

Integrating Outside Specialists into Product Development Project

Teemu Surakka

Researcher, BIT Research Centre, Helsinki University of Technology, teemu.surakka@tkk.fi

Abstract

Companies around the world are differentiating their products from competitors' products with such means as design, usability or branding. In many cases specialized service providers have to be used to supplement the skills inside the company. This means that product development partners have to take into account numerous interest groups and use different integration methods to ensure product development success. Focus of this paper is on the organizational level of collaboration with knowledge intensive service companies and on the early steps of this collaboration. The empirical part of this study consists of three longitudinal case studies. In these case studies, our multidisciplinary research group observed and analyzed how these different Finnish companies worked with outside partners and interest groups in design intensive product development projects. Based on this material a categorization of the influencing factors on the integration in collaborative development is proposed. This categorization refines current literature on the matter and is aimed to help further research on collaborative product development and especially using knowledge intensive service providers in that process.

Keywords

KIBS, interorganizational collaboration, integration, knowledge transfer, case study

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Introduction

Consumers around the world have become more sophisticated and demand personalized products that incorporate quality and design features. At the same time, product developers face ever increasing demands for shortening time-to-market in product development. In this pressure, current work organizations and development practices are no longer meeting all the expectations. The keyword has become flexibility: the use of labor and recourses in a strategic fashion to enable organizations to be responsive to changes (Coffey & Bailly, 1991; Feller, 2004; Verganti, 1999). One way to achieve the needed flexibility is to use specialized service providers to supplement the skills inside the company (Toivonen, 2004).

In product development literature there is a continuous line of empirical studies of the importance of organizational integration for the product development performance, going back for over 30 years now. From this broader tradition, a disciplined problem solving approach (Brown & Eisenhardt, 1995) has emerged in the 1980's. Our research follows this general research tradition, but we have also looked into organizational behavior literature to supplement this research tradition with political and psychological phenomena. Previous research in this research tradition has mainly overlooked these phenomena (Brown & Eisenhardt, 1995), which are often intensified when product development collaboration crosses the organizational boundaries.

Knowledge Intensive Business Service (KIBS) companies as a part of collaborative product development

Some of the more recent research on interorganizational collaboration has concentrated on the goals and motives of collaborative product development. Collaborative product development is usually performed out of one of the following four motives (Feller, 2004): First, the companies try to access new technology and skills that they do not possess themselves – so-called alliances of scope. Second, they may not have enough resources to perform the desired activities in the specified time – so-called alliances of scale. Third, companies engage in alliances in order to learn and fourth, companies need to share the risks and costs associated especially with breakthrough products and services. In times of economic downturns, companies tend to engage especially in alliances of scope. In contrast, in times of economic booms, when R&D staff is often working to the limits, firms try to enlarge their capacity and reduce lead-time by forming alliances of scale (Dussauge et al, 2000).

The motives for using knowledge intensive business services (KIBS) to supplement in-house product development resources includes some or all of the motives mentioned above – depending on the market situation (Toivonen, 2004). In response to the changes in the overall business environment, some researchers have seen specialized service companies facilitating economic change and adaptation. For example, according to Coffey & Bailly (1991) the intensified uncertainty and increased competitiveness require that companies are able to combine and recombine together in loose, rapidly shifting coalitions and more flexible modes of production. Gillespie & Green (1987) have shown that specialized service functions influence the modernization of the productive system, assist in adopting the skills and attitudes required by the changes and reduce structural, organizational, administrative and knowledge-related obstacles. In addition, the complexities of the global economy are seen as increasing considerably the need for knowledge and adaptation (Goe, 1990). As an example the need for advice related to regional regulations has increased demand for services functions such as accounting and legal services (Toivonen, 2004). On the contrary, some researchers have seen all the same environmental factors as favoring formal organizations over knowledge intensive business services when considering the effectiveness of research and development (Dosi, 1988).

The scope and the intensity of interaction between firms is increasing and thus the need for coordination and control is not restricted inside companies any more (Toivonen, 2004). And whenever interorganizational knowledge transfer occur, one need to have substantial in-house capacity in order to recognize, evaluate, negotiate, and finally adapt the knowledge potentially

available from others (Dosi, 1988). These two aspects have increased the need for integrative actions in interorganizational knowledge transfer and collaboration.

Integration in interorganizational collaboration

Research on organizational and interorganizational collaboration has produced many models and also acknowledged many other influencing factors affecting the success of collaborative product development. Recent studies on functional integration inside organizations have concluded that differences in organizational performance can be attributed largely to the degree of integration in their development processes (Hoopes & Postrel, 1999). These studies stress the importance of (a) frequent, early, and rich communication among the various special functions needed to launch the product, (b) the need for 'boundary-spanning' individuals, and (c) the value of searching both inside and outside of the organization for solutions to design and technology problems. Griffin & Hauser (1996) have looked more deeply into the underlying factors in their paper about R&D and marketing function integration. They have identified five negatively affecting factors in their review of the functional integration literature. These negatively affecting barriers include differences in personality, cultural thought worlds, language, and organizational responsibilities and also physical barriers.

On the other hand, previous research on interorganizational collaborative product development has shown that collaboration can be costly, the expectations of the partners are often not met, and many collaborative projects are terminated unsuccessfully (Littler et al, 1995). Considering the influencing factors, the complexity of the situation may increase as the collaboration spans organizational boundaries. For example Littler et al. (1995) has found out that effective product development collaboration management usually means that collaborating parties need to balance diverse and sometimes contradictory influences: (a) balance between the need to establish ground rules and maintaining the flexibility in collaboration; (b) balance between guarding proprietary knowledge and skills in the company and building a climate of trust between partners; (c) balance between internal management and a focus on wider environmental and market factors; and (d) balance between monitoring the progress and recognizing the more intangible benefits collaboration can bring. Ragatz et al. (1997) have studied supplier integration into new product development and identified several processes and factors differentiating successful and unsuccessful collaboration. The most influential processes in their study include communication and learning processes (participation, co-location, cross-functional communication, common information systems, shared training) and formal or informal trust building processes. The most influential factors include supplier involvement enablers (familiarity, confidence on the choice of partner) and top management involvement.

Models and frameworks of both functional and interorganizational integration usually categorize influencing factors into communicational and co-operational factors (for example Kahn, 1996; Ragatz et al, 1997). In their study about knowledge sharing in organization, Hoopes & Postrel (1999) further divides communicational factors into coordination and shared knowledge related factors – the latter category referring mainly to factors affecting the absorption of the knowledge. Taking into account the nature of KIBS and the knowledge transferred between organizations, this tripartite categorization is adopted in this paper.

Hoopes & Postrel (1999) focus purely on factors related to the sharing of knowledge in their study. However, other researchers, such as Jassawalla & Sashitta (1998) claim that co-operational factors are of most importance in collaboration. In this paper these categorizations are treated equal and following the viewpoints of Araujo (1998) these factors are seen as interwoven network of factors affecting knowledge and learning (figure 1).

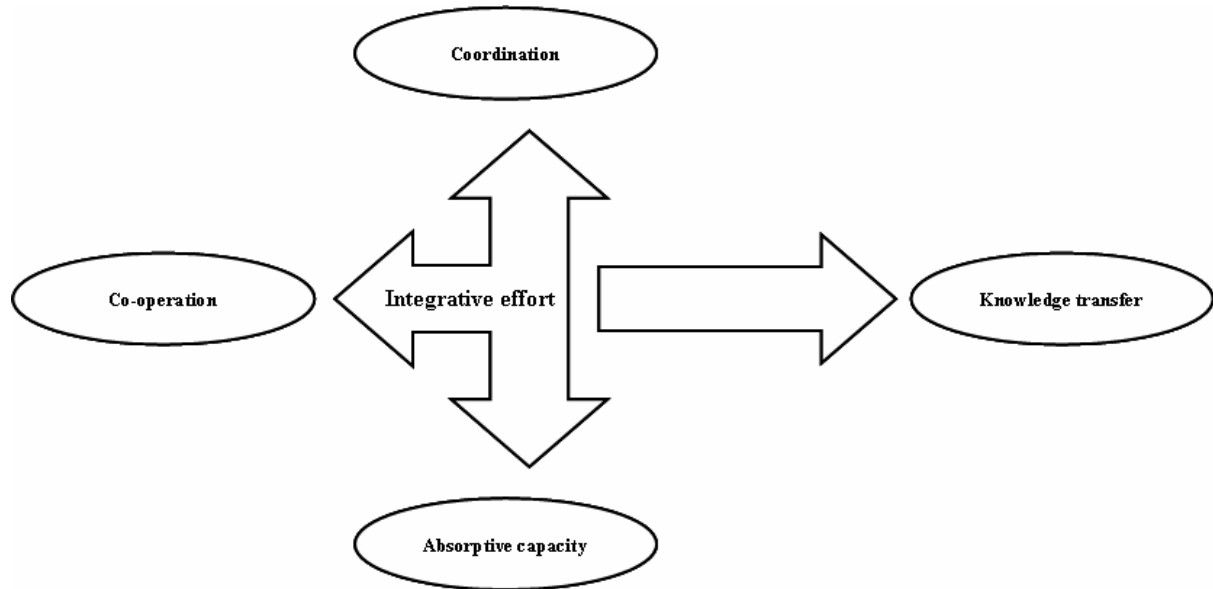


Figure 1. Interwoven network of categories of factors that influence integration and eventually the success of knowledge transfer

Purpose of this paper

Organizations in industrial settings often tend to find novel and unexpected associations between practices in different physical setting and across the portfolio of relationships they conduct with third parties (e.g. customers, suppliers, research institutions). In this respect the use of knowledge intensive business services may be, in many cases, a sound idea. However, companies have to make sure that they can take full advantage of the services that they pay for. This usually calls for integrative methods in the collaborative effort.

The factors and processes affecting integration, discussed above, mainly consider established relationships and thus collaboration with project based firms and especially the early steps of this collaboration are overlooked in these studies. *The purpose of this paper is to investigate influencing factors of the integration in product development that utilizes KIBS in a collaborative manner.* Focus of the paper is on the organizational level of collaboration and on the early steps of this collaboration – the latter point of view has been chosen since KIBS are sometimes used only on case-by-case basis. Based on the findings of the case studies, a categorization of the influencing factors in collaborative product development is proposed. This categorization further refines existing models and categorizations found in literature. Also, juxtaposing the findings with existing literature this study makes propositions on further research.

Methods

During the *Desiré* (Design research) research project, our research group conducted nine qualitative studies with five companies between the years 2002 and 2005. These studies were conducted in companies using KIBS to supplement their product development efforts in some stage of the product development process. In the beginning of our research project, we conducted preliminary interviews that helped us to shape our theoretical framework. Thus our theoretical framework is the result of a literature analysis complemented by insights of different service providers in the field of product development.

Out of these nine studies, five have been selected to this study on the basis that they incorporated some integrative methods set into action by the client company in the course of collaboration. These five studies have been grouped into three longitudinal case studies (three different companies). In these cases our multidisciplinary research group both acted as sources of expert knowledge and at the same time observed how these Finnish companies worked with outside partners and interest groups in design intensive product development projects.

Based on our theoretical framework we focused on factors and events affecting knowledge transfer between different parties in collaboration. In addition to direct observations we used visual mapping techniques and interviews to discover possible hidden factors. In the analysis phase we reflected previous literature on collaborative product development and organizational behavior in the identification of the possible factors behind observed events. Finally we categorized these factors mainly on the basis of tripartite categorization suggested by Hoopes & Postrel (1999).

Cases

Using the theoretical framework and methods discussed above, three case studies have been carried out. Next, a general description of the cases is presented. After that the observations are looked into more closely – focusing more on the first case and only adding supplementary observations from the other cases.

Overview of the cases

Chronologically, the first case in this study was with a Finnish manufacturer of work vehicles. Company is facing a fierce competition in global markets and also a fundamental change in the user requirements of the vehicle. Company representatives thought that usability issues could be used as an asset in this global competition and our research group stepped in to aid them in the development of next generation of these machines. From the start, the idea was to carry out usability studies in one of their division and then continue with the studies to the second division in order to have a unified look and feel, although in some respect these products are very different. This company had a long, partnership like relationship with an industrial design service company and both the divisions used the services of this company. In respect of these product development efforts, no other outside service providers were included in the product development teams.

The second case was carried out with a service provider that is operating globally. In the ever increasing pressure to streamline operations, this company decided to focus more on self-service machines in their business. Our research group was brought in to test and improve the usability of these self-service machines, supplied by a third party supplier. In addition to working with this outside technology supplier (and with our research group), this company had to take into account, for example, the opinions of a governmental authority as an interest group. This case started as a straight-forward product development project. It soon developed into a broader case of rethinking the company's services, which was tackled in a follow-up study with only a little addition to the core development team.

The last case was carried out in a Finnish SME manufacturer of household items that are based on their superior manufacturing capabilities and material knowledge. Historically they have been quite technology driven and they have relied on their supply chain, but lately they have concentrated on the end users of their products. Nowadays they have done excellent job, for example, on improving the usability of their products and they have both outside and in-house resources in industrial design. Our research group couldn't give them any new knowledge on these aspects of product development, but we thought that they could enter new markets with their product with only little modifications to their products – giving a new meaning to this product. Together with their product development and senior management we thought up new product categories (and markets) for their product, using product semantics as a starting point for the development. In addition to our research group and the established relationship with outside industrial designer, this company used extensively outside service providers on case-by-case basis.

Case: work vehicle manufacturer - observations

This first case was carried out between May 2003 and October 2003 with two different divisions of this Finnish work vehicle manufacturer. The development work had already started in the first division by the time our research group started to negotiate the terms of the collaboration. This situation caused severe constraints to our work later on, but at first it actually helped to clarify the problem areas in development effort.

Negotiations were carried out with the senior management in a speedy manner - thus our participation in the development effort came as a bit surprise to other collaborating parties and also to some members in the core development team. This caused understandable concerns among these members about their role in the development effort. During the rest of the development effort our research group had direct contacts with senior management, technical development and procurement, with a member of procurement acting as a primary contact person for our research group.

Our research group was given hands-on training in the use of the vehicle and we were also given all the material we needed to carry out our part of the development (usability evaluation). This gave us a good start to the work, despite unfortunate vehicle / equipment malfunctions in the training and observations phases. Also since we were given such a rich material, we could carry out the analysis and development phases despite the physical distance between us and the core development team. However, quite soon in the development effort, both our research group and the client company started to apply integrative efforts.

These included face-to-face trust building meeting with designers from our part and the introduction of new in-house usability trainee from the company's side.

These integrative efforts enhanced greatly knowledge flows between different partners. They also clarified the roles of different specialist to such extent that outside designers noticed a possibility to make big improvements to the product and even tried to coordinate the effort in favor of all the participating parties. Soon it became clear though that overlapping effort had already been done by the research group and designers and this coordinating effort wasn't successful. In the end software development in the company appeared to be a severe bottleneck postponing the whole development effort to distant future.

With the second division of the company our direct contacts were limited to senior management and to not so frequent face-to-face meetings with product development team. While the development effort hadn't been started with this division by the time we started our work, the company wide branding effort caused constraints and also uncertainty in our work since the previous development effort was postponed. All of the information about this branding effort wasn't given to us, which caused overlapping effort from our part. Our primary contact person in this part of the case was part of the senior management in the company. This guaranteed the senior management support in the development work, but on the other hand we relied too much on the company's internal communication, which later on turned out to be a huge mistake on our part.

Once again we got extensive training and adequate amount of material at our disposal. Since we were already familiar to the training and manufacturing departments of the company, they increased the depth of the information and we soon ran into difficulties with all the technical terminology and overall complexity of the vehicles. Once we resolved these difficulties, our understanding of the development need was enhanced. Once again we encountered unfortunate vehicle malfunctions during observation period, but at this time we were already used to these problems.

In this part of the project we had the opportunity to interview representatives of company's customers early on the project and also observe the machines in actual production environment. These observations and viewpoints could then be included in our analysis and development work better than in the first part of the case. The general feeling in the second part of the case was that we started to learn how to collaborate with this particular company. At this point, a hidden agenda was discovered as the company's usability trainee started actively collect all the material possible – in that respect knowledge transfer was successful since they too learned to construct in-house capabilities during the development effort. However, since this capability building was not agreed upon initially, it violated the trust between our research group and the company, and made it hard to collaborate on any further development efforts.

Simplified version of our visual map concerning this case is presented in the figure 2.

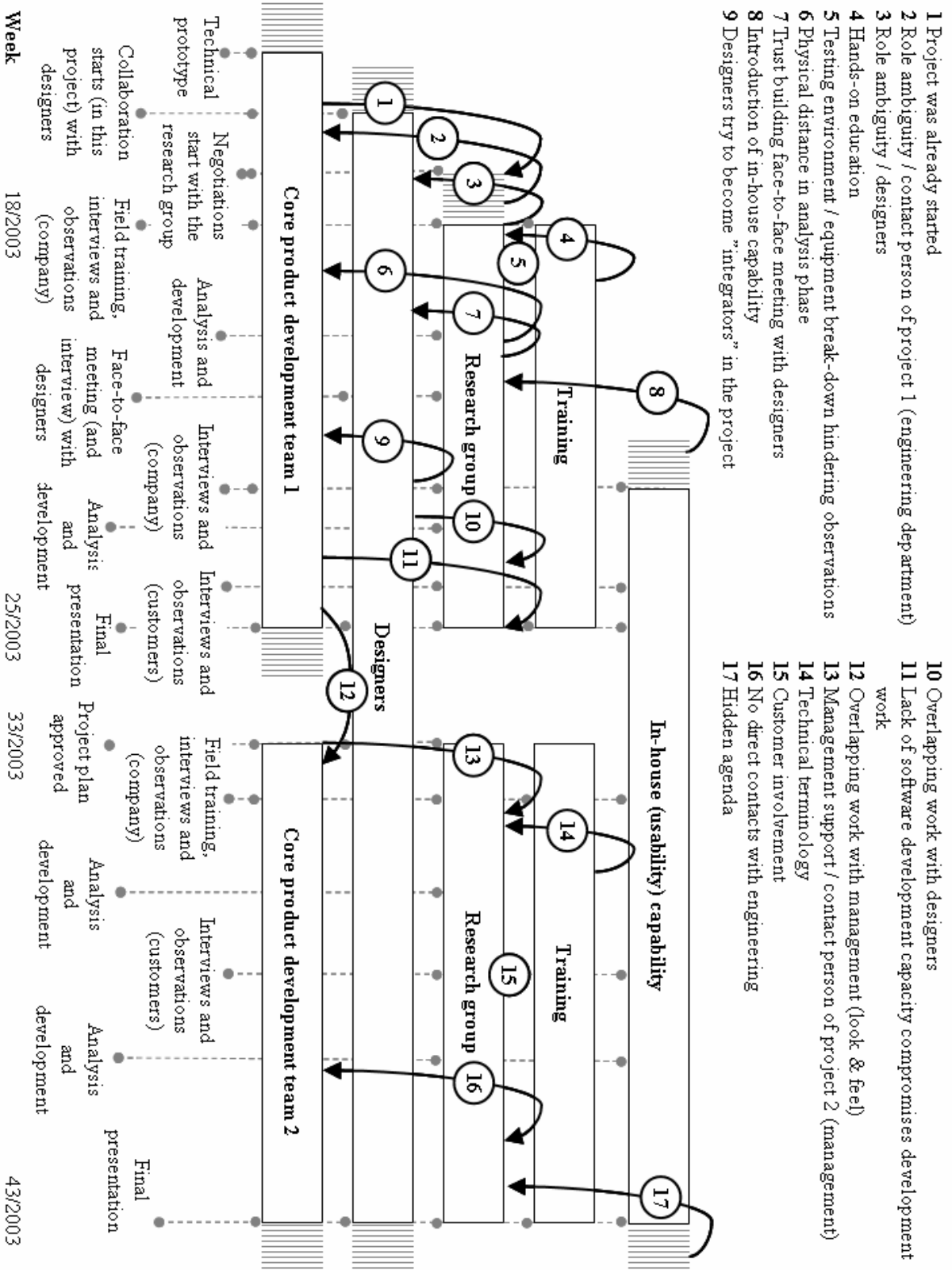


Figure 2. Simplified visual map of the case 1. Possible causal links between observations are omitted for clarity. Direction of the arrows points to the principal influencing direction of the event / factor.

Case: service provider - observations

The second case was carried out between September 2003 and May 2004 in two distinct parts. The customer company in this case was a Finnish service company that needed someone to test and improve the usability of their self-service machines, supplied by a third party supplier. In the first part of the study, knowledge sharing was some times overwhelming from our point of view – initially we had to learn the tricks of a wholly new industry. Since this case overlapped a little bit with the previous one, we had trouble with resources. But in just seven weeks we managed to analyze and streamline (from the usability point of view) all their customer channels and particularly the self-service machine.

Initially we had two contact persons with the different departments of the company, but after the initial development with the self service machines, the amount of communication sky rocketed – we were contacted from the other departments of the company with requests for assistance. Since our client company's organizational structure was really complex, we faced a coordination problem that was beyond our capabilities to handle – we had numerous direct contacts, different departments implementing our results in different pace and still the workload expanding the capacity of our research group from time to time, although all other cases were finished at this time. But since cooperation was on healthy ground (they understood that we were researchers providing unique guidelines and prototypes – not consulting) these coordination problems were understood and tolerated by the service development team. There was some work that was done without necessary information or that was overlapping with the work of other partners, but these were minor problems compared to the previous case.

The ability to change and the actual pace of change in this company really took us by surprise. For example, by the end of the first part of this case, the service development department had already implemented two software improvements to the self-service machines. How much learning too place in this first part of the development effort is not clear – at least one time during the process, our prototype was implemented without considering all the aspects or testing it in real environment, and the result actually worsened the usability of the product.

While our research group focused on the usability issues in the first part of the study, there was an IDBM (International Design Business Management) student group working parallel with our research group. Our research groups supervised this student group's work and it was from this combined effort that the underlying problems in the service offering were discovered and presented to the board of the company. Before this broader service development project could be started, there was a need to build more trust between different development partners. Our research group had proven ourselves by improving the self-service machines in very concrete manner, but it was felt necessary to bring together senior management from both collaborating parties in order to build trust and confidence in our research group.

Once again, process learning too place in the second part of the case. The more familiar departments of the company, together with our research group, invested resources to validate previous improvements and to learn together from past experience. This prevented quite many of the similar problems occurring. However, since the development spanned now the whole company, the core development team became too big for efficient knowledge transfer. Also

the number of interest groups increased beyond any possibilities of fast testing and implementation that was the strength of the development effort in the first part of the study.

Case: SME manufacturer - observations

The last case was carried out in a Finnish family-owned manufacturer of household items between February 2004 and April 2004. This case was by far the smallest in terms of resources used, but the collaboration went a lot deeper than in any other cases. There are several reasons for this:

Since the organizational structure in this relatively small company was very flat, we were able to establish communication on every level of the organization quite easily. After the storming face, the distributed product development team started to work efficiently and cooperatively with the coordination of the effort tightly in the hands of the general manager of the company.

The experience of the client company in utilizing outside resources becomes apparent in the trust building process. Knowledge sharing was rich in both quality and quantity. Company representatives weren't afraid (after non-disclosure agreements were signed) to openly present the results of previous research efforts and related market information. This open communication ensured that we wouldn't duplicate the work that others have already done, but it also committed our research group to live up to the expectations. In fact, this knowledge sharing relationship continued long after the case ended officially in the form of mentoring from our part. This mentoring relationship has deepened the collaboration even more and has helped to start additional development efforts with this company. In addition to open knowledge transfer, trust building events such as common fact-finding tours and recreational evenings were held.

Compared to their vast experience in utilizing knowledge intensive business services in search for new knowledge, they had implemented relatively few of the results of these collaborative efforts. This may stem from the quite conservative and careful approach that the owning family has adopted as their way of doing business. That doesn't undermine the fact that they had in many respects already out learned our research group in many areas that we consider our main strengths!

Concluding remarks of the cases

Since all of these cases were design intense product development projects, we expected a degree of inter-professional rivalry with different professions (Abbott 1988). It turned out that all the outside partners were conscious of this emphasis on design in these studies and eventually this may have defined the roles of different professions without any formal procedure. In one of the cases observed there was tension between groups of professionals, but this tension cleared in face-to-face meetings. In fact, after these professional groups didn't feel their status threatened they become allies in getting senior management support for the project. As a summary, clear roles and direct contacts to the different levels in the client organization were found to be the important conditions in building the needed cooperation.

The definition of goals and process of working are important when outside partners are introduced into product development process. In the observed product development projects the coordination of effort succeeded as planned only with one of the outside partners.

Similarly the definition of goals succeeded rarely without any confusion, but the more scientific nature of these development efforts may have caused this confusion.

The transfer of knowledge is even more important when outside service companies are introduced into product development. Developing trust and common ground improves flexibility in recipients and all this enhances knowledge transfer. We found out that all the effort invested in face-to-face meeting and all kinds of visual presentations paid off in improved understanding. The visual way of presenting soon became de facto in these projects, since there were so many industrial designers involved, but also because visual quality made the knowledge flow more concrete and deeper in some respect.

Influencing factors in the success of collaborative product development

Following the propositions of Hoopes and Postrel (1999) the influencing factors in this paper are categorized in three major categories. These categories are cooperation, coordination and absorptive capacity.

Smith et al (1995) have studied the nature of **cooperation** and have come up with a general description of the “process by which individuals, groups and organizations come together, interact, and form psychological relationships for mutual gain or benefit.” In product development, a lack of cooperation can arise between groups with different immediate interests. Lack of cooperation can also be a result of poorly defined roles, haste or poor personal relationships between group members.

Hoopes & Postrel (1999) define **coordination** in product development as “the process of sequencing and scheduling activities.” Problems in coordination can result in product development when goals haven’t been defined clearly, when there is a sudden change in timing or product specifications or when the product development group brings in new members who are unaccustomed to the group’s process of working.

Hoopes & Postrel (1999) define their concept of shared knowledge as “concepts, facts or propositions held in common by two or more people”. In this paper this concept is replaced with to more common concept of **absorptive capacity**. The inability to absorb knowledge can cause problems in product development when special knowledge is important to the next phase of product development and especially if the knowledge creating party is left with the impression that knowledge is properly transferred.

Using this categorization we can quite nicely group the affecting factors behind the observations in our cases. For example, factors related to role ambiguity, trust building and management support in the figure 2, all influence the knowledge transfer by creating or destroying cooperative environment. In similar vein, factors related to overlapping work or timely manner of introducing new resources are related to the coordination of the effort. Building in-house capabilities, investing on training or difficult terminology are examples of the influencing factors that affect absorption of the knowledge.

Integrative efforts in collaborative product development can either improve some aspects of this interwoven net of influencing factors – or these integrative methods can become wasted effort if some aspect of this interwoven net is overlooked.

Some of the observed factors cannot be grouped into these categories though, but these factors are mainly environmental aspects – structures and influencing factors that are necessary to be in order for the product development process in general to be effective. Supplemented with these factors, the proposed categorization with examples of the factors in every categorization is presented in the figure 3.

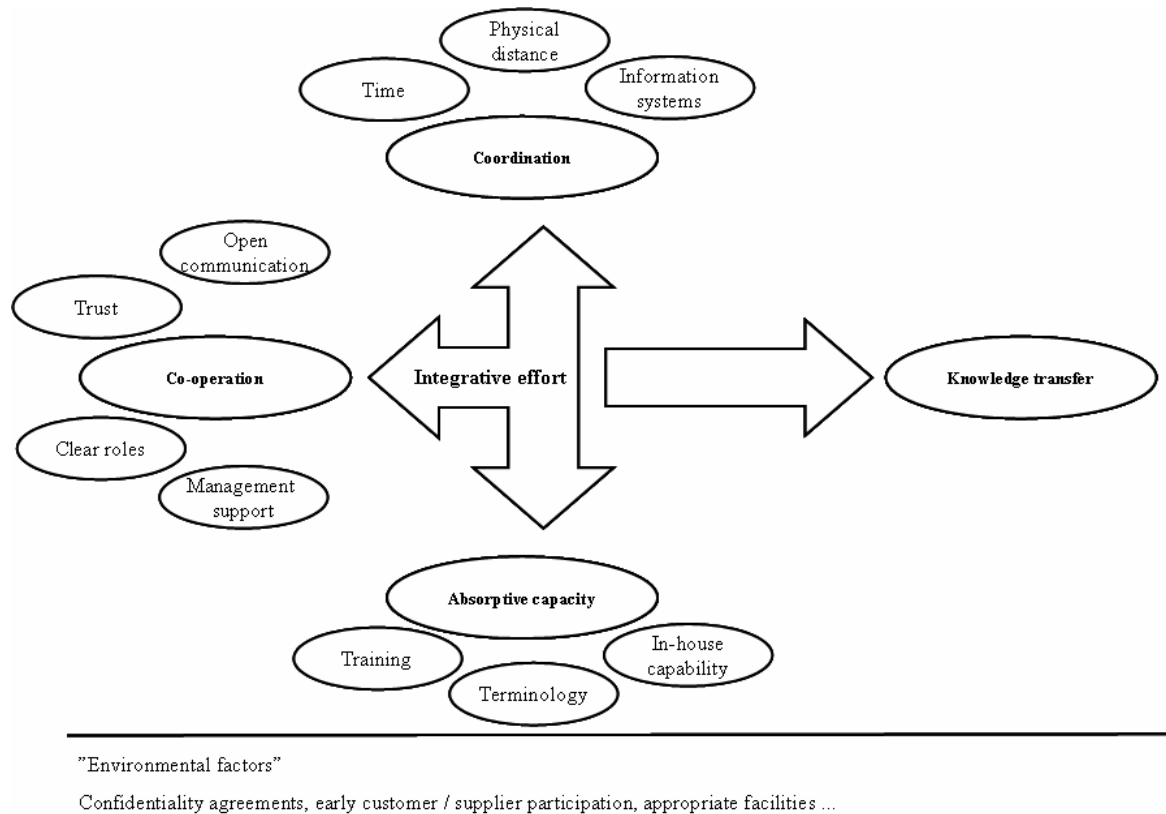


Figure 3. Interwoven net of influencing factors of effective knowledge transfer

Conclusions

Consumers around the world have become more sophisticated and demand personalized products that incorporate quality and design features. At the same time, product developers face ever increasing demands for shortening time-to-market in product development. In this situation companies are increasingly using specialized production services to supplement in-house capabilities. However, companies have to make sure that they can take full advantage of the services that they pay for. This usually calls for integrative methods in the collaborative effort.

The purpose of this paper was to investigate influencing factors of the integration in product development that utilizes knowledge intensive business services in a collaborative manner.

Focus of the paper was on the organizational level of collaboration and on the early steps of this collaboration – the latter point of view has been chosen since KIBS are sometimes used only on case-by-case basis. Based on the findings of the case studies, a categorization of the influencing factors in collaborative product development was proposed.

This descriptive study has several implications to further research in this field. It brings up the temporal aspect of these influencing factors – factors hampering integrative efforts, such as role ambiguity, can turn into an asset when they have been overcome in collaborative manner. In addition, this study points out that the early steps of the collaboration is extremely important when utilizing the services of knowledge intensive companies – in time collaborating parties may learn to work together better, but in fast changing environments companies may not have the time or opportunities to learn. The categorization proposed further refines similar findings in the previous literature by presenting the influencing factors as an interwoven net of equal categories of influencing factors. Also this paper and presented categorization underlines the importance of dealing the absorptive capacities of the organizations as an essential part of the knowledge transfer and research focusing on these issues.

Practical implications are few at this stage of the research and this is mainly due to the limitations of the chosen research approach – the cases presented in this paper couldn't be chosen in a way that they would have been comparable with each other. To construct a practical model or more robust theoretical construction, more research that takes into account the special aspects of these business services is needed.

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