Governance Modes For Systemic Innovation. Service Development In Mobile Telecommunications

J. van den Ende and F. Jaspers

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GOVERNANCE MODES FOR SYSTEMIC INNOVATION. SERVICE DEVELOPMENT IN MOBILE TELECOMMUNICATIONS

Jan **VAN DEN ENDE**
Ferdinand **JASPERS**
Rotterdam School of Management, F2-67
Erasmus University Rotterdam
P.O. Box 1738,
3000 DR Rotterdam
The Netherlands
31-10-4082299
J.Ende@fbk.eur.nl
F.Jaspers@fbk.eur.nl

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GOVERNANCE MODES FOR SYSTEMIC INNOVATION.
SERVICE DEVELOPMENT IN MOBILE TELECOMMUNICATIONS

ABSTRACT

This paper focuses on governance modes for systemic innovation projects. The central question is: to what extent does the newness of a system and its components affect the most appropriate governance mode for component development projects? Component development projects can be performed by either the system developer, the component developer or by some combination of these parties in a collaborative governance mode. This paper presents a model to determine the most appropriate governance mode for component development depending on the newness of the system and the component. We include in our model considerations of both appropriation and integration of knowledge. We tested the model on thirty new service development projects for mobile telecommunications systems. The study shows support for the claim that misfit between the modeled and the actual governance modes negatively affects the performance of component innovation projects.

Keywords: governance modes, system innovation, component innovation, performance of innovation projects.

INTRODUCTION

A central concern in innovation projects on components of a larger system involves the choice of parties to be involved and the intensity of cooperation. Component development projects can be performed by the party responsible for the system as a whole, by a party responsible for the component in particular, or in some form of collaborative setting. This paper addresses the issue of governance modes for component development projects of larger systems. More in particular, we address the influence of the system and component newness on the governance mode of component innovation projects.

In the literature opposing views can be found on the issue of governance modes for innovation on technological systems. The literature on the resource-based view of the firm emphasizes the advantages of collaboration for systemic innovation in terms

of specialization, learning and flexibility (Hamel, Doz and Prahalad, 1989; Nooteboom, 2000). Collaboration for innovation is also advocated in the literature on networks and alliances (Doz and Hamel, 1997; Gulati and Singh, 1998; Hagedoorn and Duysters, 2002). The literature in industrial economics emphasizes the advantages of integrated structures from the perspectives of transaction costs and appropriation (Rindfleisch and Heide, 1997; Teece, 1996). Particularly, in his seminal publication, Teece (1986) has emphasized the importance of complementary assets as a means to appropriate returns on innovation, and the choice of integrated governance modes to produce those assets if they are not yet available in the market. Component technology can be considered a complementary asset from a system perspective.

Chesbrough and Teece (1996) and Teece (1996) have integrated these different perspectives in a model for governance modes for systemic innovation. According to these authors, innovation under high interdependency between components can best be performed in integrated or strong cooperative structures. In contrast, according to them, autonomous or 'stand alone' innovations with low degrees of interdependency can best be developed in disintegrated governance modes.

In this paper we develop and test a model for component innovation in which we take the life cycles of the system and the component into account. Our model reflects the view that the most appropriate governance mode for component development depends on the life cycles, i.e. the newness, of the system and the component. By including the aspect of appropriation explicitly in the model we add to the information processing view of organizing for systemic innovation (Brusoni and Prencipe, 2001). Moreover, we operationalize the concept of governance mode in a way that it becomes possible to systematically test the implications for different dimensions of performance.

We tested our model on the development of mobile telecommunications services. Mobile telecommunications services are part of the larger mobile telecommunications system, consisting of several components, such as mobile networks, handsets, protocols and the mobile services themselves. In this paper we only distinguish the network (the 'system') and services (the 'components'). In the 'network' we include both the physical transmission networks, e.g. GSM and UMTS networks, and the middleware. 'Middleware' refers to the software and protocols that facilitate the operations of the network and that specify interfaces between networks and other components, such as handsets and services. Examples are WAP, SMS and MMS, and

more specific systems such as i-mode (the mobile internet service introduced by NTT DoCoMo in Japan). Mobile services refer to the user applications available on mobile networks that provide extra functionality over basic voice and data services. Examples are location-based services, information and entertainment services, and mobile office applications. The issue of this paper concerns the most appropriate governance mode for mobile service development projects: by the telecom operator, by an independent service firm, or in some form of collaborative setting.

This paper is organized as follows. In the next section, we apply the product life cycle model to the system and component, and we discuss the implications for the characteristics of innovation projects on components. Next, we present a framework for a typology of governance modes for component innovation, depending on the newness of the system and the component. Subsequently, the research methodology is described, after which we test the framework on thirty development projects of mobile telecommunications services. Finally, we present our results and discuss the implications for theory and practice.

A LIFE CYCLE MODEL OF SYSTEMIC INNOVATION

We apply the product life cycle model to systems and components. We consider a system to consist of a number of components united in a common architecture (Henderson and Clark, 1990). The interfaces between components are an important part of the system. Baldwin and Clark (1997) call the interfaces between components 'visible design rules' versus hidden design rules within the components. System innovation means that the architecture or the interfaces between the components change. Component innovation means that one or more of the components change, which may involve that also the interfaces between that component and other components change. If clear interfaces are defined between the components of a system, so that component innovation does not affect these interfaces, component innovation is largely autonomous.

The product life cycle model distinguishes three phases of maturity for a product: fluid, transitional and specific (Abernathy, 1978; Utterback, 1994). The emergence of a dominant design for the product separates the fluid phase from the transitional and specific phase. The dominant design results from the choices of producers and customers and has both a technical and a functional aspect. The technical aspect specifies the dominant architecture and character of product elements, whereas the

functional aspect relates to the preferences of users regarding product features (Cusumano et al., 1992: p. 56). Since we will argue that the dominant design is important for the choice of governance mode, we distinguish only the fluid and mature phases in this paper, capturing the transitional phase in the mature one.

The phase in the life cycle of a product affects several characteristics of innovation projects. When a product is new, the firm(s) producing the system have to acquire the dominant design in the market, and, in the presence of network externalities, have to create an installed customer base to acquire the dominant design in the market (Arthur, 1988, 1989, 1996; Schilling, 2002; Shapiro and Varian, 1999; Teece, 1986; Utterback, 1994). Lambe and Spekman (1997) have introduced the concept of urgency referring to the need for the innovator to acquire the dominant design by developing products in a timely manner. Moreover, the newer the product, the higher the level of uncertainty involved in innovation. We can make a distinction between technological and market uncertainty as a consequence of newness (Kamien and Schwartz, 1982: pp. 109 ff). Technological uncertainty relates to technical problems in development trajectories and to technological knowledge that has to be generated. Market uncertainty refers to the behavior of competitors, to the number and preferences of customers and to substitutes that may appear.

The life cycle perspective can be applied to both the system and the component level of systemic innovation. The life cycle of the system concerns the architecture and the interfaces, and defines the newness of the system as a whole. The life cycle of a component depends on the degree of similarity to existing components of the system and to components of other systems.

In the case of mobile telecommunications systems, the network and the middleware define the architecture and many of the interfaces between the components, and thereby the system. The interfaces are not established up-front but develop in the course of time. Even when telecom authorities have agreed up-front on a *de jure* standard for the transmission system (Bekkers, 2001; Funk and Methe, 2001), *de facto* a number of technical choices for the interfaces with components such as handsets still have to be made. In the course of the development of the system normally a dominant design for the architecture and interfaces is set, to which service developers can conform. We consider a new mobile service to start a new life cycle if it offers features unavailable by means of services on other networks or available by means of other channels. At this moment many location-based services are new

according to this criterion, because they could not be offered through other channels before. We consider a new mobile service to be mature if it is an extension of an existing mobile service, or if it is a close copy of and existing service offered by means of another channel. An example of the latter is an electronic telephone directory offered on a mobile network. This service is a close copy of and existing service, except for the fact that the mobile service can be reached independent from the location of the user.

The life cycle perspective makes clear that the newness of the system and its components affect the characteristics of component development projects. Firstly, when the system is new, the firm(s) producing the system will feel a high level of urgency to create installed base, to be able to appropriate the returns of the development of the system. Components are complementary assets for the development of the system, and so they will also feel a high sense of urgency with respect to component development. Urgency considerations can exist at the component level itself, since the firm(s) developing a completely new component for a mature system also has to acquire the dominant design for that component.

Secondly, the newness of the system and components increase the levels of technological and market uncertainty in component development. Newness of the system creates uncertainty on the interfaces between the component and other components, on the prospective users and their preferences. Newness of the component creates uncertainty on technological knowledge involved in the component itself, and concerning the preferences of the users of the system concerning the component.

In summary, the life cycle perspective makes clear that the newness of the system and the component are expected to affect the degrees of urgency and uncertainty involved in component innovation. Urgency will be felt most by the party or parties that are responsible for the newest elements, system or component. The combined newness of the system and component define the levels and sources of uncertainty in component development.

Governance modes for component development

Based on the degrees of urgency and uncertainty, and in line with contingency theory (Burton et al., 2002; Donaldson, 2001; Gerwin, 2004; Naman and Slevin, 1993; Reuer and Arino, 2002), we propose that the newness of the system and

component also affect the most appropriate governance mode for component innovation projects. We distinguish two types of parties that may be involved in component development: the system developer and the component developer. The system developer is responsible for the architecture and the interfaces of the system as a whole, whereas the component developer is responsible for the component. If one firm is responsible for both the system and the component, the system and component developer are identical.

We address two dimensions of governance modes: the involvement of the different parties, and the degree of integration (Robertson and Langlois, 1995. see also Gerwin, 2004; Gerwin and Ferris, 2004). The involvement of different parties refers to the division of investments between system developer and component developer. If the system developer does all investments in the component, the situation of common ownership occurs. In that case the system and component developer are identical. The degree of integration refers to the degree that the governance mode facilitates intensive coordination between system and component development.

We assume that the degrees of urgency and uncertainty involved in a component development project affect the optimal governance mode. The degrees of urgency experienced by the system and component developer affect the appropriate division of investments between system and component developer. In case at least one of the two parties feels a high sense of urgency, apparently appropriation concerns exist for the respective part of the system. The best conditions to meet those concerns are created if the firm experiencing the highest sense of urgency imposes its requirements concerning time-to-market and creation of installed base upon the project management. Time-to-market and installed base are important conditions for appropriation (Teece, 1986; Schilling, 2002). We assume that that situation is created if the respective party has the highest involvement in the component development project.

We furthermore assume that the degree of uncertainty affects the optimal degree of integration in the innovation project. Under high uncertainty, the availability of different types of knowledge reduces transaction costs between the different parties, and thus a higher degree of integration will be more appropriate (Brusoni and Prencipe 2001; Tushman and Nadler, 1978; Wheelwright and Clark, 1992). Under conditions of low uncertainty, disintegrated organizational forms will be more efficient (Rindfleish and Heide, 1997; Worren, Moore and Cardona, 2002).

To sum up, we assume that the relative division of urgency between the system and component developer affects the appropriate relative involvement of the two parties in the component development project, and that the combined degree of uncertainty involved in system and component development affect the appropriate degree of integration between the parties.

The model

The considerations mentioned above can be translated into a typology for the most appropriate governance modes for component development projects under different conditions of newness of the system and component (Doty and Glick, 1994; Gerwin 2004). The newer the system, the higher the system developer involvement and integration. The newer the component, the higher the component developer involvement and integration. In Figure 1 we present the typology (see also Van den Ende, 2003).

Figure 1. Model of Appropriate Governance Modes

Newness of the component	New	Mature
Mature	High system developer involvement Intermediate integration I *System developer develops system and finances component development. Component developer performs the component development activities under contract with the system developer.*	Intermediate system developer involvement Low integration II *System developer provides system. Component developer performs component development tasks within functional departments. System and component developer share the costs and benefits.*
New	Intermediate system developer involvement High integration III *Independent organization or unit. System and component developer share the costs and benefits of component development.*	Low system developer involvement Intermediate integration IV *System developer provides system and technical assistance. Component developer develops and finances service.*

Newness of the system

In quadrant I a mature component is adapted to a new system. The urgency for the system developer will be high, whereas the component developer will experience low urgency and will not be prepared to take high risks. Therefore the system developer should make the largest investments (system developer involvement is high). Because the uncertainty levels are intermediate, a moderate level of integration is expected to be appropriate. For instance, a mode of governance in which the system developer develops the system and finances the component development activities performed by a component developer in mutual coordination with the system developer, will fulfill these conditions.

In quadrant II both the system and the component are mature. The dominant design of the system has been established both in a technological sense and with respect to user preferences concerning applications and features. The component has proven to be successful and the component developer will generally be an established one. Neither the system developer nor the component developer will experience high urgency to introduce the component. As a solution they may share the costs and benefits. Technological and market uncertainty are low for both system and component. The development tasks are therefore relatively straightforward and the required degree of integration is low. A governance mode in which the system developer provides the system and the component developer performs the component development tasks fulfills these conditions best.

In quadrant III both the system and the component are new and as a result both technological and market uncertainty are high for both the system and the component. The development of the system and the component is highly interdependent in this quadrant. Since both the system developer and the component developer are expected to sense a high degree of urgency, they should share the costs and benefits in the component development project. Because of high uncertainty levels, high integration is expected to be most appropriate in this quadrant. An independent project organization is likely to provide the appropriate level of integration (Lorange and Roos, 1992: pp. 10-11). Another possibility is that the system developer develops the component within a separate unit internally, with some contribution of the component developer.

In quadrant IV, the component is completely new and the system is mature. Since the urgency for the system developer is low, the component developer can best finance the component completely by itself. The newness of the component may

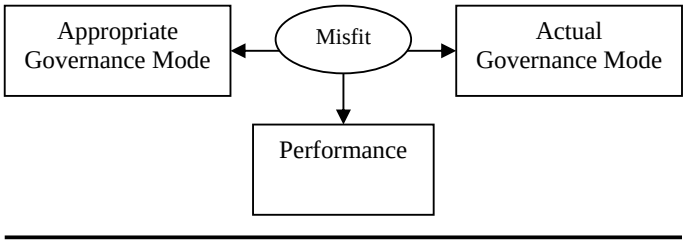
require information on the system that is not readily available. The system developer may provide this information. A situation in which the component developer develops and finances the component, supported by dedicated information of the system developer, seems most appropriate in this quadrant.

Misfit and performance

To summarize the theoretical considerations and the model presented above, we propose that the appropriate level of system developer involvement in component development projects is positively related to the system newness and negatively related to the component newness. Furthermore, we posit that the appropriate level of integration between the system developer and the component developer in a component development project is expected to increase with the combined newness of the system and the component.

We use the central idea from contingency theory that the degree of alignment between actual governance mode and appropriate governance mode affects performance (Naman and Slevin, 1993). We hypothesize that component development projects showing a misfit between the actual governance mode and the appropriate governance according to the newness contingencies suffer from sub-optimal appropriation and/or inefficiencies, resulting in disappointing project and market performance (see Figure 2).

Figure 2. Governance misfit



METHODOLOGY

Sample and data collection

We empirically tested our ideas in the mobile telecommunications industry. In this empirical setting, as has been mentioned before, the system consists of the physical mobile telecommunications network and the middleware. Furthermore, we focused on mobile service development as the component development activity. The telecom operator is in this case the system developer, whereas the firm developing the mobile service is the component developer. Our sample consisted of thirty-five mobile service development projects that were executed in the Netherlands. Five projects did not appear to involve the development of a new service, but either the development of middleware or the redesign of an existing mobile service, and were therefore omitted from the analysis. The projects covered all five Dutch mobile telecom operators and numerous service firms, ranging from firms dedicated to mobile applications to firms with core activities in other markets, such as a retail bank. Furthermore, the dataset included projects covering a wide range of both services and technologies. At the time of study, most projects were completed less than a year ago. In terms of project size, the projects ranged from projects with fewer than five project members and lead times of less than a month to a project with over two hundred project members and another project taking over a year until completion.

The sample also varied regarding the level of telecom operator involvement. Fifteen projects were financed and executed by service firms without any involvement of a telecom operator. Twelve projects were financed and performed by a telecom operator in an alliance with a service firm. Three projects were completely financed by a telecom operator. We found the following number of projects in the four quartiles of figure 1: six projects in quadrant I, five in quadrant II, five in quadrant III and fourteen projects in quadrant IV.

We studied each project in a structured interview. From each project performed in a single firm at least one project manager completed the questionnaire. In our analysis the mean of the results was taken if more than one project manager was interviewed for a single project. During the interview, each project manager first completed the questionnaire in the presence of the interviewer. Next, discussions allowed us to test the validity of the questionnaire. This also improved our understanding of this

particular empirical setting. Moreover, the discussions enabled us to write a case description on each project that served to rate the degree of integration.

Description of variables

We measured the variables in our conceptual framework using both four-point and five point scales. Prior exploratory case studies of mobile service development projects (Van den Ende, 2003) helped developing these scales. Network newness and service newness were each measured by a single item. To capture network newness we asked for the degree of standardization of the platform to which the mobile service was connected. This scale ranged from 'no standardization' to 'a very high degree of standardization'. Platforms are middleware systems within mobile networks that support the implementation of mobile services. Newly introduced networks provide tailor-made interfaces to mobile services, whereas over time standard platforms emerge that manage the development and interconnection of services, such as i-mode.

Service newness was measured by asking for the newness of the service features to consumers. This scale ranged from 'no new service features' to 'very new service features'. The absence of new service features indicated that the mobile service was a close copy of a service that was already being offered either in the mobile market or in other markets.

Telecom operator involvement was measured by the investments made by the telecom operator in the innovation project (Nooteboom, 1999: p. 67). This variable ranged from 'no investments' to 'all investments'. The level of integration was measured on a five-point scale. A rate of 1 indicated the lowest level of integration and represents internal development of the mobile service by a service firm. This meant there was no organizational arrangement in place for the service firm to coordinate its activities with the middleware and/or network facilities. A rate of 2 indicated that a service firm and a telecom operator cooperated to develop the service, with each of the partners performing their tasks internally. Consequently, this involved only a minor degree of integration between the service and the network development activities. Alliances between a service firm and a telecom operator were characterized by a rate of 3 when a dedicated service development unit included personnel from both partners. A rate of 4 represented internal service development by a telecom operator. However, within this firm, the service development tasks were performed in a unit without the direct involvement from personnel of the network or

middleware department. We are of the opinion that this organizational arrangement results in a higher level of integration than in any of the previous situations, since this internal solution minimally facilitates upstream coordination by the telecom operator (Gerwin, 2004) and lateral communication between the service development unit and the network department. The highest level of integration - indicated by a rate of 5 - referred to the situation where the telecom operator developed the service internally in a unit that integrated personnel from the network department in the service development task. We rated this five-point scale themselves using the information that was gathered during the interviews. Each of us rated the cases individually. A correlation of 0.70 resulted. Subsequently, we together agreed on the final rates.

Using the newness and the governance variables as described above, we operationalized our misfit propositions to test them empirically. In line with earlier considerations, we stated that the appropriate level of telecom operator involvement (Appropriate T) in mobile service development projects should increase with the network newness and decrease with the service newness (Formula 1). Furthermore, we posited that the appropriate level of integration of telecom operators in mobile service development projects (Appropriate I) should increase with the newness of both the network and the service (Formula 2).

In line with Naman and Slevin (1993) we calculated misfit as the absolute difference between the actual and the appropriate governance mode according to the newness considerations (Formulas 3 and 4). Since we assume that the performance implications are greater when both types of misfit are present, we defined total misfit (Misfit) as the product of the two dimensions of misfit (Formula 5).

(1)	Appropriate T	=	Network Newness – Service Newness
(2)	Appropriate I	=	Network Newness + Service Newness
(3)	Misfit T	=	| Actual T – Appropriate T |
(4)	Misfit I	=	| Actual I – Appropriate I |
(5)	Misfit	=	Misfit T * Misfit I

To investigate the performance implications of governance misfit, we measured two types of performance: project performance and market performance. Each type of performance was comprised of five items and measured the actual performance relative to expectations as perceived by the project managers. The lowest rate

represented very disappointing performance, a medium rate meant that the performance came up to expectations, and the highest rate indicated a performance level well beyond expectations. The items on project performance asked for judgments regarding (1) the efficiency of the project, (2) the budget performance of the project, (3) the quality of the project, (4) the time-to-market of the service, and (5) adherence to interim project deadlines. Varimax rotated principal axis factoring revealed two factors with eigenvalues greater than 1 that accounted for over seventy percent of total variance. The first factor clearly referred to the financial performance of the project (item 1 and 2). We therefore labeled this factor *project efficiency* (Cronbach's alpha = 0.6). The second factor related to the non-financial criteria for project performance (item 3, 4 and 5). We labeled this factor *project timeliness* (Cronbach's alpha = 0.7).

The market performance items asked for the degree to which the service could meet expectations regarding: (1) the number of users for the service, (2) revenues, (3) the growth of the service, (4) user satisfaction, and (5) the reliability of the service. A varimax rotated principal factor analysis revealed two common factors with eigenvalues greater than 1. These factors explained over seventy percent of total variance. The first factor, item 4 asking for user satisfaction, had a factor loading of 0.8. This factor was therefore simply labeled as *user satisfaction*. The remaining four items formed the second factor. The item asking for reliability showed a relatively low factor loading however. We decided to remove this item from further analysis. This significantly improved the internal consistency for this factor and it increased the level of explained variance to over eighty percent. Furthermore, the three remaining items (items 1, 2, 3) clearly pointed toward the commercial performance of the service. Therefore we labeled this factor *commercial performance* (Cronbach's alpha = 0.8).

RESULTS

Table 1 presents descriptive statistics and correlations for the variables described in the previous section. The table shows a high correlation (0.59) between the two dimensions of governance modes (telecom operator involvement and integration), but each variable reflects considerable unique information. Table 2 presents the results of the regression analyses. For each of the four performance constructs three regression

analyses were performed. Model 1 investigates the direct effects of telecom operator involvement and integration. In Model 2 we added the misfit measures related to the two governance mode dimensions in order to test whether these types of misfit negatively influence performance. Finally, in Model 3, we added the interaction term of the two types of misfit to test whether this combination has a negative effect on performance. To mitigate multicollinearity problems as a result of this interaction term, we mean-centered Misfit T and Misfit I. In the regression models most variance inflation factors were well below the value of 2.0 (which is below the acceptable value of 2.5).

Table 1. Descriptive statistics and correlations

	Variable	Mean	Range	S.D.	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
1.	Network Newness	2.1	1.0 - 4.0	1.0										
2.	Service Newness	2.9	1.0 - 4.0	0.9	-0.05									
3.	Telco Involvement	2.1	1.0 - 5.0	1.4	-0.13	-0.10								
4.	Integration	2.2	1.0 - 5.0	1.3	-0.07	-0.01	0.59**							
5.	Project Efficiency	3.0	1.3 - 4.5	0.8	0.14	0.06	-0.40*	-0.36	0.61					
6.	Project Timeliness	2.9	1.5 - 4.5	0.7	0.08	-0.31	-0.54**	-0.52**	0.35	0.73				
7.	Commercial Performance	2.8	1.0 - 4.7	0.9	0.24	0.14	-0.33	-0.12	0.32	0.35	0.81			
8.	User Satisfaction	3.6	2.0 – 5.0	0.9	-0.08	0.17	0.11	0.40*	-0.11	-0.11	0.13			
9.	Misfit T	1.1	0.0 – 3.7	0.9	0,25	-0,55**	0,29	-0,06	-0,13	0,07	-0,34	-0,27		
10.	Misfit I	1.2	0.2 – 2.9	0.8	0,19	0,20	0,22	0,54**	-0,27	-0,47**	-0,22	0,19	-0,03	
11.	Misfit	1.3	0.0 – 6.5	1.5	0,07	-0,27	0,47**	0,29	-0,38*	-0,30	-0,56**	-0,08	0,68**	0,54**

Pearson, * $p < 0.05$, ** $p < 0.01$, N=30 (N=28 for correlations with 7. CP and 8. US), Cronbach Alpha on diagonal.

Model 1 significantly explains project efficiency, but shows no significant regression coefficients. Furthermore, Model 1 significantly explains project timeliness. This model indicates that telecom operator involvement is negatively related to the timeliness of mobile service development projects. This finding is significant, since it continues to appear after adding the misfit variables in Model 2 and Model 3. This finding is in line with the expressions of many project managers from both service firms and telecom operators that decision-making within telecom operators involves many departments and delays the project's execution. Telecom operator involvement also has a negative effect on commercial performance. This effect is weak since it only appears in Model 1. Apparently, the negative impact of telecom operator involvement on project timeliness is not reflected in a strong effect on the commercial performance of the projects. Finally, integration has a positive

effect on user satisfaction that persists in Model 2 and 3. As might be expected from the perspective of cross-functionality in innovation projects, this result shows that the combination of expertise on both the network and the service contributes to the extent that users are satisfied with the mobile service.

Table 2. Regression results for the performance effects of governance and misfit

	PROJECT EFFICIENCY[a]			PROJECT TIMELINESS[a]			COMMERCIAL PERFORMANCE[b]			USER SATISFACTION[b]		
	1	**2**	**3**	**1**	**2**	**3**	**1**	**2**	**3**	**1**	**2**	**3**
TELCO INVOLVEMENT	-0.16	-0.16	-0.09	-0.18*	-0.26**	-0.26**	-0.28*	-0.20	-0.01	-0.13	-0.06	-0.08
INTEGRATION	-0.11	-0.07	-0.10	-0.17	-0.01	-0.01	0.09	0.14	-0.07	0.34**	0.31*	0.32*
MISFIT T		-0.05	-0.11		0.15	0.15		-0.26	-0.45**		-0.19	-0.17
MISFIT I		-0.15	-0.15		-0.31*	-0.32*		-0.31	-0.37		-0.06	-0.06
MISFIT			-0.25			0.00			-0.57**			0.07
CONSTANT	3.56***	3.47***	3.39***	3.68***	3.50***	3.50***	3.16***	2.89***	2.62***	3.06***	2.98***	3.01***
F CHANGE		0.30	1.33		2.54*	0.00		1.50	5.15**		0.60	0.07
F	2.95*	1.55	1.52	7.50***	5.44***	4.18***	1.73	1.65	2.59*	2.84*	1.68	1.30
R^2	0.18	0.20	0.24	0.36	0.47	0.47	0.12	0.22	0.37	0.19	0.23	0.23

* p<0.10, **p<0.05, ***p<0.01, [a] N=30, [b] N=28.

Adding the two types of governance misfit (Model 2) fails to significantly improve the explanation of project efficiency. Based on transaction cost considerations, we would particularly expect an effect of Misfit I on project efficiency, but we found no confirmation. However, the negative signs of the misfit coefficients do provide directional support for our assumptions. Model 2 does significantly improve the explanation of project timeliness. We find that Misfit I is negatively related to project timeliness. This indicates that a level of integration between the network and the service that does not correspond to the newness of the network and the service results in project delays. For example, a low level of integration for the development of a very new service on a new network is likely to result in a failure to meet time-to-market objectives. As we expected, in order to meet the market window, the integration of knowledge on the network in mobile service development projects becomes crucial under conditions of high newness for both the network and the service. Adding the two types of misfit (Model 2) does not

significantly improve the model with respect to commercial performance and user satisfaction.

Adding the interaction term between the two types of misfit in Model 3 improves the explanatory power of the model on commercial performance. Model 3 shows that a misfit in terms of telecom operator involvement significantly reduces commercial performance. One of the important assumptions behind our model was that system owner involvement is particularly important for reasons of appropriation. Since appropriation is primarily reflected in market performance, this finding corroborates this assumption. This finding involves that a high level of telecom operator involvement is most necessary for the development of relatively mature services for new networks. The high commercial success under these conditions shows that telecom operators can successfully attract new users for their networks by offering different services, and recoup the large investments. Furthermore we find a significant interaction term, supporting our expectation that a combination of the two types of misfit strongly reduces the commercial performance of mobile services.

We performed several additional regression analyses with a number of control variables. These variables failed to reach significance and were therefore not included in the models presented here. For example, the project performance indicators did not help explain the market performance indicators. Neither did the newness of the network and the newness of the service or the duration of the project help explain the performance constructs. Furthermore, the addition of too many explanatory variables would be problematic given our small sample.

We may conclude that the results show considerable support for our model. Misfit with respect to telecom operator involvement affects commercial performance of the projects, whereas misfit with respect to integration affects the direct project performance. The combined misfit affects commercial performance. We could not demonstrate effects of misfit on the other two performance measures, and the results show that there are several direct effects of telecom operator involvement and integration on performance. It means that the results show a partial confirmation of our contingency view of governance modes, and a partial confirmation of a view showing preference for specific governance modes, irrespective of the circumstances.

DISCUSSION

In this paper, based on life cycle considerations for the system and its components, we developed a framework for the most appropriate governance modes for component development of the larger system. The theoretical grounds for our expectations that specific governance modes have a positive impact on performance contingent on the newness of the system and components were mainly related to appropriation and transaction costs. We particularly postulated that, when the system was new relative to the component, system developer involvement had a positive effect on performance since it created better conditions for appropriation, and that, when the system and component were both new, integration had a positive effect on performance because it created better conditions to reduce transaction costs.

Our empirical study in the mobile telecommunications industry demonstrated several effects of governance misfit on project timeliness and commercial performance. We could not demonstrate an effect of misfit on project efficiency and user satisfaction. We also found several direct effects of governance mode on performance. In general, the results are in favor of a contingent approach of governance mode for component development for larger systems.

Our study faces several limitations as well. Firstly, the two measures for governance modes are conceptually very close and one of them was self-scored by the authors. More detailed and distinct multidimensional measures for organizational characteristics have to be developed. Moreover, and despite the fact that most of the single item scales measure fairly concrete objects and attributes (Rossiter, 2002), multi item scales and multiple respondents may provide more valid results, whereas a higher number of cases may provide more significant results. Secondly, in the case of mobile telecommunications, we considered the physical network and the middleware as one entity, the system. Since new middleware systems are sometimes developed for an existing network and existing middleware systems can operate on new networks, the network and the middleware can better be considered as two independent components, taking the middleware as indicative for the system. And thirdly, the financial situation in the mobile telecommunications industry forms a possible limitation of this research. Several cases in this study referred to periods in which the UMTS biddings in the telecom industry had not yet taken place. These biddings have severely deteriorated the cash position of telecom operators, leading to a decreasing ability of telecom operators to participate in service development projects. This may

have affected the degree of misfit in our sample, although we do not expect effects on the results with respect to the implications for performance.

In spite of these limitations, our paper makes some important contributions. In this paper we developed indicators of governance modes and mathematical representations of these indicators to be able to perform statistical analysis. Further work has to be done on this issue, which at the same time contributes to organization theory. Moreover, organization theory usually discusses organizational forms in relation to uncertainty and interdependency of tasks to be performed (Donaldson, 2001; Lawrence and Lorsch, 1976; Thompson, 1967). We included appropriation concerns as an determinant of organizational forms, which adds to the literature in this field. Moreover, the contingency approach is usually applied to the firm as a whole, whereas we apply a contingency approach to a specific process within one or more firms, the innovation process. This can also be done for other processes in the firm (Liker et al., 1999), and hence this study may also contribute to other areas of management studies.

Our results indicate several implications for the practice of system and component development as well. For instance, in the field of mobile telecommunications at this moment most telecom operators prefer to rely on the market for the development of services, since they themselves lack the required resources and capabilities, and since they are short of cash as a result of large investments in UMTS licenses and infrastructure. Our results show that under conditions of newness of the network, internal development or strong cooperative structures, may be more appropriate. A high degree of telecom operator involvement may be detrimental for timeliness of the project, but if in accordance with the newness, and if combined with a appropriate degree of integration, it is likely to render higher returns. For practitioners in other fields of systemic innovation, our results indicate that newness matters, particularly from a revenue perspective.

CONCLUSION

In this study we tested a model for the most appropriate governance modes for component innovation, based on the life cycles of the system and component. The main purpose of this paper was to test whether the misfits between the governance modes as expected by us and actual governance modes had negative performance implications. We distinguished two elements of governance modes: the involvement

of the system developer relative to the component developer, and the level of integration. We tested the framework on thirty service development projects in the Dutch mobile telecommunications industry.

We find considerable support for our idea that system and component newness are important determinants of the organization of component development projects, in this case service development projects. Misfit significantly reduces project timeliness and commercial performance. Furthermore, we found that, irrespective of newness conditions, the degree of system developer involvement decreased project performance and that integration improved user satisfaction.

These results largely support the contingency approach reflected in our model, according to which governance modes have to be adapted to the specific phases in the life cycles of both system and component. For instance, this means that outsourcing of component development is not always the best alternative for a system developer. When the system is new relative to the component, a higher involvement of the system developer relative to the component developer positively affects performance, whereas a high degree of integration may positively affects performance when both system and component are new. Internal development of services becomes a serious option for the system developer under these circumstances, whereas outsourcing is better under more mature conditions. Such a view requires flexibility of firms operating in systemic markets to adapt organizational forms permanently to life cycle conditions.

This study implies for practitioners that performance requires a choice of governance mode in accordance with newness. Particularly, to increase market performance it may be beneficial to involve the system developer more than seems desirable at first sight. Disappointing effects of system developer involvement on project performance should not hide away the positive effects in the market. In the same way the degree of integration should be in line with newness conditions. Taking these contingencies into account might improve performance in one of the most difficult environments for innovation, the one of larger systems.

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