Summer 10-6-2011

A FRAMEWORK FOR THE STRATEGIC POSITIONING OF INTRA-COMPANY ICT RESEARCH ORGANIZATIONS

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Abstract

By the early twentieth century, Schumpeter had already stressed the importance of innovation for a sustainable development of enterprises. Innovation is especially important for information and communication technology (ICT) companies as their business model is based on rapidly changing technology. They therefore often profit from innovation developed in intra-company research organizations. However, ICT research organisations often face a special challenge: the integration of research results into existing ICT architectures. This challenge has neither been analysed in literature on information systems nor on innovation management. In order to gain a deeper understanding of this challenge, we analysed case studies in four intra-company research organisations, among them one in-depth case study. Our research shows that an intra-company ICT research organisation can make a decision based on three important strategic parameters: (a) the desired degree of innovativeness, (b) the desired degree of integrability into existing architecture, and (c) the desired degree of orientation towards prospective users' needs. Based on our case study analysis, we argue that these three strategic goals are concurrent, i.e. to achieve one of them makes it difficult to achieve the others. Adhering to contingency theory, we believe that there is not one best strategic position, but that the quality of a strategic position depends on environmental contingency factors. In addition to the development of the framework, we consider contingency theory and formulate two hypothetical propositions. They describe stable strategic positions of intra-company ICT research organisations in our framework, dependent on contingency factors. To the best of our knowledge, this is the first research publication dealing with the special requirements of intra-company ICT research organizations and the challenge of integration. Nevertheless, our research is limited by its exploratory nature and by the relatively small number of case studies taken. For generating more hypotheses, further explorative research in the field has to be done. Moreover, in order to confirm the assumptions our framework is based upon and the hypothetical propositions generated, further confirmative research is necessary.

Keywords: ICT research project, architecture management, case study, literature review.

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1 Challenges of Intra-Company ICT Research Organisations

In the early twentieth century, Schumpeter (1988, first published in 1911) stressed the particular importance of innovation for a sustainable development of enterprises and even for national economies as a whole. Since then, his proposition has been empirically investigated in a variety of studies. Amongst other findings, research confirmed

- that the profit margin of innovative companies is higher than that of non-innovative ones (Geroski, 1994),
- that innovative companies are less challenged by economic depressions than non-innovative ones (Geroski, 1994),
- that the equity price of a company announcing a new product increases by around 0.75 percent (Chaney et al., 1991),
- that the ratio of research and sales efforts does not only significantly influence the number of new products, but also the economic value added (Tidd et al., 1996; Tidd, 2000), and
- that efforts for research reduce the return on investment in the short term, but increase it in the long term (Clayton, 1998).

In summary it can be stated that intra-company research is an important path to organisational innovativeness. At the same time it can be shown that it is often instrumental to decouple innovation units from operational business units in multiple dimensions such as location, processes, and culture (cf. section 2). However, the challenge is to still deliver research results that fit operational business units' requirements and architectures and thus to reduce efforts of transfer and integration projects. This is especially true in the area of information systems (IS), since technology innovation here is mostly linked with organisational changes making integration of research results even more challenging compared with other research areas like for instance pharmaceutical research.

Whilst the management of entrepreneurial research projects has been established in the scientific discipline of innovation management (Ulrich, 1995; Andriopoulos, 2001; Garcia & Calantone, 2002; Elkins & Keller, 2003; van der Panne et al., 2003; Adams et al., 2006), it has rarely been discussed in the area IS research. This is surprising since information and communication technology (ICT) nowadays is an integral part of almost every enterprise.

In the paper at hand, we focus on the challenge of integrating ICT artefacts into an existing enterprise architecture, i.e. the infrastructure architecture, the software architecture, and the alignment architecture establishing a link to the organizational architecture (for architectural layers cf. Hoogervorst, 2004; Winter & Fischer, 2007; Aier & Winter, 2009; Schönherr, 2009). According to IEEE Std. 1471-2000, we define architecture as "the fundamental organization of a system, embodied in its components, their relationships to each other and the environment, and the principles governing its design and evolution" (IEEE, 2000) wherein 'system' can be substantiated as an enterprise meaning "any collection of organizations that has a common set of goals", e.g. a company or government agency (The Open Group, 2009).

Integration is a core issue of IS research (cf. e.g.; Mertens, 1966; Boehm & Abts, 1999; Hoogervorst, 2004; Braun & Winter, 2007) and a component of several methods for ICT project management, e.g. in the *spiral model* (Boehm, 1986) or the *v-model xt* (Anonymous, 2006). For an artefact to be integrated prior to be used in an existing architecture, either the artefact has to be adapted to the existing architecture, or the existing architecture has to be adapted to the artefact, or they have to be mutually aligned (Aier et al., 2009; The Open Group, 2009).

Although IS research has generated many publications on integration in general, we could not find any publication considering the special requirements of ICT projects conducted in intra-company research organizations. In the area of innovation management, the problem of integration has not been extensively dealt with either—a notable exception being Bhattacharya et al. (1998). They distinguish three

phases of a product development process: definition, realisation, and integration. By integration, they mean the usage and the adaption of existing production systems for industrially producing new products. In summary, the challenge of integrating ICT research results into an existing ICT—or enterprise—architecture is neither captured in innovation management literature, nor has it been extensively researched, neither in IS nor in innovation management.

In order to explore the field, we reviewed relevant literature and took case studies with four intra-company ICT research organisations. While the challenge of integrating ICT research results into existing architecture can be addressed in several ways, e.g. by means of research project controlling or integration project methodologies, our case study analysis reveals that ICT research organisations are forced to decide for a strategic position on a more fundamental level. The need for integrating ICT research results into an existing architecture makes the managerial decision for a strategic positioning of intra-company ICT research organisations complex. We address this challenge in this paper; the aim of our paper is twofold:

1. We aim to develop a framework providing options for the strategic positioning of intra-company ICT research organisations. We aim to show the applicability of our framework by positioning our case study companies in the framework.
2. Adhering to contingency theory, we formulate two hypothetical propositions describing stable strategic positions in our framework.

Both the framework and the propositions result from exploratory research; they are therefore of hypothetical nature. Further research for confirming these hypotheses is necessary, cf. our discussion.

The paper is structured as follows: Firstly, we review foundational work on innovation management. Secondly, we describe the case study method applied and the case study results. Thirdly, we analyse the case studies, developing (1) a framework for strategic positioning of intra-company ICT research organisations and (2) propositions for stable positions inside this framework, based on contingency factors. Fourthly and finally, we summarise our research findings and discuss their strengths and limitations.

2 Foundations

For our research, the special environment of research organisation is critical. As we will show, the development of radical innovation requires a special climate forwarding creativity and freedom. In order to outline these requirements, we present important findings from innovation management.

In innovation management, heterogeneous definitions for the term *innovation* can be found. (Garcia & Calantone, 2002; Hausschildt & Salomo, 2007, pp. 3-31). In this publication, we adopt a broad understanding of innovation, including product innovation, process innovation, and business model innovation (Chmielewicz, 1991, p. 556; Damanpour, 1991; Damanpour & Aravind, 2006; Johnson et al., 2008), but focus on the field of ICT. In literature, several degrees of innovation are discerned, depending on the degree of the innovation's newness. The extreme positions in this continuum are often referred to as *incremental* and *radical* innovation (Garcia & Calantone, 2002; Hausschildt & Salomo, 2007). Verworn et al. (2008) also use this distinction when analysing a large number of research and development projects. They found that market and technology uncertainty are higher for radical innovation than for incremental innovation. Particularly, it is statistically significant that market and price sensitivity for radical innovation are less common than for incremental innovation; moreover, the product's specification is less clear.

Innovative and routine tasks are significantly different. Therefore, in companies, innovative tasks are often separated from routine tasks by founding a dedicated intra-company research organisation (Wilson, 1967; Galbraith, 1982; Moss Kanter, 1983). This way, it is possible to create an innovation-friendly climate for intra-company research organisations (Andriopoulos, 2001; Elkins & Keller, 2003). In 1965, Bower (1965) already found that innovative organisations give more freedom to their

employees than less innovative ones, e.g. freedom to experiment or to develop ideas (Feurer et al., 1996). Creativity is restricted by a culture hostile to innovation, e.g. political problems or harsh criticism of new ideas (Amabile et al., 1996; Amabile, 1998). For implementing a creative climate, norms are important that encourage the employees' freedom; in contrast, rigid and punitive norms reduce the employees' creativity (Amabile, 1988). Leadership style should be democratic and participative (Nyström, 1979). Leaders in innovative organisations support their employees; they do not give them restrictive instructions nor do they control them intensively (Brand, 1998). Instead, successful executives in innovative environments lead by example (Amabile et al., 1996; Amabile, 1998). For motivating employees, it is essential to communicate the vision of research (Kimberly & Evanisko, 1981; Delbecq & Mills, 1985). A plethora of studies confirms that both technological and market-related factors are critical for an innovation's success (Madique & Zirger, 1984; Cooper & Kleinschmidt, 1987; Link, 1987; Kleinschmidt & Cooper, 1991; Cooper, 1993). Schmidt (1995) points out that technological factors are more important than marketing factors; in contrast, Rackham (1988) observes that viable innovations may fail due to emphasis that is too strong on the product and too weak on the customer.

In conclusion, management of innovation projects fundamentally differs from that of routine projects. Many mechanisms for the governance of routine projects, would restrict the researchers' freedom and therefore reduce their degree of innovativeness.

3 Case Studies

We analysed explorative case studies in order (i) to build a conceptual framework for the strategic positioning of ICT research organizations and (ii) to formulate propositions for stable positions and their environmental circumstances. In this section, we first outline the method of our case study and then describe the case study results.

3.1 Case Study Method

We took case studies with four intra-company research organisations. The case study approach was chosen as case studies are generally preferred for exploring a new research area and for gaining a deep understanding of problem and possible solutions (Eisenhardt, 1989; Yin, 2009). Our research is explorative as ICT research projects have not been sufficiently studied, up to now. The particular challenges related to the integration of research results into an existing architecture have not been sufficiently dealt with (cf. section 1).

In order to explore the research field, we selected case study companies meeting the following criteria:
- The company is big and internationally active.
- It has a dedicated research organization.
- A high number of the research projects are related to ICT.
- A member of the organization has been willing to be interviewed (Yin, 2009).

No.	Company	Sources of Funding	Interview Partner	
A	Global ICT provider, headquartered in Europe	Parent company	A1	Member of the research organisation's management board
			A2	Manager of a group of research project managers
			A3	Research project manager
			A4	Research project manager
B	Global electrical engineering company, headquartered in Europe	Parent company	B1	Manager of a group of research project managers
C	Global producer of business software, headquartered in Europe	Public agencies	C1	Research project manager
D	Global IT and consulting company, headquartered in North America	Parent company	D1	Research project manager

Table 1   Description of case study companies and interview partners

We took case study interviews in four companies (Table 1). The interviews were conducted in summer and autumn 2010. All interview partners are senior researchers and hold a Ph.D. in their area of research. Each interview lasted between 30 and 60 minutes. In company A, we took an in-depth case study and conducted interviews with four interview partners. The interview partners of company A were selected such that all hierarchical areas were covered. In addition to the interviews, publically accessible information about the companies and their research organisations were studied (e.g. web page, annual reports).

We conducted semi-structured interviews and used a questionnaire with open questions. At first, the interviewees were asked to introduce themselves and to describe their company, the research organisation they work in, and its strategy. Secondly, different challenges and possible solutions related to the integration of ICT research results into the company's ICT architecture were discussed. The interviews were documented in interview protocols.

3.2   Case Study Results

Company A is an important global ICT provider, headquartered in Europe. Its research organisation was founded as the company's management board recognised the high importance of technological innovation for their business model. Being an enormously large company, the management board noticed that smaller companies that had emerged from the new economy era had become severe competitors. The research organization is meant to reinforce the long term strength of the company, to develop solutions for the markets of the future, to cultivate future competencies, and to develop and test new methods and approaches. Nearly all research projects are mainly funded by the company; most projects are operated in cooperation with renowned European and international universities or other external research partners. In return, the company aims to usefully apply the research organisation's innovations in their operative business. The projects of the research organisation must pass a gate process before being accepted and funded. In this gate process, not only the research idea must be outlined, but also at least two members from different business units must confirm that they would profit from the innovation when applying it in their daily business. Moreover, the prospective income resulting from the innovation must be estimated; projects are only accepted if their prospective incomes exceed the innovation project's costs many times over. Although company A's management is aware that these requirements restrict the researchers in creatively developing radical innovation, they consider them to be essential for their main goal; i.e. to develop innovation that will be usefully applied by company A. Nonetheless, the interviews revealed some severe problems. On the one hand, the member of the management board we interviewed explained that only a small minority of research project results is factually used by the business units. Business units often avoid the high costs for integrating an innovation into their existing architecture, i.e. into their processes landscape, the application and software landscape, and the technical infrastructure. Project managers, on the other hand, stated they were under pressure to rapidly develop prototypes. They therefore had "no time for assessing and considering existing architecture." Moreover, another project manager said, that his project is highly innovative and that he could not regard the restrictions of existing architecture. If he did so, only incremental, non-radical innovation would result. For creating radical innovation, he needed a high degree of freedom for experimenting. "And, by the way," he said, "for introducing a radical innovation into a business unit, it should also be possible to adapt their existing technical architecture."

Company B is an important, globally active electric engineering company, headquartered in Europe. The company's mid-term and long-term success is highly dependent on the use of innovative technology and on offering innovative products to its clients. Therefore, the company does research in two important, globally spread research organisations; each of them is focused on one of its main product lines. Similar to company A, most research projects in company B are funded by company B; therefore, company B is interested in applying all research results in their daily business. We interviewed a manager of a group of research project managers. He explained that requirements of prospective users are very important and have to be considered for each research project. Furthermore, each project

manager has to regard relevant, existing architectures. The research organisation's explicit objective is to integrate every innovation into a business unit. He stated, consequently, that it is dangerous to assume that existing architecture would be adapted in order to integrate an innovation. They, as a research organisation, do not have the right to decide on changes of existing enterprise architecture; they can only give advice to business units. Therefore, existing architecture and users' requirements often restrict researchers' design freedom and hinder development of radical innovation, while fostering development of incremental innovation.

Company C is an important, globally active vendor of business software products, headquartered in Europe. Similar to companies A and B, the use of innovative technologies allows company C to sustain its position as a market leader. Nevertheless, the business model of their research organisation fundamentally differs from that of A or B: Research projects are not funded by the company—rather, the research organisation has to acquire its funding itself. Research is therefore often funded by public agencies and done in cooperation with universities and other industry partners. Therefore, the research organisation has developed strong capabilities in acquiring funding from public agencies. Research results are not specifically designed to be used in the parent company and there is no formal process to transfer research results into business units. The research organisation of company C therefore has the freedom to decide on research topics, methodologies, and partners. In consequence, its business model makes it easier and more likely to develop radical innovation.

Company D is a globally active IT company, mainly acting in the areas of consulting, software development, hardware, and financing. It is headquartered in North America. Company D invests a significant part of its income in research and has several research organisations worldwide; most research is therefore funded by the company. Our interview partner was a project manager in a research organisation in North America. She explained that her research organisation develops innovative software for the company's IT consultants in order to increase their performance, e.g. business process modelling tools. Consultants mainly use these tools as stand-alone applications. Therefore, instead of needing to be integrated into an existing technical architecture, the tools only need to fit the consultants' requirements. This is nevertheless problematic as consultants are incentivised to work in client projects as much as possible. Time-intensive contact to the research team therefore contradicts the consultants' goals. Our interviewee explained that their research freedom is restricted by the consultants' needs. In contrast, as stand-alone applications are developed in most cases, existing architectures need not to be considered in most of the research projects. Our interview partner said she feels free to bring forward her own ideas as far as the technical architecture of the research result is concerned. Nevertheless, some tool vendors had been purchased by company D. Some of the researchers are presently occupied with integrating their former innovations with these acquired tools.

4 A Conceptual Framework for the Strategic Positioning of ICT Research Companies

4.1 Framework Development

The literature analysed points out the importance of researchers' freedom for developing radical innovation. The case studies reveal two important factors that restrict researcher's freedom: the prospective users' requirements and the need to integrate the innovation into an existing architecture.

The prospective users' needs are strongly considered by companies A, B, and D. The interviewees of these three companies confirmed that they have to consider the users' and the market's needs. As described, the gate process for project acceptance in company A requires that at least two business units confirm they consider an innovation to be useful for themselves. Moreover, the estimated incomes generated by the innovation's usage in routine operations must exceed the costs of a research project many times. Company B's research organisation also strongly considers prospective users' needs. This

is also true for company D's research organisation although researchers are challenged by the low availability of their prospective users. In summary, interviewees from research organisations of companies A, B, and D agreed that their creativity and design freedom are restricted by user requirements. As outlined in section 2, such restrictions hinder the development of radical innovation. In contrast, company C's research organisation is free from user requirements and is only restricted by requirements for publicly funded research. Researchers state that their research model allows for creativity. Based on the findings of section 2, such creativity is a necessary condition for radical innovation.

Existing architecture is presently only considered by company B's research organisation. Consistent with Dietz's (2006; 2007) definition of architecture as a restriction of design freedom (cf. also Hoogervorst, 2004; Hoogervorst, 2009), company B perceives architectural requirements to limit their creativity. Company A's research organisation presently does not exhaustively consider the existing architecture, but aims to consider it in future. The interviewed project managers advise against this development, pointing out the estimated negative influence on the research organisation's innovativeness. Company C presently fully ignores architectural requirements and claims to have much freedom, also for generating radical innovation. For company D, architectural requirements are not applicable in many cases. Although being restricted by user requirements, company D's research organisation feels free in their choices of technology.

As our case study analysis shows, each of the research organisations has to make strategic decisions
(a) whether it aims at radical or incremental innovation (*degree of innovativeness*),
(b) whether it aims at innovation that can be rapidly integrated into the existing architecture or that requires the existing architecture to be fundamentally changed (*degree of integrability into existing architecture*), and
(c) whether or how it considers the prospective users' needs (*degree of orientation towards users'/market's needs*).

As outlined, our case studies moreover show that the three strategic decisions are interdependent. To aim at one of the three goals makes it more difficult to aim at the two others. Further empirical studies also support our observation: For instance, Verworn et al. (2008) support the assumption that (a) and (b) as well as (a) and (c) are rivalling goals. Verworn et al. find that market uncertainty and technological uncertainty are higher for radical innovation than for incremental innovation.
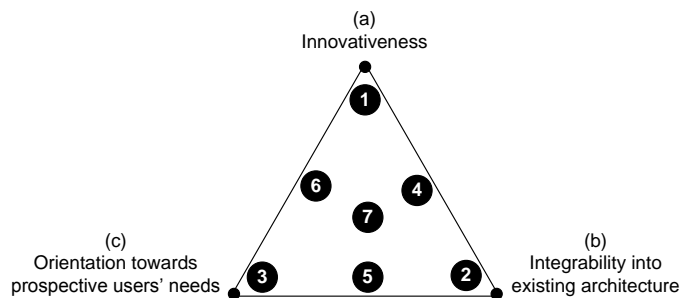

Figure 1:   *Conceptual Framework for strategic positioning of ICT research organisations (based upon Verworn et al., 2008)*

Based upon the case study findings and on the literature analysed, we propose the framework illustrated in Figure 1. The framework spans a triangular space inside which every ICT research organisation can be positioned. Each angle of the equilateral triangle represents one of the following three strategic goals: (a) *degree of innovativeness*, (b) *degree of integrability into existing architecture*, and (c) *degree of orientation towards prospective users' needs*.

Every ICT research company takes a strategic position inside this equilateral triangle. The distance to each of its angles shows in how far the research organisation aims to achieve the respective goal. In Figure 1, we illustrate seven extreme positions inside this triangle (positions 1 to 7). Position 1 represents a research organisation that strongly focuses on radical innovation, but neglects users' needs as

well as technical feasibility/existing architecture; positions 2 and 3 can be interpreted analogously. Position 4 represents a research organisation that focuses on technical feasibility and innovativeness of research results, but neglects prospective users' needs; positions 5 and 6 can be interpreted analogously. Finally, position 7 represents a research organisation that aims to reach all three goals.

4.2 Positioning of the Case Study Companies

In order to demonstrate the applicability of the framework, we position the case study companies in our conceptual framework. The result of our analysis is illustrated in Figure 2; it describes the as-is and to-be position if applicable.

At present, **company A**'s research organisation strongly focuses on the stakeholders' needs and aims to develop innovative solutions. However, as interviews show, existing architecture is presently heavily neglected. In the future, according to the interviewed member of the research organisation's management board, the company aims to integrate all its innovation into business units. To this end, the research organisation will need to reduce the innovativeness of their research projects. **Company B**'s research organisation is presently at the position which company A aims to attain. It strongly focuses on existing architecture and prospective users' needs. **Company C**'s research organisation neglects prospective intra-company users' needs and existing architectures in most cases. Therefore, they can concentrate on developing radical innovations, which are, however, rarely used by company C. **Company D**'s research organisation, similar to that of company A, mainly aims to develop radical innovations, by exclusively considering prospective users' needs and neglecting existing technical architectures. However, in contrast to company A's research organisation, company D is rather satisfied with its present position. Only due to the acquisition of further tools, attempts for considering existing architectures are presently made; therefore, in the future, the research organisation's to-be position considers existing architectures more strongly.
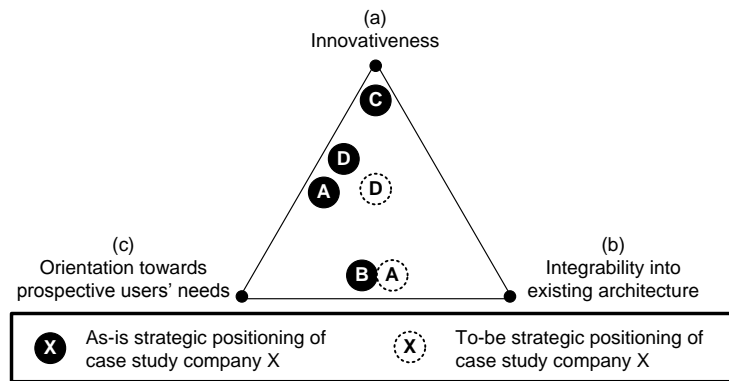

Figure 2:   *Positioning of the case study companies inside the conceptual framework*

4.3 Propositions for Stable Strategic Positioning of Intra-Company ICT Research Organisations

Our analysis shows that strategic positioning of some of the research organisations is stable whilst others are planning to change their strategic positioning. In accordance with contingency theory, we believe that there is not one best strategic positioning for intra-company ICT research organisations, but that the suitability of any strategic positioning depends on contingency factors.

Contingency theory was first expressed by Fiedler (1964) who investigated the effectiveness of leadership styles and found that appropriateness of leadership style depends on contingency factors. "At the most abstract level, the contingency approach says that the effect of one variable on another depends upon some third variable" (Donaldson, 2001, p. 5.). The core proposition of contingency theory is that

a fit between contingency factors on the one side and strategy and organisation of an enterprise on the other side leads to performance whilst a misfit leads to a lack of performance. The analysis of four case studies reveals two main contingency factors which are relevant for strategic positioning of ICT research organisations: (1) need to integrate innovation and (2) sources of research funding. Based on these contingency factors, we formulate propositions which are a basis for further empirical investigation.

The first contingency factor is almost tautological: Company D's research organisation does not consider any existing architecture. However, in contrast to company A's research organisation, it is broadly satisfied with this positioning. The difference between both organisations is that company D's research organisation develops stand-alone applications while company A's research organisation develops applications that need to be integrated into existing architectures in order to work efficiently. We formulate proposition P1:

> **P1**: Intra-company ICT research organisations that develop stand-alone applications do not need to consider existing architecture; they can therefore aim to develop more radical innovations and/or consider stakeholders' needs more strongly.

The second contingency factor is the source of research funding. Company C's research organisation is the only organisation that is not funded by its parent company and, simultaneously, it is the only organisation that can continuously do radically innovative research. The analysis of company A moreover shows the difficulties which occur if a research organisation aims at radical innovation while simultaneously being funded by the parent company. Finally, company B's research organisation—also funded by its parent company—is satisfied with its positioning oriented towards users' needs, existing architectures, and incremental innovation. We therefore formulate proposition P2:

> **P2**: Intra-company ICT research organisations that are funded by the company aim at incremental innovation, thereby considering the prospective users' needs and existing architectures, whilst publicly funded ICT research organisations do incremental innovation, but the company does not sufficiently benefit from its research results.

5 Summary and Discussion

5.1 Summary

In our explorative research, we have developed a conceptual framework for strategic positioning of intra-company ICT research organisations. Based on the analysis of literature and four case studies, we have found that three important parameters allow for configuring strategic positioning of ICT research organisations: (a) desired degree of innovativeness, (b) desired degree of integrability into existing architecture, and (c) desired degree of orientation towards prospective users' needs. Based on the literature and the case studies analysed, we argue that all three goals are concurrent, i.e. aiming at one of these goals makes it difficult to aim at the other two goals. Finally, we have formulated propositions for stable strategic positioning. In proposition P1, we argue that intra-company ICT research organisations which develop stand-alone applications can focus more strongly on the prospective users' needs and aim at more innovative research results. In proposition P2, we argue that publicly funded intra-company ICT research organisations can aim at radical innovation, largely ignoring existing architectures and prospective users' needs, whereas research organisations that are funded by their parent company aim at less innovative research results, thereby considering existing architectures and needs articulated by prospective users.

5.2   Strengths, Limitations, and Further Research

To the best of our knowledge, this is the first publication dealing with the special challenge of ICT research organisations that need to integrate their research result into an existing architecture. Our exploratory analysis of case studies shows that this challenge is important for intra-company ICT research organisations. The framework and the propositions resulting from our exploratory research provide a foundation for future research in the field which is certainly the main strength of our paper.

Our research is primarily limited by its exploratory nature. Although the four case studies taken allow for a first understanding of the challenges of intra-company ICT research organisations, four case studies are not a sufficient foundation for gaining certain knowledge. To this end, the validity of assumptions our framework is build upon as well as the validity of the propositions should be tested in further confirmative research. To this end, either more case studies should be taken and analysed or the propositions should be tested in a field study.

Moreover, we doubt that the formulated proposition P1 and P2 exhaustively capture the relevant contingency factors. In order to identify further contingency factors and to generate more propositions, further case study research will be necessary.

Finally, by focusing on research organisation as a whole, we strongly simplified our research. Instead of positioning whole research organisations inside the framework, one could also position single research projects. Indeed, by diversifying its research project portfolio, an intra-company research organisation can cover all positions inside the framework. Although our simplified view leads to reasonable research results, a deeper study of single research projects in case studies or field studies will certainly allow for the accumulation of further insights.

References

Adams, R., Bessant, J. and Phelps, R. (2006). Innovation management measurement: A review. International Journal of Management Reviews 8 (1), 21–47.

Aier, S., Gleichauf, B., Riege, C. and Saat, J. (2009). Empirische Validierung von Integrationstypen am Beispiel unternehmensübergreifender Integration. In Business Services: Konzepte, Technologien, Anwendungen. Tagungsbände der 9. Internationalen Tagung Wirtschaftsinformatik, Band 1 (Hansen, H. R. and Karagiannis, D. and Fill, H.-G., Eds), 99–108, Österreichische Computer Gesellschaft, Wien.

Aier, S. and Winter, R. (2009). Virtual Decoupling for IT/Business Alignment – Conceptual Foundations, Architecture Design and Implementation Example. Business & Information Systems Engineering 1 (2), 150–163.

Amabile, T. M. (1988). A Model of Creativity and Innovation in Organizations. Research in Organizational Behavior 10 (1), 123–167.

Amabile, T. M. (1998). How to Kill Creativity. Harvard Business Review 76 (5), 76–87.

Amabile, T. M., Conti, R., Coon, H., Lazenby, J. and Herron, M. (1996). Assessing the Work Environment for Creativity. Academy of Management Journal 39 (5), 1154–1184.

Andriopoulos, C. (2001). Determinant of Organisational Creativity: A Literature Review. Management Decision 39 (10), 834–841.

Anonymous (2006). V-Modell XT, http://ftp.tu-clausthal.de/pub/institute/informatik/v-modell-xt/Releases/1.3/V-Modell-XT-Complete.pdf, last accessed 23.11.2010.

Bhattacharya, S., Krishnan, V. and Mahajan, V. (1998). Managing New Product Definition in Highly Dynamic Environments. Management Science 44 (11), 50–64.

Boehm, B. (1986). A Spiral Model of Software Development and Enhancement. SIGSOFT Software Engineering Notes 11 (4), 14–24.

Boehm, B. and Abts, C. (1999). COTS Integration: Plug and Pray? Computer 32 (1), 135–138.

Bower, M. (1965). Nurturing Innovation in an Organisation. In: The Creative Organisation (Steiner, G. A., Ed.), Chicago University Press, Chicago.

Brand, A. (1998). Knowledge Management and Innovation at 3M. Journal of Knowledge Management 2 (1), 17–22.

Braun, C. and Winter, R. (2007). Integration of IT Service Management into Enterprise Architecture. In: Proceedings of the 2007 ACM Symposium of Applied Computing, 1215–1219, ACM, Seoul, Korea.

Chaney, P. K., Devinney, T. M. and Winer, R. S. (1991). The Impact of New Product Introductions on the Market Value of Firms. Journal of Business 64 (4), 573–610.

Chmielewicz, K. (1991). Unternehmensverfassung und Innovation. In: Innovations- und Technologiemanagement. Festschrift für N. Szyperski (Müller-Böling, D. and Seibt, D. and Wienand, U., Eds), 83–101, Stuttgart.

Clayton, T. (1998). Brands, Innovation and Growth: A Pims Study of Brand Value. International Journal of Innovation Management 2 (4), 455–468.

Cooper, R. G. (1993) Winning at New Products: Accelerating the Process from Idea to Launch. 2nd Edition, Addison Wesley, Boston.

Cooper, R. G. and Kleinschmidt, E. J. (1987). Success Factors in Product Innovation. Industrial Marketing Management 16, 215–223.

Damanpour, F. (1991). Organizational Innovation: A Meta-Analysis of Effects of Determinants and Moderators. Academy of Management Journal 34 (3), 555–590.

Damanpour, F. and Aravind, D. (2006). Product and Process Innovations: A Review of Organizational and Environmental Determinants. In: Innovation, Science, and Institutional Change (Hage, J. and Meeus, M. T. H. and Meeus, M., Eds), 38–66, Oxford University Press, New York.

Delbecq, A. L. and Mills, P. K. (1985). Managerial Practices that Enhance Innovation. Organizational Dynamics 14 (1), 24–34.

Dietz, J. L. G. (2006) Enterprise Ontology – Theory and Methodology. Springer, Berlin, Heidelberg.

Dietz, J. L. G. (2007) Architecture. Building Strategy into Design. Academic Service, The Hague.

Donaldson, L. (2001) The Contingency Theory of Organizations. Sage, Thousand Oaks.

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

Elkins, T. and Keller, R. T. (2003). Leadership in Research and Development Organizations: A Literature Review and Conceptual Framework. The Leadership Quarterly 14 (4–5), 587–606.

Feurer, R., Chaharbaghi, K. and Wargin, J. (1996). Developing Creative Teams for Operational Excellence. International Journal of Operations & Production Management 16 (1), 5–18.

Fiedler, F. E. (1964). A Contingency Model of Leadership Effectiveness. Advances in Experimental Social Psychology 1, 149–190.

Galbraith, J. R. (1982). Designing the Innovating Organization. Organizational Dynamics 10 (Winter), 5–25.

Garcia, R. and Calantone, R. J. (2002). A Critical Look at Technological Innovation Typology and Innovativeness Terminology: A Literature Review. The Journal of Product Innovation Management 19 (2), 110–132.

Geroski, P. (1994) Market Structure, Corporate Performance, and Innovative Activity. Oxford University Press, Oxford.

Hausschildt, J. and Salomo, S. (2007) Innovationsmanagement. 4. Franz Vahlen, München.

Hoogervorst, J. A. P. (2004). Enterprise Architecture: Enabling Integration, Agility and Change. International Journal of Cooperative Information Systems 13 (3), 213–233.

Hoogervorst, J. A. P. (2009) Enterprise Governance and Enterprise Engineering. Springer, Berlin.

Ieee (2000). IEEE Recommended Practice for Architectural Description of Software Intensive Systems (IEEE Std 1471-2000).

Johnson, M. W., Christensen, C. M. and Kagermann, H. (2008). Reinventing Your Business Model. Harvard Business Review 86 (12), 50–59.

Kimberly, J. R. and Evanisko, M. J. (1981). Organizational Innovation: The Influence of Individual, Organizational, and Contextual Factors on Hospital Adoption of Technological and Administrative Innovations. Academy of Management Journal 24 (4), 689–713.

Kleinschmidt, E. J. and Cooper, R. G. (1991). The Relative Importance of New Product Success Determinants: Perception versus Reality. Journal of Product Innovation Management 8, 240–251.

Link, P. (1987). Keys to New Product Success and Failure. Journal of Industrial Marketing Management 16, 109–118.

Madique, M. A. and Zirger, B. J. (1984). A Study of Success and Failure in Product Innovation: The Case of the U.S. Electronics Industry. IEEE Transactions on Engineering Management 31 (4), 192–203.

Mertens, P. (1966) Die zwischenbetriebliche Kooperation und Integration bei der automatisierten Datenverarbeitung. Hain, Meisenheim.

Moss Kanter, R. (1983) The Change Masters: Innovation for Productivity in the American Corporation. Simon and Schuster, New York.

Nyström, H. (1979) Creativity and Innovation. John Wiley & Sons, Chichester.

Rackham, N. (1988). From experience: Why Bad Things Happen to Good New Products. Journal of Product Innovation Management 15, 201–207.

Schmidt, J. B. (1995). New Product Myopia. Journal of Business & Industrial Marketing 10 (1), 23–33.

Schönherr, M. (2009). Towards a Common Terminology in the Discipline of Enterprise Architecture. In Service-Oriented Computing - ICSOC 2008 Workshops (Feuerlicht, G. and Lamersdorf, W., Eds), 400–413, Springer, Berlin.

Schumpeter, J. A. (1988, first published in 1911). Theorie der wirtschaftlichen Entwicklung. Verlag Wirtschaft und Finanzen, Düsseldorf.

The Open Group (2009) The Open Group Architecture Framework TOGAF Version 9. Van Haren, Zaltbommel.

Tidd, J. (2000) From Knowledge Management to Strategic Competence: Measuring Technological, Market and Organisational Innovation. Imperial College Press, London.

Tidd, J., Driver, C. and Saunders, P. (1996). Linking Technological, Market & Financial Indicators of Innovation. Economics of Innovation and New Technology 4 (3), 155–172.

Ulrich, K. (1995). The Role of Product Architecture in the Manufacturing Firm. Research Policy 24 (3), 419–440.

Van Der Panne, G., Van Beers, C. and Kleinknecht, A. (2003). Success and Failure of Innovation: A Literature Review. International Journal of Innovation Management 7 (3), 309–338.

Verworn, B., Herstatt, C. and Nagahira, A. (2008). The Fuzzy Front End of Japanese New Product Development Projects: Impact on Success and Differences between Incremental and Radical Projects. R&D Management 38 (1), 1–19.

Wilson, J. Q. (1967). Innovation in Organization: Notes Toward a Theory. In: Approaches to Organizational Design (Thompson, J. D., Ed), 193–218, Pittsburgh.

Winter, R. and Fischer, R. (2007). Essential Layers, Artifacts, and Dependencies of Enterprise Architecture. Journal of Enterprise Architecture 3 (2), 7–18.

Yin, R. K. (2009) Case Study Research: Design and Methods. 4. Sage Publications, Los Angeles.