Modes of governance of new service development for mobile networks.

A life cycle perspective

Jan van den Ende

ERIM REPORT SERIES *RESEARCH IN MANAGEMENT*	
ERIM Report Series reference number	ERS-2002-94-ORG
Publication	October 2002
Number of pages	39
Email address corresponding author	j.ende@fbk.eur.nl
Address	Erasmus Research Institute of Management (ERIM) Rotterdam School of Management / Faculteit Bedrijfskunde Erasmus Universiteit Rotterdam P.O.Box 1738 3000 DR Rotterdam, The Netherlands Phone: +31 10 408 1182 Fax: +31 10 408 9640 Email: info@erim.eur.nl Internet: www.erim.eur.nl

Bibliographic data and classifications of all the ERIM reports are also available on the ERIM website: www.erim.eur.nl

ERASMUS RESEARCH INSTITUTE OF MANAGEMENT

REPORT SERIES

RESEARCH IN MANAGEMENT

BIBLIOGRAPHIC DATA AND CLASSIFICATIONS		
Abstract	This paper focuses on governance modes for service development of mobile telephone networks (GSM, WAP, GPRS, UMTS). 'Services' refer to services embodying a specific content. The paper shows that the phase of the life cycle of the network and the service affects the choice of governance mode of new service development projects. Governance modes include internal development by the telecom operator, several forms of collaboration between telecom operator and service firm, and only providing a network by the telecom operator to the service firm, which then develops and provides its services (external). In this paper a model is developed for the governance mode of service development in different phases of the life cycles of the mobile network and service, based on the degrees of uncertainty and urgency involved in the network and service development processes. Four cases are presented of service development projects for mobile telecom networks. These cases indicate that the number of redesigns and the level of communication costs in collaboration projects indeed depend on the degree of urgency and uncertainty involved in these projects, which are in turn affected by the life cycle of the network and service.	
Library of Congress Classification (LCC)	5001-6182	Business
	5546-5548.6	Office Organization and Management
	HD 30.28	Strategic management
Journal of Economic Literature (JEL)	M	Business Administration and Business Economics
	M 10	Business Administration: general
	L 2	Firm Objectives, Organization and Behaviour
	L 1	Firm strategy
European Business Schools Library Group (EBSLG)	85 A	Business General
	100B	Organization Theory (general)
	240 B	Information Systems Management
	270	Strategic management
Gemeenschappelijke Onderwerpsontsluiting (GOO)		
Classification GOO	85.00	Bedrijfskunde, Organisatiekunde: algemeen
	85.05	Management organisatie: algemeen
	85.08	Organisatiesociologie, organisatiepsychologie
	85.10	Strategisch beleid
Keywords GOO	Bedrijfskunde / Bedrijfseconomie	
	Organisatieleer, informatietechnologie, prestatiebeoordeling	
	Samenwerking, bedrijfsbeleid, productontwikkeling, diensten, productlevenscyclus, mobiele communicatie	
Free keywords	Collaboration for service development, mobile networks, product and service life cycles.	

Modes of governance of new service development for mobile networks. A life cycle perspective

Jan van den Ende

Address:
Rotterdam School of Management, F2-67
P.O. Box 1738
3000 DR Rotterdam
the Netherlands.
Tel. 31-10-4082299.
fax 31-10-4089014.
J.Ende@fbk.eur.nl

Acknowledgements
The author acknowledges Jan Zonjee, Bas Reimers and Wouter Hoff for their research on the case-studies. He thanks the representatives of the organizations participating in the case-studies for their cooperation, and Wilfred Dolfsma, Floortje Blindenbach-Driessen and three anonymous referees for their stimulating and helpful comments on earlier drafts of this article.

Modes of governance of new service development for mobile networks. A life cycle perspective

Abstract

This paper focuses on governance modes for service development of mobile telephone networks (GSM, WAP, GPRS, UMTS). 'Services' refer to services embodying a specific content. The paper shows that the phase of the life cycle of the network and the service affects the choice of governance mode of new service development projects. Governance modes include internal development by the telecom operator, several forms of collaboration between telecom operator and service firm, and only providing a network by the telecom operator to the service firm, which then develops and provides its services (external). In this paper a model is developed for the governance mode of service development in different phases of the life cycles of the mobile network and service, based on the degrees of uncertainty and urgency involved in the network and service development processes. Four cases are presented of service development projects for mobile telecom networks. These cases indicate that the number of redesigns and the level of communication costs in collaboration projects indeed depend on the degree of urgency and uncertainty involved in these projects, which are in turn affected by the life cycle of the network and service.

Key-words: collaboration for service development, mobile networks, product and service life cycles.

Introduction

Services embodying content are indispensable for the success of mobile telecommunication networks. Examples of such services are route planners and location based restaurant guides. Services for mobile networks are not just modifications of existing Internet services since the value of the use of mobile phones for the customer often depends on the availability of services and their characteristics, such as reference to the present location of the customer. Moreover, the format of the display of the mobile phones does not allow for displaying complete Internet pages. Thus, development work of new, dedicated services is needed.

In many cases it is not attractive for telecom operators to develop these services themselves. They often do not possess the content required, and many telecom operators are short of cash as a consequence of large investments in UMTS licenses. Recently, many authors have stressed the benefits of outsourcing innovation in general, facilitated by the increased benefits of IT (Hagel III and Singer, 1999; Quinn, 2000). On the other hand, outsourcing to independent service firms may create transaction costs for the telecom operator and service firm, particularly under high uncertainty and frequent changes of product design and target application (Bruce, 1995; Robertson and Langlois, 1995). Moreover service firms may not be willing to take risks under high uncertainty.

In this paper, I advance the view that the most appropriate mode of governance of the service development process depends on the maturity of the network and the maturity of the service. Governance modes include internal development by the telecom operator, several forms of collaboration between telecom operator and service firm, and just providing a network by the telecom operator to the service firm, which then develops and provides its services (external). The ‘network’ refers not only to the physical communication infrastructure, but also to the software infrastructure that facilitates the provision of services on the network. Below, I will argue that for an assessment of the maturity of the network the degree to which a dominant type of use exists is also important.

In the paper, based on the literature, I first discuss the degrees of uncertainty and urgency in network and service development related to the network and service life cycles. This leads to a model to infer the most appropriate mode of governance of service development. Four cases are presented of service development projects for mobile tele-

com networks. The cases have been selected to represent each of the four different situations distinguished in the model. In the discussion and conclusion I reflect on the appropriateness of the model and its practical implications.

Uncertainty and urgency in product and service development

Uncertainty during the product and service life cycles:

The form of cooperation between telecom operator and service firm can be viewed from a resource based or transaction cost perspective (Nooteboom, 1999b, pp. 8-20). The resource based perspective emphasizes the importance of cooperation alliances to complement internal competencies and for learning purposes (Doz and Hamel, 1997). For telecom operators considerations resulting from this perspective underscore the importance of cooperating with outside parties. The transaction cost perspective (Nooteboom, 1999a, 1999b, 2000; Rindfleisch and Heide, 1997; Williamson, 1975, 1985, 1991) is more instrumental in determining the form of cooperation, the object of this paper. Traditionally, transaction cost theory attempts to explain the choice between market and hierarchy, with many intermediate forms between the extremes.[1] For a transaction costs perspective it is important that, depending on the maturity of the market, innovation increases uncertainty, which may stimulate the choice for internal development or more integrated forms of cooperation. We can distinguish technological and market uncertainty as a consequence of innovation (Kamien and Schwartz, 1982, pp. 109 ff). Technological uncertainty relates to the technical problems, to the technological knowledge that has to be generated, and to adaptations that have to be made in the development trajectory of the new product or service. Market uncertainty refers to the behavior of competitors and customers and for instance to substitutes that may appear. As a consequence of technological and market uncertainty design changes may have to be made in the course of the development process, which require communication between the parties involved in joint development processes. Dependent on the mode of governance that is applied, uncertainty thus creates transaction costs, such as the costs of negotiation and contracting (Coase, 1996).

The product life cycle model (Abernathy, 1978; Abernathy and Utterback, 1979; Utterback, 1994) is relevant to assess the level of uncertainty involved in new service development. The model was initially developed for products, not for services. The model

distinguishes three phases of maturity of a new product: fluid, transitional and specific (Utterback, 1994). In this model the dominant design separates the first, fluid phase from the transitional and specific phases. The dominant design is considered to be the result of choices of producers and/or customers. The dominant design has a technical aspect, relating to the dominant configuration of elements of the product or service, and a functional aspect, relating to the dominant preferences of users with regard to product features (Cusumano et al., 1992, p. 56). In the transitional phase, the basis of competition changes from product features to quality and cost of the product, and the orientation of firms changes from product innovation to process innovation. In the third, mature, phase the market stabilizes and competition focuses on differentiated products or services for specific market niches. It is clear that the level of uncertainty varies during the product life cycle, from high uncertainty on technology and market in the first fluid phase, decreasing rapidly during the transitional phase.

This model can be applied to both telecom networks and new services. In this article telecom networks include physical networks, such as GPRS, but also protocols, such as WAP (Wireless Application Protocol, a mobile phone system with a facility to display information from Internet or other sources. WAP can be transmitted by GSM or other physical network), since these have the same dynamics. Telecom networks can be considered to form new products in the sense of the life cycle model. Additionally, when telecom authorities have agreed on a 'de jure' standard for the transmission system (Funk and Methe, 2001), de facto a number of technical choices, e.g. software standards, standards for the interfaces between network and services, and the technical specifications of the handsets and billing systems, still have to be made. The technical alignment that is required between the design of the telecom hardware and software and the service software creates a high technological uncertainty in the fluid phase of the network. In the course of time, telecom firms develop standards to which services have to conform, which are often incorporated in so-called platforms. Such a platform provides the communication between service application and the mobile network, including the different types of handsets of customers. These platforms offer service providers easy access to the telecom network. By offering its services on a platform, a service provider does not yet have to bother about changing software standards; the service provider only has to adapt the

service to the specifications required by the platform, and the network or platform owner organizes the interface with other technical devices, particularly with the telecom network and handsets. These platforms can thus be considered to be part of the dominant design of the network. Moreover, the dominant character of the services that will be offered on the network, and the most important user preferences, can be considered part of the dominant design. These two features are uncertain in the early phase of a network. As a consequence of technological and market uncertainty, in the early fluid phase of a network several adaptations of the service may be required before it successfully matches technical and market requirements. Sometimes market requirements will only become clear in repeated market experiments (Lynn et al., 1996).

The life cycle model can also be applied to the services offered on the network. Barras (1986, 1990) has developed a 'reverse product cycle' for services, referring to the development of services in sectors, such as the banking sector, in reaction to the introduction of a new technology, starting with just the efficient replacement of existing services and leading later on to the development of completely new services. This dynamics has been noted by others for technology sectors (Van den Ende and Kemp, 1999, 834). Here I refer to the life cycle of single services, not to the development of services in sectors as a whole. The maturity of a service on mobile networks can be defined on the basis of its similarity to existing services that are distributed by other channels, with respect to their features and target customers. A new service on a mobile network can be considered in the fluid phase of the life cycle if it offers such new features to users that it creates a new market. Many location-based services are in this category, because they could not be offered through other channels before. For a service in the fluid phase a search process will take place concerning the type of use and preferred features by users. A new service can be considered in the transitional or mature phase in the life cycle if it is a close copy of existing services offered by other channels. An example of this may be an electronic telephone book offered on a mobile network. The service may have no additional features to existing telephone directories except for the fact that it can be reached independent of the location of the customer. In this case we do not expect to find the search process concerning the use and features of the new service.

The degree of uncertainty involved in service creation for mobile telecom networks depends on the phase in both the product and service life cycles. Technological and market uncertainty are high in the fluid phase of the mobile network, because the dominant design of the network has not yet been established and because the target customer and the target uses are still uncertain. The degree of uncertainty is considerably lower in the specific and mature phases of the telecom network. In these phases information is available on the standards applied in the network, on the size of the potential market and on the type and preferences of the customer. The same counts for new services. If a new service is developed that resembles existing services closely, and which we thus consider to be in the transitional or mature phase of the life cycle, knowledge is available on market demand, also if the service is offered on a new network. Scale effects in offering services on different networks often reduce the risks involved, decreasing uncertainty even more.

Urgency in product and service development:

The life cycle perspective highlights another important consideration affecting the choice of mode of governance in service development for mobile networks: the need to offer unique and attractive products (in this case products and services) in the fluid phase of the life cycle of the network to acquire an installed based of customers (Shapiro and Varian, 1999), to acquire the dominant design and to appropriate returns from the investments in product and service development. Teece (1986) has demonstrated the importance of complementary assets as a means to appropriate returns from innovations. The services provided on a telecommunications network can be considered complementary assets (to be more specific: related products) in the sense of Teece. Since in the early phase of the telecom network the telecom operator needs to acquire an installed base rapidly, the timely delivery of these complementary assets will often be critical.

Lambe and Spekman (1997) have introduced the concept of urgency referring to the need for the innovator to develop products in a timely manner to acquire the dominant design. This also applies to the service firm developing a completely new service. The service must be offered in time to generate an early installed base. As a consequence the service firm may feel a high degree of urgency when it wants to bring a new service on

the market. The considerations on uncertainty and urgency during the product and service life cycles are reflected in figure 1. For both network and service the transitional and specific phases have been taken together, since these two phases are relatively close to each other in levels of uncertainty and urgency.

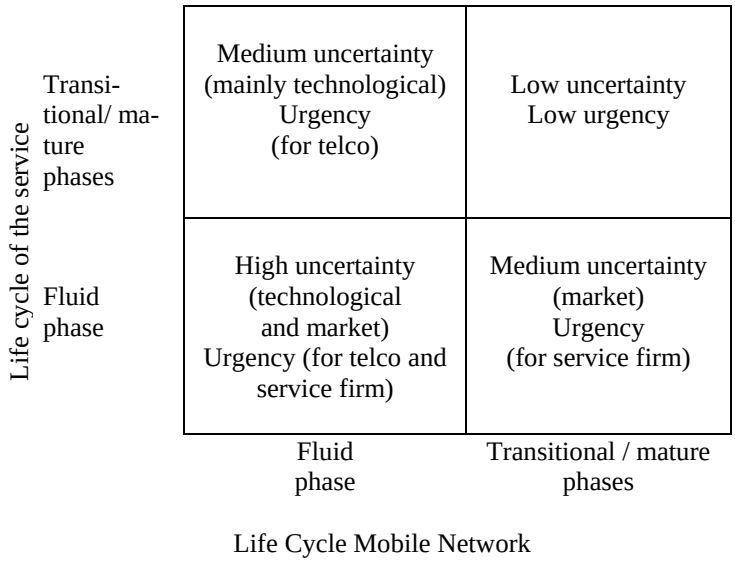

Figure 1:. Uncertainty and urgency during the phases of the life cycles of mobile telecom networks and services ('telco' refers to 'telecom operator').

Governance modes

Many authors have discussed governance modes for innovation with different degrees of integration in the firm. According to them the choice between these modes depends on the degree of product and process change involved (Wheelwright and Clark, 1992), the degree of change in the market (Christensen, 1997), familiarity of the firm with technology and market (Roberts, 1980; Roberts and Berry, 1985) and strategic importance of the innovation to the firm (Burgelman, Maidique and Wheelwright, 1996). The situation of service development for mobile networks is different from the single product development situation discussed by these authors since two dependent products (a product and a service) are involved. Others have discussed the governance modes for the acquisition of complementary assets required for an innovation, and the implications of the product life cycle model for the choice of governance modes (Gemser et al. 1996; Lambe and Spekman, 1997; Teece, 1986). As mentioned above, services can be considered complementary assets for the development of the network. According to Robertson and Langlois (1995) the most appropriate mode of governance for the acquisition of complementary assets depends on the type and the degree of novelty involved in the innovation. These authors consider vertical integration most appropriate for very novel innovations of the so-called 'strategic' and systemic types (Robertson and Langlois, 1995, pp. 553-555). Nooteboom (2000) emphasizes the advantages of cooperation and contracting between different firms for the development of a radical innovation, although he also considers close relationships most appropriate when much of the knowledge involved is tacit (Nooteboom, 2000, p. 931).

The development of services for mobile networks differs from the acquisition of complementary assets for an innovation since two dependent life cycles are involved. Both the network and the service have their own life cycle causing their own levels of uncertainty and urgency, which affect the appropriate governance mode of service development. As has been mentioned above, uncertainty implies that design changes and high intensity of communication are required, which stimulate more integrated modes of governance during the innovation process. In the case that the mobile network is well established, the telecom operator can just offer the network to service firms to offer their services to customers and a disintegrated mode of governance may be most appropriate.

Not only does the level of uncertainty affect the governance mode, the degree of urgency is also of influence (Lambe and Spekman, 1997). If the telecom operator is in a situation of high urgency, and depends on service providers to get the network adopted, he will have to be certain of the speed of the service development process and the quality of the service delivered. If the service provider feels a high level of urgency to get its service adopted, he will also have to be certain of the reliable provision of the network by the telecom operator. In general, the distribution of decision rights (Nooteboom, 1999b, p. 67) can best be proportional to the degree of urgency felt by the two parties. The party with the highest decision rights will consequently also take the highest risks.

These considerations can be translated into the model in figure 2. The two basic parameters are the phase of development of the network and service. The governance modes involved are internal, collaboration with different degrees of intensity and division of risks, and external. Service firms do not only refer to pure service providers, but also include suppliers of telecommunication equipment who enter the services market. The appropriateness of the governance modes is mainly judged from the perspective of efficiency to deal with redesigns and with the intensity of communication required, and from the perspective of fit with the degree of urgency felt by the two partners. In the upper right hand quartile (1) innovation is incremental. The dominant design of the network has been established, both in a technological sense as well as with respect to user expectations concerning applications and features. The service has demonstrated to be successful on other networks and the service firm will generally be an established firm. Technological and market are uncertainty low. The position of the two parties is identical in the sense that none of them will feel a high level of urgency. A low number of redesigns and a low intensity of communication are expected. A situation in which the telecom operator offers the network to the service firm seems most appropriate, particularly for reasons of efficiency. The risks can be left to the service firm, or, if it concerns a larger application, the risk can be shared between the telecom operator and the service firm. (2) In the lower right hand quartile technological uncertainty is low, and market uncertainty can be classified as medium: it is low for the network, since the market for the network is known, but it is high for the service. The urgency is low for the telecom operator, but high for the service firm. In this case, design changes will be required to match the features of the

service to the market, but the intensity of communication can be low since these design changes do not require communication between the telecom operator and service firm. A mode of government in which the telecom operator does not participate and leaves the risks to the service firm seems most appropriate. (3) In the upper left quartile technological uncertainty is high. The interface between service and network (the above mentioned software infrastructure of the network) still has to be developed. Market uncertainty can again be classified as medium, but this time because it is high as far as the network is concerned, and low as far as the customer requirements with respect to the service are concerned, since the service has demonstrated to be successful on other networks. Urgency will be high for the telecom operator, and low for the service firm. Redesigns of the service may be required because of new insights resulting from the development of the software of the network, and because of uncertainty on the target customers of the network. In this case a high intensity of communication between telecom operator and service firm is required, particularly to cope with design changes, and a high involvement of the telecom operator in terms of decision rights and risk taking. Since in this quartile the development of the service itself is a limited task, and large part of the design work concerns the interface between the service and the network. A governance mode involving a division of tasks between the telecom operator and the service firm seems most appropriate, in which the service firm only develops the content of the new service and the telecom operator develops the network and the interface between network and service. Since this means that the telecom operator does the larger part of the design work, he also takes the largest part of the risks involved. (4) And finally, in the lower left quartile, in which the innovation is most radical, the uncertainty and urgency are highest. Redesigns have to be expected, and a high intensity of communication is required. Internal development by the telecom operator or mode of governance in which a separate project organization is created by the telecom operator and the service firm seems most appropriate. In both cases the telecom operator will be responsible for the development of the software infrastructure, and thus takes the largest part of the risks involved (or all risks in case of internal development). The model involves an increasing degree of intensity of cooperation from the lower right quartile (2, most extensive), via upper right (1) and upper left (3), to the lower left quartile (4, most intensive).

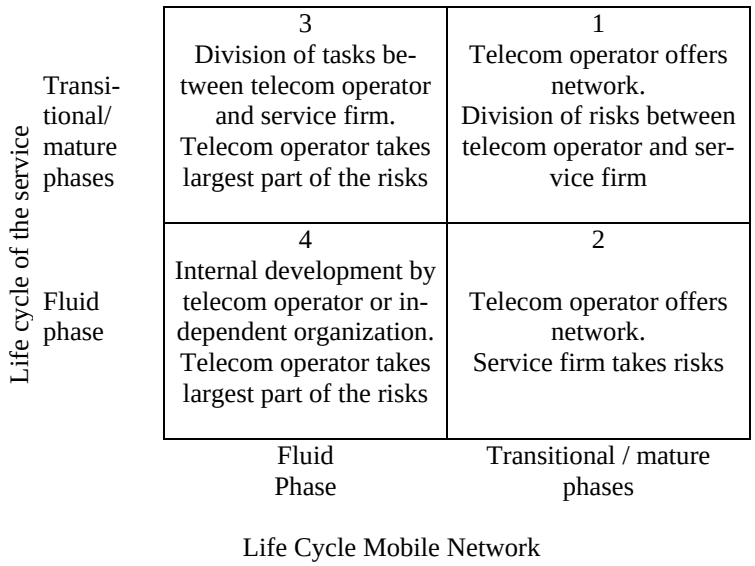

Figure 2: Model of the governance modes of service development for mobile telecom networks.

Four Cases

Methodology:

In what follows, four cases are presented of service development projects for mobile networks, one for each quadrant in the model. They aim to illustrate the relationships between the concepts in practice. Since the initial propositions involved in the model are compared with the findings from the cases, the cases be characterized as 'explanatory' in terms of Yin (1994, pp. 110-111. See also Eisenhardt, 1989).

For each case study, four sets of variables and their relations are assessed (figure 3). Firstly, the life cycle of the network and service is determined based on the criteria mentioned before. For the network these include the degree to which the type of users and the dominant type of use have become clear and the degree of standardization of interfaces with services. For the service this depends on the degree of similarity with existing services, and, consequently, the degree that the target user group and the dominant type of use have become clear. Secondly, for each case the degree of uncertainty and urgency are assessed. The technological uncertainty depends on the availability of informa-

tion on the software infrastructure and interfaces. The market uncertainty depends on information on the target customers and their requirements. The degree of urgency depends on the need felt by the parties to develop the service within a short time-to-market, for the purpose to acquire an early installed base. Thirdly, the number of redesigns and their reasons (market or technology factors) and the required intensity of the communication are investigated for each case. And fourthly, the mode of governance is determined, including the division of the decision rights, and the opinions of the participants on its appropriateness. The appropriateness depends on the degree that the governance mode has facilitated the required redesigns and intensity of communication in an efficient way, and the degree that the division of decision rights and risks conforms to the degrees of urgency felt by the parties involved. For each case I evaluate the extent that these four sets of variables are related and confirm the hypothesized relations behind the model.

In the data collection procedure first five cases were selected from the popular press. Product documentation was collected and an interview was held with a project manager. Based on this information three cases appeared to concern content services (and not just a platform development or the development of a new channel). These three cases appeared to cover three of the four quartiles. An additional case was sought for the last quartile (1). For all cases additional interviews with project managers and participants of the projects were held. To increase the quality of the case studies (Yin, 1994, pp. 144-145), the main informants reviewed the draft case reports. Corrections on the actual facts were made, if necessary by collecting additional information.

In the description of the cases in the next section we again start with the case for the upper right hand quartile of the network (1), via lower right (2) and upper left quartile (3), to the lower left quartile (4) (see figure 4). The text on each case starts with a short description of the network, the service and the firm. This is followed by a description of the development process of the service. Next the variables from the model are discussed, in the same order as they were mentioned above. Finally the relationships between the variables are discussed and the variables are compared to the model.

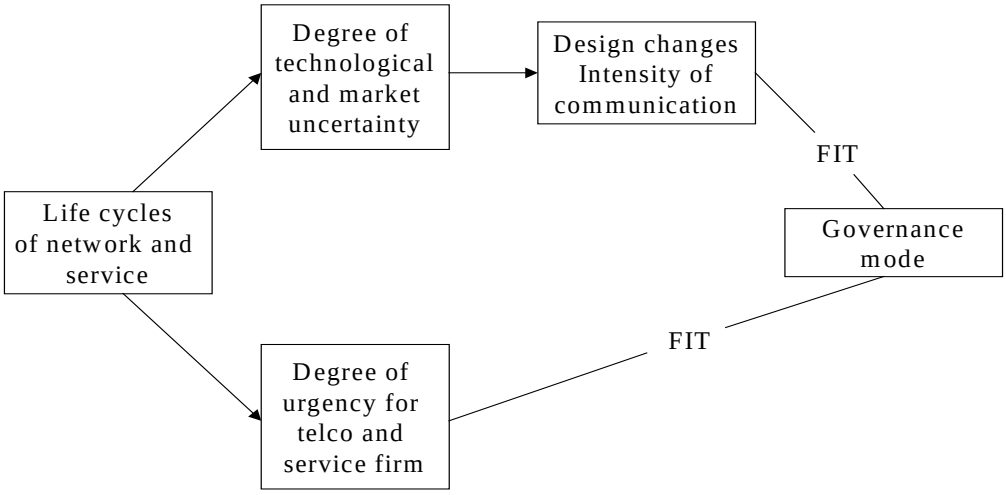

Figure 3: The conceptual framework.

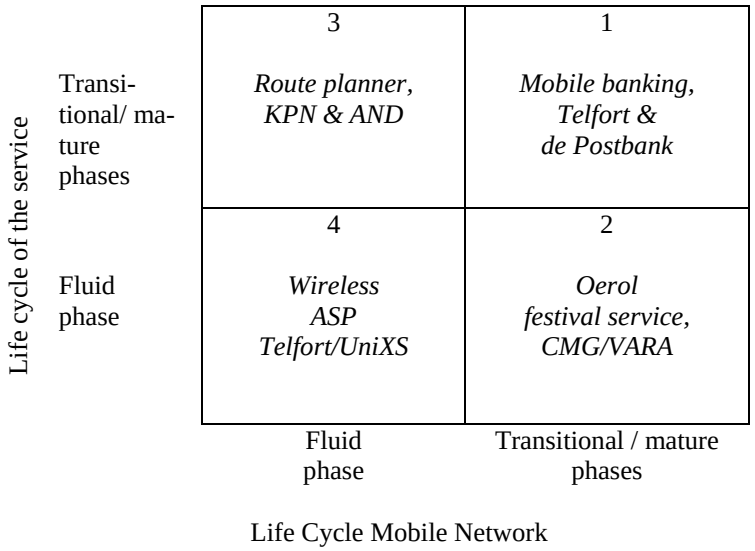

Figure 4: The position in the life cycle of the four cases.

1. The Mobile Banking project *(Specific/mature network, specific/mature service)*[2]
Near the end of 2000 the Postbank NV and Telfort started a project to offer mobile banking services to customers of the bank on a large scale. The Postbank is one of the Netherlands' largest retail banks with more than seven million customers. At that moment more than one million of its customers used the bank's existing Internet banking facilities. Telfort is a medium-sized telecom operator with 920,000 postpaid en prepaid Dutch clients on its GSM network in April 2001. Telfort is wholly owned by MmO2, the former mobile business of British Telecom. The purpose of the Mobile Banking project was to be the first to introduce mobile banking in the Netherlands. The customers were offered a mobile WAP phone at low cost to stimulate adoption of the new service.

For the telecom operator this project offered the possibility to extend its customer base considerably. The project aimed at a maximum of 500,000 customers, which meant that this telecom operator would in one step extend its customer base by more than 50%. For the bank the project provided an opportunity to promote the use of its electronic services by means of a new channel. The bank wanted to offer several basic services on a mobile network: electronic transfers and reproduction of balance. It meant that Telfort was aiming to acquire new customers and the Postbank aimed to deliver its services through a new channel for existing customers. An additional occasional reason was that the bank wanted to provide the phones as the regular summer gift promotion for customers, which required fast delivery. Each user that applied for this service got a mobile phone for free, with a free prepaid budget of 25 guilders (10 dollars) and the only obligation to increase the budget by the same amount within some weeks. Upgrading of the phone credit could be done from the bank account by means of the mobile phone.

The Postbank initiated the project, and found in Telfort its partner. The Postbank was responsible for the development of the Mobile Banking service, which would be offered through the special WAP handsets. Telfort provided the necessary network infrastructure and knowledge of mobile data communication, and Telfort purchased the handsets and the SIM-cards. Genie, the mobile Internet division of MmO2, provided the so-called portal through which the users got access to their account. Genie also provided the platform that formed the connection between the service and the mobile network. Siemens supplied the specially prepared handsets. Customer service was provided by both

Telfort and Postbank, each for its respective part of the services offered to the customer. A separate project organization was formed, located in the city of Baarn. The project organization not only consisted of Telfort and Postbank employees, but also a number of consultants and a number of employees of Genie and Siemens were involved.

The project organization's primary purpose was to overcome technical difficulties. Intensive preparation and communication between Telfort and Postbank was required, for example to connect bank accounts to SIMs, and to offer a secure access to customers. But also communication about packaging, manuals and marketing took place between the Postbank and Telfort, although three separate customer manuals were made for the handsets, the mobile services and the banking services. Technical decisions and decisions on the design of the service were made jointly between them. The bank decided on the functionality, which included the service that was delivered. As far as the design of the service was concerned some specific choices were made. On the SIM-card the Postbank application and encryption was inscribed. For security purposes a type of PKI (Public Key Infrastructure) was used. This software secured the identity of the user and the secrecy of the connection. Users had to identify themselves with a PIN-code for each transaction. The two parties disagreed on the type of payment by the users for the use of the handsets. The bank preferred a prepaid form, since this would reduce potential barriers for users. Telfort preferred a subscription. In the end, the bank got what it wanted, after intervention from top management.

The reaction of the target customers on the offer was very positive. The number of requests exceeded the number of handsets available. First delivery of the handsets started in early July 2001. After three months, 90% of all handsets were delivered, about 80% of the customers had activated the telephone in order to use it. However, only 20% of them had used the mobile banking functionality at that moment, and their number did hardly increase later on.

In terms of our framework, this project fits best in the quartile: transitional/specific network and transitional/specific service. The network, WAP, was already proven technology. Although the network had very few users, it had matured in the sense of its technological infrastructure and its usability (data communication), embodied in the platform of Genie. The service can be characterized as transitional/specific since the bank

already had offered the same electronic banking services for quite some time on the Internet. The bank wanted to create a new channel to its customers for these services, but the services themselves were not new. The technical choices that were made in this project can be considered diversifications within the specifications of the WAP network. The design choices, such as building software into the SIM-chip, would be considered better optimizations of the product design of the mobile phone for a specific type of use, a characteristic of products in the mature phase of the life cycle. In fact it meant that the software infrastructure of the WAP network was adapted for this specific application.

In accordance to our model, technological and market uncertainty appeared to be low. Within the project technical design choices had to be made, but these had no relation to radical changes in technology or market, as is often the case in the fluid phase. There was intense communication in the project, which was neither caused by changes in the technology or market. The market uncertainty was low, since the target users and their requirements were reasonably well known. In accordance with our model, urgency for Telfort was rather low. The fact that Telfort used this application to extend its customer base dramatically did not serve to acquire the dominant design of the network (which would be the case in the fluid phase of a product or network) but was just an attempt to extend its market share through diversification (a characteristic of the mature phase). The Postbank felt a higher sense of urgency than expected. The fact that other Dutch banks were developing mobile banking facilities as well motivated it to press on in its efforts. It wanted to be the first to offer mobile banking services in the Netherlands to its customers. This would not bring additional benefits, since customers will not easily change banks because of the mobile banking applications, but the bank wanted to strengthen its innovative image. The function as summer gift formed an additional reason for the urgency felt. In accordance to the expectations resulting from the model, hardly any redesigns were made in the development project. However, the communication between the two parties was more intense than expected, mainly because of the technical adaptations in the network (particularly in the SIM-card).

The mode of governance in this project agrees with the framework to a limited extent (‘*Telecom operator offers network. Division of risks*’). The two parties collaborated on an equal basis, sharing the risks. The telecom operator offered its network. How-

ever, a separate project organization was formed, which would not be expected in this case. The fact that the Postbank felt a higher urgency than expected and the changes required in the software of the telecom network and in the handsets may explain this situation. According to the Postbank employees involved, they in reality had a lead in the project and Telfort employees did a lot of their work within their own organization, which in fact conforms to the model. Moreover, in retrospect the CEO of the Postbank stated that if he did the project again, he would take a longer time-to-market. Apparently, in retrospect he considered the urgency in the project higher than functional. It means that on the point of urgency and intensity of communication this case differed slightly from the expectations resulting from the model.

2. The 'Oerol'-festival service *(Specific/mature network, fluid service)*[3]

In the first half of 2001 the Dutch public broadcast organization VARA and the software house and consultancy firm CMG developed an SMS service for the visitors of the so-called Oerol festival. This festival is a yearly event which place on a Dutch island; people from all over come together to enjoy theatre, music, cabaret and acrobatics. The service offered the visitors an 'alert service': regular SMS-messages with information on specific activities in the program, changes in the program, surprise acts, etc. Furthermore, the visitors received information on the weather, lodging facilities, special offers by local shops and restaurants; they could participate in a telephone guided bicycle tour with hidden theatre acts on the road (questions had to be correctly answered to get the next route instructions), and other games. Users could also make a SMS mailing list of people to whom they could send a simultaneous SMS message, and they could send requests and questions to DJs of the VARA. 10.000 of the 40.000 visitors to the festival subscribed to the services, which were free except for the cost of the SMS-messages. This number of users was about the target. The initiators developed the service mainly for publicity purposes, and did not aim to have revenues from it. CMG and VARA developed the service and paid the development costs. The telecom operators had the income of the SMS messages, which were paid by the telephone owners. VARA and CMG refrained from the possibility of generating income by charging an extra fee for the SMS messages. In case

they had charged, the Telecom operator had clear tables of rates for the division of those extra fees between themselves and the service providers.

In the development project, first a multi-channel platform (GSM, Internet) was developed (called Mobile2You) which provided access to different telecom operators to support the implementation of new services. This phase took about two months. Next the service itself was designed and built in about four weeks. A third party, the German firm Materna, organized the transmission of the messages between the CMG network and the networks of the telecom operators. Technical changes had to be made in between because it appeared that the connections were not always stable. In the course of the development trajectory hardly any changes were made in the design. The target services were clear, and there was no opportunity to test them. The period of the festival was too short to make changes in applications, except for a hunt that was developed on request of the radio station during the event. However, after the event the software supporting the service was split to modules, parts of which were re-used for a similar application at a trade fair and to support TV-events. It means that a search process involving the target market and the requirements of the customers took place after the Oerol application.

In terms of our model, the Oerol service for SMS is a clear example of a mature network (SMS) and a new, fluid service. The two institutes developed the service in co-operation, whereby VARA was the content owner and CMG the technological expert. Together they formed the 'service firm' from our model.[4] In accordance with the model, technological uncertainty in this case was low. CMG still had to build a platform, but similar platforms already existed and thus the technological uncertainty involved in this design and development of the platform was low. Consequently the platform was built in a short period. The existence of clear tables of rates for the division of income from additional charges for SMS messages also indicates that the network was mature. The market uncertainty has to be rated medium, since the market of the network was established but this type of service did not yet exist in the Netherlands. The urgency of the telecom operator with respect to the development of the service was of course low. The urgency felt by one of the service firms was slightly lower than expected, since this service was not central to the business of the VARA. For CMG the service and its time-to-market were important, since CMG wanted to create a new business based on this type of services.

The market uncertainty resulted in a search process concerning market and customers' preferences. Communication between telco and service firms was, of course, almost nil in this case, as expected in this quartile of the model.

As far as the governance mode is concerned, according to the model in this situation a disintegrated form in which the service firm takes the risks is most appropriate ('*Telecom operator offers network. Service firm takes risks*'). That mode of governance facilitates the frequent design changes that are required as a consequence of market uncertainty, whereas communication with the telecom operator on technical aspects is not required. Indeed, in this case the service firms developed the service on their own, without the involvement of telecom operators, and they also took the risks. Although CMG was not satisfied with the fact that the telecom firms did not remit larger part of the basic revenues of the SMS-traffic, the governance mode can be characterized as appropriate. Or, put another way, if in this situation the telecom operator had been involved, a lot of communication would have been required to facilitate the design changes that resulted from the high level of market uncertainty.

3. The WAP route planner *(Fluid network, mature service)*[5]

The third case involves a product-development project of a route planner for WAP mobile telephones. The service was developed in the period October 1999 – March 2001. The telecom operator involved was the Dutch KPN. The service firm, AND Publishing Co. (pronounce AND as A-N-D), was a producer of route planners on CD ROM and the Internet. The route planner for the WAP telephone was a derivative of existing route planner services for the Internet, running on a new network. For AND the project opened the possibility for future new business on the WAP network. Moreover, the presence of AND and its route planner on WAP could be a stimulus for other firms which would require a route planner as part of their WAP services in the future (for instance a yellow page service on WAP including a route planner) to use the AND route planner for their purposes, since the end customers would already know it. This would create additional revenues in the future in the form of license fees. The product manager responsible for the WAP route planner stressed the importance of the telecom operator for the future success of the WAP route planner: "Its application by this telecom operator in fact means

free advertisement for our product. The supply of our product forms an investment in visibility."

The project was planned and executed as a cooperation project between KPN and AND. KPN was in the build-up phase of its WAP services and took the initiative for the project. KPN invited AND to participate. KPN insisted that AND would take the costs of development itself, which delayed the negotiations. AND would participate in the revenues that the use of the route planner would generate. AND only agreed to develop the service shortly before the WAP network became operational.

The product manager at AND managed the relations with KPN. He developed the product specifications in close interaction with KPN. The required alignment between the design of the route planner and the software for the WAP telephone was an important reason to communicate regularly with the telecom operator. Moreover the telecom operator had experience with, and knowledge of, the requirements of the end customers. A design was chosen that remained very close to other route planners of AND. The customer had to specify the locations of the place of departure and of the destiny, and then the service responded with the shortest route. No use was made of information on the location of the user, since that was not yet technically feasible. During the development trajectory the telecom operator did not ask for changes in the design. In retrospect the Product Manager of AND concludes: 'We chose the right design from the beginning, right the first time'. A change was made some months after the introduction when a zooming function was added, which allowed the user to get more detailed information on a specific part of the road system. Nevertheless, the functional design did not require much communication. Technical issues required more communication, for instance the billing system of the service had to be adapted to the software of both KPN and AND. Moreover a technical problem emerged when it became clear that handsets of different manufacturers all had their own specifications. AND had to make variations of its service for every type of mobile phone.

The project was successful as far as the primary result, a working route planner was developed. However, the WAP network as such was not successful, at least in the short run. Many early adopters conceived WAP as too slow to be interesting. Moreover

the handsets were only produced in low quantities, since manufacturers were at the same time busy producing telephones for the booming GSM network.

In terms of the model presented above the project aimed to develop a service for a network (WAP) that then was still in its fluid phase. The service itself was in fact in its mature phase, since it was a variation of an existing route planner for a new channel. AND did not add important new features, such as automatic reference to the actual location of the user, which might have created new types of use and a new market. Technical uncertainty was high, since information on the software infrastructure was lacking. Market uncertainty with respect to the network was high, resulting from the unpredictability of the use of WAP network, since it was uncertain who would use this telephone and for what types of new services. Market uncertainty with respect to the service itself was low. As far as the degree of urgency is concerned, in accordance to the model KPN clearly felt a high degree of urgency with respect to the timely delivery of the service. However, AND experienced a higher degree of urgency than the model anticipates. For AND the new service was not just a new channel to the customer, but AND expected to create a new business. The number of design changes has to be classified as medium, particularly because of the adaptations to the handsets. In fact also adaptations in the design to the market would be expected, based on the fact that the use of the phones normally is different from expected. Paradoxically, one of the reasons that no larger number of modifications of the design had to be made was the low diffusion of the WAP telephone. The small number of users hardly made demands on the lay out of services either; and if they did, it would not have been worth the investment for the operators to respond by adapting the services. Technological uncertainty did require communication in the project. Particularly the billing system and the standards of the handsets required intensive communication on, and adaptations of, the design of the software of the route planner.

In terms of the model, in this case the governance mode '*Division of tasks. Telecom operator takes largest part of the risks*' would be expected. The telecom operator indeed participated in the design of the service, but the service firm took most of the risks. In retrospect AND does not consider the actual mode of cooperation in this case appropriate. According to this firm, the telecom operator should have taken a larger share of the business risk and should have provided the technical infrastructure to make this

business model successful. This is of course an understandable position, since AND was not prepared to share the risk for further product development alone, which of course induces the opinion to members of this firm that the telecom operator would have had to take a larger part. For the same reasons in retrospect the telecom operator was satisfied with the form of cooperation that was chosen. From an outside point of view it is clear that a larger role of the telecom operator could have created advantages in efficiency, since the telecom operator was the appropriate party to build the billing system and to adapt the service to the manufacture of the handsets. This form of cooperation would have diminished the cost of communication.

In general, the relations between the variables in this case conforms to the model as far as the degrees of uncertainty, the redesigns for technical reasons and the degree of urgency experienced by KPN are concerned. The degree of urgency experienced by AND and the governance mode differed from the model since the telecom operator performed a smaller part of the activities, and took a smaller part of the risks than anticipated by the model. However, the information on the development trajectory supports the view that the mode of governance advanced by the model would possibly have been more appropriate from an efficiency perspective.

4. Wireless ASP *(Fluid network, fluid service)*[6]

In the period May-September 2001 the Dutch telecom operator Telfort and the Dutch firm UniXS Solutions developed a wireless ASP service for Telfort's GPRS network. UniXS was a wireless ASP (Application Service Provider) which offered customers the opportunity to use the GPRS network to provide data and application support to their mobile employees. The customer's application was run on the system of UniXS. One of the first customers of this service was a mental health care organization (*Robert Fleury Stichting*) that used the service for an electronic medical record system. With this system the health care organization provided on line data and application support to its mobile practitioners. The practitioners could retrieve and modify the record of a specific patient at the patient's home or elsewhere, also if he or she visited the patient unprepared (for instance since the patient or others had asked for assistance). The data included, for instance, the prescription of the medication of the patient. With this system the practitioner remained online the whole day. Telfort pro-

vided the GPRS network. UniXS, a start-up firm dedicated to Wireless ASP solutions, built the application, including the software to support the service. For that purpose UniXS developed a platform (based on IBM software) that formed a standard basis for this type of services, and on which the application of a specific customer could be developed. The customer's application (in this case the electronic medical record system) ran on the servers of UniXS, which were connected to the GPRS network. The database itself remained with the customer, but was in contact with the ASP server.

Up to the first pilot, the project took about half a year (May 2001- October 2001). The first idea was to provide the practitioners with a hand-held organizer connected to a GPRS phone by a cable. This idea was abandoned when Ericsson, the supplier of the GPRS phones, offered the possibility to use a BlueTooth connection between the two devices. Compaq supplied the hand-held organizers (iPAQ). UniXS and Telfort organized the communication between all parties involved. Telfort managed the relations with Compaq and Ericsson, UniXS integrated the relations with these parties and managed the relation with the health care organization and with the software vendor of that organization. In October 2001 a test was conducted involving four practitioners, which was received favorable by the health care organization. As a result of the application, the practitioners involved could even visit five patients a day instead of four.

In this phase of the project the three most important parties involved shared the costs of the development of the service: Telfort, UniXS and the health care organization. Both Ericsson and Compaq participated financially in the project by providing respectively the GPRS phones and the organizers. The health care organization paid a fixed fee for the development of the service and for its operation during the test period. UniXS made an upfront investment in the platform, and took the risks in case unanticipated events occurred. The relation between Telfort and UniXS was open in the sense that UniXS had an agreement with Telfort for an exclusive cooperation in the health sector, but in other sectors they could both collaborate with other parties. UniXS and the customer had a more exclusive relation, since changing the customer's application to another platform would require new development activities.

In the second phase, new negotiations started about the financial arrangement between the customer, UniXS and Telfort. In the new arrangement the revenues of the service

were split between the Telfort, for the use of the network, and UniXS, for the Wireless ASP service. A second redesign took place in this phase, since the mobile telephone and the handheld were replaced by a single device (a so-called XDA). In this period, the relation between UniXS and Telfort became tighter: the parties agreed that in the future Telfort would do the marketing of the services, and UniXS in fact became the supplier. Still, both parties invested in this application.

In terms of our model, this application concerns a fluid service for a fluid platform. The service was new, since no similar mobile service had existed for these users up to that point. GPRS as a network was also new at the time; this case even was one of the first GPRS applications in Europe. It has to be noted that the case differs slightly from the general issue of this paper, which refers to content services. In this case two services are developed: (1) UniXS and Telfort offered a channel as a service to the customer, in this case the health care organization, through which it could communicate with its employees. (2) The customer supplied content to its employees.

In spite of this difference, the case is in line with the assumptions from the model regarding the degree of uncertainty, urgency, the number of redesigns and the intensity of communication. Technological and market uncertainty were high. Technological uncertainty was high since platforms for GPRS were not generally available, as was the case for GPRS handsets with integrated computer facilities. Market uncertainty was high since it was yet unclear which type of customers would become dominant for GPRS (e.g. business or private customers) since it was unclear what the dominant type of use would be. Both the telecom operator Telfort and the service firm UniXS clearly felt a high degree of urgency, since both wanted to remain ahead in the market. As a consequence of the high levels of uncertainty, intensive communication between the parties involved was required. Moreover two important redesigns were made up to the moment of this case study and more had to be expected. The high level of uncertainty required repeated negotiations on the alliance.

The model assumes for this case the governance mode: *'Internal development by telecom operator or independent organization. Telecom operator takes largest part of the risks.'* The case does not completely confirm this assumption. Two firms were involved as a supplier (UniXS and Telfort), but although these firms did enter into a tighter collaboration

in the course of time, they did not create a separate project organization. The establishment of such an organization would have made redundant the repeated negotiations on the relation, since it would have been more flexible with respect to design or market changes. Moreover, UniXS as a partner and the health care organization as a first customer took larger parts of the risks involved than follows from the model. Particularly UniXS, in fact, took a high risk; if the Wireless ASP market for business users did not materialize, the investment in the platform would be lost. Financial reasons in the telecom sector, which had invested heavily in UMTS licenses, seem important in the explanation of the difference between this case and the model. In fact, an alternative would have been not to build a platform at all in this phase of the network, and first find out what the dominant users and type of use would be. The character of UniXS as a start-up company may be another factor. Start-ups often make considerable up-front investment and take considerable risk in view of future prospects. They are not used or able to charge every activity to partners.

Discussion

This paper presented a model for the governance modes of service development for mobile networks, based on life cycle considerations and transaction cost theory. A definition of the phases of the life cycle of networks and services was proposed, which involved that not only the basic standard of the network formed the dominant design, but that the software supporting the network (often embodied in a platform) and the type of applications were integral parts of the dominant design. The definition of the maturity of the service was based on its similarities with existing services on other networks, mainly affecting the degree of market uncertainty involved in the service development process. Four case-studies served to explore the usefulness of our definitions of maturity of network and service, and to provide indications for the practical relevance of the model.

The basic premise of the model involved that the life cycle of the network and the service is important for the degrees of uncertainty and urgency involved, which in their turn affect the most appropriate mode of governance. It was also assumed that the development process of the software supporting the network was an important cause of technological uncertainty. This software infrastructure is required to facilitate easy access for service providers and clients, and includes the software for billing, security and other

control tasks of the telecom operator. The cases indeed corroborate the importance of the availability of this software for the development process of new services. The design of this software system depends on, and has to be developed concurrently with, the new services, and thus was not always available beforehand. In the fluid phase of the life cycle of the network we found that this software was developed together with, or after, the new service (in the Route Planner and Wireless ASP cases). In later phases of the life cycle of the network so-called platforms were available, which facilitated the easy provision of services by service developers, and which decreased the required intensity of communication between telecom and service firm on technical issues concerning the network during the development process considerably. In fact these platforms create an interface between network and service provider. They create the possibility for the service firm to provide its service without worrying about the technical specifications of the network on which the client offers the service.[7] Some firms today develop these platforms in a very early stage, before inviting service firms to develop services. This, however, creates the danger that the platform becomes rigid in a too early stage, inhibiting specific adjustments of the services in response to customer feedback.

The influence of the life cycle on the second source of uncertainty, market uncertainty, was also apparent. Market uncertainty concerning the success of the network and the type of target customers existed in the fluid phase of the network in the Route Planner and Wireless ASP cases. In the Route Planner case market uncertainty became evident from the failure of the WAP network as such. In the Wireless ASP case uncertainty clearly was high on the target customer group. Market uncertainty on the preferences of the users was evident in the Wireless ASP and Oerol cases. In the Oerol case market uncertainty resulted in design changes after the Oerol application. In the Wireless ASP such changes still have to be expected when the service will be applied to other customers. In the Mobile Banking case the degree of uncertainty was considerably lower, and hardly any design changes took place.

In the model the life cycle of network and service was assumed to affect the level of urgency involved. This was assumed to be another factor behind the choice of governance mode and the division of risks. In the Wireless ASP and Route Planner cases we found clear evidence of the importance of urgency at the side of the telecom operators,

who had to make respectively the WAP and GPSR network successful. However, contrary to expectations, although its service can hardly be qualified as completely new in terms of our definitions, also the Postbank appeared to feel a high degree of urgency for reasons of reputation associated to m-commerce. In that case the communication between the telecom operator and service firm was also more intense than expected. The required changes in the software of the network form an explanation. Moreover, the communication was only necessary for the once-only development of the service, not for repeated trials as in other cases. In general, we may conclude that also the distribution of the levels of urgency did conform to the assumptions. On the contrary, the forms of governance that were applied did not always agree with the expectations. Particularly in the Route Planner and Wireless ASP cases the service firm took a higher share in the costs and risks than expected. The fact that both service firms were start-ups, for which prospects in general are of course the primary source for their existence, may have been of influence. Moreover, in the Wireless ASP case not separate project organization was formed, as expected.

The model has practical value for telecom firms and service firms developing new mobile services. An interesting aspect in practical applications concerns the transition between the four different situations (the quartiles). A service firm that changes from developing completely new services to developing extensions of mature services for new networks has to adapt its mode of cooperation with the telecom firm, but in an incremental way. This is different for a telecom firm that sees its network mature and that cooperates with service firms developing completely new services (the lower half of the model, moving from left to right). The model suggests that such a firm has to change its mode of cooperation drastically, from establishing separate project organizations and taking large part of the risks, to leaving the activities and the risks with the service firm. Of course, only awareness and flexibility of the managers of both the telecom operator and the service firm can bring about such transitions.

Finally, it has to be mentioned that in the research leading to this paper finding a case of a really new service in the early fluid phase of the network (thus for the quartile ‘fluid network, fluid service’) appeared to be the most difficult. Several telecom operators appear to choose a low risk strategy when they start a new network by first copying existing services from other networks. Only after the customers have adopted the network do

they introduce completely new services. The financial pressure resulting from the high licensing fees that governments in several countries have charged for new mobile networks stimulates this behavior. Elsewhere it has been emphasized that government policy that 'accelerates' the life cycle, for instance by stimulating economies of scale, may be detrimental for the long term innovative capabilities of firms (Van den Ende, Wijnberg and Meijer, 2001). The question is if in this case the licensing policy has such an accelerating effect. It might mean that firms at the moment do not explore really innovative applications in the first fluid phase of the life cycle of a new network. If also a platform is already built in this first phase, they may severely limit the possibilities for really innovative services on the network in the future.

Conclusion

In this paper a framework was developed for the choice of mode of governance for the development of new services for mobile networks, based on life cycle perspective and on transaction cost theory. The innovation involved an example of a systemic innovation, since network and service are intricately connected. A definition of the life cycle of mobile services was developed based on the differences between that service and existing services offered by other channels, including an extension of the concept of dominant design of the network to the software infrastructure and to its dominant types of use.

The basic assumption of the paper involved that outsourcing innovation needs not always be the most appropriate form in such cases because of rising transaction costs under high uncertainty and because there is no unequivocal division of interests between the partners, which hinders the division of risks. Transaction costs resulting from varying degrees of uncertainty and urgency during the life cycle were assumed to be the dominant factor behind the choice of governance mode. Four case studies (Mobile Banking, Oerol Festival Service, Route Planner, Wireless ASP) corroborated the usefulness of the definitions and provided indications that the factors in the model indeed were important in the choice of governance mode. Uncertainty was reflected in redesigns and the required intensity of communication; the degree of urgency affected the optimal division of risks. The mode of governance has to facilitate the redesigns and the division of risks in a way that transactions costs were minimal. Some differences between the proposed govern-

ment modes and the cases appeared, particularly in the Route Planner and Wireless ASP cases (fluid network). However, in both cases there are reasons why the governance mode advanced by the model may be a serious alternative. The model seems to be useful for the management of firms involved in service development for mobile telecom networks. It is an aid in the choice of an appropriate governance mode, but also for the effective management of the service development process itself.

Notes

[1] Asset specific investments, frequency of transactions and uncertainty involved in the transactions are considered important factors in the choice of governance mode (Williamson, 1975, 1985, 1991).

[2] This case study is based on interviews and email communication with Eric Gimbergh, Telfort launch manager in the M-banking project (31.05.01), on an interview with Marc van den Held, consultant and program manager in the M-banking project on behalf of Telfort (28.05.01), and communication with several Postbank employees involved in the project. Furthermore project documentation was used.

[3] For this case study several interviews were held with Edgar Borst, Consultant Business Development at CMG, and with Erik Homoet, Manager Business Development at CMG, in the period August-October 2001. Borst and Homoet were responsible for the Oerol project at CMG. Furthermore, Gerco Grandia, system developer at CMG, was interviewed in September 2001 and use was made of several documents on the project, including project evaluations.

[4] The fact that two firms together formed the service firm in this case does not make much difference for our analysis, since we focus on the relation between the telecom operator and the service firm, including transaction costs made in the relation between the two parties, and not on the relation between different firms involved in service development.

[5] The information on this case was derived from two personal interviews with René Mijs, Product Manager route planners at AND International Publishers and responsible for the WAP route planner project, on March 31, 2000, and on August 23, 2001, on a telephone interview with Jeroen Kaandorp, responsible for this project at KPN Mobile, on October 1, 2001, and from several written and telephone conversations with René Mijs and with Jasper Brouwer, Product Manager for flight data and services at AND Publishers.

[6] For this case study interviews were held with Roy Schutt, Manger Business Development and Partnerships of Telfort (16.10.01) and with Evert A.J.F. Kroll, COO and CTO of UniXS (20.11.01).

[7] The importance of such interfaces also appears from other observations in the mobile telecom industry. XML as a language provides an interface between telecom operator and service provider, to be able to create a division of tasks between telecom operator and service firm in which the burden of the technical software infrastructure is kept away from the service firm.

References

Abernathy, W.J., 1978. *The Productivity Dilemma*, Baltimore/London, John Hopkins University Press.

Abernathy, W.J. & Utterback, J.M., 1979. 'Dynamics of Innovation in Industry', in Hill, C.T. & Utterback, J.M. (eds.) *Technological Innovation for a Dynamic Economy*, Oxford, Pergamon.

Barras, R., 1986. 'Towards a theory of innovation in services', *Research Policy* 15, 161-173.

Barras, R., 1990. 'Interactive innovation in financial and business services. The vanguard of the service revolution', *Research Policy* 19, 215-237.

Bruce, M., 1995. Complexities of collaborative product development. *Technovation* 15(9), 535-552.

Burgelman, R.A.; Maidique, M.A.; and Wheelwright, S.C., 1996. Designing and Managing Systems for Corporate Innovation. In: Burgelman, R.A.; Maidique, M.A.; and Wheelwright, S.C. (eds.), *Strategic Management of Technology and Innovation*. Boston, MA: Irwin, 493-507.

Christensen, C.M., 1997. *The Innovator's Dilemma*. Cambridge, MA: Harvard Business School Press.

Coase, R.H., 1996. The Nature of the Firm. In: *Firms, Organizations and Contracts. A Reader in Industrial Organization*. Buckley, Peter J. and Michie, Jonathan (eds.), Oxford: Oxford University Press pp. 40-58.

Cusumano, M.A., Mylonadis, Y., and Rosenbloom, R.S., 1992. Strategic Maneuvering and Mass-Market Dynamics: The Triumph of VHS over Beta, *Business History Review* 66 (Spring), 51-94. Also in: Tushman, M.L., and Anderson, Ph. (1997), *Managing Strategic Innovation and Change*, New York: Oxford U.P., 75-98.

Doz, Y., and Hamel, G., 1997. The Use of Alliances in Implementing Technology Strategies. In: Tushman, M.L., and Anderson, Ph. (1997), *Managing Strategic Innovation and Change*, New York: Oxford U.P., 556-580.

Eisenhardt, K.M., 1989. Building Theoriies from Case Study Research. *Academy of Management Review* 14(4), 532-550.

Funk, J.L., and Methe, D.T., 2001. Market- and committee-based mechanisms in the creation and diffusion of global industry standards: the case of mobile communication, *Research Policy* 30, 589-610.

Gemser, G., Leenders, M.A.A.M., and Wijnberg, N.M., 1996. The Dynamics of Inter-firm Networks in the Course of the Industry Life Cycle: The Role of Appropriability, *Technology Analysis and Strategic Management* 8(4), 439-453.

Hagel III, J. and Singer, M., 1999. Unbundling the Corporation, *Harvard Business Review* 77, pp. 133-141.

Kamien, M.I., and Schwartz, N.L., 1982. Market structure and innovation. Cambridge, Cambridge U.P.

Lambe, C.J. and Spekman, R.E., 1997. 'Alliances, External Technology Acquisition, and Discontinuous Technological Change'. *Journal of Product Innovation Management* 14, 102-116.

Lynn, Gary S., Morone, J.G. and Paulson, A.S., 1996. 'Marketing and Discontinuous Innovation. The Probe and Learn Process', *California Management Review*, 38(3), 8-37. Also in: Tushman, M.L., and Anderson, Ph., (eds.), *Managing Strategic Innovation and Change*, New York, Oxford University Press, pp. 353-375.

Nooteboom, B., 1999a. Innovation and inter-firm linkages: new implications for policy. *Research Policy* 28, 793-805.

Nooteboom, B., 1999b. *Inter-firm Alliances*. London and New York: Routledge.

Nooteboom, B., 2000. Institutions and Forms of Co-ordination in Innovation Systems. *Organization Studies* 21(5), 915-939.

Quinn, J.B., 2000. Outsourcing Innovation: The New Engine of Growth. *Sloan Management Review* 41(4), 13-28.

Rindfleisch, A., and Heide, J.B., 1997. Transaction Cost Analysis: Past, Present, and Future Applications. *Journal of Marketing* 61(October), 30-54.

Roberts, E.B., 1980. New Ventures for Corporate Growth. *Harvard Business Review* 58(4), 134-142.

Roberts, E.B., and Berry, C.A., 1985. Entering New Businesses: Selecting Strategies for Success. *Sloan Management Review* 26(3), 3-17.

Robertson, P.L., and Langlois, R.N., 1995. Innovation, networks, and vertical integration. *Research Policy* 24, 543-562.

Teece, D.J., 1986. 'Profiting from Technological Innovation. Implications for Integration, Collaboration and Public Policy', *Research Policy* 15, pp. 285-305.

Shapiro, C., and Varian, H.R., 1999. *Information Rules. A Strategic Guide to the Network Economy*. Boston, MA: Harvard Business School Press.

Utterback, J.M., 1994. *Mastering the Dynamics of Innovation*, Boston: Harvard Business School Press.

Van den Ende, J., and Kemp, R., 1999. 'Technological transformations in history: how the computer regime grew out of existing computing regimes', *Research Policy* 28, 833-851.

Van den Ende, J., Wijnberg, N., and Meijer, A., 2001. 'Public Policy and Innovative Capabilities. The Case of Philips' IT Activities', *Technology Analysis and Strategic Management* 13(3), 389-405.

Wheelwright, S.C., and Clark, K.B., 1992. *Revolutionizing Product Development*. New York: The Free Press.

Williamson, O.E., 1975. *Markets and Hierarchies. Analysis and Antitrust Implications*, New York: The Free Press.

Williamson, O.E., 1985. *The Economic Institutions of Capitalism*, New York: The Free Press.

Williamson, O.E., 1991. Comparative Economic Organization: The Analysis of Discrete Structural Alternatives. *Administrative Science Quarterly* 36, 269-296.

Yin, R.K., 1994. *Case Study Research*. Thousand Oaks (CA): Sage Publications.

Publications in the ERIM Report Series Research* in Management

ERIM Research Program: "Organizing for Performance"

2002

Trust and Formal Control in Interorganizational Relationships
Rosalinde Klein Woolthuis, Bas Hillebrand & Bart Nooteboom
ERS-2002-13-ORG

Entrepreneurship in China: institutions, organisational idendity and survival. Empirical results from two provinces.
Barbara Krug & Hans Hendrischke
ERS-2002-14-ORG

Managing Interactions between Technological and Stylistic Innovation in the Media Industries. Insights from the Introduction of eBook Technology in the Publishing Industry
Tanja S. Schweizer
ERS-2002-16-ORG

Investment Appraisal Process in the Banking & Finance Industry
Mehari Mekonnen Akalu & Rodney Turner
ERS-2002-17-ORG

A Balanced Theory of Sourcing, Collaboration and Networks
Bart Nooteboom
ERS-2002-24-ORG

Governance and Competence: How can they be combined?
Bart Nooteboom
ERS-2002-25-ORG

ISO 9000 series certification over time: What have we learnt?
Ton van der Wiele & Alan Brown
ERS-2002-30-ORG

Measures of Pleasures: Cross-Cultural Studies and the European Integration
Slawomir Magala
ERS-2002-32-ORG

Adding Shareholders Value through Project Performance Measurement, Monitoring & Control: A critical review
Mehari Mekonnen Akalu & Rodney Turner
ERS-2002-38-ORG

Web based organizing and the management of human resources
Jaap Paauwe, Rolf Visser & Roger Williams
ERS-2002-39-ORG

---

* A complete overview of the ERIM Report Series Research in Management: http://www.ers.erim.eur.nl

ERIM Research Programs:
LIS Business Processes, Logistics and Information Systems
ORG Organizing for Performance
MKT Marketing
F&A Finance and Accounting
STR Strategy and Entrepreneurship

Challenging (Strategic) Human Resource Management Theory: Integration of Resource-based Approaches and New Institutionalism
Jaap Paauwe & Paul Boselie
ERS-2002-40-ORG

Human Resource Management, Institutionalisation and Organisational Performance: a Comparison of Hospitals, Hotels and Local Government
Paul Boselie, Jaap Paauwe & Ray Richardson
ERS-2002-41-ORG

The added value of corporate brands: when do organizational associations affect product evaluations?
Guido Berens, Cees B.M. van Riel & Gerrit H. van Bruggen
ERS-2002-43-ORG

High Performance Work Systems: "Research on Research" and the Stability of Factors over Time
Paul Boselie & Ton van der Wiele
ERS-2002-44-ORG

Diversification and Corporate Governance
George W. Hendrikse & Aswin A..C..J. Van Oijen
ERS-2002-48-ORG

Governance Structure, Product Diversification, and Performance
Aswin A. Van Oijen & George W. Hendrikse
ERS-2002-51-ORG

Global Sourcing: Fad or Fact?
Michael J. Mol, Rob J.M. van Tulder, Paul R. Beije
ERS-2002-55-ORG

Internationalization Of Management Buyouts: Firm Strategies And Venture Capitalist Contribution
Mike Wright, Andy Lockett, Paul Westhead, Hans Bruining
ERS-2002-58-ORG

The Importance Of Customer Satisfaction In Organisational Transformation: A Case Of A Dutch Temporary Employment Agency
Martijn Hesselink, Ton van der Wiele and Paul Boselie
ERS-2002-60-ORG

A Study On The Applicability Of SERVQUAL Dimensions For Web Sites
Jos van Iwaarden, Ton van der Wiele
ERS-2002-61-ORG

Entrepreneurial Orientation In Management Buy-Outs And The Contribution Of Venture Capital
Hans Bruining and Mike Wright
ERS-2002-67-ORG

The odd role of proximity in knowledge relations - High-tech in The Netherlands
Gerben van der Panne, Wilfred Dolfsma
ERS-2002-75-ORG

Organizing as Improvisations (Methodological Temptations of Social Constructivism)
S. Magala
ERS-2002-76-ORG

Best Practice in Company Standardisation
Florens J.C. Slob, Henk J. de Vries
ERS-2002-81-ORG

Standardisation education
Henk J. de Vries
ERS-2002-82-ORG

Elective Identities
(Culture, Identization And Integration)
Slawomir J. Magala
ERS-2002-92-ORG

Technology Push, Demand Pull And The Shaping Of Technological Paradigms - Patterns In The Development Of Computing Technology
Jan van den Ende & Wilfred Dolfsma
ERS-2002-93-ORG

Modes of governance of new service development for mobile networks. A life cycle perspective
Jan van den Ende
ERS-2002-94-ORG

The Development Of Mutual Trust In British Workplaces Through 'Partnership': Conceptualisations, Definitions And Experiences.
Graham Dietz
ERS-2002-97-ORG

Why Do European Venture Capital Companies Syndicate?
Sophie Manigart, Andy Lockett, Miguel Meuleman, Mike Wright, Hans Landström, Hans Bruining, Philippe Desbrières, Ulrich Hommel
ERS-2002-98-ORG