researcher control over events and the temporal focus of the research. Case studies can be useful when the focus is on a contemporary phenomenon within real-life context where the researcher has no control over the events,

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and where “how” and “why” questions are being posed in order to explain and better understand a set of events and process issues (Eisenhardt, 1989; Yin 1994). The nature of these research questions require observations traced over time, retrospective or prospective.

The objective of this thesis is to study commercialization process over time and to explore how operational capabilities enable or restrict processes and hence have an impact of the outcome for the commercialization process, i.e. whether it was successful or not. A case study design is then the most appropriate for answering the research question of interest here. Moreover, in order to answer our research questions we had to compare successful with not successful cases. Hence, we had to define on beforehand the cases as successful or not successful which further required that our observations needed to be traced retrospective. A “case” in this study is thus a commercialization process followed retrospective, from the initial start when a new potential product was identified and to an end. An end means here that the commercialization process was either manifested in a new service producing profit or in a cessation.

Network products are of particular interesting in this study. In order to be able to comment specific on network product we have to compare products exhibited characteristics giving network effects, i.e. network products, with products without network effects. Four different cases then were selected, two successful and two unsuccessful commercialization processes. Furthermore, one successful and one unsuccessful commercialized product exhibited characteristics giving network effects, and the remaining were products which did not exhibited characteristic giving network effects (see table 1 below for case descriptions). The dependent variable is then successful/unsuccessful commercialized network products.

Table 1: Case descriptions

Case	Successful/ Unsuccessful	Network effects	Number of interviews
SMS	Successful	High degree	8
IntraWAP	Unsuccessful	High degree	10
VoiceMail	Successful	Low degree	6
AlphaNumber	Unsuccessful	Low degree	9

Methods of data collection and analysis

In order to fulfil the second requirement, exploration of how routines, structures and systems restricted or promoted commercialization of network products, we found it necessary to gather information from various key-personnel at different levels in the organization and from other data sources as well. The case studies presented in this thesis involved multiple data-collection methods and various data sources. Initial interviews were conducted with the various project leaders in order to get an overall understanding of the various commercialization processes. They were asked to describe the commercialization process from beginning to end and to describe critical situations and events along a timeline. Highlighted situations and events were then discussed in terms of their impact on the commercialization process and its progress. Later on we used semi structured interviews asking more specific questions to refine and elaborate themes that emerged from the analysis of earlier interviews, and to check factual data. These in-depth interviews consisted of several open-ended questions; concentrating on facts and events, rather than on respondent's interpretations. Following the methods of inductive research, these questions were supplemented with ones that seemed fruitful to pursue during the interviews. During all interviews, we encouraged informants to illustrate their statements with specific events and examples. The informants were here various key personnel involved in the four commercialization processes. All key personnel were asked, after the interview, to identify

people who had been involved in the commercialization process. Hence, a “snowball” method was used. Data collection stopped when theoretical saturation was reached (Strauss, 1987), i.e., when additional data resulted in minimal incremental understanding (Lee, 1999). Interviews were drawn from multiple functional areas (e.g. R&D, marketing and operation) and from various organizational levels. Interviews commonly lasted from 45 to 95 minutes and were tape-recorded and later transcribed. Secondary sources as published materials about the cases, internal documents and e-mail discussions relevant to the selected cases were also used. A list over interviews and documents is enclosed in appendix A.

We developed a literature based conceptual model relevant for successful network products commercialization, in which the research question and empirical findings would be used to develop and concretise. By such we wanted to avoid that the case studies were limited to thick descriptions with no more than a weak link with theory, or too specific to the particular situation (Yin, 1994), not appropriate for theoretical generalization. According to Yin, the key is a greater reliance on theory. He thus suggests that the search for relevant theories is a vital part of the design phase and should therefore be conducted prior to any data collection (Yin, 1994). Hence, our literature based conceptual model was used as a guide for both case reports, for the single case report analysis, across case analysis and discussions, and to aid the interpretation of the data. With the vast amount of data that had been gathered there was a necessity to organize the data, Eisenhardt (1989) notes that the overall idea with the within-analysis is to become intimately familiar with each case as a stand alone entity, which allows unique pattern of each case emerge before investigators generalize across cases.

Generalization from case studies implies identification of main pattern and variation in the selected cases that is valid for a broader context (Andersen, 1997). We thoroughly read interview transcript and document looking for analytical themes and general patterns. Critical passages were highlighted and coded and initial interpretations were recorded in marginal notes. We performed a content analysis from the preliminary interviews in order to identify themes and issues, i.e. main pattern in the empirical material. These main pattern or key categorizes were sought to be confirmed in the more in depth interviews. From a list of similarities and differences between the selected cases, we induced tentative variables and propositions. This work required an inductive approach, which means an iterative interaction between data and predefined variables. After several iterations between data and propositions, we used existing literature to sharpen the insights yielding by the inductive process. This iterative process of

constantly comparing emergent theory and data led to additional often more qualified and refined memos.

Quality of research design

The traditional set of criteria used to establish quality in empirical social research involves *validity* and *reliability* (Yin, 1994). A research design is assumed to be *reliable* if the study produces the same results and conclusions when repeated by another researcher (Yin, 1994; Eisenhardt, 1989). Furthermore, the results are said to be *valid* when the study has investigated the problem that the researcher intended to investigate and when the categories and values derived from the collected data are in agreement (Dubin, 1969).

Validity

Case studies is about capturing the complexities of the real world, and then making sense of it. It involves converging on constructs definitions, measures, and a framework for structuring the findings, which all are intimately tied with empirical evidence (Eisenhardt, 1989). A case study, involving a large amount of data collected through interviews, will contain personal judgments and interpretations at all stages of the research process. Not only will the individual interview present subjective judgments and interpretations of their reality, but also so will the researcher (Leonard-Barton, 1990). This makes current the claim of objectivity. Moreover, tacit knowledge can be hard to communicate and that will leave out relevant information. A weakness will then be that researcher is only getting access parts of the “truth”.

Using multiple cases and data sources and clearly describing each step of the process help reduce the threat of not detecting flaws in the validity of the case study (Eisenhardt, 1989). We have in this study investigated four commercialization cases and interviewed several subjects relevant for the single case, representing various organizational levels and special fields. Moreover, we have used several sources for data, e.g. interviews, e-mails, documents and reports, and thus increased the objectivity of the data analysis. We have described the procedure and the actual sequence of data collection and to test the credibility of the interpretation of the data, we checked the emerging insights on an ongoing basis with informants, asking for their feedback, sometimes in a second interview.

External validity is to generalize a study's findings beyond the immediate case study (Yin, 1994). The current research has focused on commercialization processes in a particular research context, which means commercialization cases in one Norwegian telecommunication company. This limits the results relevancy for this kind of product and industry, and cannot unconditionally be transferred to other markets and products types, as they may require other types of capabilities. A limitation with regard to generalization outside the telecommunication industry calls for future additional research investigating the empirical based conceptual model outside the industry.

Reliability

As regards reliability, an empirical indicator produces reliable values if it is independent of a particular observer and proof against haphazard (Dubin, 1969). To enhance the reliability of the cases we used distinct protocols for data collection, data handling and data analysis. The procedure in data collection and analysis described above enables other researchers to trace this study. Reliability was promoted by using a case study protocol in which all informants were subjected to the same sequence of entry and exit procedures and structure of the interviews (Yin, 1994).

CASE REPORTS

The structure of these four case reports will be as follows: The single case report starts out with a short presentation of the product/service. The subsequent description of the commercialization process is divided in two main activities: (1) production, meaning vital components and technology where technology is in main focus, and (2) packaging, marketing, and distribution where market is in the driver's seat. Organizational characteristics, various events, knowledge and skills, technical and managerial systems, values and norms enabling or restraining the commercialization process will be presented here.

Whether the technological, customer and alliance competences were important for the commercialization process, and thus could be considered as a capability, is discussed after each single case report. Further, to what extent linkages between the eventual capabilities enable the commercialization process and, by such, affect the outcome, will be discussed. Then, how possible dynamic capabilities enable the proposed organizational capabilities to evolve to match the changing environment will be elaborated on. Whether network effects were present in the commercialized product constitute a part of this discussion, and to what extent the proposed capabilities were important for attaining critical mass and a rapid rollout will be discussed. These results will be cross-case discussed further in Chapter 5 and the presented R&D question attempted answered.

4. Short Message Service (SMS)

The Short Message Service (SMS) is today a communication service which enables the users to send and receive short text messages from their mobile phone¹². SMS, as a person-to-person service, became available in 1994 and was the first mobile data service to become a mass-market success in Europe. Only the mobile operator and the subscribers are involved in the production of this communication service.

SMS has been followed by a successful deployment of information services distributed by SMS. Information SMS enables the mobile phone user to buy different types of information and content using text messages. Examples of these are downloading of logos and ring tones, news alerts, financial information, voting and games, etc. Information SMS is usually provided by a separate content provider and therefore often involves several commercial players. The subscribers are charged extra for receiving this content, and the amount is generally split with the mobile network operator and the content provider by dividing the income either through revenue sharing or a fixed transport fee. Information SMS is also increasingly being used for "real-world" services where the customer is sending a text message to a given number whereupon the cost of the item bought is added to the user's phone bill.

Production – vital components and technology

Short Message Service as a bearing service was tailor-made for GSM and embedded in the GSM-infrastructure standard. SMS had no parallel or predecessor in any other system for offering mobile service to the public. Two additional technical resources or equipment were necessary for offering SMS as a communication service. These were an SMS-platform for handling to-way data traffic and mobile phones supporting the SMS-function.

SMS specification in the GSM standard

Development of the GSM-standard started as early as 1982 when the European Post and Telecommunication Conference (CEPT) established a

¹² Is now also available on other mobile devices with Internet access

working group (named “Groupe Special Mobile”)¹³ for developing a set of common standards for a pan-European mobile communication system¹⁴. The participants in this work were representatives from different European mobile operators and their industrial partners. The main requirements of the system were to define the necessary interface specifications for an automatic European network with ISDN interconnection, allowing full roaming¹⁵ capabilities in all participating networks, as well as a wide choice of non-voice services (where SMS became one of them). Norwegian Telecom (Televerket) and operators in the other Nordic countries were heavy contributors to both the technical GSM specifications and the administrative procedures and interfaces between the operators. Their contribution was, for one thing, based on long time experience and development of the older NMT system (Nordic public mobile telephone systems). Just like NMT, the main function of the GSM switches would be to connect the mobile subscriber with other subscribers through the fixed network. One new feature, however, was that GSM was opened to several competing operators in each country, and the subscriber’s identity would be contained in a separate module (SIM), which is inserted into the mobile station.

In 1987, the GSM architecture and the basic services were outlined. The GSM community then established several working parties with the purpose of specifying in detail different areas of services and technology. Working party 1 (WP1) was to deal with the services, WP2 with the radio aspects and WP3 with the core network and the signaling aspects. The responsible group for data and Telematic¹⁶ service in WP1 was first named “Implementation of Data and Telematic Services Experts Group”. This group later changed its name to WP4 after gaining status as their own working party. The main group in the GSM community was the group to survey the progress of the whole project, assign task to the working parties, and approve the solution produced.

¹³ The name of the system comes from this name (in French). However, the meaning of the initials has changed, and today GSM stands for Global System for Mobile Communication.

¹⁴ From 1988 the standardization work was carried further at the European Telecommunications Standards Institute (ETSI)

¹⁵ Roaming is a general term in wireless telecommunication that refers to the extension of connectivity service in a location that is different from the home location where the service was registered. Roaming occurs when a subscriber of one wireless service provider uses the facilities of another wireless service provider in a location where one’s own provider does not supply coverage (for example, another country)

¹⁶ Telematic is the science of sending, receiving and storing information via telecommunication devices.

WP4 defined four areas that the group had to concentrate on, of which circuit switched data, fax services and short message services were some. A senior engineer from the Research and Development (R&D) department in Televerket was appointed as chairman of the draft group responsible for the short message handling. He had been a project manager in the mid 80s for an extensive study called “Mobile Networks for Special Purposes” and had long experience with mobile communication and message services. The intention of the “Mobile Networks for Special Purposes” study was to explore the potential of mobile communications for other services than telephony and to specify a mobile messaging system. An experimental digital system¹⁷ was set-up by Televerket and tested on pilot customers who used the network for fleet management of vehicles in the transport industry. The study included a market analysis of mobile non-voice services in general and mobile messaging in particular. Based on this study, the main points in the conclusion was that offering mobile messaging within the framework of a public telephony service portfolio could be a worthy business and services should be offered jointly to both private and corporate segments. This conclusion was based on the fact that the Norwegian corporate segment was small. Moreover, at that time, there was a rather low coverage degree rate and low battery capacity for mobile phones entailing that the mobile users would often not be available. Mobile communication and messaging service would then make a good match. Voice Mail notification is an example of this.

The official guiding documents from the main group in the GSM community consisted of rudimentary descriptions of three short text messages services with different level of importance: (1) Short Message Point-to-Point Mobile Terminated, which was the service of carrying a text message through the network to the mobile terminal, was classified as one of the high priority services in GSM; (2) Short Message Point-to-Point Mobile Originated, which was the service of carrying a text message from the mobile terminal through the network to an entity for further conveyance. This service would be optional for a GSM network operator; (3) Short Message Cell Broadcast would allow messages like advertising and public information to be broadcast to mobile users in a specific geographical area (Trosby, 2004).

¹⁷ At this time (mid-80s) separated digital networks were needed for transferring data. Voice services were based on analogue signals.

Most people in the GSM community regarded SMS as a machine-to-person service mainly, and the expectations related to the message services' significance to the operator's business were rather low and vague.

The major part of the GSM community expected the circuit switched data and fax services to be the most important non-voice services, and regarded SMS to be more like an add-on that might increase the attraction of the GSM system without any commercial significance. In the years to come it was proven to be the other way around (CHAIRMAN of drafting group dealing with messaging services in WP4).

The experience from earlier work with messaging for mobile communication had provided the chairman and the rest of the draft group with a "hunch" that messaging between mobile users might be a good idea and worthwhile pursuing. They, therefore, argued strongly for these two services, "Mobile Terminated" and "Mobile Originated" to be equalized. Finally, it was decided to merge the two original point-to-point services into one service specification named "Technical Realization of the Short Message Service Point-to-Point", with complete reciprocity for "Mobile Terminated" and "Mobile Originated" (Trosby, 2004). The designer crew of the draft group was also responsible for several important features that provided SMS simplicity and high functionality, both as a notification and as a communication service. An automatic delivery of messages to a recipient just after she had switched on her mobile phone and a "Messages Waiting" signal were viewed as useful to those who had the mobile phone turned off or were outside the coverage area at the time of delivery. A receipt confirmation when a sender was offered information concerning if and when the recipient actually received the message was also considered useful. A repeated delivery of messages until the recipient could receive the message required a store-and-forward capability. It was explicitly stated in the early requirements that none of the regular network nodes of the GSM should offer store-and-forward capabilities. The Draft Group for "Message Handling" therefore added an additional node named "Service Centre" (SC) to the topology of GSM and decided logically to locate the SC-node outside the network¹⁸.

We did not have a crystal clear business idea behind all features we included in the specification but we had a "hunch" that they could be useful. The story has a slight resemblance to those of the

¹⁸ SMS were at that time defined as a value-added service and according to this definition the SMS-platform should reside outside the network.

Norwegian fairy tale character Askeladden, who picks up all kinds of items that he encounters given the presumption that they may come to use some day. In the adventure they always do, resulting in a massive success. In real life, they sometimes pay off – as with SMS (CHAIRMAN of drafting group dealing with messaging services in WP4).

There was a generous culture which allowed us to be in the technological front. It was looked upon as nice that we (R&D department) struggled with difficult things, because it would come to use one day. “Hunch” is what you get when – in between the tightly scheduled tasks of today’s demands – you are allowed to stray into areas of terra incognita almost without any other purposes but to explore. The “Mobil spesialnett” endeavor was one such exploration of mine, and it meant a lot to my qualifications for carrying out the objective that we were confronted with. The previous telecom could afford that luxury. The present ones cannot, and the soil is inevitably less fertile. I am not sure that the SMS sketches of 1987 would have passed the WP1 examination if its members had possessed the mindset of the operator community of 2004. (CHAIRMAN of drafting group dealing with messaging services in WP4).

Implementation

The specification work of GSM standard was finished in 1991. The Nordic telecommunication operators cooperated in making joint specification for the required GSM equipment. The former Norwegian Chair of the text messages group was appointed leader of the Nordic group responsible for the SC-platform specification. This group discussed several features that would increase the SMS functionality, but were kindly requested to be more moderate.

We were not bold enough in terms of exploiting future possibilities for MS to MS (i.e. mobile-to-mobile) conversations, e.g. group chatting. Both address conversion and handling of distribution lists within the SC were discussed, but a number of people clearly expressed that we had gone far enough with our perspectives on SMS conversations! (LEADER of the SC-platform specification group and formerly CHAIRMAN of draft group dealing with messaging services in WP4).

The European mobile operators the same year (1991) signed a commercial agreement (“memorandum understanding”) regulating, among other factors, roaming and interconnection. The worldwide organization GSM Association today administers this agreement. GSM was put into commercial operation in 1993 with two competing operators in Norway: Telenor Mobil AS and the private operator NetCom GSM AS. Telenor started testing SMS in their network in November 1993 and the services were put into ordinary operation in the beginning of 1994. At first, it was only possible to send text messages to mobile phones (as, for example, “VoiceMail” notification). In 1995, Telenor opened up for two-way traffic in their network and, in this way, allowed for “Mobile Originated” text messages. This coincided with Nokia’s launching of the first mobile phone that had incorporated text-editing software supporting text messages. Most of the Nordic operators and the leading mobile phone manufactures in the 80s were engaged in mobile data transfer but, as earlier mentioned, in a net separated from telephony. Nokia was the manufacturer that had the strongest belief in data transferring in the GSM-network and was, therefore, first on the market.

Packaging, marketing and distribution

Short Message Service was, from a marketing point of view, not looked at an isolated product that would give new income. SMS was seen as a part of the GSM-service, i.e. telephony, where the data channel could be used to send voice mail notifications from the network operators to their subscribers. The user interface was judged to be too complicated and the functionally too limited for a communication service. This was the main cause for not appointing any product responsible person for SMS in 1995.

The responsibility for the daily SMS-service operations was placed in the operation department of Telenor Mobile, while the technical responsibility for the SMS-platform was placed in the product department in a group working with data communication. The appointed person in this group had earlier worked as a technical manager for a data network system called MobiTex where he was responsible for building this network from scratch. This “packet switching”¹⁹ network was to offer mobile data services

¹⁹ In packet switched networks the data is split up in packets (units of information carriage), each labeled with the complete destination address and routed

for increased efficiency of mobile enterprise communication during field operations, i.e. fleet management by text messages between vehicle and a central. This service was, however, experienced by the operator as premature as the involved application had to be tailor-made for each company. The volume was small and the cost in developing the applications was high. The service ceased after a short period of time.

In the absence of a product responsible person for SMS the technical responsible person for the platform was assigned to operate as responsible for product when necessary. The close link between system technical (i.e. SMS-platform) and product responsibility, was looked upon as an advantage, at first due to the bipartite responsibility and later due to a tight collaboration between the system technical and the product group,

The SMS-service was very much characterized in what was technically possible and you could not detach the technique from the service. Our responsibility with SMS-platform was more related to development of the service than to service operation. Focus in the product department on both the service as such and the system technical issues were therefore an advantage. (TECHNICAL RESPONSIBLE for the SMS-platform).

In the first year, the major part of the technical work attached to the SMS-platform was upgrading and installing new functionalities. The marketing activities were confined to produce a product-sheet with SMS information and a price list where they adopted the European price levels. Gradually, as the SMS traffic increased, capacity maintenance became more and more important. Figure 1 below shows the growth in number of person-to person text messages in Telenor's network from 1996 to 2002.

individually. Packet switching is used to optimize the use of bandwidth available in a network, to minimize the transmission latency and to increase robustness of communication.

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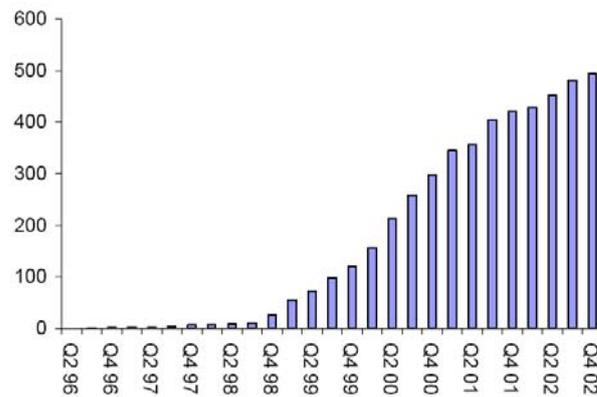


Figure 2. Number of mobile originated SMS (in Millions) in Telenor's network (Q2 1996 - Q4 2002). Source: Telenor

Figure 8. Number of mobile originated SMS (in Millions) in Telenor's network (Q2 1996 - Q4 2002) Source Telenor

90-95% of the SMS traffic in Telenor's network in 1995 was attributable to "VoiceMail" notifications from the operator. In 1996, the person-to-person text messages traffic started to increase gradually. At that time, SMS was bundled with Telenor Mobile's ordinary GSM subscription and all GSM mobile phones on the market had integrated the SMS standard. For ordinary phone calls the subscribers could reach any other GSM subscriber in Europe independent of operator. This interconnect functionality was regulated by the European Post and Telecommunication Conference. An SMS function was, however, not part of this agreement, and it was up to the operators to decide whether their subscriber could send cross-network text messages. A debate persisted for a while whether Telenor Mobile should enter into an SMS interconnect agreement with their national competitor NetCom. Some people in Telenor viewed SMS interconnection with NetCom as a way of increasing SMS traffic and thus income, while others viewed it as a threat. However, they finally decided to go for an interconnect agreement. This agreement was implemented in the first quarter of 1997 and the number of SMSs increased by about 30% in Telenor's network immediately after that (Andersson et al., 2006). In the subsequent period, there was also a rapid growth in mobile subscribers²⁰ that contributed to further growth in the SMS traffic.

²⁰ Telenor and NetCom reported record-breaking increases in the sale of mobile subscription during 1997-1999 (Andersson et. al 2006)

Up to this moment, the person in charge of the SMS-platform had carefully followed the SMS traffic development. The experience with MobiTex had provided him with a belief in SMS as a communication service and he expected the traffic to increase. He had also learned that it was important to be prepared for capacity expansion in the case of traffic growth. He estimated the growth curve, which went much further than his colleagues expected, and by then he was on the front edge with increasing the SMS-nodes capacity as the SMS traffic escalated. The exception was, however, when Telenor Mobile in the third quarter of 1998 introduced free SMS function on "Pre-paid". The traffic was then more than quadrupled in a short time. When the manager director and the product director saw these SMS traffic foresight curves they realized that text messages, as a communication service, could be a source of significant new income. Thereafter, SMS gained more attention from the marketing department and a new SMS product manager was appointed.

In the beginning, we had, of course, a unit price per message, but it was only when people started to really use SMS we saw that we could earn money on it. When we recognized that this could mean business, it gained a stronger foothold in the organization and became an adequate product. There are few products that come to pass as a kind of curiosity like this did. (PRODUCT DIRECTOR, Telenor Mobile).

In the third quarter of 1997, Telenor Mobile introduced a subscription type called "Pre-paid". This subscription offered a lower fixed fee and a higher price per minute for mobile phone calls compared to the ordinary subscription type "Post-paid". As the name "Pre-paid" indicates, the subscriber had to pay a certain amount up-front and could make phone calls until the account (stored on the chip) was empty. The SMS-function was not included in this type of subscription. The technical person responsible for SMS-platform pointed out to the new product manager that introduction of an SMS feature to "Pre-paid" would present some technical challenges. Billing text messages in real time, which was crucial if they wanted to get paid for the SMS-function on "Pre-paid", required a technical solution they did not have at that time. There was an ongoing project working with a billing solution in the longer term, but the product portfolio management did not expect the new subscription type to be a source of a large income and therefore did not want to prioritize more resources to increase the "Pre-paid" functionality. Moreover, "Pre-paid" was judged to be in competition with "Post-paid" and there was a concern that the most profitable customers would change their subscription type if Telenor Mobile upgraded "Pre-paid" to include SMS function.

The decision to tone down the functionalities on “Pre-paid” changed when the market and the product director got negative sales feedback from distribution. In the third quarter of 1998, more than 50% of the new mobile subscribers had chosen “Pre-paid” and they preferred NetComs “Pre-paid” that included the SMS-function. Especially teenagers were attracted to this new type of subscription. Based on this feedback, the SMS was introduced immediately to “Pre-paid” even though that meant that the service would be for free.

Our concerns were mainly that we later on had to charge for a service that had been free for a period and that a rapid traffic growth could burst the SMS-platform capacity. However, the conclusive factor was that we would lose market shares if we didn't immediately meet Netcom in the market. During this period the market rose rapidly from a 6-7 % share to 70-80% over a few years. There was a rivalry for market shares every day. This involves a lot of effort to gain new market shares when the market is established for network products. So you have to fight when the market growth there. We (market and product director) took this decision without conferring with the network director or top management. (PRODUCT DIRECTOR, Telenor Mobile).

Due to the capacity concern the introduction of the SMS function to “Pre-paid” was not announced. After five days, however, the SMS-platform's capacity burst even though only 30% of the capacity was occupied beforehand. Increasing the capacity then became a prioritized task and while waiting for delivery of necessary hardware temporary solutions were introduced to release some capacity. Established functions like, for example, receipt for received messages were removed to secure the production of the basic SMS. Telenor Mobile received many complaints from established customers regarding an experienced decrease in services compared to what they were used to. However, the capacity problem lasted for a short period and was restored after a week. Parallel to the capacity maintenance work the technical group worked with a billing solution for “Pre-paid”. After approximately 3 months they were able to start invoicing SMS on “Pre-paid” (Christmas 1998). The solution was, however, infected with some weaknesses entailing that many users could send SMS for free during a lengthy period. It took over a year before the solution functioned satisfactorily.

Telenor Mobile did not initially have a clear strategy for the SMS introduction but started with marketing campaigns after observing that new

customer groups such as, for example, teenagers began to use SMS as a communication form. In 1999, Telenor Mobile started to attract new pre-paid customers with introduction offers whereby new customers were given a specific amount of messages for free or at reduced prices for a given period of time. Some refer to this strategy as “the heroin principle”, meaning “give it away for free until they become addicted”. The communication service SMS was followed by a successful deployment of information services distributed by SMS. Telenor Mobile agreed with their national competitors NetCom to introduce a high degree of interlinking for Information SMS. In April 2000, the two mobile network operators launched what was, to a large extent, a common Information SMS concept, Content Provider Access (CPA), with a very similar wholesale pricing and technical interface towards SMS content providers and SMS units.

For Information SMS services like TV-related text-messaging where viewers vote and send comments, it is important that the providers offer common short codes (four-digit numbers) for all subscribers. A complete interlink through common short codes, transparency, and almost identical wholesale pricing was introduced long before the other European markets. Several other countries have now adopted the Norwegian business model for information SMS.

Organizational structure

The mobile unit in the mid 1990s was distinct from the fixed line business in a separated company (LTD), Telenor Mobile. As early as 1990, a division had been established for mobile telephony with the intention of being a separate company. Tele-mobil, which was the name of this mobile division, became an Ltd. in 1993 with the name Tele-mobil Ltd. In 1994, they changed the name to Telenor Mobile. This was the first time that a network, which was Televerket’s core business, was established as a separate company. A year later, in 1994, Televerket became a limited company and changed its name to Telenor Ltd.

There are several technical systems involved in the production line²¹ of a telecommunication service. Telenor was organized into several departments reflecting the various technical systems and profession areas

²¹ A production line can be defined as the technical systems and applications involved in producing a service which must interact for the service to be delivered properly and be judge to be valuable to the customer. Other concepts used to describe a production line are “technical course” and “value chain”.

involved in producing a telecommunication service. The control of different vital parts in the service production was, in this manner, placed in different departments. Telenor Mobile was initially organized in three divisions, according to the various production lines, i.e. "Mobile telephony" (90% of the activity), "Pager" ("Beeper") (9%), and "Mobile data" (1%). The mobile data division ceased when the GSM-network, which had the embedded data channel, was put into operation. "Pager" ceased in 1996.

Telenor Mobile operated in a business environment characterized by a rapidly growing demand for mobile services and the presence of a national competitor. Such markets require both rapidity and effectiveness in the organization. When a network service starts to take off the customer orientation must be better, the quality of the service must be better, and "time to market" must be shorter. If the enterprise is organized across production lines there will be problems with rapidness. (MANAGER DIRECTOR, Telenor Mobile).

First, all core activities decisive for the ability to provide valuable mobile services were held inside Telenor Mobile. This involved activities linked to infrastructure operation, services provision and development and marketing. The fundamental network infrastructure included operation of radio base stations, switches and various technical platforms for access and capacity. The product management included various customer handling systems, billing systems and customer support systems. In addition, the market outlet was involved with promotion and sales activities.

There was a large degree of freedom to build and develop our network. We had an organizational structure that reflected our value chain (i.e. core activities), which gave us control of our core activities and a loose management structure. This was decisive for the success we had in the market, and also with SMS. Mobile and fast network is today (in 2006) much more integrated with a tighter control structure. Such structure gives cost efficiency and makes it easier to develop new products across network access and technology. However, it would have hampered the growth in the mobile network because we then would have to consider right and left while driving. We could drive on, as we wanted to. I think that was a great advantage to SMS. (PRODUCT DIRECTOR, Telenor Mobile).

Second, the management introduced an end-to-end responsibility along the production lines that involved all technical systems and courses.

We used a lot of time and resources to build an organization with an end-to-end responsibility where the technical side was aware of what went on the market side and reverse. A free weekend calls campaign would, for example, involve preparedness on the technical side responsible for the infrastructure; it would imply consequences for customer support and for the manager involved who had to be prepared for questions from customers who were not offered the service. (MANAGER DIRECTOR, Telenor Mobile).

For Information SMS services like TV-related text-messaging where viewers vote and send comments, it is important that the providers offer common short codes (four-digit numbers) for all subscribers. The feature of a common industry standard has obviously been an important one for the success. The consumers and the non-strategic market players, such as small providers of information SMS, need not fear that they are choosing the wrong standard (the loser in the case of a standard war). A complete interlink through common short codes, transparency, and almost identical wholesale pricing was introduced in Norway long before the other European markets. Several other countries have now adopted the Norwegian business model for information SMS.

Single case report analysis

The source of the cardinal “hunch” that laid the groundwork for SMS as a communication service was a combined in-depth technological know-how (what is technically possible?) and customer know-how (is there any business in it?) acquired through research work in the Research and Development (R&D) department at Televerket in the mid 80s. A great part of the terminology used in the technical specification of text messages came from this research work. The question is why management, in the absence of market analysis and any expectations related to the message services’ significance to their business, allowed their research personnel to spend time and money on Telematic²² systems? According to Telenor’s representative in the “Messages handling” group there was an apparent corporate willingness to see business in a broad and long-term perspective. This willingness implied that the employees could follow a “hunch”, without any ideas on prospective use and businesses. Thus, a generous R&D culture existed which allowed the researcher to struggle with technical issues for a potential

²² Telematic is the science of sending, receiving and storing information via telecommunication devices.

prospective use and “to stray into areas of terra incognita almost without any other purpose but to explore”.

The R&D activities included both basic research, where the prospective use was unclear, and research with a more applied character where technology was tested with respect to its applicability. Testing new developments on pilots and appurtenant market analysis gave the researchers a valuable marked insight. The customer related activities in the research project “Mobile Networks for Special Purposes” gave the Norwegian delegates in the GSM standardization work confidence in SMS as a service with a market potential, which was the reason why they so eagerly argued for the “Mobile Originated” text messages in the GSM-standard. The original idea behind “Mobile Terminated” was, as mentioned in chapter 3.1, a voice mail notification from the network operators to their subscribers²³. Few people in the GSM community believed that SMS would be used as a means of sending text messages from one mobile user to another. This may explain why “Short Message Point-to-Point Mobile Originated” initially was defined as optional to network operators. Before the official guiding documents were made a different delegation was able to produce proposals related to the realization of a service for Telematic application. The rudimentary descriptions in the official documents may have been the result of reaching a consensus between the different initial contributions. Nevertheless, these rudimentary descriptions gave the “Message Handling” Draft Group considerable latitude in the design of the various message services.

The connection between technological and customer know-how thus seems a decisive factor in this initial phase, and there are indications that such a connection was an important enabling factor later on when SMS was distributed throughout Telenor’s network. However, before we discuss this issue, we would like to enhance the effect of SMS’s distinctive product characteristics on the adoption rate. SMS was part of the non-proprietary industry GSM-standard and bundled with ordinary “Post-paid” GSM subscription. The GSM network was rapidly distributed and by then an underlying growing network of potential SMS users existed. Moreover, mobile phones supporting SMS were rapidly increased, and after 1995 all mobile handset manufactures had integrated the SMS (Andersson et al., 2006). The non-proprietary GSM-standard formed the basis for

²³ The initial purpose could also explain the limited function and capacity of SMS, where an SMS message can only contain up to 160 characters. (Andersson et al., 2006). To overcome these problems the handset producers have included new features to improve the user interface.

interconnection in the SMS market and the network increased significantly when Telenor Mobil and NetCom implemented a SMS interconnect agreement. In addition, SMS had some characteristics where the individual perception of these qualities enabled the adopting process and, in this manner, adoption rate. These characteristics are identified through past research as relativity advantage, compatibility, trialibility, observability and low complexity (Rogers, 2003).

As SMS was bundled with GSM subscription and integrated into the mobile handset the threshold for experimentation and learning by doing was low. The user did not have to make any decisions related to purchasing new hardware or subscription to a new service. This was an advantage for SMS compared to other mobile services such as WAP. At the time WAP was introduced to the market, it required the majority of customers to buy a new mobile handset. Moreover, the SMS interface was relatively simple. Hence, when the users first learnt about SMS, they were able to start using SMS themselves right away. Furthermore, a message generally required an answer, which lowered the threshold for the receiver to adopt the service. Using SMS often involve a characteristic punching posture were the user falls into a deep concentration ignoring the surroundings. This behavior was easy for others to observe and such visibility stimulates peer discussion of the new service. The perceived relative advantage, which is the degree to which an innovation is perceived as better than the idea it supersedes, can also be said to be high. Teenagers, for instance, realized that they could communicate much more cheaply by SMS than by making phone calls. Initially, SMS on "Pre-paid" (which teenagers preferred) was for free, due to the lack of a billing solution. Moreover, when Telenor Mobile started to charge for SMS on "Pre-paid" the prize was relative low compared to mobile phone call charges. Text messaging could also be used in situations where the sender or receiver could not talk, i.e. meetings, concerts etc. Finally, the youth image and the growth of a specialized language to overcome the interface limitations gave SMS a cult status. These distinctive product characteristics, together with an enlarged network (due to an interconnect agreement) and low prize (for free in the beginning), were important factors in the rapidly growing use of SMS and reaching critical mass. The distribution of SMS thus occurred without marketing effort from the service provider.

However, some events occurred that could have been critical to the distribution of SMS. The fear of losing market shares of GSM-subscribers when Telenor's national competitor introduced SMS on "Pre-paid" subscriptions, was the reason why Telenor introduced SMS on "Pre-paid" before a billing solution was developed and capacity was secured.

Introduction of free SMS on “Pre-Paid” entailed that the SMS traffic was more than quadrupled in five days, and it seems that this growth in SMS users triggered an explosive growth of text messages. SMS as a communication service is a network product exhibiting a high degree of network effects, meaning that the value lies in the connection among users. In other words, if SMS could not be used to communicate it would not have any value. A service breakdown or prolonged reduced service quality could thus have affected both established and potential customers in their choice of mobile operator in a critical phase of SMS distribution. Established customers who had adopted SMS could discontinue using SMS as a communication service or change service provider. Furthermore, potential new GSM subscribers who valued the SMS-function could choose the competitor NetCom. The SMS platform’s capacity was thus vital for producing SMS as a stable service to established customers as well as for distribution of SMS to new adopters.

A prolonged service breakdown was, however, avoided. The person who had the combined responsibility for the SMS infrastructure (i.e. SMS platform) and for SMS as a product had increased the platform capacity in accordance with his own estimated growth curves for SMS traffic. His earlier experience with operation of data networks had given him a faith in SMS as a communication service and he was therefore ahead with platform capacity. The effect of the unexpected significant growth was thus limited to a reduced SMS functionality for less than a week. Again, as with the earlier specification work, an in-depth technological know-how (how to maintain and develop the platform’s functionality and capacity) and customer experience (expecting a growth) seem to be a vital combination for the ability to commercialize SMS, in this case produce and distribute the service.

SMS was “very much characterized with what was technically possible” to quote the technical/product manager and “detaching the technique from the service” was not feasible. *“The SMS-service was very much characterized in what was technically possible and you could not detach the technique from the service. Our responsibility with SMS-platform was more related to development of the service than to service operation. Focus in the product department on both the service as such and the system technical issues were therefore an advantage.”* Developing the infrastructure technology opened up to new service functionalities and improved user interface, while introduction of new SMS functionalities required changes in the infrastructure and traffic growth required an increased platform capacity. This immediate interdependence between SMS’s infrastructure and SMS’s functionalities, including capacity, required a strong coordination between technical and more market related activities. The technical responsibility for

the SMS-platform was placed where the relevant knowledge was, i.e. in the product department, and not in accordance with the formal responsibility structure, which would be in the operation department. By such, a close link between system technical and product responsibility was established, first due to the bipartite responsibility and later due to a tight collaboration between the system technical group and the product group. This close link between the technical side and the market side seems to be an advantage for distribution of SMS in a critical phase. The attached importance to succeed with an end-to-end responsibility in the original organization of Telenor Mobile, which should secure an efficient coordination of different vital parts in the various services' production lines, supported this "linking". *"We used a lot of time and resources to build an organization with an end-to-end responsibility where the technical side was aware of what went on the market side and reverse."* (MANAGER DIRECTOR, Telenor Mobile).

It was then a shared understanding that the responsibility across the production line should be placed in the same sub unit or closely linked sub units. The sub units were formed based on business logic rather than on a functional logic. An end-to-end responsibility was also pointed out to be the reason why they could make rapid decisions regarding the product's functionalities. An example of this is when the product director and market director at Telenor Mobile decided to upgrade the "Pre-paid" subscription type with the SMS function. This spontaneous decision, as a response to the negative sales signals from the distribution channels, was taken without conferring with other departments or the top manager of Telenor Mobile, even though the decision had consequences on the platform's setup and its interplay with the customer handling system.

Three operational capabilities: technological capability, customer capability and alliance capability are proposed in this thesis to be important for reaching the turning point where a critical mass of users is obtained. Having access to vital resources and knowledge possessed by external actors were not an issue in the SMS case. The required knowledge and technology for commercializing SMS was accessible in-house Telenor Mobile. An alliance capability was thus not important for a successful commercialization. Nevertheless, both technological know-how and customer know-how were vital, for the origin of SMS as well as for distribution. It is, however, difficult to disconnect the organizational routines and structures supporting acquirement and employment of technological know-how, and those who supported acquirement and employment of customer know-how. The in-depth know-how about the technology underlying SMS and that of customers' needs and preferences first became significant to commercialization of SMS when they were combined.

Operational capabilities are referred to in the literature as being vital to “a particular end result”; in this context a successful commercialization. Technological know-how and customer know-how can thus not be regarded as independent operational capabilities in this context, but more like fundamental ingredients that had to be linked in order to be important to a successful SMS commercialization. Factors that enabled this “linking” were a generous R&D culture which included both basic research and applied research where new technology and applications were tested on pilots, a shared understanding for the importance of an end-to-end responsibility of a production line, representation of relevant technological and customer know-how in the same mind, and an individual employment of all these.

It seems that this linking facilitated information sharing between the “technical” and “market side”. Such dynamics may be important when commercializing products where there is a direct technological dependence along the service’s production line. A dynamic capability, defined as mechanisms facilitating transfer and storage of knowledge learned through the commercialization process, is in this thesis proposed to be important for the organizational capabilities to co-evolve over time to match emerging opportunities in technology and the market place. Consequently, it seems natural to propose that the same factors and mechanisms enabling the link between technical and customer know-how important for successful commercialization may also result in dynamics where the technical part learns from the more market oriented activities and vice versa.

Conclusion

The individual perception of SMS distinctive *product characteristics* or qualities, together with an enlarged GSM network and low prize, enabled distribution of SMS and the reaching of critical mass. Both *technological* and *customer know-how* was vital to both the origin of SMS as a communication service and distribution of SMS in a critical distribution phase. However, it was through *linking* that these two seemingly separated skills became the decisive factor for a successful commercialization of SMS. Factors that enabled this “linking” were a generous R&D culture, which including both basic research and applied research where new technology and applications were tested on pilots, a shared understanding for the importance of an end-to-end responsibility of a production line, representation of relevant technological and customer know-how in the same mind, and an individual employment of the necessary know-how. The same factors and mechanisms enabling the link between technical and customer

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know-how important successful commercialization may also result in dynamics where the technical part could learn from more market oriented activities and vice versa. The required know-how and technology for commercializing SMS were accessible in-house Telenor Mobile and handling alliances during commercialization was not an issue.

5. IntraWAP

IntraWAP was a service that should give companies and their employees secure access to the company's corporate intranet through wireless terminals with WAP²⁴-functionality. Groupware applications like "E-mail", "Calendar" and "To Do-list" could, in this manner, be employed via a mobile phone. A pilot solution was launched in June 2000, and after various upgraded versions and three re-launchings, the service IntraWAP ceased in 2003.

Production – vital components and technology

IntraWAPs production line comprised several technical systems that were built around a software packet from IBM²⁵/Lotus Software²⁶. This software connected groupware applications on a corporate system to a WAP-interface. The "connector" software had to be installed at the corporate site. Telenor Mobile's infrastructure included an access server, a WAP-gateway and several security mechanisms. This way the information could be encrypted securing the information from intruders. In addition, various systems for handling payment and customer rights were involved in producing the service. Last but not least, a wireless terminal (e.g. mobile phone) with WAP-functionality was necessary. IntraWAP was a combination of an IT-product (software package implemented on a corporate data platform) and a telecommunication product (mediating via mobile phone).

Project initiative

Development of a WAP-protocol in 1999 opened up to wireless access from hand held terminals to Internet contents and services. An important driver for initiating development of IntraWAP was a joint venture agreement

²⁴ WAP (Wireless Application Protocol) is a standard for mobile Internet.

²⁵ IBM (International Business Machines Corporation) is an international computer technology corporation manufacturing and selling computer hardware, software, infrastructure services, hosting services, and consulting services in areas ranging from mainframe computer to nanotechnology.

²⁶ The software company Lotus Software, which develops and sells the groupware system Lotus Notes, is a subsidiary of IBM. Lotus Notes is also called a PIM-solution (Personal Information Manager)

between Telenor Mobile and IBM. The Telenor Mobile objective was to increase data traffic in their network. System integration was, hence, viewed as a critical success factor for linking the GSM-network to Internet. In order to gain access to this critical competence they established a unit to take responsibility for realizing agreements with system integration partners. As a result of this work Telenor Mobile and IBM in January 2000 signed a joint venture agreement with the intention to develop and commercialize new products and services.

Up to this date, Telenor Mobile had worked with various solutions for wireless data transfer. IBM, on their part, worked with connector software for Lotus Notes and WAP. These two activities were viewed as a good “match” and were integrated in a project with the intention of developing and commercializing IntraWAP. The IntraWAP project thus became a joint venture between Telenor Mobile and IBM/Lotus Software. Telenor Mobile’s responsibility for delivering the service was to operate the wireless infrastructure for data traffic between terminals, via the Internet and the corporate intranet. A vital part of this infrastructure was a WAP-gateway, developed and delivered by Ericsson²⁷. IBM/Lotus Software, on their part, were to produce, install and offer support for the connector software at the corporate site.

Project planning

The IntraWAP project was established in March 2000 with Telenor Mobile’s Mobile Internet Division as the responsible unit. The appointed person who became responsible for developing and accomplishing a commercial launching of IntraWAP came from the Net division in Telenor Mobile. He had experience from the management of technological development projects but not with commercial launching. With strong signals from the management group to show some concrete results (i.e. an innovative service) shortly after signing the IBM-agreement he decided to divide the project into two steps. The first step was to result in a commercial launching of an early version (1.0) within 15 June 2000. This version would comprise a technical solution for Lotus Notes users. A later version (2.0) would contain a technical solution for Microsoft Outlook²⁸ users, increased functionality for the corporate intranet administrator including selective access control based on advanced authentication, and other updated security mechanisms. The project teams planned to promote the updated security

²⁷ Telecommunication Equipment Manufacturer

²⁸ Microsoft’s groupware system

mechanisms in September 2000. The planned date for launching the final version (2.0) was April 2001.

IntraWAP's launching date was not based on a detailed and thorough feasibility study. It was based on a strong wish from the management group to be the first on the market with this kind of service. It viewed it important to show the market that Telenor Mobile was an innovative company and that they could handle partnership (IntraWAP's PROJECT LEADER).

Step one was planned as a progress in three phases. Concept-, implementing- and launching-phase with concluding decision points between the phases. The latter contained a planned delivery of the product to the market division for further sale. The estimated need for human resources was four persons full-time (core team) and a handful of part-time specialists. The core team divided the project responsibility into project management and management of technical, integration and marketing activities. Lotus Software participated with a technical person with competence in the connector software. IntraWAP's technical manager came from the Internet division and was to oversee that the technical cooperation with the involved actors went without problems. The person in charge of system integration would coordinate the total service delivery together with IBM/Lotus Software and the affected internal units (e.g. customer support). The person in charge of market and sales activities, which included the product concept, came from the market division. The intention was that he would be IntraWAP's product chief after launching. The two latter persons were tied up with other projects and, hence, were limited to a 50% employment in the IntraWAP-project. The core team secured the participation of about ten specialists in a 20% employment to support the activities connected with technical architecture, safety issues and sales. A resource agreement was signed between the project leader, the involved person and his/her superior in the organization in order to dedicate the human resources to the project. Several external consultants were engaged mainly to work with technical challenges related to implementation as the project progressed. At its highest, over 20 people was involved in the project.

Human resources

As early as the beginning of May 2000, the project leader experienced problems with access to the contracted resources. Some project participants changed jobs implying that their project engagement ceased. They had to be replaced. Other project participants, both core members and part-time

specialist, were “over-booked”. In other words, their total engagement in various projects exceeded 100%. This meant that they had to prioritize between projects and tasks in the organizations when unforeseen challenges turned up. The resource scarcity was seen as a threat to the planned progress. The project’s steering committee made it clear that no delay was accepted. The project leader’s dilemma and a source of frustration was that the same members of the steering committee, who were to secure resource access, did not prioritize the project when resource scarcity occurred in the organization.

There was no clear and evident product portfolio strategy or thinking behind the development of IntraWAP beyond the importance of collaboration with system integrators. That gave the project vagueness and a loss of belonging in the organization. The steering committee did not prioritize the project when other important tasks arose in the organization. Tasks and activities were what their performance was measured or judged by (IntraWAP’s PROJECT LEADER).

Technical solutions

The connector software making Lotus Notes compatible with the WAP-protocol had been tested. Moreover, the WAP-gateway worked to satisfaction according to Ericsson, even though the security mechanisms had to be updated parallel to the technological development in that area. Although the project teams did not expect any particularly large challenges in connection with the IntraWAP’s infrastructure, they knew that offering security mechanisms that matched corporate requirement for security could involve some technical challenges. To prevent intruders’ access to classified information, the security mechanisms were installed on the WAP-gateway. The “WAP-gateway” main function was to convert the information to an appropriate format (encrypt/de-encrypt) and to forward the information according to setup. Two different protocols or encryption technologies were used: one technology (WTLS) for the first transport segment between the wireless terminal and the WAP-gateway, and a corresponding technology (SSL) in the second transport segment, securing the transfer between the WAP-gateway and corporate Intranet, via Internet (see figure 5 below). These security mechanisms were critical parts for providing employees secure access to the corporate intranet.

The (

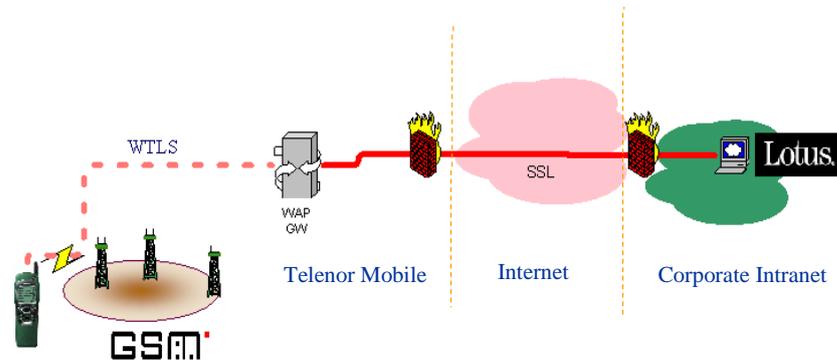


Figure 9. A principle drawing of IntraWAP's technical solution

The security mechanisms were, at that time, an immature technology and the mechanisms needed to be improved parallel to the technological development. Ericsson, the provider of the WAP-gateway, had appointed a technology group working with technology upgrading in this area. The project team was informed by Ericsson in May 2000 that they could not update the planned security upgrading until August 2000. This entailed that the security would not function to satisfaction at the planned launching date. A dilemma was that the management group in Mobile Internet considered it very important to uphold the deadline for commercial launching. Both Telenor Mobile and IBM/Lotus Software had loudly declared through press releases and other promotion activities that IntraWAP would be launched 15 June 2000. Not being able to commercialize new innovative products according to planned schedule would then be a negative signal to the market and competitors. The solution to this dilemma was sticking to the launching date as a gimmick to show that the service worked for the pilot customers. The commercial part, where the service was available for purchase, would be postponed until the security mechanism was properly updated. This way, they introduced the concept of version 1.5 which would be finished within October the same year. Version 2 would be launched as planned within April 2001.

The IntraWAP's project team experienced that it was difficult to get access to Eriksson's competence. By the end of June, they still had no date for when the security mechanisms would be updated.

Our main technical challenge was the WAP-technology where we were dependent on Ericsson for upgrading this technology. There were few people in Ericsson with relevant and adequate knowledge and they were quite busy with several projects. We had a broad contact surface with Ericsson, but there was no decision maker involved (PROJECT PARTICIPANT from Lotus Software).

The project team tried to establish a development project with Ericsson in order to improve communication with them and to secure delivery of the security mechanism. The project team got around to a planned workshop to discuss development of IntraWAP components and a written contract proposal for collaboration. Telenor Mobile, however, never succeeded in establishing collaboration with Ericsson. A contributory factor to that was, according to several project members, that Ericsson lacked relevant resources.

Pilot customers

The project team started testing IntraWAP on two test pilots in May 2000, with the intention of potential improvements in technology and user interface. The next planned step after this pilot test was to establish ten new corporate customers through a limited launching when the security mechanism was updated in October 2000.

The test pilots were quite enthusiastic about IntraWAP and wanted to use the service actively in connection with their work. These pilots experienced several technical weaknesses and failures when using IntraWAP, mainly from problems with the connector adjustment and problems with firewalls and other security mechanisms in the WAP-gateway. A third weakness was the poor terminal interface. At this point, no systematic customer support was established where the test pilots could inquire in case of a service failure, neither for the corporate system administrator nor the employees using IntraWAP. Telenor Mobile and IBM/Lotus Software had at that time not made any Service Level Agreement that regulated the operational co-operation. What should be done in case of a failure; where should the customer inquire; what should the time of response be; costs? Later on, when customer support was finally established some

ambiguity arose related to cause, to whom the failure should be reported and who where responsible for repairing it.

Packaging, marketing and distribution

Packaging

A previously performed market survey was used as basis for IntraWAP's product concept. This survey had explored the need for telecommunication products in the so-called "nomad" segment or "People-on-the Road" segment. The "nomad" concept categorized people relocating their residence or work place implying they were seldom accessible on a stationary PC. This segment was further divided into customers who were affiliated with a corporate intranet (corporate customers) and customers who were not (private customers).

The employees' needs for having access to office functions while traveling or working outside the corporate site had been revealed through the market survey. The corporate market was then appointed as a target for IntraWAP. The project team performed a detailed follow-up market survey towards the corporate decision makers responsible for data and telephone solutions. A majority of the respondents appraised IntraWAP as an interesting service and technically credible. Access to E-mail systems, employee's task calendar and databases were the most current services. There were some skepticism connected to limitations in WAP, mainly to small displays and the fact that only text and no graphics could be shown, and that the system was slow. Moreover, there was also some skepticism to placing the security mechanism at Telenor Mobile, mainly because they regarded Telenor Mobile as a more attractive target for hackers than their own corporate intranet. There was also the recurring concern whether implementing IntraWAP would imply upgrading, converting and changing established solutions, and whether Telenor Mobile could support and follow up technical implications. There was a noticeable "wait and see" attitude with an expectation connected to a further technological development and price reduction. Convincing the potential customers that the solutions were secure enough was evaluated as a critical success factor in the sales process.

The project team decided that the first version should provide access to e-mail, personal calendars and telephone lists to enterprises using Lotus Notes. The intention was to extend the service to other, both Lotus Notes and Microsoft office based, groupware applications at a time when the security

mechanisms were updated. The sales activities were to be organized both through Telenor Mobile's established sales system and through software and integration partner IBM/Lotus Software. At a later time, Telenor Mobile wanted to open up to other integration partners in the sales process.

Our distribution strategy was to provide IntraWAP through several sales channels; through Telenor's sales systems and through our integration partners. We did not appraise the sale process to be challenging. We thought that distribution of IntraWAP would be more or less a self-generating process, which means that the demand for IntraWAP would grow as the service was distributed. That does not necessarily mean a network effect, but it is clear that if I knew that all my colleges could read IntraWAP when they were traveling or in meetings, I would send e-mail about things that I wouldn't do ordinarily, and vice a versa which would encourage me to use IntraWAP (IntraWAP's PROJECT LEADER).

Telenor Mobile responsibility in the delivery was to provide a secure access to the corporate intranet. IBM/Lotus Software was responsible for installing the connector software at the customer site and offer customer support for the connector software during operation. The project teams had several discussions in connection with the business model and how IntraWAP should be priced. Initially, Telenor Mobile would invoice for data traffic in their network (i.e. air time) and IBM/Lotus Notes would invoice a current software license, which included support. The installation costs would be a one-time charge. The project team later changed on this price model in such a way that the customer only needed to have one permanent economic relationship.

We thought that the product concept would be much clearer for the potential customers if they only needed one current economic relationship. IntraWAP would be the project as a Telenor Mobile product and we saw that as an advantage in the sales promotion. (SUB-PROJECT LEADER, Market)

The customers would then be charged from Telenor Mobile for data traffic and a subscription fee which would include the connector software license. The two partners were to settle an account afterwards. The single charge for the integration cost should still be a settlement between the customer and the integrator. The project team had to establish several new procedures and routines for handling a joint venture for commercialization

and operation of IntraWAP. In addition to new routines and processes for selling and invoicing the service, they needed to establish new installation routines, operation routines, and failure handling routines

We hadn't tracked the route with partnership for commercializing data services, so we had to develop many new routines. There were many new things that were needed to arrange for joint venture services, among other things an agreement with our collaboration partner. (IntraWAP's PRODUCT MANAGER)

The driver behind the project was not economy, and financial results were not an issue. The whole organization was driven by technology. We wanted to enter into a new business area where we lacked competences and our main strategy was that we had to do something with our partners. At that time we had little experience with partners and the organization had many different ways to industrialize it. This was before we developed the **CPA-model** (Content Provider Access) for handling third parties²⁹. The CPA-model may have been the largest success in Telenor's history on how to handle third parties. We have now hundreds of partners selling content with billing on the phone. (SUB-PROJECT LEADER, Sale and Distribution).

dJuice

In March 2000, the Mobile Internet division launched a new Internet portal for wireless WAP terminals (mobile phones and PDA's), dJuice. The dJuice-project had an ambiguous vision of being a "branded" mobile Internet portal in 25 countries within three years. In June 2000, they realized that they needed a concrete functionality attaching the user to the portal. The dJuice team contacted IntraWAP's project manager in mid June 2000 suggesting that they merge the two concepts. IntraWAP was viewed as the first "killer" application on WAP, representing a real value for a company which they were willing to pay for.

dJuice.com is already on its way internationally, but lacks the ultimate loyalty-promoting functionality that makes it *the* preferred wireless portal. This is where the access to corporate

²⁹ A third party is used by Telenor to describe a commercial actor that has a freestanding product accessible through Telenor's infrastructure. Examples are ring tones, financial news, movies or groupware applications.

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intranet solutions comes in. This is exactly what dJuice needs. The merger of dJuice and IntraWAP will provide attachment to dJuice and the possibility of earning real money from customers who are willing to pay for secure access to their corporate intranets (Mail from dJuice PROJECT LEADER to IntraWAP's PROJECT LEADER).

The IntraWAP's project team was quite enthusiastic about what possibilities this could bring. First, dJuice engagement in an international rollout could help IntraWAP become an international service. Second, dJuice was an appropriate platform for enabling web-based administration of the company's IntraWAP account. A web-based administration would enable small and medium sized companies to use IntraWAP solutions without having to deal with any system integration or acquiring new hardware. At the end of June 2000, it was decided to merge these two projects and have a joint international commercial launching. For IntraWAP's part this entailed several new technical tasks connected to system architecture and required international partners on infrastructure, technology, test pilots and distribution. These tasks required a lot of resources at a time when an adequate IntraWAP solution for the home market still remained to be developed. This merge changed the IntraWAP project's direction and focus.

We still lacked a complete technical solution at that time. The administrator's interface and internal routines and IT-systems connected to billing and failure handling were not commissioned. Training and developing the bundling packaging with selected retailers remained and the sales links were not trained. We lost our focus when they tried to integrate IntraWAP into the international dJuice profile (PARTICIPANT in the IntraWAP's project team).

The amount of tasks that had to be performed in a relatively short time entailed that the IntraWAP's project leader asked for assistance. His main argument was that the apparently complex situation with many new tasks, where some had to be performed in a high tempo, implied that they could not follow the established project manager tools to support the product development and commercialization process. He proposed sharing his project leader responsibility with one of the project team members and thus write a report with recommendation on how to perform prospective corresponding projects.

We were confronted with huge challenges, especially on the technical part. In addition came all the challenges linked to marketing and bundling with dJuice. Both dJuice and IntraWAP

can be categorized as activities marked by new technology, new market, new business models, high speed, scarcity of human resources, young people and involvement of many professions and organizational departments. Both projects were living in their own world in spite of a link to the Mobile Internet division. The management was less visible than before and the project leaders, pro forma, had a larger responsibility. We had to manage the project on a higher degree of a strategic level. (IntraWAP's project leader).

During autumn 2001, Telenor Mobile reduced its mobile Internet focus in coherence with the general market development. Telenor Mobile realized increased economic demand on dJuice and its delays in technology that would improve the WAP-mobiles interface. Approximately one year later, in October 2002, Telenor Mobile resolved to phase out dJuice.

Marketing and distribution

IntraWAP was promoted on several occasions from both Telenor Mobile and IBM/Lotus Software. The first time was as early as March 2000 and later on in connection with the various launching activities and at different technical arrangements. An incomplete IntraWAP was launched in June 2000 as a market gimmick. The rationale behind this promotion gimmick was to send a signal to the market that this innovative service was in the "pipeline" and soon on the market. Two test pilots, who were looked upon as prospective users of the complete IntraWAP service, had tested the service for potential improvements in technology and user interface. The next planned step after the security mechanisms were updated in October 2000 was to establish ten new corporate customers through a limited launching.

As already mentioned, these pilots experienced several technical weaknesses and failures with IntraWAP. At that time, there was no systematic customer support where the test pilots could inquire in case of a service failure, neither for the corporate system administrator nor the employees using IntraWAP. Moreover, it took some time before an effective customer support was established. One of the pilots ceased using IntraWAP and acquired a corresponding solution.

The effort getting new customers did not go as expected and much of the focus in the project was directed towards the dJuice-integration. According to planned schedule, version 2.0 of IntraWAP should be launched in April 2001 as "an even greater IntraWAP". A complete IntraWAP, with all the

promoted functions and technical and procedure documents, would then be handed over to the product manager in the Market division of Telenor Mobile. This division was responsible for the ordinary sales activities. However, several shortcomings were revealed a couple of weeks before this handover. The internal systems for handling customer data were missing and the administration interface was poor.

The project team had discussed a system sketch with the IT-department as early as January, 2001 and they therefore expected that the IT-department had developed the customer data system. The IT-division, on their part, felt that the project team did not follow the established procedures for getting IT-support and had to adapt a priority line to get this fixed.

IntraWAP was incomplete when I took over the responsibility. Much of my time was used on technical issues and there was less time left for sales activities. At this point the project team was dissolved and all technical resources available in the project were now spread in the organization busy with new tasks. It was a long and demanding task to get everything in place (IntraWAP's PRODUCT MANAGER in Market division).

A person was later that year engaged to be responsible for making IntraWAP a complete and a stabile service. IntraWAP was this way re-launched for the third time. Telenor Mobile had at that time established a department responsible for handling third parties. This department strived to find more installation partners who could sell IntraWAP. There were some sales where the technical delivery and installation worked, but the sale did not "take off".

Retrospectively, we saw that the system integrators' incentives and profit in the IntraWAP concept were low. It was, therefore, not so interesting for them to put so much effort into selling IntraWAP. Our internal sales channels, where some had been quite enthusiastic about IntraWAP, were at this time critical to the service due to all the technical difficulties. The user interface on WAP-phones was still too poor and after the burst of the so-called "dot.com" bubble, there was a large distrust of WAP-phones in the market (PROJECT MANAGER for the third launching).

Several alternative solutions with lower expenses and standardized software were introduced on the market. These were viewed as better alternatives. In 2003, Telenor Mobile went through a re-organization where

the new regime focused on downsizing and a large profit. IntraWAP was shut down in March 2003.

It has been a clear objective in other projects that before we launch a product all qualities should be settled with price models and a “package”. This is the traditional model. Regarding IntraWAP, there were no clear crossovers where development stopped and launching started. We exploited the branding effect first to show that here was a new possibility (IntraWAP’s MARKET RESPONSIBLE).

Organizational structure

Telenor Mobile structured their international establishment in 2000 and organized the activity in three companies: mNorway, mHorizon and mFuture. mNorway was to concentrate on the Norwegian market and mHorizon on the international market. One of the reasons for this grouping was that the technologically new developments would first be tested in the home market and then rolled out internationally. mFuture would work with prospective business areas. Mobile Internet, first established as a strategic activity in 1999, became a division of mNorway in 2000. At end of the year, there were 50-60 people involved in different projects, IntraWAP and dJuice being two of them.

Mobile Internet division was, however, demobilized when dJuice became a large international establishment. dJuice and rest of the Mobile Internet project portfolio were then placed in mFuture where parts of the IntraWAP project were organized under dJuice.

We were hanging in mid-air when we followed dJuice to mFuture. That implied that we as a project were poorly anchored in the organization, because dJuice had enough with their grandiose ambitions and we lacked a formal anchoring in Telenor Mobile. That entailed that we went without a steering committee for a long period and we became very dependent on individuals for progress. The strategy that mNorway should be a test bed before an possible international roll-out in mHorizon shattered when we were pulled into a international strategy in a early phase. That implied that we did not have time for a sequential product development phase. We had to do many things in parallel (IntraWAP’s PROJECT MANAGER).

The Capability to Commercialize Network Products in Telecommunication

Single case report analysis

Commercialization and operation of IntraWAP was a joint venture between Telenor Mobile and IBM/Lotus Software requiring a coordination of several technologies and systems. A broad technological insight into several fields was in this case vital to understand the manner of operation for the single component and system, and to understand how they worked as a unit. Furthermore, a technological insight was necessary to identify and solve technical challenges. Moreover, a market insight and knowledge about potential corporate customer's data system, needs and demands were necessary to both develop an appropriate product concept and to adapt the various technical systems.

IntraWAP represented a new type of service with a duplicate responsibility of providing service. Telenor Mobil was responsible for securing access to the corporate intranet via handheld terminals, while IBM/Lotus Software was responsible for implementation and operation of the central connector software at the customer's site. Telenor Mobile had relevant technical know-how for parts of IntraWAP infrastructure, which was based on long experience with ordinary network operation, but they needed access to both technological and customer know-how from IBM/Lotus Notes. Moreover, Telenor Mobile was dependent on Ericsson in updating the immature security technology installed on the WAP-gateway. Telenor Mobile was in this manner both technologically and operationally dependent on external actors possessing critical technical and customer related know-how. There were no established routines and clarified guidelines for joint venture in commercialization projects, vital technologies were immature, time limits were short and the project focus changed during progress when merging with dJuice. The main challenges were, however, getting access to this vital technology and know-how and to coordinate the various activities involving external know-how and technology.

IntraWAP was an access service where the corporate customer could use groupware applications on corporate Intranet from a mobile phone. The employees using IntraWAP thus had access to an established network of e-mail users. In this case, IntraWAP had an intrinsic value, i.e. the service had a value for the single user independent of other users. The service would, however, increase in value if there were several others using IntraWAP to get access to their e-mail. The more people that used IntraWAP when

travelling or out of office, the more colleges and business connections a single user could communicate with. By definition network effect takes place when the benefits to any individual consumer of a product or a system increase with the number of other users. In this matter, IntraWAP exhibited characteristics that gave network effects.

The original plan was to commercialize IntraWAP in two steps; first by introducing a limited version to Lotus Notes users and then, in a second step, as a complete version with updated security mechanisms. IntraWAP was, however, a project where nothing went as planned, and the many delays deteriorated the pilot service, causing the commercial launching to be postponed several times. The repeated promotions where service quality and launching dates were announced ended in breach of promises. An association we make here is the tale of the shepherd boy, as a practical joke, cried “Wolf!”, whereupon the whole village came running to help him protect the flock of sheep. After repeating this practical joke several times, it ended in catastrophe when a wolf pack really appeared. The village mistrusted the shepherd boy after been put upon several times and did not assist him when he really needed it. Although the “cry” about IntraWAP was a positive message, there is a parallel here. The pilot customers, the sales corps (both internal sales channels and integration partner), the market and potential customers built a gradual mistrust of IntraWAP and finally, when the service was complete, the confidence was lost.

Users of network products in an early phase of distribution can be viewed as users “on trial”, meaning that they need some time to adapt to the service and to experience value while using the service to communicate and interact with other people or systems. Users “on trial” are vulnerable to malfunctions. If the communication service is unstable, it will be unstable for all users who may discontinue using the service and then find other communication methods. Although pilot customers are informed that the service concept is not technically and commercially commissioned and that their role in this respect is to give feedback that contributes to improvements, they will have expectation regarding the service’s functionality. Moreover, they are also expected to be ordinary customers after testing and commissioning.

The IntraWAP’s project team decided to promote and launch IntraWAP to pilot customers when they realized that there would be delays in commissioning the first version. Their intention was by such to “exploit a branding effect” by creating expectations and, hopefully, a demand for IntraWAP. IntraWAP at that time had a lot of failures and an absent customer support, which may indicate that the service was more at the

“proof-of-concept” than the pilot stage. An additional point that might have contributed to the pilot customer expectation of IntraWAP’s grade of completeness is that there was no clear crossover point where the developing phase and testing were finished and commercialization started. *“It has been a clear objective in other projects that before we launch a product all qualities should be settled with price models and a “package”. This is the traditional model. Regarding IntraWAP, there were no clear crossovers where development stopped and launching started. We exploited the branding effect first to show that here was a new possibility”* (IntraWAP’s market responsible). If the pilot customers, i.e. users “on trial”, were not able to use the communication service in a tolerably good way, it is likely that they discontinued using the service and, thus, did not affect other potential users in adapting to the service. Using IntraWAP in a “tolerably” good way means sending or reading e-mail on their WAP-phones.

Telenor Mobile had no established relationship with Ericsson beyond the ordinary customer/supplier kind. Nevertheless, they had a formal relationship with IBM/Lotus Software anchored in a joint venture agreement. *“The driver behind the project was not economy, and financial results were not an issue. The whole organization was driven by technology. We wanted to enter into a new business area where we lacked competences and our main strategy was that we had to do something with our partners”* (Sub-project leader, Sale and Distribution). Commercialization and service operation in a joint venture with third parties³⁰ was thus not an everyday phenomenon at Telenor Mobil and joint venture commercialization can be characterized as newly cleared ground. *“We hadn’t tracked the route with partnership for commercializing data services, so we had to develop many new routines. There were many new things that were needed to arrange for joint venture services, among other things an agreement with our collaboration partner”* (IntraWAP’s Product manager).

The main challenges were, consequently, getting access to technology and know-how possessed by Ericsson and IBM/Lotus Software, and to coordinate the various activities concerning external know-how and technology. There was a lack of appropriate agreements and established routines and guidelines for how to work together, how to secure that critical tasks involving external know-how’s and technology, were performed at the right times. The roles and responsibilities were not fully clarified and the business models and collaboration incentives were unclear. Knowing how to

³⁰ A third party is used by Telenor to describe a commercial actor that has a freestanding product accessible through Telenor’s infrastructure. Examples may be ring tones, financial news, movies or groupware applications.

handle external actors you depend on, technological and/or operational, seems to be an important capability.

Conclusion

An in-depth *technological* and *customer know-how* was important for commercializing of IntraWAP. Seeing the association between these know-how's was considered important for developing an appropriate product concept and adapting the various technical systems in IntraWAP's production line. The project team, accordingly, consisted of both technical and market resources and the project organization, and their weekly meetings and discussions would see to it that these resources and know-how's were *linked*. Hence, the factor that enabled this linking was the project organization, and the necessary in-house knowledge was available. This is a truth with modification, as the allocated resources were quite busy with other projects and, for that reason were not always accessible. Another restricting factor for the commercialization process of IntraWAP was that time limits were short and the project focus changed during progress when merging with dJuice. Moreover, the vital technology was immature and the *user interface* on WAP-phones perceived as poor. The largest challenge for the project team was, however, getting access to technology and know-how possessed by Ericsson and IBM/Lotus Software, coordinating the various activities regarding external know-how and technology. Knowing how to handle external actors you depend on, technologically and/or operationally, seem to be an important capability. An appropriate *alliance capability* could secure access to the vital know-how when needed and secure that critical tasks were performed at times. In this case, an alliance capability would comprise routines and/or guidelines for joint venture in commercialization project with clarified roles and responsibility, collaboration incentives and business models.

6. VoiceMail

VoiceMail is an answering service connected to a centralized computerized network system that handles incoming voice messages in personalized mailboxes linked to the user's phone number. This service has more sophisticated functions than the previous answering machines connected to the individual telephone. VoiceMail enables the users to play different message greetings to different callers, to forward received messages to another voice mailbox, add a voice introduction to forwarded messages and store voice messages for future delivery, etc. VoiceMail has since introduction into the NMT-network (1993) and GSM-network (1994) been upgraded continuously with new functionalities. VoiceMail was bundled with Telenor Mobile's GSM-subscription in 1994 and was in 2001 rated as the most value-adding service in a user inquiry.

Production – vital components and technology

Vital components in VoiceMail are a switch forwarding calls to the VoiceMail platform after certain ring signals, a centralized computerized system handling the various functionalities, a standard phone for the user interface, and various customer support functions (e.g. handling customer rights and billing).

Project initiative and establishment

The coverage range and battery capacity for mobile phones were low in the beginning of 1990s compared to today (2006). A mobile user would then frequently not be available. An answering service was in this connection seen as a value-adding service to the mobile phone subscription. An important economic driver for development of this service was that it could generate income in two "directions": when the message was recorded, and at play-back. Moreover, messages could also generate several new calls.

The VoiceMail project started up in December 1991. Two people were employed full time (100%): the project leader and another person to have

combined responsibility for technology and market. The project leader and subproject leader for technical and market issues came from a technical unit at Tele-Mobile and had know-how and experience in developing a corresponding system for a “pager”-service³¹ in the NMT-network. The technical/market subproject leader was responsible for specification of the VoiceMail platform’s functionalities and qualities and development of the user interface. Additional project resources were a handful of people in 20% employments supporting legal, market and operation activities.

No formal steering committee connected to the project was appointed. However, the department manager and product-group manager at Tele-Mobile represented the employer and the resource owners and in this manner functioned as a kind of steering committee. Their involvement was restricted to contract closing and to periods when extra technical resources were needed, as when repairing and upgrading the VoiceMail platform.

Specification and implementation

The platform specification involved a detailed description of all functionalities, the user interface, and the interplay with the various components in the service’s production line in both NMT and GSM-network. The VoiceMail-platform was to be built on a precursor system that had been developed for a radio based “pager”- service for the NMT-network. The platform then had to adapt to this old system and required a solution that was not “standard” on the market.

The specification made the basis for a tender request that was sent to several network component suppliers. One important requirement in the tender request was that the technical/market sub-project leader wanted to be involved in developing the platform and in the implementation process.

As we wanted to have a solution that was not “standard” on the market, we assessed it as very important to have the know-how in-house for handling possible failure and system upgrading. We therefore wanted to participate in developing the platform and the succeeding implication process (SUB-PROJECT LEADER, Technical/Market).

³¹ Pager is an electronic device used to contact people via a paging network. It pre-dates mobile phone technology, being most popular during the 1980s and 1990s, but similarly uses radio transmissions to communicate between a control/call centre and the recipient. This service or device was also called “beeper”.

The network component supplier was selected based on a combination of their technical sketches and their attitude towards performing the platform development and implementation work in collaboration with the technical sub-project leader. In this tender grant an agreement for prospective platform upgrading was embedded. The implementation work mainly consisted of developing specially adapted software securing the specified functionality in the service, developing and installing software for adjustment of the VoiceMail-platform to the other service components.

Packaging, marketing and distribution

VoiceMail was meant to be an add-on service where the users had to subscribe separately to the NMT/GSM-subscription and the VoiceMail-service. The user would then pay a registration fee and airtime after ordinary taxes. This product and price concept was used when VoiceMail was introduced in the NMT-network in 1993 but was changed in 1994 when VoiceMail became bundled with the GSM-subscription. The registration fee was therefore removed and the users paid only for using the VoiceMail service, i.e. airtime.

The VoiceMail service was launched in February 1993. The platform and software had been tested thoroughly to see if the system and production line were stable enough to put into operation and the service user interface had been tested on pilots. The service was, however, not formally handed over to the product department. The reason for this was that the project team wanted to test and verify the service during operation. This activity would require a tight follow-up on the technical systems and would be best ensured in the project organization according to the technical/market leader. Moreover, he felt it would require a relevant technical insight to introduce VoiceMail onto the market. In order to prepare the operations department and customer service for ordinary operation of VoiceMail service he handed over a user instruction and a list comprising platform weaknesses and when these weaknesses would be repaired.

VoiceMail had new types of functionalities that needed new concepts and definitions. Selling VoiceMail required a technical understanding and use of a concept appliance which were new. The sales channels and other involved units therefore needed to be trained before they could take over the responsibility for selling VoiceMail. Moreover, even though the system was “de-loused” of most failures through testing we wanted to test and

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verify the service during operation and, at the same time, accomplish the necessary teaching (SUB-PROJECT LEADER, Technical/Market).

Shortly after launching, however, it turned out that setup in the system for handling customer and billing data had not been completed. The reason for this delay was ascribed to a large proceeding re-organization with ensuing changes in various responsibilities in the unit. The consequences were, however, that the interplay between the platform and the administration system did not work. The technical/market sub-project leader completed the lacking set-up himself and after a couple of days the VoiceMail service was in function.

I think it is very important to have resources in pioneer work that are “burning” for the result, i.e. to have an ownership of the new product. The technical/market sub-project leader was such a resource. In innovative work, where you are building a new type of service, you cannot only decide how the service should work functionally; you also have to explain it to others and then you have to develop new concepts (PROJECT LEADER).

The VoiceMail-service was marketed in a series of campaigns on television during the first half of 1993. During this campaign, VoiceMail was offered without a subscription fee. As the campaign continued for a rather long period and VoiceMail became bundled with the GSM-subscription later on, the subscription fee was not actively used. During the summer of 1993, a product manager for VoiceMail was employed. At that point there were approximately 23.000 subscribers.

We did not go out in the market and actively sell VoiceMail as a service. Distribution of VoiceMail rather took place by making established customers aware of this new service through various advertising campaigns (SUB-PROJECT LEADER, Technical/Market).

During the same period, the VoiceMail project team also worked with adjustment of the platform for the coming GSM-network. By the end of 1993, a pilot test in the GSM-network was commissioned testing the interplay between the VoiceMail-platform, the administrative systems and the NMT and GSM-network. The VoiceMail service had a new functionality in the GSM-network called “Message Waiting” and comprised a message sent through the appurtenant data channel in the GSM-network to the subscribers telling them that they had received a new VoiceMail.

Correspondingly, they introduced a call-up signal instead of a text message to the subscribers of the NMT-network. An SMS notification was considered a very important function as there at that time were low coverage range and low battery capacity for mobile phones. The VoiceMail service was bundled with the “GSM-package” soon after the initial introduction of the GSM-network in 1994; this bundling resulted in an increased use of the service.

Introduction of VoiceMail to the GSM-network required a separate subscription system for the platform; the main reason being that the SMS-function needed a tailor- made system. The customer handling systems for GSM-subscribers, therefore, became more complicated than for the NMT-subscribers. When a new GSM-subscriber was to be registered, several other registrations needed to be done which had to be forwarded to other systems for getting the various functionalities processed. The new subscriber system consequently had to be connected to other subscribers system within Telenor Mobile. Initially, this was performed manually but became automated later on, and in this connection some quality failures with the platform were later revealed.

The VoiceMail-service was formally handed over to the product portfolio department for ordinary operation autumn 1995, and the project team was demobilized. The former technical/market sub-project leader, however, continued to have the technical responsibility for the VoiceMail-platform as a technical manager for the VoiceMail-service in operation, a position he had possessed earlier as a stand-in while working on the VoiceMail project.

At the end of 1995, some serious quality failures arose with the platform which triggered several activities. According to the agreement with platform supplier, they were responsible for potential repairs and future upgrading. However, they did not have time to repair the failure, and the technical person responsible for VoiceMail at Telenor Mobile had to do the job. Fixing the failures also required the involvement of resources from many other implicated units and entailed a general upgrading for simplifying the user interface and interplay between several administrative systems. The upgrading also necessitated more attention to testing procedures and verification ahead of the upgrading. A so-called “roll-back” procedures was introduced which secured the possibilities of going back to the original version should there be a failure after the upgrading.

The earlier technical/market sub-project leader was appointed as the project leader for several following upgrading projects. In 1998, “Mobile Fax”, the “Call-back” function and UMS (universal message central on net)

were introduced. The latter implied that the customers could receive VoiceMail on e-mail and introduce their own personal welcome message on their VoiceMail number. A consequence of the introduction of a personal voice on VoiceMail was a significant increase in the number of users. The latest upgrading came in 2005, which implied a coordination of the traffic across the borders in Scandinavian, where the plan was to simplify the interface further and to introduce new English-speaking voices.

There was a continuous need for upgrading the VoiceMail-service, either as a consequence of newly identified customer needs, or as a result of technological opportunities, or qualitative upgrading that would give more income (SUB-PROJECT LEADER, Technical/Market).

Organizational structure

A comprehensive re-organization process started in 1991 and was completed in 1994. As already mentioned in 2.1.3, the mobile division Tele-Mobile in Televerket (Norwegian Telecom) became a separate company in 1993 with the name Tele-mobil. In 1994, they changed the name to Telenor Mobile and Televerket changed their name to Telenor Ltd. Telenor Mobile organized their business in areas based upon earlier technical groups in the divisions Tele-Mobile, "Mobile telephony", "Pager" and "Mobile data". The latter division ceased in 1994 when the GSM-network was put into operation. This lengthy reorganization process resulted in several areas of responsibilities being relocated up to several times.

Single case report analysis

The specially adapted VoiceMail platform needed to be adjusted to several established technical systems. The VoiceMail-service was thus, as with the other presented telecommunication products, dependent on interplay between several components. Development, implementation and commercialization of VoiceMail required a thorough know-how about technology underlying the VoiceMail platform and how this platform would interplay with the other components in the VoiceMail production line. Know-how and experience in developing a corresponding system for a "pager"-service in the NMT-network were the bases for specification of the VoiceMail-service. This know-how was built on further through collaboration with the platform supplier through development and implementation activities. Having the relevant technical know-how in-house

later became decisive when they needed to repair and upgrade the VoiceMail-platform.

The point of departure for VoiceMail was an expected need for an answering service connected to mobile subscription. This expected need was based on the fact that mobile users in the mid '90s would not always be available as the coverage range and battery capacity for mobile phones was low. The VoiceMail-service contained various functionalities considered new to the users. The project team's experience in developing and distributing a very popular electronic device used to contact people via a paging network was useful when defining new market related concepts to VoiceMail functionalities. Hence, both technical and customer know-how were important for developing and commercializing VoiceMail. Technical know-how was important for developing the VoiceMail platform and repairing it during distribution, while a combined technical and customer know-how was important for developing VoiceMail as a customer-oriented service.

Distribution of VoiceMail was promoted by making established mobile phone users aware of VoiceMail through various advertising campaigns and the user-friendly VoiceMail was easily adopted by mobile phone users. When VoiceMail was bundled with GSM-subscription in 1994 the result was an additional increase in the number of VoiceMail users. A characteristic that is particular to network products is that relative advantage with a network product is difficult to obtain in the beginning of the distribution period. VoiceMail was not a communication service per se, but an advanced answering machine. VoiceMail thus has an intrinsic value independent of the number of other users. It would, however, be correct to say that the individual VoiceMail service would increase in value for the user when people in his/her network spoke in messages. Nevertheless, the main point here is that a network effect was not strong at that time and that the early users of VoiceMail were not as dependent on other users in appraising the utility value of the new service.

The cross-representation in technical and market related activities seem to have enabled the commercialization of VoiceMail. The technical/market sub-project leader was responsible for both specification of the platform's functionalities and qualities, and development of the service's user interface. He was well experienced in developing and commercializing an earlier popular pager service and assessed the importance of transition from technical functionalities to customer friendly functionalities. Moreover, he also trained the sales organization in how to use and communicate these new concepts. *"VoiceMail had new types of functionalities that needed new*

concepts and definitions. Selling VoiceMail required a technical understanding and use of a concept appliance which were new. The sales channels and other involved units therefore needed to be trained before they could take over the responsibility for selling VoiceMail” (Subproject leader, Technical/Market). This implied that when VoiceMail was introduced the new functionalities were relatively intuitive for the users which enabled adoption of VoiceMail as a service.

Representation of relevant combined technological and customer know-how and an individual employment of this know-how enabled a link between the vital technical and customer know-how, i.e. linking technical infrastructure and the service’s user interface. This linking was supported by a feeling of a strong personal ownership to VoiceMail held by the technical/market sub-project leader. He wanted to secure that VoiceMail would function both technically and in the market place. *“I think it is very important to have resources in pioneer work that are “burning” for the result, i.e. to have an ownership of the new product. The technical/market sub-project leader was such a resource. In innovative work, where you are building a new type of service, you cannot only decide how the service should work functionally; you also have to explain it to others and then you have to develop new concepts”* (Project leader). Moreover, this strong ownership entailed that the project team continued to have the technical responsibility for a period after VoiceMail had been launched since they wanted to secure the platform’s functionalities and integration with various components or systems in VoiceMail’s production line.

The relevant technical know-how and resources were thus accessible during development, as well as during the distribution phase when the platform needed to be repaired or upgraded. An important reason for this “accessibility” was the project team’s independence of the platform supplier when repairing the platform. The technical/market sub-project leader secured access to vital knowledge by adding a collaboration clause in the contract with the platform developer. The VoiceMail-platform was custom-made and not a standard product and, by such, the project leader and technical sub-project leader decided they wanted to have this knowledge in-house. Their strong ownership to the VoiceMail-service can therefore be said to be the motivation behind this decision. This ownership did not only lead to an independence of the supplier’s know-how; it also triggered a strong link between the infrastructure and the service, since the sub-project leader wanted to be responsible for both technical and market related issues and taught relevant units of Telenor Mobile how to use the new concepts for VoiceMail’s technical functionalities. Finally, he extended the project in time to secure that the vital technical resources were accessible when Voice

Mail was tested and verified during operation. This individual empowerment can be said to have enabled commercialization of the VoiceMail service.

There were no clear directives in the beginning of the '90s for collaboration with external actors possessing vital knowledge for developing, commercializing and operating telecommunication services. Nevertheless, the VoiceMail's project team acted adequately when securing access to this vital knowledge by acquiring it through collaboration with the platform supplier. An alliance capability was earlier defined as the ability to handle external actors possessing vital resources for the service to be commercialized. By such, it would be natural to claim that alliance handling was an enabling factor in the commercialization of VoiceMail.

Conclusion

Both *technical and customer know-how* were important for developing and commercializing VoiceMail. Technical know-how was important for developing VoiceMail as a service and repairing the platform during distribution, while customer know-how was particularly important for developing customer-oriented user interface. A *user-friendly interface* resulted in a relatively low threshold for adoption of VoiceMail. This was enabled by *linking* technical and customer know-how where the technical/market sub-project leader was responsible for both specification of the platform's functionalities and qualities, and development of the service's user interface.

This vital link between technical infrastructure and the service's user interface was thus supported by a cross-representation of technical and market related activities. The VoiceMail's project team secured access to critical, technical know-how through close collaboration with the platform supplier in developing and implementing activities. In this way, they had the critical knowledge in-house and accessible when they needed to repair or upgrade the VoiceMail-platform. An alliance capability was earlier defined as the ability to handle external actors possessing vital resources for the service to be commercialized. It is thereby natural to claim that *alliance handling* was an enabling factor in the commercialization of VoiceMail. As the early users of VoiceMail were not as dependent on other users in appraising the utility value of the new service, they were not as vulnerable to malfunction in the early distribution phase.

7. AlphaNumber

Universal Personal Telecommunication (UPT), named AlphaNumber when launched in 1995, was an advanced call-forwarding service entailing that the subscriber could be available on any telephone in the fixed and wireless network. Subscribers of AlphaNumber were allocated a single, personal telephone number and connections were set up automatically based on the programmed instructions. Furthermore, subscribers could call from any telephone where the call was automatically charged to a UPT account. AlphaNumber was closed down autumn 2000.

Production – vital components and technology

Vital components of the UPT-service were Intelligent Network, an UPT-platform and various customer support functions.

Project initiative

Norwegian Telecom (Televerket), in 1988, started working with specifications for Intelligent Network (IN). Their motivation for doing so was that the functionality in Intelligent Network opened up for the telecom operators themselves to develop new services in a couple of months. This was in contrast to traditional service development in the telephone switches, which could take four to five years. The most important advancement in this new architecture was the possibility to build new services by building blocks, referred to as SIBB (Service Independent Building Blocks) in international standardization work. Norwegian Telecom was well versed in SIBB's technology from their work in standardization bodies. Representatives of the Network division and Research and Development department had participated in ETSI (European Telecommunication Standardization Institute) during the period 1989 to 1995, with the mission to arrange ISDN as a European Standard.

The Network division sent a general tender request to their network suppliers and Ericsson was appointed to deliver the IN-platform. In 1991, Ericsson launched Intelligent Network in Norway. In 1992, a new updated IN-platform with building blocks came that enabled user-controlled changes of data. This functionality opened up for the UPT-concept where subscribers

themselves could control their accessibility, independent of terminals and net.

A clear drive to develop the UPT-service was the imminent competition between fixed and mobile net. In 1991, division Private was responsible for fixed lines in the private market, while division Tele-Mobil was building up the wireless network. Private wanted to compete with Tele-Mobile by launching a service where phone numbers could be associated with people rather than network and terminals. Ericsson, on their part, were eager to show the functionality of the IN-platform and to sell their platform on the global market.

It was a very technically driven project. We wanted to implement what we could obtain with the UPT concept. Televerket was at that time in the leading front internationally on Intelligent Network and the background for the project was that we wanted to demonstrate how excellent our technology was. It was also important for us to have some tempo in the technology and product development connected to the wired network when we saw the increasing enthusiasm around the mobile phone concept. We wanted to show that we could develop new and prospective products (PRODUCT MANAGER).

Project establishment

In the autumn of 1992, Ericsson and Televerket agreed to establish a joint project for development and implementation of a UPT service. The appointed project leader came from a department in division Network responsible for service development on the new IN-platform. He had earlier held a central position in the IN-specification work. This project leader would manage the project through the specification and development phase; the market division would take over the project leader responsibility later on when the UPT service approached launching.

The market side took over the role as a project leader when market resources were getting more crucial for the project's proceeding. We therefore had various project leaders depending on which phase the project was in. I was the project leader in the development phase because I was responsible for the technical resources. We started to discuss marketing when UPT was

technically complete and the market side took over the project baton (PROJECT LEADER during development phase).

The project organization was kept to a minimum with one technician from Televerket and one from Ericsson. One person from the product group in the market division participated later on in order to prepare the market activities. The project was to report frequently to a steering committee with representatives from both Televerket and Ericsson. The members of the steering committee represented the resource owners, i.e. the company, division or department the resources came from. A technical advisor at Televerket, who participated in European Standardization group (ITU) responsible for the UPT-concept standard, was also a member of the steering committee.

Specification and implementation

The project team started by conducting a joint specification and feasibility study where specified functionalities, required resources, cost, etc. formed a framework for the ensuing development, implementation and testing activities. Televerket and Ericsson jointly conducting tests gave spin-off effects. As Televerket had full insight during the development phase, the need for them to double-test functionality during implementation was avoided. Lead-times for testing were therefore cut by one half, and it took less than nine months from the specification work was commissioned to the commercial implementation was done.

Packaging, marketing and distribution

The UPT subscribers were supposed to be able to decide exactly how accessible they wanted to be, in addition to being able to forward calls to the phone selected by them. By calling a voice-guidance system, they would program telephone numbers and times indicating where and when they wanted to be reached. When the subscriber UPT number was called connections would be set up automatically based on the programmed instructions. The call would automatically be charged to the subscriber's UPT account. The idea was that UPT to begin with was to open up for voice communication, but in the near future the UPT service would include fax and data communication. The project team also felt that integrated video and multimedia could well be a reality in the future.

The market division took over the project leader role in the autumn of 1994, approximately ½ year before UPT was launched. At this time, it was

still not definitively decided whether the UPT should be launched as a service. The discussion concerned whether there would be a market for UPT when the mobile phone was widespread. They performed a market survey up front before deciding if UPT should be commercialised or not. This market survey revealed a certain interest in such a service, and based on this they estimated the market potential and identified potential early users. During this period, a person responsible for UPT's product was appointed and became responsible for the commercialization of UPT. He came from the Network division where he had worked with net infrastructure and started to work with developing price models and adapting the UPT service to the administration systems to handle billing and customer rights. A pilot service was introduced in November 1994 under the name "TelePersonal" (TelePersonlig) and tested out in six months on 350 pilot customers. These pilots were employees in Norwegian Telecom and Ericsson.

The decision to launch UPT as a service was taken during a steering committee meeting in April 1995. The service was named "AlphaNumber", a name the project team felt was more market friendly than UPT or "TelePersonal".

The word Alpha means "the first" or "number one". The idea was that the service would be so widespread that when people, some years ahead, searched for the word "AlphaNumber" in a dictionary, they would find "portable number independent of locations and net". Alpha was also written as the Greek letter A (@), because we saw the coming, issuant Internet (PRODUCT MANAGER).

At this time, a new functionality was added to the AlphaNumber-service, which allowed for duty-free calls to Norway when travelling abroad. The intention was to make AlphaNumber so advantageous and attractive that it could compete with the expanding mobile-phone which international calls were very expensive. When the AlphaNumber subscriber dialled a certain number when he/she was abroad, and keyed a pin-code and the number they wanted to be connected to, the call would be arranged from the Telenor's operation centre. The final cost depended on the destination and whether the receiver was in the fixed or wireless net, but it was significantly lower compared to ordinary cost of international calls. These duty-free numbers were originally meant for operators at Norwegian Telecom and not to be used for commercial purposes. The pilot customers tested this service when travelling abroad and were very positive to this functionality. On May 18, 1995, AlphaNumber was launched as the first UPT service in the world.

The Capability to Commercialize Network Products in Telecommunication

Relatively high product know-how was required for selling AlphaNumber and customer support, normally an ordinary sales-channel, did not possess this know-how. The sales responsible person, therefore, took direct contact with people and organizations regarded as advanced users (i.e. early adopters) to market the new service. The user interface was advanced and the users had to call an “800 number” and key different numbers many times in order to use and control the service. The product responsible person tried to find a solution that could reduce the amount of keystrokes, e.g. making electronic units for saving access numbers and account numbers that could automatically be transferred to the UPT-system.

AlphaNumber was an engineered product and technically complicated for end users. I had earlier worked with net infrastructure and I think I had too much of a quantitative approach to the whole project. I did my job when it comes to advertising agency and focus groups etc., but I was too indifferent to how important simplicity and user friendliness are for market acceptance and, hence, for success (PRODUCT MANAGER).

The AlphaNumber service received considerable international attention, for one thing aided by Ericsson who marketed the service actively with their IN-node. Televerket obtained a world-wide reputation as being among the best in the world on UPT-services and hosted many delegations from operators in Australia, Europe and America who wanted to learn about the UPT-concept.

The competition on home ground, however, between fixed and wireless priority areas, now organized in two separate companies, Telenor Private Ltd. and Telenor Mobile Ltd., had become critical. Telenor Privat marketed AlphaNumber as an umbrella covering the home phone, office phone, mobile phone and the fax-machine. Telenor Mobile, on their part, marketed the mobile phone by saying that nobody needed a fixed line phone anymore. At that time, Telenor Mobile sold mobiles for one Norwegian krone (about 1/7 of one Euro). The project manager realized that it would be difficult to sell AlphaNumber at a price that would exceed the mobile phone's total amount. He and the market director of Telenor Private, therefore, approached Telenor Mobile's leader team with a collaboration inquiry. The mobile phone number was at that time encoded in the mobile phone, which entailed that the customers had to change their phone number when they wanted to change and upgrade their mobile phones. The AlphaNumber service could give the mobile phone subscribers a number regardless of type of mobile and that could, according the AlphaNumber product manager,

prevent a potentially large customer turnover when the mobile phones were so inexpensive.

There was some interest in collaboration at Telenor Mobile, but there was also a large resistance. Telenor Mobile assessed AlphaNumber as a direct competitor to the mobile phone. At that time it was unusual to think that the mobile phone would be *the* preferred product. AlphaNumber had very low prices on calls from abroad. Moreover, Telenor Mobile saw that the fixed network earned money, even if the conversation went over the wireless network. The reason for this was that AlphaNumber was connected to the fixed network (PRODUCT MANAGER).

Telenor Mobile offered Alpha Number's product manager a job at Telenor Mobile. This offer was not of interest. Telenor Mobile developed a "personal number" through a subscriber identity module card³² (SIM-card) where the phone numbers were stored. The mobile phone number thus became independent of a specific mobile phone and could easily be transferred from one mobile phone to another. Furthermore, Telenor Mobile made an attempt to block calls in the wireless network when the calls came from an AlphaNumber, and to increase the price for termination of an "AlphaNumber-call".

I tried to have a dialogue with Telenor Mobile in order to stop this aggressive competition. I gained an overview over Telenor Mobile's real costs for receiving a call from the fixed net to the mobile net and for termination of such a call. When I addressed this question to Telenor Mobile, they presented costs four times higher than the actual costs. After that, there was a kind of strained relationship between Telenor Mobile and Telenor Private (PRODUCT MANAGER).

AlphaNumber product advantages were gradually impaired when mobile phones were widespread, their coverage range became better, the prices for international calls were reduced and the SIM-card was introduced. The phone number was encoded in the SIM-card, which easily could be removed and inserted into a new phone. In 1998, the product manager decided to upgrade AlphaNumber and to simplify the user interface in order to meet the

³² A Subscriber Identity Module (SIM) is a smart card roughly the size of a postage stamp that stores the key identifying a mobile phone service subscriber, as well as subscription information, saved telephone numbers, preferences, text messages and other information.

mobile phone competition. The whole concept was evaluated with new market and volume analyses. Some simplifications were made, the user interface was up-graded and AlphaNumber was re-launched. In 2000, the IN-node was to be upgraded, involving a required change in the AlphaNumber platforms. The estimated cost of doing this change was high. According to the economical estimates the break-even point for AlphaNumber would be reached at 8000 customers. There were a total of 6500 customers in 2000, and Telenor Private decided, in the autumn of 2000, to close down the AlphaNumber service.

Organizational structure

In 1995, Televerket converted from a governmental department to an enterprise named Telenor ASA. In this organizational transformation the Private, Enterprise and Net divisions became established as independent companies. Tele-Mobile had been separated one year earlier. The responsibility for development of the various IN-functionalities was placed in the new network company Network Ltd., while Private division and Enterprise division were responsible for marketing and selling AlphaNumber to each of their customer segments.

There had, however, been some disagreement in the organization where the market responsibility should be placed for the IN based services. The earning based on the IN functionality was expected to be high, therefore all divisions wanted to be the "lucky one". (PROJECT LEADER during development phase).

During autumn 1995, however, the company decided to release the issuant new services from the traditional telecom operations in order to have enough focus on the new businesses. A new company with the name Link was established with the aim to provide the value adding services based in IN, while Nextra was established to be responsible for providing Internet. The product manager was then relocated from Private to Link. These two companies merged later on and became Telenor Plus. At this time, AlphaNumber was moved back to Private as a result of a long discussion about which company possessed the best competence on UPT, and by then could perform the best service.

Single case report analysis

Development of the UPT-platform was driven by the latest development in Intelligent Network (IN) technology. Telenor's position as the leading front internationally on IN-technology was acquired through participation in standardization activities. Technical staff involved in developing the UPT-platform was well versed in the new underlying technology through their work in the respective standardization bodies. "Intelligent Network" (IN) and "SIBS"-technology³³ opened up for UPT³⁴-services, a new type of service where subscribers could control their accessibility independent of terminals and net. Technical know-how underlying IN technology was thus vital for developing the UPT-platform and, thus, for commercializing the AlphaNumber-service.

Ericsson contributed with valuable IN technology knowledge and was, accordingly, an important collaboration partner in developing the UPT platform. Both Ericsson and Telenor had great interests in launching a UPT-service. Ericsson wanted to demonstrate the functionality of the IN-platform for marketing purposes, and the "Private" division of Telenor wanted to compete with division "Tele-Mobile" by launching a service where phone numbers could be associated with people rather than network location and terminals. Commercializing and providing AlphaNumber as service were, however, Telenor Private's own business. The underlying IN technology and UPT platform were complete when Telenor Private decided to commercialize AlphaNumber as a service. Telenor Private possessed the necessary technical know-how in-house to commercialize AlphaNumber and was therefore independent of Ericsson.

The main focus in this project was technical functionalities. Market resources were involved only a short time before launching. *"We started to discuss marketing when UPT was technically complete and the market side took over the project baton"* (Project leader during development phase). The project leader role for developing AlphaNumber was first placed in the net division and later handed over to the market division when the time for a potential launching approached. The person in charge of launching and distribution of AlphaNumber in the market division was an engineer who had worked with infrastructure in the net division. He had rather little experience with marketing and, as he said, "I was too indifferent to how important simplicity and user friendliness are for market acceptance and, for that reason, for success". The result was a service with a user interface

³³ Service Independent Building Blocks

³⁴ Universal Personal Telecommunication

perceived as technically complex, which increased the threshold for potential users to adapt to the service. Furthermore, AlphaNumber product advantages were gradually impaired when mobile phones were widespread, their coverage range became better, the prices for international calls were reduced and the SIM-card was introduced. A collaborating factor was that there was an internal power struggle between fixed and wireless priority areas, now organized in two separate companies, Telenor Private Ltd. and Telenor Mobile Ltd. Moreover, the ambiguity of where at Telenor Private responsibility, and thus income, for AlphaNumber belonged, may have been a restraining factor in commercializing AlphaNumber.

Conclusion

A *technical know-how* underlying IN technology was vital for developing the UPT-platform, and thus for commercializing the AlphaNumber service. Relevant *customer know-how*, like how to lower the adaptation threshold for technically complex services, was considered late in the project. This was caused by an insufficient acknowledgement of the transition of technical functionalities to customer friendly functionalities. Thereby, there was a *weak link* between technical and customer know-how which would have contributed to service being perceived as technically complex by users, i.e. *low user friendly interface*. Telenor collaborated with external actors, in this case Ericsson, in developing the basic technology behind AlphaNumber. Ericsson thus contributed with valuable technical know-how. However, the underlying IN technology and UPT platform were complete when Telenor Private decided to commercialize AlphaNumber as a service. Nevertheless, being independent of external actors during commercialization was perhaps a conscious action from Telenor's side, and, in that way, considered an *appropriate alliance handling*. This is, of course, only speculation as it was not possible to confirm.

8. Analysis and discussion

The purpose of this chapter is to analyse and discuss the results of the four cases presented in Chapters 4 to 7. The main question of interest is whether it would require specific operational capabilities to commercialize network products in telecommunication industries. To accomplish this question, four sub-questions were developed. First, how do technological, customer and alliance capabilities enable commercialization of new products in telecommunication industries? Second, in which way will linkages between the three operational capabilities enable the commercialization process? Third, are some of the proposed operational capabilities important for reaching critical mass and a rapid rollout, i.e. rapid distribution of the service? Finally, how do dynamic capabilities enable the operational capabilities to evolve to match the changing environment?

The following discussion is organized such that, first, shared properties and the potential common factors enabling commercialization in all four cases will be presented. Then, common denominators for the two successful cases (SMS and VoiceMail) will be presented and analyzed. Likewise, the common denominators for the two unsuccessful cases (IntraWAP and AlphaNumber) will be dealt with. Further, the shared properties and the factors enabling or restraining commercialization processes for the two network products (SMS and IntraWAP) will be presented and analyzed. In the same way, the two cases that present commercialization of the telecommunication products not exhibiting characteristics giving network effects (VoiceMail and AlphaNumber) will be dealt with. Any potential factors enabling the commercialization processes that have not been addressed in the conceptual model will also be emphasized. The four sub-research questions will then be discussed and attempted answered. A natural outcome of this discussion will be an answer to the main research question. A summarized conclusion and a revised conceptual model based on the empery of this thesis will be presented in Chapter 9, which closes with theoretical and practical implications, together with suggestions for future research.

SMS, IntraWAP, VoiceMail and AlphaNumber

SMS, IntraWAP, VoiceMail and AlphaNumber are all telecommunication services. A telecommunication service comprises a specific

set of user-information transfer capabilities provided to a group of users by a telecommunications system³⁵. Users require a telephone and a network of telephone users, in order to employ the service. Operation of a telecommunication service includes operation of radio base stations, switches and various technical platforms for access and capacity, i.e. infrastructure, and more customer related activities like operation of various customer handling systems, billing, and customer support systems. There are in this manner several technical systems involved in the production line³⁶ of a telecommunication service which have to function or operate in synchrony³⁷. Characteristic to telecommunication services is, thus, simultaneously technical interdependency between the network infrastructure and the service's functionalities. Furthermore, technological development of the infrastructure opens up for new service functionalities, while introduction of new functionalities requires changes in the infrastructure. These above-mentioned characteristics are common dominators for the various services presented in the four cases. The product characteristics responsible for network effects during distribution were, however, different. This variation will be dealt with in chapter 8.4 and 8.5.

Linking technical infrastructure know-how and customer know-how seems to have been important for success in all four cases. A link between technical and customer know-how laid the foundation for SMS, as the "Message group" employed both technical and customer know-how when they opened up for "Mobile Originated" messages in the standard. Moreover, technical and customer know-how were a vital combination in foreseeing the need for increased capacity during SMS distribution. By such Telenor Mobile avoided a service breakdown during a critical phase of SMS distribution. In the IntraWAP case, a broad technical know-how in several fields and customer know-how were vital, both to adapt the various technical components and systems in the service production line, and to develop an appropriate product concept. A close link between technical know-how and customer know-how, represented in one person, resulted in VoiceMail's

³⁵ A telecommunication service is provided by a telecommunication provider. The telecommunication service user is responsible for the information contents of the message. The telecommunication service provider has the responsibility for acceptance, transmission, and delivery of the message (Federal Standard 1037C, Telecommunication: Glossary of Telecommunication Terms).

³⁶ A production line can be defined as the technical systems and applications involved in producing a service which must interact for the service to be delivered properly and be appraised as valuable to the customer.

³⁷ Synchronization means the coordination of simultaneous threads or processes to complete a task in order to get correct runtime order and avoid unexpected race conditions.

customer-oriented user interface which further enabled distribution of this service. The opposite was the case with AlphaNumber, where the lack of a link between technical and customer know-how was a contributing factor to a low user friendly user interface for the AlphaNumber service. To what extent the various project teams or responsible persons for commercialization had full access to both technical and customer know-how varied between the cases. The above-mentioned findings will be discussed in the sub-chapters below.

Successful commercialization, SMS and VoiceMail

Short Message Service (SMS) is a communication service enabling users to send and receive short text messages by using their mobile phones. SMS has, since it came on the market in 1995, had a significant growth in the number of sent text messages every year. Moreover, this success has been followed by a successful deployment of information services distributed by SMS. VoiceMail is an answering service that handles incoming voice messages in personalized mailboxes linked to users' phone numbers. VoiceMail has since it was introduced in the GSM-network in 1994 been upgraded continuously with new functionalities and was rated the most value-added service by GSM subscribers in 2001. Both SMS and VoiceMail service were bundled with the GSM subscription a short time after they were launched. A bundling lowered the users' threshold to adapt to the new services since they did not have to make any decision related to purchasing new hardware or subscription to a new service.

Employment of technical and customer know-how in a combination was important for commercializing SMS and VoiceMail and gave the incorporation of "Mobile originated" messages function in the GSM standard equal status with the "Mobile Terminated" function, classified as one of the high priority services in GSM. The possibility to send text messages from a mobile phone, and not only receive text messages, was a vital function for communication via SMS. During distribution of SMS, employment of both technical and customer know-how involved that Telenor Mobile was ahead with platform capacity at a time when there was a significant growth in SMS traffic. A prolonged service breakdown was thus avoided in a critical phase of SMS distribution. Likewise, employment of a combined technical and customer know-how enabled the distribution of VoiceMail, as translating technically advanced functionalities to user-friendly market related concepts resulted in a relatively low threshold for adoption of VoiceMail.

Knowledge vital to the origin of SMS as a communication service was acquired through research work in the Research and Development (R&D) department in Televerket in the mid-80s. The R&D activities included both basic research and research with a more applied character where technology was tested on pilots with respect to its applicability. A great part of the terminology used in the technical specification of text messages came from the basic research work. Testing new developments on pilots and appurtenant market analysis gave the researchers valuable market insight, which was the reason why they argued so eagerly for the “Mobile Originated” text messages in the GSM-standard. Likewise, the person who later got the responsibility for the SMS platform during service operation had a corresponding experience. Earlier, he had built and tested a data network system for mobile data services for enterprise communication. This experience had given him a belief in SMS as a communication service, resulting in estimated growth curves indicating a rapid expansion. Therefore, he increased the platform’s capacity up front, causing a significant growth in text messages traffic.

Both technical and customer know-how were here represented by the same person in situations where individual employment of both was important. Factors supporting acquisition and employment of both expertise’s were a generous R&D culture, including both basic and applied research, and participation in standardization activities. Here, it seems that by accepting individual empowerment in this respect the organization enabled commercialization of SMS. Another factor enabling employment of both proficiencies was a shared understanding of the importance of an end-to-end responsibility for a production line for securing efficient coordination of different vital parts of the service. This understanding resulted in technical responsibility for the SMS-platform being placed where the relevant knowledge was, i.e. in the market department, and not in accordance with the formal responsibility structure, in the operations department. This way, a close link was established between system technical and product responsibility, first due to the bipartite responsibility and later due to a tight collaboration between the system technical and the product groups.

There was also a close link between system technical and product responsibility in the VoiceMail case through a cross-representation in technical and market related activities. The technical/market sub-project leader of the VoiceMail project was responsible for specification of the platform’s functionalities and qualities and development of the service’s user interface. Moreover, he was technically responsible for the VoiceMail platform for a period of time after launching. He had acquired valuable know-how through an earlier project where he was responsible for

developing and commercializing a popular electronic device used to contact people via a paging network. In this project they emphasized the importance of the transition of technical functionalities to customer friendly functionalities, i.e. user interface. This experience was useful when defining new market related concepts to VoiceMail functionalities. Moreover, the technical/market sub-project leader trained the sales organization in how to use and communicate these new concepts. This implied that when VoiceMail was introduced, the new functionalities were relatively intuitive to the users enabling adoption of VoiceMail as a service. The link between system technical and product responsibility was supported by a strong feeling of personal ownership to VoiceMail held by the technical/market sub-project leader. He wanted to ensure that VoiceMail would function both technically and in the market place. Moreover, this strong ownership entailed that the project team continued to have the technical responsibility for a period after VoiceMail had been launched, as they wanted to ensure the platform's functionalities and integration with various components and systems in VoiceMail's production line.

Not all necessary know-how for commercializing VoiceMail was originally represented in-house Telenor Mobile, like it was in the SMS case. The project leader and the technical sub-project leader made the VoiceMail requirement, but there was an external supplier who developed the VoiceMail platform. The platform was custom-made in order to match other components in the service's production line. The VoiceMail platform was, in this manner, not a standard product on the market. The project team considered it important to have relevant know-how for repairing the platform in-house and added a collaboration clause in the contract with the platform developer, demanding participation in developing and implementation activities. This way, the VoiceMail's project team acquired the technical know-how necessary for repairing and up-grading the platform and, thus, became independent of the platform supplier in upgrading/repairing the platform, which, later, on appeared to be an advantage.

The cross-representation in technical and market related activities created a vital link between technical infrastructure and the service's user interface which enabled commercialization of VoiceMail. Furthermore, securing relevant platform know-how in-house for upgrading and repairing the VoiceMail platform was advantageous. Relevant technical and customer know-how were then, as in the SMS case, represented by one and the same person in situations where an individual employment of both expertises was critical. One factor supporting employment of both know-how's was an organizational structure or culture accepting individual employment driven by a strong personal ownership to the service.

Characteristic to SMS and VoiceMail is user friendly interface lowering the threshold for new users to adapt to the service. Furthermore, a bundling with the main service, i.e. GSM-subscription, in an early phase of distribution involved that new users did not have to make any decisions related to purchasing new hardware or subscription to a new service. These product characteristics enabled distribution of SMS and VoiceMail. Another common denominator enabling the commercialization process was employment of technical and customer know-how's based on an earlier individual experience with both technical and customer's issues. A cross-representation of technical and market related activities during "packaging" and distribution made a strong link between the technical infrastructure and the service's user interface, and this enabled distribution. This cross representation combined with a strong ownership to these two services arranged for an individual empowerment was also an enabling factor during distribution.

Unsuccessful commercialization, IntraWAP and AlphaNumber

IntraWAP was a service that was to give companies and their employees secure access to groupware applications on corporate Intranet from a mobile phone. A pilot solution was launched in June 2000 and after various upgraded versions and three re-launchings IntraWAP ceased in 2003. AlphaNumber was an advanced call-forward service entailing that subscribers could be available on any telephone in the fixed and wireless network. AlphaNumber was launched in 1995 and closed down autumn 2000.

Technical know-how in several fields, combined with customer know-how, was in the IntraWAP case vital for both adapting the various technical components and systems in IntraWAP's production line, and to develop a customer directed product concept. Telenor Mobile had relevant technical know-how for parts of the IntraWAP infrastructure, which was based on long experience with ordinary network operation. The project team consisted of both technical and market resources with relevant know-how for commercializing IntraWAP. Some of the allocated human resources were, however, busy with several other projects and for that reason not always accessible. Nevertheless, a larger challenge for the project team was getting access to technology and know-how possessed by external actors, as well as coordinating the various activities involving external know-how and technology. This challenge was partly a result of the double responsibility of

providing IntraWAP as a service. Telenor Mobil was responsible for securing access to the corporate intranet via hand-held terminals, while IBM/Lotus Software was responsible for implementation and operation of the central connector software at the customer's site. Moreover, Telenor Mobile was dependent on Ericsson in updating the immature security technology installed on the WAP-gateway. Telenor Mobile was, in this manner, both technologically and operationally dependent on external actors having critical technical and customer related know-how. A limited access to vital know-how possessed by external actors resulted in an incomplete product concept and delays in security mechanisms at a time when IntraWAP was considered more or less complete. IntraWAP was also marketed by the providers as being complete.

A weak link between technical and customer know-how was also the case with AlphaNumber resulting in a service with a user interface perceived as technically complex by the users. Telenor Private in this case had the necessary technical know-how in-house and was thus independent of external actors, in contrast to the IntraWAP-case where there was a dependence on external know-how for commercializing the service. In the AlphaNumber instance Ericsson contributed with valuable technical expertise and was an important collaboration partner in developing the UPT platform. However, the underlying IN technology and UPT platform were complete when Telenor Private decided to commercialize AlphaNumber as a service. The main focus in the AlphaNumber project was, as already mentioned, technical functionalities. Development of the UPT-platform was driven by the latest development in Intelligent Network (IN) technology where Telenor had acquired an in-depth know-how through participation in standardization activities. Market resources were involved only a short time before launching AlphaNumber as a service. The person in charge of launching and distribution AlphaNumber had rather little experience with marketing and acknowledged too late how important simplicity and user friendliness were for market acceptance of AlphaNumber and, thus, for success. Another factor that hampered commercialization of AlphaNumber was the internal power struggle between fixed (Telenor Private) and wireless (Telenor Mobile) priority areas. Telenor Mobile marketed the mobile phone as a competitor to AlphaNumber, which product advantages gradually were impaired when mobile phones were widespread, their coverage range became better, the prices for international calls were reduced and the SIM-card was introduced. Moreover, the indistinctness of Telenor Private, who had responsibility for AlphaNumber, as well as income, may have been a restraining factor in commercializing AlphaNumber. In the case of IntraWAP, short time limits, changed project focus during commerciali-

zation progress, immature technology and poor user interface were restricting factors.

The common denominator, however, for the IntraWAP and AlphaNumber case was a weak link between vital technical and customer know-how resulting in several delays in commissioning IntraWAP during a critical phase of service distribution. Joint venture commercialization with third parties³⁸ was newly cleared ground in the '90s, which may also partly explain this weak link. There was an absence of established routines and clarified guidelines for joint venture in commercialization project and for handling external actors on whom one depends technologically. Telenor Mobil had a formal relationship with IBM/Lotus Software anchored in a joint venture agreement, and they were represented in the project team. Therefore, it can not be said that limited access to their knowledge was the bottleneck. Rather, it was lack of appropriate agreements and established routines and guidelines for how to work together, as well as how to ensure that critical tasks, where external know-how and technology were involved, were performed at the right times. The roles and responsibilities were not fully clarified and the business models and collaboration incentives were unclear. A weak link between vital technical and customer know-how in the AlphaNumber case resulted in a complex user interface which increased the threshold for users to adapt to the service. Insufficient acknowledgement of the significance of transforming technical functionalities to customer functionalities, i.e. user interface, may be the reason for this weak link. The necessary expertise for commercializing AlphaNumber was represented in-house, but the ability to link these vital know-how's failed.

Strong network effects, SMS and IntraWAP

SMS is a communication service meaning that it is used to communicate. The value of SMS lies in the connection among users in a network, and, hence, has no intrinsic value. SMS increases in value to a single user as the number of other users increases. IntraWAP was both an access service and a communication service. Employees using IntraWAP had access to an established network of e-mail users. IntraWAP, thus, had an intrinsic value, i.e. a value to the single user independent of other users. The service would, however, increase in value if there were several others using IntraWAP to get access to their e-mail system. The more people that used

³⁸ A third party is used by Telenor to describe a commercial actor that has a freestanding product accessible through Telenor's infrastructure. Examples can be ring tones, financial news, movies or groupware applications.

IntraWAP when travelling or out of office, the more colleagues and business connections a single user could communicate with. By definition network effects take place when the benefits to any individual consumer of a product or a system increase with the number of other users. In this matter both SMS and IntraWAP exhibited characteristics giving network effects during distribution, and can, as such, be characterized as network products. They differ, however, in that SMS became a large success, while IntraWAP was closed down after various upgraded versions and re-launchings.

Distribution of SMS occurred without mentioning marketing efforts by Telenor Mobile. The relative advantage of SMS, which is the degree to which SMS was perceived as being better than the idea it superseded (in this case telephony), was evaluated early by the users. Teenagers' comprehended that they could communicate much more cheaply by SMS than by making phone calls. Text messaging could also be used in situations where the sender or receiver could not talk, i.e. meetings, concerts etc. Finally, the youth image and the development of a specialized language to overcome the interface limitations gave SMS a cult status. SMS was bundled with GSM subscription and integrated in the mobile handset and the user did not have to make any decisions related to purchasing new hardware or subscription to a new service. Moreover, the SMS interface was relatively simple. Hence, when the users first learnt about SMS, they were able to start using SMS by themselves right away. The threshold for experimentation and learning by doing were thus low and was an advantage to SMS compared to other mobile services such as WAP. By the time IntraWAP was introduced to the market it required the majority of customers to buy a new mobile handset supporting WAP-functionality. These mobile phones were in their "early childhood" and the user interface was perceived by many as poor. The threshold for adopting IntraWAP was thus higher than for adopting SMS.

Early users of SMS on the whole experienced a stabile service. There was, however, an incident that could have been critical for the distribution of SMS. Introduction of free SMS on "Pre-Paid" entailed that the SMS traffic was more than quadrupled in five days and it seems this growth in SMS users triggered an explosive growth of text messages. A service breakdown or prolonged reduced service quality could thus have affected both established and potential customers in their choice of mobile operator during a critical phase in SMS distribution. A prolonged service breakdown was, however, avoided. The person who was responsible for both the SMS platform and SMS as a product had increased the platform capacity in accordance with his own estimated growth curves for SMS traffic. The effect of the unexpected significant growth was hence limited to a reduced SMS functionality for less than a week.

Early users of IntraWAP experienced, in contrast to early users of SMS, a high threshold for adopting the service and a prolonged reduced service quality. Potential users of IntraWAP had to buy a new mobile handset that supported WAP-functionality, which had a user interface perceived by many as poor. Furthermore, IntraWAP was launched before the service was commissioned. When the project team realized that there would be delays in commissioning the first version, they decided to promote and launch IntraWAP to pilot customers in order to “exploit a branding effect”. By such, they wanted to create expectation and, hopefully, a demand for IntraWAP. IntraWAP had at that time no customer support and comprised an immature technology. Although pilot customers are informed that the service concept is not technically and commercially commissioned and that the customers’ role is to give feedback that contributes to improvements, they will have expectations connected to the service’s functionality. IntraWAP was also marketed at that time as a commercial service, which contributed to pilot customers’ expectations of IntraWAP’s grade of completeness.

Early users of a network product have to experience the relative advantage of the service through an influx of new users. This did not occur in the IntraWAP case. The pilot project lasted for a relatively long period of time and there were several repeated promotions where service quality and launching dates were announced but ended in breach of promises. The pilot customers did not experience advantages big enough to persist in an early phase of distribution; they lost their patience and some pilots discontinued using the service. Hence, they did not affect new potential users in adopting the service. Furthermore, the sales corps and potential customers built a gradual mistrust to IntraWAP and, finally, when the service was complete the confidence was lost. Some of the main reasons for delays in the long drawn out pilot period were (1) reduced access to vital know-how and technology and (2) lack of established routines for sharing rights, roles and responsibilities implying weak links between vital know-how’s in a critical phase of distribution. In the SMS case, however, a strong link, represented by a cross-representation in technical and market related activities, enabled distribution of SMS by avoiding a service breakdown or prolonged reduced service quality.

Weak network effects, VoiceMail and AlphaNumber

VoiceMail is an answering service handling incoming voice messages in personalized mailboxes linked to users’ phone numbers. VoiceMail has an

intrinsic value and will not increase in value for the individual user when others use *their* own VoiceMail service. AlphaNumber had a corresponding intrinsic value. This service was an advanced call-forward service entailing that the subscriber could be available on any telephone in the fixed and wireless network. AlphaNumber did not increase in value for the single user when other people gained *their* own personal AlphaNumber. VoiceMail's and AlphaNumber's common product characteristics, in addition to being a telecommunication service, are that these services did not exhibit characteristics giving strong network effects during distribution.

A visible difference, however, between these two services was that VoiceMail had a user friendly interface, while AlphaNumber's user interface was perceived as technically complex by users. The project team in the VoiceMail case emphasized the importance of transforming technical functionalities to customer friendly functionalities, i.e. user interface. The technical/market subproject leader had acquired valuable know-how through an earlier project where he was responsible for developing and commercializing a popular electronic device used to contact people via a paging network. In this project they emphasized the importance of customer friendly user interface. This experience was useful when defining new market related concepts to VoiceMail functionalities. Moreover, the technical/market subproject leader trained the sales organization in how to use and communicate these new concepts. This implied that when VoiceMail was introduced, the new functionalities were relatively intuitive for the users which enabled adoption of VoiceMail as a service. The link between system technical and product responsibility was supported by a strong personal ownership to VoiceMail held by the technical/market sub-project leader. He wanted to ensure that VoiceMail would function both technically and in the market place. Moreover, this strong ownership entailed that the project team continued to have the technical responsibility for a period after VoiceMail had been launched, since it wanted to ensure the platform's functionalities and integration with various components and systems in VoiceMail's production line.

In the AlphaNumber case there was a weak link between technical and customer know-how, which resulted in a service with a user interface perceived as technically complex by the users. The main focus in the AlphaNumber project was, as already mentioned, technical functionalities. Development of the UPT-platform was driven by the latest development in Intelligent Network (IN) technology where Telenor had acquired an in-depth know-how through participation in standardization activities. Market resources were involved only a short time before launching AlphaNumber as a service. The person in charge of launching and distributing AlphaNumber

had very limited experience with marketing and acknowledged too late how important simplicity and user friendliness was for market acceptance of AlphaNumber and, hence, for success.

Discussion

In the four preceding sub-chapters, we have called attention to likenesses and differences between successful and not successful commercialization of telecommunication services exhibiting characteristics giving either strong or weak network effects during distribution. Now we will make an effort to answer the research questions proposed in Chapter 2.

Technological, customer and alliance capabilities

Handling relevant technology and handling customers and markets are indicated to be vital operational capabilities in a successful commercialization (Danneels and Kleinschmidt, 2001; Dougherty, 1992; Mitchell, 1992; Moorman and Slotegraaf, 1999). Furthermore, development-oriented and market-oriented collaborative relationships appear to help firms acquire needed commercialization capabilities in order to commercialize complex goods in the software system industry (Mitchell and Singh; 1996). We have, therefore, proposed three operational capabilities as being important for attainment of successful network products. These capabilities are (1) technological capability, (2) customer capability and (3) alliance capability. A technological capability was in the context of this thesis defined in Chapter 2 as an in-depth know-how about the technology underlying the new network product and the organizational routines and structure supporting both acquirement of this know-how and employment in such a way that turning point³⁹ is reached during distribution. In the same way, a customer capability was defined as an in-depth know-how about customers' needs and preferences and the organizational routines and structure supporting both acquirement and employment of this know-how. Moreover, an alliance capability was defined as the ability to handle external actors possessing vital resources for network products to be commercialized. To empirically link the three proposed operational capabilities to successfully commercialized network products, our first sub-question was:

³⁹ The point at which enough individuals in a system have adopted the innovation so that the further rate of adoption becomes self-sustaining.

how do technological, customer and alliance capabilities enable commercialization of new products in telecommunication industries?

Operational capabilities are in the literature referred to the ability of an organization to perform a coordinated set of tasks, utilizing organizational resources, for the purpose of achieving a particular end result (Helfat and Peteraf, 2003) or producing significant output of a particular type (Winter, 2003). Leonard-Barton (1992) defines a core capability as a knowledge set that distinguishes and provides a competitive advantage. In this thesis, “a particular end result” or “a competitive advantage” involves a successful commercialization. According to Leonard-Barton (1992), excellence in the technical and professional skills and knowledge base underlying major products is one of the most necessary elements in a core capability. It seems obvious from the results in this study that an in-depth know-how about the technology underlying the four services presented in this thesis enabled the commercializing processes. The origin of SMS as a communication service was based on an in-depth technical know-how acquired through earlier basic research. The same know-how was crucial to capacity maintenance for the SMS-platform during SMS distribution. IntraWAP consisted of many different technical components and systems which had to interact synchronously to have value to the customers. In this case, it was necessary with a broad technological insight into several fields in order to understand the manner of operation for the single component and system, and to understand how they worked as a unit. In the VoiceMail case technical know-how of a corresponding system was the basis for a thorough specification of the VoiceMail platform and, later on, crucial for both repairing and updating the service during operation. Development of AlphaNumber service was technically driven and technical know-how was the starting point for development of the UPT-platform and AlphaNumber service.

There seems to be some evidence in the present material, however, that technical know-how had to be combined with customer know-how in order to have significance to the commercialization result. With customer know-how we mean customers' needs, preferences, technological insight, experience, etc. The combination of technical know-how and customer experience, acquired through testing new technology on pilots, was the reason why the researchers in the SMS case argued for the “Mobile Originated” text messages in the GSM-standard. Likewise, the person who later had responsibility for the SMS platform during service operation had a corresponding experience, giving him confidence in SMS as a communication service. The result was estimated growth curves indicating a rapid escalation and, thus, an increased platform's capacity to face a

significant growth in text messages traffic. In the IntraWAP case market insight and knowledge about potential corporate customers' data system, needs and demands were necessary to both develop an appropriate product concept and to adapt the various technical systems. The combination of technical know-how and customer know-how was important in the VoiceMail case for developing a user friendly interface, something the project team indicated as being one of the reasons why VoiceMail distributed so easily. On the other hand, in the AlphaNumber case a poor user interface was explained by late involvement of customer know-how in the commercialization process. A poor user interface was further explained to be one of the main reasons for AlphaNumber not being profitable.

Based on these results, it seems unnatural to view technical and customer know-how separately and to disassociate the organizational routines and structures supporting acquirement and employment of technical know-how from those who supported acquirement and employment of customer know-how. Technical know-how and customer know-how can, rather, be viewed as fundamental "ingredients" that have to be connected in order to have significance to the commercialization result. The results of this study indicate that it is more the ability to connect and integrate these "ingredients" that can be viewed as an important operational capability for commercializing telecommunication products. Which routines and structures would support integration of technical and customer know-how are discussed in the following sub-chapter 8.6.2.

The fundamental "ingredients" necessary for commercializing the services presented in this thesis were not always represented in-house. Know-how and technology crucial for commercializing SMS were both presented and accessible in-house. Moreover, the mobile phones necessary for sending and receiving SMS were rapidly distributed when SMS was available to GSM-subscribers in 1996. Some of the vital know-how and technology in the IntraWAP case were, however, not presented in-house, and not always accessible. There was a dual responsibility for providing IntraWAP as a service, and the service comprised immature technology possessed by an external supplier. This involved that Telenor Mobile was both technologically and operationally dependent on external actors. Telenor Mobile was responsible for securing access to the corporate intranet via handheld terminals, while IBM/Lotus Software was responsible for implementation and operation of the central connector software at the customer's site. Moreover, Telenor Mobile was dependent on Ericsson in updating the immature security technology installed on the WAP-gateway. Telenor Mobile had not established any formal relationship with Ericsson beyond the ordinary customer/supplier relationship, and Ericsson's technical

know-how was not always accessible when required. Telenor Mobile apparently had access to IBM's know-how. IBM participated in the project team and their joint venture was formalized in an agreement. Nevertheless, commercialization and service operation in joint venture with third parties was not an everyday phenomenon in Telenor Mobil in the '90s. No routines and guidelines were established for how to work together, the roles and responsibility were not fully clarified and the business models and collaboration incentives were unclear. A limited access to vital know-how and technology and a lack of appropriate agreement for joint venture commercialization resulted in an incomplete product concept and delays in security mechanisms at a time when IntraWAP was considered more or less complete.

Neither was all necessary know-how for commercializing VoiceMail originally represented in-house. Nevertheless, the project team in this case secured access to critical technical know-how through close collaboration with the platform supplier in developing and implementing activities. In this way, they had the critical knowledge in-house and accessible when they needed to repair or upgrade the VoiceMail platform. In the AlphaNumber case, Ericsson contributed with valuable technical know-how and was an important collaboration partner in developing the UPT platform. However, Telenor Private had the necessary knowledge in-house when they decided to commercialize AlphaNumber. Handling external actors one depends on to secure access to vital know-how and technology when needed, can for that reason be viewed as an important issue in the IntraWAP and VoiceMail case. These results indicate that not only is it important to integrate technical and customer know-how to commercialize telecommunication products successfully, but also to secure access to vital know-how and technology possessed by external actors. In conclusion, the findings of this study indicate that the ability to link technical and customer know-how was significant to the result in the presented commercialization processes. Moreover, in the case where vital know-how and technology for commercializing the product were delivered by external actors, the ability to handle external actors to secure access to these resources was crucial.

We initially asked how three operational capabilities, (1) technological, (2) customer and (3) alliance, would enable commercialization of new products in telecommunication industries. An operational capability refers to the ability of an organization to utilize organizational resources for the purpose of achieving a particular end result (Helfat and Peteraf, 2003) or producing significant outputs of a particular type (Winter, 2003). An interpretation of this definition might be that an operational capability could merely be responsible for a successful commercialization. Based on the

results in this study we would argue that it would be more appropriate to view the ability to integrate technical and customer know-how as an important operational capability than viewing the ability to handle technology and customers as two separate capabilities important for developing and commercializing new products (Danneels and Kleinschmidt, 2001; Dougherty, 1992; Mitchell, 1992; Moorman and Slotegraaf, 1999). Instead of viewing technical and customer know-how with accompanying knowledge-set (Leonard-Barton, 1992) as operational capabilities in a successful commercialization, it is more useful to view these know-how's as necessary ingredients in an integration capability. Our results indicate that it is employment of these two know-how's together that enable the commercialization process toward a "particular end result", in this context a successful commercialization. It would then be the ability to integrate these two know-how's that will be the success factor. We must, however, point out that several authors have emphasized that there must be a link between the previously suggested capabilities in order to develop and commercialize viable products (Danneels, 2002; Cooper, 1993; Dougherty, 1992; Song and Parry, 1997). Our main point is that technical and customer capabilities are not independent operational capabilities for commercializing new products successfully in telecommunication industries.

We propose that the ability to integrate technical and customer know-how will be an important operational capability to commercialize telecommunication products successfully. Characteristic to telecommunication services is technical interdependency between the network infrastructure and the services' functionalities. An *integration capability* would enable the commercialization process by linking vital technical and customer know-how in such a way that the various resources and activities relevant for building and operating technical infrastructure and for developing the product concept, user interface and customer handling, are operated concurrently.

Moreover, a telecommunication product involves several systems, components, and applications, delivered by several actors in some cases, which have to interact or operate in synchrony in order to be considered valuable. In the cases where vital know-how and technology are delivered or provided by external actors, the ability to handle these relationships to secure access to vital resources will be decisive. An *alliance capability* would thus enable the commercialization process by securing access to vital know-how and technology when required. Mitchell and Singh (1996) argued that collaborative relationships, either development- or market-oriented, appear to help firms in the software system industry to acquire needed commercialization capabilities in order to commercialize complex goods.

We would argue that the presented cases in this thesis were more about acquiring know-how and technology than acquiring capabilities. Acquiring capabilities would, besides adding know-how, involve adding routines, systems for using the know-how, which is a much more comprehensive and long-term task.

Linkages

The second research question in this study was in which way linkages between the three operational capabilities will enable the commercialization process. Our findings showed that a strong link between technical and customer know-how enabled the commercialization processes in such a way that the various resources and activities relevant for building and operating technical infrastructure and for developing the product concept, user interface and customer handling, are operated concurrently. In the previous chapter we then concluded that technical and customer know-how can be viewed as necessary “ingredients” that have to be linked and integrated in order to achieve successful telecommunication products. Hence, an integration capability would “replace” the initially proposed technological and customer capabilities in Chapter 2. To our knowledge, it has not been investigated what these linkages comprise or require in the form of routines and systems, although it has been pointed out that there must be a link between technical and customer know-how in order to develop and commercialize viable products (Danneels, 2002; Cooper, 1993; Dougherty, 1992; Song and Parry, 1997). Who knows, inside the firm, which technical and customer know-how the firm has? Does linking require an in-depth understanding of technical and customer know-how, i.e. do they have to be represented cognitively in the same mind or is it sufficient with an awareness of their existence?

The question is then which organizational routines and structure will support linkages and employment of technical and customer know-how, the necessary “ingredients” of an integration capability. Furthermore, which way will linkages between alliance capability and integration capability enable the commercialization process, or, in other words, how does an integration capability act in accordance with an alliance capability?

Vital know-how was represented *in the same mind* in several of the presented cases. Representation of both technical and customer know-how by one person participating in the early standardization activities opened up for “Mobile Originated” messages in the standard, and, hence, was decisive for the origin of SMS. Furthermore, representation of both know-how’s by

the same person responsible for the SMS-platform avoided a platform breakdown in a critical phase of SMS distribution. The researcher from Televerket who participated in the text messages group for standardization, had *acquired* the necessary technical and customer know-how *through experience* with both technical and customer related issues. He had been involved in both basic research in telematics where the potential use was unclear, and applied research where new technology and applications were tested on pilots. From this work, he gained both an in-depth technical know-how which made him capable of assessing what was technically possible, and a customer know-how which gave him an insight into how this might be received by customers, enabling him to assess the potential for business. The person responsible for the SMS-platform during the early distribution phase had a corresponding experience.

In the VoiceMail case, representation of both know-how's by one person was advantageous when the technical subproject leader made the specification of the platform's functionalities and developed VoiceMail's user friendly interface. The project leader and technical sub-project leader in the VoiceMail case both had experience with developing and commercializing an earlier popular pager service. In this project, they had experienced the significance of transferring technical functionalities to customer friendly functionalities. We did not, however, find any indications in the unsuccessful cases that representation of both technical and customer know-how by one and the same person enabled commercialization of IntraWAP and AlphaNumber. In the AlphaNumber case, the various project leaders had a lack of experience with customer related issues; their focus was technical possibilities. A poor user interface perceived as technically complex by users has been mentioned as the main factor why it was not a success. Developing and commercializing IntraWAP required know-how in several fields and the project team lacked parts of the necessary experience. Ericsson possessed vital security mechanisms technology and know-how, while IBM/Lotus Software had both technical and customer know-how relevant to the product concept. It was a challenge to the project team to obtain access to vital technology and know-how and to coordinate the various activities involving external know-how and technology. A limited access to vital know-how possessed by external actors and lack of experience and routines in working with third parties resulted in an incomplete product concept and delays in security mechanisms at a time when IntraWAP was considered and marketed as more or less complete.

A personal motivation and ownership of the new services seem to have been a strong drive in the successful cases. In the VoiceMail case, *employment* of relevant technical and customer know-how, represented by

one and the same person, was supported by a strong *personal ownership* felt by the technical/market subproject leader. He wanted to ensure that VoiceMail would function both technically and in the market place. His ownership to VoiceMail resulted in a *cross-representation* of technical and market related activities; he was responsible both for specification of the platform's functionalities and qualities and for development of the service's user interface where he emphasized the importance of transferring technically advanced functionalities to customer friendly functionalities. The new functionalities became relatively (intuitive to the users) user friendly, enabling adoption of VoiceMail as a service. Moreover, his strong ownership entailed that he trained the sales organization in how to use and communicate these new concepts and he continued to have the technical responsibility for a period after VoiceMail had been launched to verify the platform during operation.

There was a corresponding personal ownership to SMS which had a positive effect on SMS distribution. The person responsible for the SMS platform operated as a product responsible when necessary. SMS was, at that time, not viewed as an isolated product that would give new income, but more as a part of the GSM-service. This was the reason why the market department did not appoint a product leader for SMS. The person responsible for the SMS-platform anticipated that SMS, as a communication service, would distribute to a great extent; an anticipation he held quite by himself. His belief in, and feeling of ownership to, SMS resulted in his estimating a growth curve that was much bigger than what his colleagues had expected. By then, he was on the front edge by increasing the SMS nodes' capacity as the SMS traffic escalated and, thus, avoided a service breakdown during a critical phase of SMS distribution. The leader of the IntraWAP-project was initially very enthusiastic about the service, indicating that he felt a personal ownership to IntraWAP. However, various challenges and delays, changes in focus etc. reduced this enthusiasm over time. We did not find a cross-representation in the AlphaNumber case. Several project leaders were involved, depending on the different phases of the commercialization course.

Developing and upgrading a telecommunication service imply changes in the infrastructure, and the development of infrastructure opens up for new service functionalities. It would, thus, be unnatural "to detach the technique from the service" as the service is "very much characterized in what was technically possible", to quote the combined technical/product manager in the SMS case. Telecommunication services are functionally dependent on the network's infrastructure, whether or not they are network products. That means that telecommunication services will not function when the network

is not functioning. A *cross-representation* in technical and customer related activities gave room for an *individual empowerment* to have an impact on both the infrastructure and the service. In the VoiceMail case, this resulted in a favourable transition from technically advanced functionalities to customer friendly functionalities, while in the SMS case the result was a platform capacity continuously adjusted to growth in SMS traffic.

An advantageous *cross-representation* was not only supported by a feeling of *personal ownership* to the service in question, but also by a shared organizational understanding for the importance of an *end-to-end responsibility* for a service's production line on growth and development. The management team in the new daughter company, Telenor Mobile, wanted to ensure that "the technical side was aware of what went on the market side and vice versa". The team introduced an end-to-end responsibility along the various services' production lines, and a stronger coordination between the various professional areas, in contrast to the organizational form in the mother company, Televerket. Here, the departments reflected various technical systems and professional areas involved in producing a telecommunication service. The control of different vital parts in the service's production line was, hence, placed in different departments. A shared understanding for the significance of *end-to-end responsibility* might increase the acceptance of an *individual employment*, driven by a feeling of strong *personal ownership* to the service and the acceptance of a rapid progress without the need "to look right and left while driving", which could hinder growth and development.

It seems that it was more the feeling of a personal ownership to the service than established routines and management structures that enabled the successful cases. An explanatory factor might be the large technological and business changes the telecommunication industry had gone through previously. Digitalization of the telecommunication infrastructure in the '80s and '90s had opened up for new types of services which could be developed in a relatively short time period (a couple of months), and for new types of actors (Tilson and Lyytinen, 2004). This was in contrast to earlier when the operators had monopoly in the telecommunication services and it could take several years to develop a new service. The established routines and structures for developing new services were seen as old-fashioned which could hinder growth and development in the new technological regime.

Establishing a close link between technical and customer know-how was a challenge in the cases where external actors had the vital know-how and technology. The project team in the IntraWAP case had reduced access to this know-how. Ericsson possessed vital security mechanisms technology

and know-how, while IBM/Lotus Software had important market insight and knowledge about potential corporate customer data systems, their needs and demands. Telenor Mobile had not established any formal relationship with Ericsson beyond the ordinary customer/supplier relationship and Ericsson's technical know-how was not always accessible when required. Telenor Mobile apparently had access to IBM's know-how; IBM participated in the project team, and their joint venture was formalized in an agreement. Nevertheless, commercialization and service operation in joint venture with third parties were not an everyday phenomenon at Telenor Mobil in the '90s. Accordingly, there were no established routines and guidelines for how to work together, the roles and responsibility were not fully clarified and the business models and collaboration incentives were unclear. A limited access to vital know-how and technology and a lack of appropriate agreement for joint venture commercialization resulted in an incomplete product concept and delays in security mechanisms at a time when IntraWAP was considered more or less complete. In the VoiceMail case, we saw that the project team initially was dependent on an external supplier for assistance in repairing the platform. The project team decided, however, that they wanted to have this knowledge in-house and added a collaboration clause in the development contract, requiring participation in development and implementation activities. The VoiceMail's project team, in this manner, acquired technical know-how necessary for repairing and up-grading the platform and, hence, became independent of the platform supplier, which later on appeared to be an advantage. In the beginning of the '90s, there were no clear directives for how to collaborate with external actors possessing know-how and technology vital for commercializing telecommunication products. Their strong feeling of ownership to the VoiceMail service might have been the motivation behind the project team's decision to acquire vital know-how in-house.

We initially asked which organizational routines and structures would support linkages and employment of technical and customer know-how. Our results showed that representation of technical and customer know-how *by one and the same person*, a feeling of *personal ownership* to the service in question, a *cross-representation* and *individual empowerment* in technical and market related activities enabled the commercialization processes in this study. This was further supported by a shared organizational understanding of the importance of an *end-to-end responsibility* in the service's production line and acceptance for a rapid progress without the need "to look right and left while driving". Furthermore, our results showed that a lack of agreements and routines for securing access to vital know-how and technology possessed by external actors, and/or lack of established routines and guidelines for how to share rights, roles and responsibilities in joint

commercialization hindered integration of vital know-how. The ability to handle relationships with external actors possessing know-how and technology vital for the commercialization process is a prerequisite to integrate all necessary know-how.

Network products

The main topic in this study is commercialization of network products in telecommunication. The theory of positive network effect has revealed that commercialization of network products can present difficulties that are specific to these types of products. The strong impact of direct network effects from inter-customer communication accentuates the importance of distribution rate, i.e. a rapid rollout, and reaching critical mass in order for customers to experience value. The question is whether these challenges require particular operational capabilities. We have proposed, based on previous discussions, that the ability to integrate technical and customer know-how is an important qualification to be able to commercialize telecommunication products successfully. Moreover, in the cases where vital know-how and technology are provided by external actors, the ability to handle these relationships to secure access to vital resources will be decisive. The question is then whether these capabilities are important for a rapid rollout and reaching critical mass for network products.

By definition, network effects take place when the benefits to any individual consumer of a product or a system increase with the number of other users. Both SMS and IntraWAP exhibited characteristics giving network effects during distribution, and may by such be characterized as network products. They differ, however, in that SMS became a large success, while IntraWAP was closed down after various upgraded versions and re-launchings. Network product in telecommunication is used for communication between various nodes in a network, i.e. between individuals, organizations and terminals. With few nodes in a network, which means few nodes to communicate with, it is difficult for the individual user to perceive a new network product's relative advantage. Network effects create utility for an individual user of a network product as other users adopt the product (Katz and Shapiro, 1984). Hence, there exists interdependency between the users in valuing a network product as its relative advantage increases for both past and future adopters when new users are participated in the network (Markus, 1987, Thompson, 1967). Users of network products in an early phase of distribution can thus be viewed as users "on trial", meaning that they need time to experience value. Nelson (1970) introduced the concept of "experienced" goods when he made

a distinction between qualities that are not determined prior to purchase, i.e. “experience qualities” and qualities of a brand that the consumer can determine by inspection prior to purchase of the brand, i.e. “search qualities”. An example of the former is purchasing a cake that has to be tasted, i.e. experienced, in order to determine the quality. Wieber (1995) used the same concept “experienced goods” on network products because of the interdependency between the users when valuing the product and that early users, before critical mass is attained, need time to experience value. The distribution phase before turning point, i.e. attainment of critical mass, is thus an unstable phase.

The relative advantage with SMS, which is the degree to which SMS was perceived as better than the idea it superseded (in this case telephony), was evaluated by the users early. Teenagers comprehended that they could communicate much more cheaply by SMS than by making phone calls. Text messaging could also be used in situations where the sender or receiver could not talk, i.e. meetings, concerts etc. Finally, the youth image and the development of a specialized language to overcome the interface limitations gave SMS a cult status. SMS was bundled with GSM subscription and integrated in the mobile handset and the user did not have to make any decisions related to purchasing new hardware or subscription to a new service. Moreover, the SMS interface was relatively simple. Hence, when the users first learnt about SMS, they were able to start using it themselves right away. The threshold for experimentation and learning by doing was thus low and this was an advantage to SMS compared to other mobile services such as WAP. When IntraWAP was introduced to the market it required the majority of customers to buy a new mobile handset supporting WAP-functionality. These mobile phones were in their “early childhood” and the user interface was perceived by many as poor and, hence, the threshold for adopting IntraWAP higher than for that of SMS. Early users of SMS on the whole experienced a stabile service. There was, however, an incident that could have been critical for distribution of SMS. Introduction of free SMS on “Pre-Paid” entailed that the SMS traffic was more than quadrupled in five days and it seems this growth in SMS users triggered an explosive increase of text messages. A service breakdown or prolonged reduced service quality could thus have affected both established and potential customers in their choice of mobile operator in a critical phase of SMS distribution. A prolonged service breakdown was, however, avoided. The person who was responsible for both the SMS platform and SMS as a product had increased the platform capacity in accordance with his own estimated growth curves for SMS traffic. The effect of the unexpected significant growth was therefore limited to a reduced SMS functionality for less than a week only.

Early users of IntraWAP experienced, in contrast to early users of SMS, a high threshold for adopting the service and a prolonged reduced service quality. Potential users of IntraWAP had to buy a new mobile handset that supported WAP-functionality, but had a user interface perceived by many as poor. Furthermore, IntraWAP was launched before the service was commissioned. When the project team realized that there would be delays in commissioning the first version, they decided to promote and launch IntraWAP to pilot customers in order to “exploit a branding effect”. This way they wanted to create expectations and, hopefully, a demand for IntraWAP which, at that time, had no customer support and comprised an immature technology. Although pilot customers were informed that the service concept was not technically and commercially commissioned, and that their role in this respect was to give feedback that contributed to improvements, they would have had expectations connected to the service’s functionality. IntraWAP was also marketed, at the time, as a commercial service, which contributed to pilot customers’ expectations of IntraWAP’s grade of completeness.

Early users of a network product have to experience the relative advantage of the service through an influx of new users. This did not occur in the IntraWAP case. The pilots’ period lasted for a relatively long period of time and there were several repeated promotions where service quality and launching dates were announced but ended in breach of promise. The pilot customers did not experience advantages high enough to persist in an early phase of distribution; they lost their patience and some discontinued using the service. Hence, they did not affect new potential users in adopting the service. Furthermore, the sales corps and potential customers built a gradual mistrust of IntraWAP and, finally, when the service was complete the confidence was lost. Some of the main reasons for delays in the long, drawn out pilot period were (1) reduced access to vital know-how and technology and (2) lack of established routines for sharing rights, roles and responsibilities, implying weak links between vital know-how’s in a critical phase of distribution. In the SMS case, however, a strong link, represented by a cross-representation in technical and market related activities, enabled distribution of SMS by avoiding a service breakdown or prolonged reduced service quality.

A simultaneous, technical interdependency exists between the network infrastructure and the service’s functionalities in telecommunication products. The ability to integrate vital technical and customer know-how and to secure access to these resources when provided by external actors is important to commercialize telecommunication products successfully.

Telecommunication products without characteristics giving network effects during distribution are valuable to the single user when they are launched. VoiceMail and AlphaNumber had an intrinsic value but did not increase in value for the individual user when other individuals started using their own VoiceMail or personal AlphaNumber. Securing access to and integrating vital know-how are therefore important until completion, ideally before launching, of these products.

Telecommunication products exhibiting characteristics giving network effects during distribution, i.e. network products are of no value to the single user when introduced to the market, but increase in value as the number of other users' increases. Our results indicate that for network products know-how and technology must be accessible and integrated until turning point is reached, where enough individuals have adopted the network product so that the further rate of adoption becomes self-sustaining (Rogers, 2003). Hence, network products are not completely commercialized until turning point is reached, a point where diffusion is going from an unstable to a stable phase. At turning point, the general perceptions of the new service change from a view that "sees novelty" to "one that sees necessity" (Allan, 1998). These results support the view that integration capability and alliance capability, in the cases where vital know-how and technology are provided by external actors, will be important capabilities for commercializing network products.

Dynamic capabilities

The progress in a commercialization process may vary, not only due to different product construction, but also because challenges and opportunities related to market and technology change. Product development and the appurtenant commercialization process in a changing business environment therefore require both exploitation of existing competences and exploration of new ones. The capability to innovate and commercialize network products in a changing market, hence, has to co-evolve over time to match emerging opportunities (Teece et al., 1997; Dougherty, 1992). In other words, to be vital and viable in a changing environment the operational capabilities needed to commercialize network products successfully have to absorb new erudition. This ability to learn through exploration and add the new competence to current stock is called dynamic capability (Helfat and Peteraf, 2003; Winter, 2003) or second-order capability (Zollo and Winter, 2002; Danneels, 2002). A dynamic capability may, in this situation, be defined as mechanisms that facilitate transfer and storage of knowledge learned through the commercialization process. The question is: what kind of knowledge, organizational mechanisms and structures facilitate transfer and storage of

knowledge learned through commercialization? In other words, what is the nature of a capability to add new competence to current stock? Our fourth research question was then: how do dynamic capabilities enable the operational capabilities to evolve to match the changing environment?

We have showed that the ability to integrate technical and customer know-how is important when commercializing telecommunication products, whereupon there is interdependency between the network infrastructure and the service's functionalities. An integration capability enables the commercialization process by linking vital technical and customer know-how in such a way that the various resources and activities relevant for building and operating technical infrastructure and for developing the product concept, user interface and customer handling, are operated in coherence. Danneels (2002) argued that technical and customer know-how constitute two learning dimensions along which products may be new to the firm. A new product may draw on existing technological know-how or on technological know-how that is new to the firm. In the same way, a new product may draw on customer know-how that the firm already has or it may require a new type of customer know-how. Hence, both technologies and customers are firm competences that can be leveraged, which involve drawing on an existing competence while using it as a stepping-stone to build a new competence. Leveraging technology competence implies appealing to additional customers through developing products based on an already achieved technological competence. Leveraging customer competence involves building additional technological competences to appeal to a greater share of existing customers' needs.

SMS, IntraWAP, VoiceMail and AlphaNumber were commercialized during a time period characterized by large changes in telecommunication industries. Digitalization of the telecommunication infrastructure in the '80s and '90s had opened up for new types of services, new types of actors and business models (Tilson and Lyytinen, 2004). These changes implied new technological and market related challenges and opportunities. Development of the services presented in this study was driven by the latest development in technology and some of the services applied to new customer segments. Parts of the technical and customer know-how necessary for commercializing these services were new to the firm. Vital parts of the SMS infrastructure were based on new technology, meaning that it had not been in commercial operation before (e.g. data channel in the GSM-network). The SMS service applied to established customers, but it was a new customer segment that adopted the service first: teenagers. The technology behind IntraWAP was both new and immature (e.g. security mechanisms, user interface on terminals) and parts of the

required customer know-how were new to Telenor Mobile. They needed both information about the potential corporate customer to develop new pricing and sales strategies as well as information about the companies' intranet system in order to adjust the rest of the components in the service's production line. Both VoiceMail and AlphaNumber were based on new technology, but these services applied to established customer segments.

Henderson and Cockburn (1994) have proposed that the skill of the firm to combine and recombine both existing and new customer and technological competences could be thought of as its integrative capability. The integration capability discussed in *this* study is proposed to be decisive to the specific service in question. Using people with experience from both technical and customer related activities in research and development projects, in commercialization projects where they are cross-represented in technical and customer activities, seems to have facilitated transfer of vital know-how which enabled the commercial process. Transfer of knowledge acquired from earlier work and transfer of customer related know-how to infrastructure work and vice versa occurred in both the SMS and the VoiceMail case. The person responsible for operating the SMS-platform had experience with development and operation of data networks. His cross-representation in technical and customer related activities meant that platform capacity continuously corresponded with the increasing text messages traffic and this way avoided a service breakdown. The technical/market sub-project leader in the VoiceMail case had relevant experience from developing and distributing a very popular electronic device used to contact people via a paging network, which was useful when defining new market related concepts to VoiceMail functionalities. He was also, as his title indicates, cross-represented in technical and market activities during commercializing VoiceMail. The technically focused project leaders in the AlphaNumber case had no experience with commercialization activities or testing new developments with pilot customers. Moreover, they did not use relevant customer know-how until a short time before launching, resulting in a poor user interface and high threshold for adopting the service.

Transferring new know-how from customer related activities to technically related issues and vice versa, gave dynamics that were advantageous in a short term perspective. In other words, it had a positive effect on the specific commercialization process. A dynamic capability modifying operational capabilities vital for commercialization to match environmental change has earlier been defined as mechanisms that facilitate transfer and storage of knowledge learned through the commercialization process. If the capability to integrate technical and customer know-how

facilitates transfer of vital know-how, the question is what mechanisms are responsible for storing or incorporating the newly acquired knowledge into the firm.

The focal point of this study was the commercialization process per se. We have thus not observed mechanisms facilitating storage of knowledge that was employed favorably in a subsequent commercialization project. However, we question whether it is adequate to look for more or less rigid routines and structures supporting storing of knowledge when technology underlying telecommunication infrastructure is continuously developing, resulting in new business models and market possibilities. Eisenhardt and Martin (2002) distinguished between fast-changing and moderately dynamic markets and provide evidence that dynamic capabilities consist of less structured and less complex routines in a high-velocity market. Teece et al. (1997) refer to the capacity to renew competence so as to achieve congruence with the changing business environment in their definition of the term “dynamic” in dynamic capabilities. Danneels (2002) argues that the “dynamics” is the ability to identify, evaluate and incorporate new technological and/or customer competences into the firm. We did not find any indications in our data on independent dynamic capabilities (Helfat and Peteraf, 2003; Winter, 2003) or second order capabilities (Danneels, 2002) enabling the operational capabilities to co-evolve, or to build new operational capabilities to match a changing business environment. We do propose, however, that a firm’s capability to integrate technical and customer know-how, a prerequisite to commercialize network products successfully, is the mechanism by which firms integrate and recombine and shed resources, and, hence, keep an intrinsic dynamic nature. The dynamic nature important for the operational capabilities to co-evolve with a changing environment is thus a part of the integration capabilities.

9. Conclusion, implications and future research

The main question in this research is whether it would require specific operational capabilities to commercialize network products in telecommunication industries. Our results showed that integration of technical and customer know-how enabled the commercialization processes. Integration of vital technical and customer know-how implied that the various resources and activities relevant for building and operating technical infrastructure and for developing the product concept, user interface and customer handling, were operated in coherence. An important consequence was a user friendly interface that enabled distribution of the successful services. Representation of technical and customer know-how by one and the same person, a feeling of personal ownership to the service in question, a cross-representation and individual empowerment of technical and market related activities supported integration of vital technical and customer know-how. A shared organizational understanding of the importance of both an end-to-end responsibility in the service's production line and of a rapid progress without the need "to look right and left while driving" implied an acceptance of individual empowerment across organizational structures. Furthermore, our results showed that in the cases where vital know-how and technology were delivered or provided by external actors, the ability to handle these relationships to secure access to vital resources was decisive. Lack of agreements and routines for securing access to vital resources, as well as lack of established routines and guidelines for how to share rights, roles and responsibilities in joint commercialization, hindered integration of vital know-how. The ability to handle relationships with external actors possessing know-how and technology vital for the commercialization process is a prerequisite to integrate all necessary know-how.

Based on these results we propose that the firm's capability to integrate technical and customer know-how is crucial to be able to commercialize telecommunication products successfully. In those cases where necessary know-how and technology are possessed by external actors, the capability to integrate external technology and know-how into the commercialization project will also be decisive. To separate these capabilities and to emphasize that the former has an internal focus and the latter an external focus, we denote these capabilities *INTERNAL INTEGRATION CAPABILITY* and *EXTERNAL INTEGRATION CAPABILITY*, respectively. The dynamic nature important for the operational capabilities to co-evolve with a

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changing environment is an intrinsic part of the integration capabilities. Table 2 and 3 below summarizes the results, cause and effect, and restrictive and promotional factors.

Table 2: Internal integration capability, its cause and effect together with restrictive and promotional factors

INTERNAL INTEGRATION CAPABILITY			
CAUSE	EFFECT	RESTRICTIVE FACTORS	PROMOTIONAL FACTORS
Representation of technical and customer know-how by one and the same person Personal ownership to the service in question Cross-representation in technical and market related activities Individual empowerment of technical and market related activities	Close link between system technical and product responsibility Technical infrastructure and product concept operated in coherence User friendly interface enabling distribution Rapid progress in the commercialization process Stable service during distribution	Organizational boundaries	Shared organizational understanding of the importance of an end-to-end responsibility in the service's production line Organizational acceptance of individual empowerment across organizational structures

Table 3: External integration capability, its cause and effect together with restrictive and promotional factors

EXTERNAL INTEGRATION CAPABILITY			
CAUSE	EFFECT	RESTRICTIVE FACTORS	PROMOTIONAL FACTORS
Agreements, guidelines and/or routines for sharing rights, roles and responsibilities in joint commercialization	Access to vital external resources Incentive business models for involved parties	Lack of experience with joint commercialization Immature technology	External project participation

Furthermore, our results showed that for the network products where value increased as the number of other users increased, it was advantageous that vital technical and customer know-how were accessible, and integrated, until turning point was reached. At this point, enough individuals have adopted the network product so that the further rate of adoption becomes self-sustaining. Hence, network products are not completely commercialized until turning point is reached. Based on these results, we propose that both internal and external integration capabilities are necessary to reach a large number of users; a critical factor for network products.

Empirical based conceptual model

In Chapter 2, we sketched out a literature based conceptual model (see figure 6 on page 35) proposing three operational capabilities important for commercializing network products successfully. These were (1) technological, (2) customer and (3) alliance capabilities. Together with linking mechanisms these capabilities would enable the firm to introduce and commercialize network products. However, the empirical data of this study have shown us that it is not appropriate to view these proposed capabilities as independent capabilities for commercializing network products. It is more about the capability to integrate technical and customer

know-how and the capability to integrate necessary external know-how in the commercialization project that will be decisive for the firm to commercialize network products successfully. The empirical based model (see figure 9) is reflecting our results and illustrates that for network products, where it is important to reach a large number of users for the customer to experience an enduring service value, an *INTERNAL* and *EXTERNAL INTEGRATION CAPABILITY* will be decisive to commercialize a network product successfully. The conceptual model illustrates that these two capabilities must be involved in the commercialization process until turning point is reached, where enough individuals have adopted the network product so that the further rate of adoption becomes self-sustaining. Successfully commercialized network products are thus the dependent variable in this conceptual model, while the firm's capability to integrate technical know-how with commercial know-how, and the capability to integrate external know-how in the commercial process are independent variables.

OPERATIONAL CAPABILITIES FOR COMMERCIALIZING NETWORK PRODUCTS

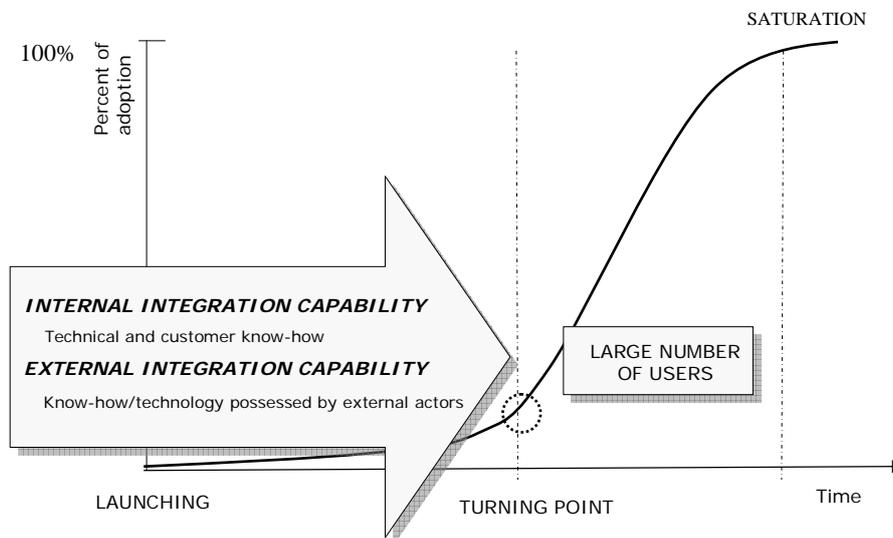


Figure 10. Conceptual model based on empirical data in this study

Both *INTERNAL* and *EXTERNAL INTEGRATION CAPABILITIES* deals with the firm's ability to integrate know-how and technology vital for the commercialization result. Integration of technical and customer know-how is vital because they represent two important disciplines having impact on the product's infrastructure and interface, which have a mutual influence. However, these two specialized fields are usually practised by various specialists and often organized in various units. The *INTERNAL INTEGRATION CAPABILITY* is therefore a question about managing internal barriers as organizational structure and/or managerial attitudes, while *EXTERNAL INTEGRATION CAPABILITIES* are more about managing external barriers, i.e. getting access to vital know-how and technology across firm's borderline. They are, however, connected in the way that they may involve each other, e.g. *EXTERNAL INTEGRATION CAPABILITIES* involves both getting access to the necessary know-how and technology and to integrate this into the project.

Both *INTERNAL* and *EXTERNAL INTEGRATION CAPABILITIES* are important for commercializing successfully both those products having characteristic giving network effects during distribution, i.e. network products, and those without these characteristics. However, as the conceptual model visualize, for the network product is it important that these capabilities are active until turning point is reached. Being active means that systems and routines supporting integration of vital know-how, as for example a project structure, must be present.

Dynamic capabilities, which were proposed in the theoretical based conceptual model to be important for the operational capabilities to co-evolve with a changing environment, is not visualized in the empirical based model (see figure 8). The reason for this is that the results from this study indicate that the dynamic nature important for the operational capabilities to co-evolve with a changing environment is an intrinsic part of the integration capabilities. Hence, the dynamic nature is embedded in the integration capabilities.

Managerial implications

Telecommunication services are characterized by a technical interdependency between network infrastructure and the service's functionalities. This interdependency means that telecommunication services will not function when the network is not functioning. Furthermore, technological development of the infrastructure opens up for new service functionalities, while introduction of new functionalities requires changes in

the infrastructure. The conclusion from this work is that the firm's capability to successfully commercialize telecommunication services is closely connected to the firm's capability to integrate technical and customer know-how and the capability to integrate external technology and know-how in those cases where necessary resources are possessed by external actors. Representation of technical and customer know-how by one and the same person, a feeling of personal ownership to the service in question, a cross-representation and individual empowerment of technical and market related activities supported integration of vital technical and customer know-how. It was thus advantageous to view and treat all components and system in the service's production lines as a whole. Then, a shared organizational understanding of the importance of an end-to-end responsibility in the service's production line implied an acceptance of individual empowerment across organizational structures. Hence, activities involving development of product concept and user interface in telecommunication services must be seen in close context with the activities involving development and adjustment of components and system in the underlying network structure. Managerial implications would be to arrange for a close co-operation and co-ordination between relevant technical and customer know-how, through a contentious responsibility and authority across the service's production line.

Moreover, our results showed that in the cases where vital know-how and technology were delivered or provided by external actors, the ability to handle these relationships to secure access to vital resources was decisive. Lack of agreements and routines for securing access to vital resources, as well as lack of established routines and guidelines for how to share rights, roles and responsibilities in joint commercialization, hindered integration of vital know-how. The ability to handle relationships with external actors possessing know-how and technology vital for the commercialization process is prerequisite to integrate all necessary know-how. Hence, managerial implications would be to secure access to knowledge and technology through written co-operation agreements/contracts and to establish routines and structures supporting integration of these vital resources in the commercialization project.

Those telecommunication services categorized as a networking service, i.e. network products, have an additionally quality making them of little value to the first individual who acquire them and more valuable as the number of other users' increases. The value of a network product exhibiting direct network effects lies thus in the connection among users. Our results showed that for the network products it was advantageous that vital technical and customer know-how were accessible, and integrated, until turning point

was reached. At this point, where diffusion is going from an unstable to stable phase, have enough individuals adopted the network product so that the further rate of adoption becomes self-sustaining. Reaching a large number of users, i.e. a critical mass, is then a critical factor for network products. Hence, network products are not completely commercialized until turning point is reached. The managerial implication would be securing access to vital resources in a critical phase of distribution by upholding the project organization until critical mass in users has been attained.

Theoretical implications

An operational capability has been defined to be the ability of an organization to utilize organizational resources for the purpose of achieving a particular end result (Helfat and Peteraf, 2003) or producing significant outputs of a particular type (Winter, 2003). In our context “a particular end result” means a successful commercialization. Handling relevant technology underlying the firm’s major products and handling its customers and markets are indicated by several authors to be vital operational capabilities in a successful commercialization (Danneels and Kleinschmidt, 2001; Dougherty, 1992; Mitchell, 1992; Moorman and Slotegraaf, 1999). Hence, an interpretation of the abovementioned definition into the context of commercialization would be that these two capabilities, i.e. technological capability and customer capability, are two separated capabilities important for developing and commercializing new products. With other words, that either a technological or a customer capability could merely be responsible for a successful commercialization. The empirical findings presented in this thesis illustrate how employment of technical and customer know-how’s together enable the commercialization process toward a “particular end result”, in this context a successful commercialization. Hence, the empirical findings suggests that it would be more appropriate to view the ability to integrate technical and customer know-how as an important operational capability for developing and commercializing new products. Future studies should with benefit focus more on the ability to integrate necessary know-how for various tasks than focusing on acquirement and employment of either technical or customer know-how.

Moreover, our empirical findings indicate that a firm’s capability to integrate technical and customer know-how is also the mechanism by which firms integrate and recombine and shed resources, and, hence, keep an intrinsic dynamic nature. The dynamic nature important for the operational capabilities to co-evolve with a changing environment is thus a part of the integration capabilities. Instead of searching for independent or superior

dynamic capabilities (Helfat and Peteraf, 2003; Winter, 2003, Danneels, 2002) enabling the operational capabilities to co-evolve with changing business environments, research should focus on the intrinsic dynamic nature of various integration mechanisms.

Last but not least, for network products the empirical findings illustrate the importance of securing access to vital know-how and technology until critical mass is attained. The implications of these findings would be to categories products and services, based on various characteristics, when studying the firm's operational capabilities to successfully commercial their products and services.

Limitations and future research

The empirical findings in this current study have some limitations. The dependent variable in this study was network products successfully commercialized. The independent variables were at the outset the firm's technical, customer and alliance capabilities, while the results indicate that the firm's capability to integrate technical know-how with commercial know-how, and the capability to integrate external know-how in the commercial process are the independent variables. An experiment possesses internal validity if the observed changes in the dependent variable are caused by manipulation of the independent variable. A shortcoming of case studies, however, is the inability to test cause-and-effect relationships due to lack of experimental control. Nevertheless, we have provided valuable insight through rich detail cases. Future research should then carry further the new insight by using more rigorous methods to test the proposed relationships in the empirical based conceptual model.

External validity threats arise when the researchers draw incorrect inferences from the sample data/results to other settings and context than the observed data and cases. The qualitative approach involving a small set of cases have limits as regards generalization to a wider and more diverse population. The current research has focused on commercialization processes in a particular research context, which means commercialization cases in one Norwegian telecommunication company. This limits the results relevancy for this kind of product and industry, and cannot unconditionally be transferred to other markets and products types, as they may require other types of capabilities. A limitation with regard to generalization outside the telecommunication industry calls for future additional research investigating the empirical based conceptual model outside the industry.

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Appendix

Interviews

Telecommunication products in general	
Interviewee's position in Telenor/Involved in:	Interview Date
Research Director Telenor	14.06.05
Managing Director - Telenor Mobile	03.11.05
Market Manager - 3G products	08.02.05
Product Development Processes	08.08.05
Mobile Business Development	29.07.05
Researcher	28.04.05
SMS	
Interviewee's position in Telenor/Involved in:	Interview Date
Senior Researcher	16.11.05
Product Manager (I)	08.08.05 15.11.05
Technical/Product Manager	10.08.05 14.11.05
Product Manager (II)	10.08.05
Product Manager - Telenor Mobile	18.08.05 06.06.06

IntraWAP	
Interviewee's position in Telenor/Involved in:	Interview Date
Project Manager	17.08.05 19.09.05
Project participant	29.09.05
Project participant - Sale and distribution	21.09.05
Project participant - Market	23.09.05
Project participant - Product Manager after launching	29.09.05
Project participant - Market	22.09.05
Project participant - from Lotus	09.12.05
Project participant	16.06.05
Project participant - Technical	04.10.05
VoiceMail	
Interviewee's position in Telenor/Involved in:	Interview Date
Project Manager	17.11.05
Project participant - Technical	14.11.05
Marketing	28.07.05
Product Manager (I)	16.11.05
Product Manager (II)	05.08.05
Product Manager (Nordic)	02.08.05

AlphaNumber	
Interviewee's position in Telenor/Involved in:	Interview Date
Managing Director - Telenor Private	18.11.05
Project Manager (I)	02.11.05
Project participant - Technical	05.08.05 02.11.05
Marketing	21.09.05
Project Manager (II)	03.10.05 13.11.05
Steering Committee	11.11.05
Business Development	16.06.05

Telenor documents

Type and Title	Produced	Relevant for:
R&D Magazine - "Vision of the future"	01.1999	Telecommunication products in general
Internal evaluation report - "Evaluation of innovation initiative in Telenor 2000-2003"	Q1/2003	Telecommunication products in general
Project report - "Extended access to Intranet"	2003	IntraWAP
Market survey - "Expectations to 3G"	2003	Telecommunication products in general
Scientific Document - "Communication need in a 3G perspective"	2004	Telecommunication products in general
Scientific Document - "Digital content distribution"	2004	Telecommunication products in general
Presentation - "3G from Telenor Mobile"	2007	IntraWAP and SMS
Telenor Magazine "Telelektronikk" - "The history of mobile communications in Norway"	1995	SMS
Reports from Project Meetings	2000/2001	IntraWAP
Telenor Magazine "Telelektronikk" - "SMS, The Strange duckling of GSM"	2004	SMS
Presentation - "The Concept of Universal Personal Telecommunication"	1998	Alpha Number
Reports from Project Meetings	1994	AlphaNumber

