COORDINATING SUPPLIER INVOLVEMENT IN PRODUCT DEVELOPMENT PROJECTS: A DIFFERENTIATED COORDINATION TYPOLOGY

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Abstract

Typologies of supplier classifications and interorganizational relationships suggest that a differentiated approach towards the organization of supplier involvement in the product development project is necessary. In this article, several coordination approaches are distinguished based on a case study of six product development projects and supplier involvement. The case study shows that interorganizational coordination differs. Three main approaches can be distinguished, an integrated approach, an independent approach, and an ad hoc approach. These three main approaches are formulated in a coordination typology, including project integration coordination, disconnected sub project coordination, and ad hoc coordination. Based on the case study and the literature, a framework is formulated for coordinating supplier involvement. The coordination approaches and the framework for coordinating supplier involvement may contribute to the understanding and management of interorganizational coordination of supplier involvement in product development projects.

Introduction

Since the 1980s, closer and more cooperative relationships with suppliers in product development have been strongly advocated and recommended as a way to stay competitive in a global, rapidly changing and demanding market (e.g. Womack et al, 1990; Wheelwright and Clark, 1992; Dussauge et al., 1996; Nishiguchi, 1996). Commitment, reciprocity and trust are issues that have been frequently discussed in the literature (Smitka, 1991; Nishiguchi, 1994). At the same time, it was reported that not all collaborative efforts turned out to lead to the alleged benefits like reduced product development time and costs, and improved product quality. Eisenhardt and Tabrizi (1995) for example found that supplier involvement in product development could only be associated to accelerated product development time when the products involved are mature and the goals of the product development effort are well defined. An important assumption they make is that the buyer alone can define the project goals and the course of action in the project, which may not be the case in every situation of supplier involvement in product development. Other risks and problems indicating that supplier involvement in product development is not always a beneficial strategy are the loss of proprietary knowledge, the reduction of control over the development process, and the costs of managing the collaboration (Bruce et al, 1995; Farr and Fisher, 1992).

As a reaction on these reports attention was paid to the factors determining the success and failure of supplier involvement in product development. Issues like establishing objectives, processes, and procedures for directing the involvement and the establishment of organizational coordination mechanisms (Bruce et al, 1995; Ragatz et al, 1997) are considered as critical success factors to overcome major differences in style, priorities, and motivation (Tabrizi and Walleigh, 1997). Takeishi (2001) refers in this context to integrative capabilities, like architectural knowledge, integrated problem solving, and internal coordination as critical factors determining the quality of the design outcome of joint development effort.

Others have argued that supplier involvement is a resource demanding strategy that can only be justified when the costs of the involvement exceed the benefits (Gadde and Snehota, 2000). This can be considered as the underlying rationale of the development of differentiated approaches towards supplier involvement in product development (Clark and Fujimoto, 1991; Kamath and Liker, 1994; Sinclair et al, 1996; Wynstra and Ten Pierick, 2000; Laseter and Ramdas, 2002). Although these classifications imply that a variety of supplier relationships is desirable, they do only provide limited insight into issues like management, organization, and coordination of supplier involvement in product development. There is only a limited understanding of the implementation of collaborative relationships (Handfield, 1999; Evan and Jukes, 2000). In this article we intend to shed some light upon the issue of differentiated organizational coordination for supplier involvement in product development. Organizational coordination concerns the alignment of firms and organizational units of their joint processes through organizational mechanisms (Sobrero and Schrader, 1998). The purpose is to examine interorganizational aspects of supplier involvement in product development projects, to develop a conceptual framework for supplier coordination including some factors influencing interorganizational coordination, and to identify interorganizational coordination approaches and develop them into coordination structures.

Methodology

The article starts out by determining the background of differentiated interorganizational coordination, based on a literature review. A case study of six product development projects at two facilities of the Swedish packaging company Tetra Brik (Tetra Pak) in Italy and Sweden provide further understanding of the approaches developed towards interorganizational coordination. The selection of case studies at this company was defined to include projects different in character. Some projects include new technology, while others are (cost) improvements of existing solutions. The projects also embrace a variety of complexity, as some projects only address the development of one or several sub-systems in the packaging machine, while in others a complete new packaging machine is designed. The six product development projects are performed in one company. This can be considered a single setting (as in contrast to multiple settings in multiple case studies at several companies), which makes it possible to investigate variations among the projects (cf. Dubois and Gadde, 2001).

Tetra Brik develops relatively complex products, which are produced in rather low to medium volumes. Furthermore, systems integration is an important aspect in product development. The company faces different conditions than for example high-volume automobile producers and need to develop supplier coordination strategies that reflect their inherent needs and types of project they undertake (Maffin and Braiden, 2001). The study of six product development projects at Tetra Brik relies on a total number of 70 semi-structured interviews. Key informants concerning purchasing and supplier related issues in the projects at the buyer companies as well as the supplier companies have been interviewed. The interviews are recorded on tape, transcribed, and corroborated with the interview persons. Based on the case study and predominantly inductive reasoning, a typology for differentiated interorganizational coordination of supplier involvement in product development projects is formulated. Deductive reasoning is used to identify factors influencing and differentiating interorganizational coordination.

An investigation of coordination of supplier involvement on a project level might miss out on some important aspects. Previous relationships as well as the embeddedness in the same social structure (Sobero and Roberts, 2001) may be important for determining the need for coordination. Circumstances in the market may also, to some extent, determine interorganizational relationships. Firms may not have an explicit choice to initiate interorganizational relationships or involve suppliers in product development, but may be forced to do this by the market (Håkansson and Snehota, 1995). Although these issues are important and external factors cannot be fully controlled, the starting point in this article is that proactive management of supplier involvement in product development can influence the competitive success of organizations (cf. Brown and Eisenhardt (1995, p. 344).

Differentiated interorganizational coordination

The issue of differentiated organizational coordination of supplier involvement in product development can be explained from two complementary perspectives; the underlying task dependencies and diverging expectations. Task dependencies are inherent to organizations under the assumption that people work together in order to achieve the organization's goals (Simon, 1965). Involving suppliers for development activities alters the dependencies between a buyer and a supplier, as the product development activities are distributed between the buyer and the supplier (Sobrero and Schrader, 1998). Therefore, when activities are carried out across the borders of an organization the activities have to be coordinated across these organizations.

Task dependency is related to the characteristics of the underlying product and the parts under development. The product composition and its underlying linkages between components determine to an important extent the choice for a coordination approach (Sanchez, 1995). Modular approaches to decompose a product through defining stable interfaces among its components may be accompanied by task partitioning, that is the division into a number of tasks and sub-tasks that may be distributed between the buyer and the supplier (Von Hippel, 1990). However, this line of reasoning assumes that there is a perfect overlap between the product boundaries and the boundaries of a firm's technological knowledge, a logic that cannot necessarily be applied in all situations as Prencipe (2000) points out. In addition to task partitioning, a more interactive approach towards organising the development effort might be necessary. Holmen and Kristensen (1998) propose two alternative approaches, (1) supplier involvement through task partitioning and (2) supplier involvement through an interactive product development process. The choice for either task partitioning or interaction is primarily related to the characteristics of the underlying product including its dependencies and interfaces, and the knowledge of the supplier about these characteristics. This latter aspect brings us to the issue of diverging expectations. Besides task dependencies, diverging expectations of a buyer and a supplier cause a need for coordination. This concerns the different but complementary capabilities and perspectives of the companies involved (Loasby, 1999) and can be related to i.e. differences in project management, technical solutions, and product functionalities. These differences need to be managed in the product development project and lead to a complementary need, besides task dependencies, for coordination. Loasby (1999) explains that modular innovation may be performed in an informally organised market. However, architectural innovation is accompanied by tighter constraints of integration, as it requires a new combination of closely integrated complementary capabilities (see also Henderson and Clark, 1990). Sobrero and Roberts (2001) find that these latter relationships prove to be less efficient, however they do provide more opportunities for learning. A trade-off between short-term efficiencies and longer-term learning opportunities may therefore be present. Dyer (1997) refers in this context to the ability of minimising transactions costs while maximising transaction value. In the next section the issue of interorganizational coordination is explored in six product development projects at Tetra Brik.

Interorganizational coordination: The case of Tetra Brik

The Tetra Brik package, a brick-shaped package suitable for aseptic as well as non-aseptic liquid packaging, was introduced in 1963 as a package adapted to the pallet-based distribution system. Tetra Brik, a product company of Tetra Pak, supplies the packaging material and packaging machine. Customers of Tetra Brik are for example dairies or juice producers. At Tetra Brik six development projects have been subject to the study of interorganizational coordination. In all of the studied projects, one or more suppliers were involved for product development activities. Table 1 summarises for each of the six projects the project goal, activities, and the suppliers involved. The project names and names of the suppliers in the Sterilisation project are fictitious.

- Insert Table 1 here -

The suppliers in the case study projects are coordinated in different ways. In the Sterilisation project the supplier Sterili was involved and coordinated in an integrated manner. This supplier contributed with the knowledge about the new sterilisation technology that had to be incorporated in the filling machine. This made an intensive interaction necessary. Much different was the coordination of the work of the other supplier in the project, Aquacool. This supplier was involved for developing and producing the cooling unit for the prototype machine. Aquacool was considered as a much less important supplier in the project and carried out its task more or less independently. Especially at the initiation and termination of the task Tetra Brik and Aquacool interacted with each other. The involvement of the suppliers in the High Speed project concerned design for manufacturing (DFM) and design for assembly (DFA) issues. This involvement took mainly place on an ad hoc basis until the test phase. During the test phase resident engineers from the suppliers had to respond quickly to problems occurring in testing the filling machine. This implies a more integrative way of working. However, another major purpose was to train the engineers from the suppliers about Tetra Brik's way of working. This was in line with Tetra Brik's supplier development programme and ambition to give suppliers more development responsibility in future projects. The project manager for the High Speed Project expresses this as follows:

"... [the supplier] has a good manufacturing capability but they are not able to develop a function from the design point of view. They do not know the function in our filling machine and that makes it impossible for them to develop a function. One or two years ago one of the suppliers did not even have any designers. [...] These people come from the work shop so they have a good knowledge of manufacturing and will learn about the function in the project."

Project manager High Speed Project

Also in the Pull Tab Splice Project and the Non Aseptic Project the supplier's work was coordinated in an integrated manner. Especially in the Non Aseptic Project the involvement was very similar to the High Speed Project. Although this project was more complex and considered new technological features, also here suppliers mainly took care of recommendations regarding DFM and DFA. An important reason to work with resident engineers from the suppliers was to make the suppliers familiar with Tetra Brik's way of working and facilitate future (more extensive) cooperation with the suppliers. Although the supplier in the Pull Tab Splice Project had some more latitude, a sub project manager from Tetra Brik was supervising the activities in the project at the supplier's premises. The Paper Splice Project considered redrawing of an existing unit in a new CAD-system. As only minor modifications had to be made, the supplier carried out its task relatively independently. In the Cost Reduction Project suppliers were involved for providing cost reduction solutions for an existing filling machine.

In Table 2 some important characteristics of the six projects at Tetra Brik are summarised.

- Insert Table 2 here -

A supplier coordination typology

Interorganizational coordination

The coordination of the supplier activities in the case study provides some inspiration for determining an organizational coordination typology. This organizational coordination typology provides opportunities to differentiate in managing the interaction between the buyer and the supplier in the project. This is important as organizational coordination mechanisms seem to have an important leverage (in contrast to contractual coordination) on the outcome of the supplier relationship (Sobrero and Roberts, 2002). Based on the case study three general types of coordination could be distinguished (see also Table 2). The first representing an integrated way of working, in which extensive information is exchanged on a more or less continuous basis. The second is based on a more ad hoc approach, that is when a problem occurs, the supplier is contacted to help solve the problem. In the third type of coordination the supplier takes a more independent role and performs the development effort within its own organization, with little support from the buyer during the process. The typology of coordination structures for supplier involvement must be considered as organizational arrangements to manage the contribution of the supplier in the product development project and represent flexible, organic solutions (cf. Mintzberg, 1979). The coordination structures are illustrated in Figure 1. Direct ad hoc coordination, disconnected sub project coordination and project integration coordination are explained in more detail below.

- Insert Figure 1 here -

Direct ad hoc coordination

Direct ad hoc coordination as a coordination approach to involve suppliers in product development bears many of the characteristics of informal individual liaisons. Direct ad hoc coordination takes place when a designer, purchaser or another person from the developing company directly contacts his counterpart in the supplier organization. This means that the persons involved from both companies have direct contact with each other about operational issues. Most of this communication takes place ad hoc, when a question arises in the project.

Direct ad hoc coordination must be considered as an informal solution. The fact that direct ad hoc coordination is not based on a formal structural solution implies that this type of coordination occurs spontaneously. It must however be clear that certain conditions must be fulfilled in order to apply this type of coordination. For example, people have to know each other to a certain extent. Otherwise they will not know whom to contact in the other organization. Furthermore, both parties need to establish congruent expectations with respect to norms, the nature of the work, and social relationships (Ring and Van de Ven, 1994). Also, a certain commitment to the relationship and willingness to become involved through direct ad hoc coordination has to exist. Fichman and Levinthal (1991) indicate that this may be the result of goodwill, prior favourable impressions, initial investments, or psychological forces. This type of coordination will therefore be facilitated by an ongoing relationship with a supplier, beyond the scope of the individual project. This is also indicated by the case study. In the High Speed Project, Cost Reduction Project, and Non Aseptic project, the suppliers involved in the project were Tetra Brik's existing system suppliers. Although the suppliers were not very experienced in product development activities, Tetra Brik and the supplier were at least familiar with each other on a personal level. This may have facilitated the utilisation of ad hoc coordination in the project.

Disconnected sub project coordination

In disconnected sub project coordination the supplier carries out a task relatively independently of the developing company. The supplier may, but does not necessarily have to, create a separate sub project within the supplier company. Disconnected sub project coordination implies a situation with relatively little dependence between the task of the supplier and the overall product development task, as is the case in the Paper Splice Project. In this project the supplier performs the work decoupled from the buyer. The project is also formed around the supplier task, i.e. the buyer performs coordination activities while the supplier takes care of all the engineering. Also, in the Sterilisation Project, the supplier Aquacool performed its task in the project independently. This task could be rather well demarcated from the overall project (a specified interface cf. Araujo et al. (1999)), which also indicates a low degree of dependence between the task of the supplier and the overall project task.

A low degree of dependence between the task of the supplier and the overall project task requires a product design with relatively independent units. A modular design, for example, decreases the number of architectural interfaces, which suggests a decrease in dependence, and thus in the need for coordination (Sanchez, 1995). In such a situation the developing company normally establishes the overall design of the product, including the general specifications for the unit to be developed by the supplier. The supplier is responsible for the detailed design of the unit, and may also manufacture a prototype. The result of the supplier effort needs to be evaluated and approved by the developing company before it can be used in the overall design.

The relative independence between the supplier task and the overall product development task reduces the need for coordination in the project, and thus the need for interaction and communication between the buyer and the supplier. In an ideal case, interaction between the supplier company and the developing company is only necessary at the beginning of the supplier task, when the task has to be explained and information is exchanged, and towards the end of the task, when the results of the effort have to be transferred to the developing company. In reality a supplier may often ask questions about certain specifications and discuss several alternative designs. Still, the most extensive communication during the supplier task will be limited to the beginning and the end of the task.

Project integration coordination

Project integration coordination includes the supplier in the product development project. This coordination structure enables extensive coordination. Project integration coordination implies that suppliers become part of the product development project team, and carry out their tasks in close cooperation with the developing company. In some cases the team can be co-located, as the supplier sends resident engineers to the developing company. Co-location is not necessary to create a team. The team can also be dispersed over several geographical locations. In this case other structures have to be developed to keep in contact with each other. Boutellier et al. (1998) argue, based on a case study of dispersed product development at IBM, that information technologies can contribute to integrating dispersed development teams in exchange for technical information, planning and control of project activities, promotion of creativity, and the establishment of trust. Although project integration coordination can never bear solely on information technologies, they can contribute a great deal to project integration coordination.

Project integration coordination results in several individuals from the supplier company and the developing company working together on a common task. Each of these individuals carries his own set of expectations and experiences with him in the team, which may or may not resemble the expectations and experiences of the other team members (Lundin and Söderholm, 1995). The expectations and experiences gathered together in the team provide a basis for commitment, and thus also for motivation and communication. This suggests that project integration coordination requires at least a minimal degree of common expectation. At the same time, an integrated way of working also facilitates the development of common expectations (Loasby, 1999). Looser interorganizational couplings may facilitate the development of distinct, but complementary capability. Project integration coordination may therefore, as we saw in several of the cases, be more directed towards joint, long-term learning capabilities (as in contrast to short-term project efficiencies) (Sobrero and Roberts, 2002).

As we saw in the case study, supplier coordination may change throughout the project. In the High Speed Project and the Non Aseptic Project supplier coordination varied from ad hoc to project integration coordination. Also, although integrative coordination may be prevalent in a project, not all tasks are carried out integratively. Instead, frequent interaction and discussions between the buyer and the supplier may take place, sometimes initiated on an ad hoc basis. This can be succeeded by short periods of disconnected sub project coordination in which the results of the interaction are 'processed' intraorganizationally. As activities and tasks may change considerably in the different project phases, the need for coordination must be established throughout the product development project.

Building a framework for coordinating supplier involvement in product development projects

The suitability of different organizational coordination structures depends on several aspects. In the literature it is argued that task characteristics, which as it is assumed are connected to the underlying product characteristics in product development, have consequences for the intraorganizational management of the product development effort. Eisenhardt and Tabrizi (1995) found a connection between a high degree of uncertainty and the need for a more flexible process as in contrast to a more heavily planned process. A similarity can be found in Perrow's (1967) theory about the relationship between technology and the organization. Katz and Tushman (1979) found that internal project communication is contingent upon the project task. A high degree of project task complexity indicates a high need for communication in the project. Typical coordination mechanisms to take care of task interdependencies and diverging expectations within organizations are directed towards integration. Cross-functionality in product development, i.e. the interaction between engineering, marketing, production, and purchasing, is considered as an important determinant of product development success (Griffin and Hauser, 1996; Adler, 1995; Dowlatshahi, 1998).

Task characteristics have thus an important impact on the way the product development effort is managed. Shenhar and Dvir (1996) distinguish between technological novelty and task complexity. The first refers to 'the degree of familiarity with the given technology' and 'the newness', to the development organization, of the technologies employed in the product development effort (Tatikonda and Rosenthal, 2000). Technological novelty is mainly associated with the way technical problems are solved in the project, i.e. the technical coordination (Shenhar and Dvir, 1996). Technological novelty is positively related to issues like the number of design cycles, the time until the final design is frozen, the need for prototype building, the extent of testing, the intensity of communication, and the frequency and complexity of trade-off decisions. Task complexity on the other hand, shows a stronger relationship with administrative, planning, control and organizational issues (Shenhar and Dvir, 1996). Technological novelty and task complexity are also positively associated with the need for integration of the project members (Hayes et al, 1988; Hobday, 1998). Task uncertainty and development risk are also mentioned in the literature as possible differentiating factors, but can be connected to task complexity and technological novelty (Tatikonda and Rosenthal,2000; Shenhar, 1993; Ali, 1994; Wynstra and Ten Pierick, 2000).

In order to determine task complexity, the number of components as well as the interfaces between the components can be evaluated (Hayes et al, 1988; Tatikonda and Rosenthal, 2000; Henderson and Clark, 1990). The number of components can be determined by answering the question: Does the project consider one component, several components, or a whole new machine? The development of only one component is less complex than the development of a complete new machine. The interfaces between the components in the product are more difficult to determine. Here, it can be evaluated whether or not the development affects the layout of the component and its surrounding components. Task complexity is thus a composite measure of the number of components and the degree of dependency between the interfaces. The technological novelty of a product development activity can be determined based on whether or not the project involves new or existing technologies. The utilisation of new technology refers to a high technological novelty, while the utilisation of existing, familiar technologies implies a low technology novelty.

In determining the need for interorganizational coordination it is important to evaluate the degree of dependence between the task of the buyer and the task of the supplier (Sobrero and Roberts, 2001). This can be evaluated based on the role and the input of the buyer in relation to the role and the input of the supplier in the project. Further, Sobrero and Roberts (2001) have emphasized that collaboration outcomes may not only be short-term but also longer-term oriented. Coordination efforts in specific projects may therefore also have longer-term objectives. Therefore, in analysing supplier coordination it is important to determine whether or not the intended outcome was more short-term or long-term oriented.

Based on the above a framework for coordinating supplier involvement in product development projects can be formulated. A situation of supplier involvement in product development brings along a situation of dependence between the buyer and the supplier. This degree of dependence is expected to determine the need for interorganizational coordination of the supplier to an important extent (Sobrero and Roberts, 2001). In determining this need two additional factors play an important role. First, the existence of diverging expectations impacts positively on the need for interorganizational coordination as differences in the management of product development and insight into the constraints of the specific development effort must be reconciled, especially in situations of a high task dependence between the buyer and the supplier. Second, the intended outcome of supplier involvement shows a relation with the need for interorganizational coordination as long-term learning intentions as higher coordination efforts provide more opportunities for learning. Explicit learning objectives can explain higher coordination efforts even though task characteristics do not seem to drive this. In its turn, the successfulness and appropriateness of the interorganizational coordination efforts determine the outcome of supplier involvement (Sobrero and Roberts, 2002). It is expected that the outcome of the supplier collaboration is an important determinant of the outcome of the overall product development effort.

In addition to interorganizational coordination, supplier involvement must be coordinated internally within the product development project (Takeishi, 2001). This concerns cross-functional coordination of supplier and purchasing related issues within the buyer organization. In order to manage these cross-functional issues within and across the borders of the organization coordinator roles may be created (Lakemond et al., 2001). Parker and Anderson (2002) refer in this context to the creation of ‘supply-chain integrators’. As was determined above, the need for cross-functional intraorganizational coordination is related to the project task characteristics. However, it is expected that the degree of interorganizational coordination also impacts on the degree of intraorganizational coordination necessary. An integrated way of working involves a high level of interaction between (many different people of) the buyer and the supplier and causes a need for updating the internal organization about this interorganizational interaction. It is expected that the extent to which the necessary degree of intraorganizational coordination is met shows a positive relationship with the outcome of the product development effort. The framework for supplier coordination in product development projects is shown in figure 2.

- Insert Figure 2 here -

Conclusion

In this article we examine supplier coordination in product development projects. Several interorganizational coordination approaches have been determined and developed into three coordination structures. The three coordination structures represent different coordination mechanisms that are suitable in different situations. Although many companies make a well-considered choice to involve suppliers for product development, management of the involved suppliers is often not as well thought-out. This article contributes to (1) the understanding of different coordination approaches and the mechanisms behind these approaches, and (2) to the insight into the factors that influence the effectiveness and efficiency of the different coordination approaches and thus to the choice for a specific coordination approach. In this article it is stressed that, besides task dependency, the degree of diverging expectations and the intended outcome are important determinants of interorganizational coordination. The framework for supplier coordination and the alternative coordination structures provide some indications for managing supplier involvement in product development projects. Further operationalization is necessary for formulating and testing hypotheses about supplier coordination in product development projects. This challenge will be an area for future attention. Practitioners may benefit from this article by getting insight into alternative forms of supplier coordination, their pro’s and con’s, and the situational requirements for coordination. This leads to better, well-considered decisions about supplier coordination in product development projects.

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Table 1 The six product development projects at Tetra Brik

Name of the project	Activities	Suppliers
The Sterilisation Project	Developing a packaging machine incorporating new technology for sterilising the packaging material.	Sterili Aquacool
The High Speed Project	Aims at developing a high speed, high capacity filling machine (increase from 8,000 to 18,000 packages per hour). This requires a completely different system to shape, seal, and form the packages.	CMS DICO Service Selcom
The Cost Reduction Project	Evaluates a well established packaging machine with respect to costs, as a consequence of the introduction of a completely new Tetra Brik filling machine on the market. Changes are made to interchangeable parts as well as parts affecting the lay-out of the machine. Suppliers are involved for providing suggestions for cost reduction.	CMS Kostwein Tetra Pak Stålvall DICO Service Wahlquist Selcom
The Pull Tab Splice Project	Develops an automatic splicing unit for the strip of the pull-tab. The pull-tab makes a hole on top of the package which can be sealed after use and which makes it easier to pour the liquid out of the package. The project is carried out in close cooperation with a supplier of this unit, Kostwein.	Kostwein
The Paper Splice Project	Enhances the paper splicing unit of a relatively newly released packaging machine. The paper splice unit automatically changes the paper bobbin when the packaging material ends. The supplier of the unit, Tetra Pak Stålvall, is involved in the development project.	Tetra Pak Stålvall
The Non-Aseptic Project	Aims to develop a new platform for non-aseptic Tetra Brik packaging machines, and thus includes the development of a completely new machine. Several suppliers are involved in the project.	Tetra Pak Stålvall Fuji Autotech Kvalitetsproduktion

Table 2 Supplier coordination and task characteristics

Project	**Coordination**	**Degree of dependence buyer/supplier task**	**Intention of coordination**	**Task complexity**	**Technological novelty**
Sterilisation	Integrated (Sterili)	High (Sterili)	Long-term learning (Sterili)	Moderate	High
	Decoupled (Aquacool)	Low (Aquacool)	Short-term efficiency (Aquacool)		
High Speed	Ad hoc and integrated	Moderate	Short-term efficiency and long-term learning	Moderate	Low
Cost Reduction	Ad hoc	Moderate	Short-term efficiency	High	Low
Pull Tab Splice	Integrated	Low	Long-term learning	Low	Moderate
Paper Splice	Decoupled	Low	Short-term efficiency	Low	Low
Non Aseptic	Ad hoc and integrated	Moderate	Short-term efficiency and long-term learning	High	High

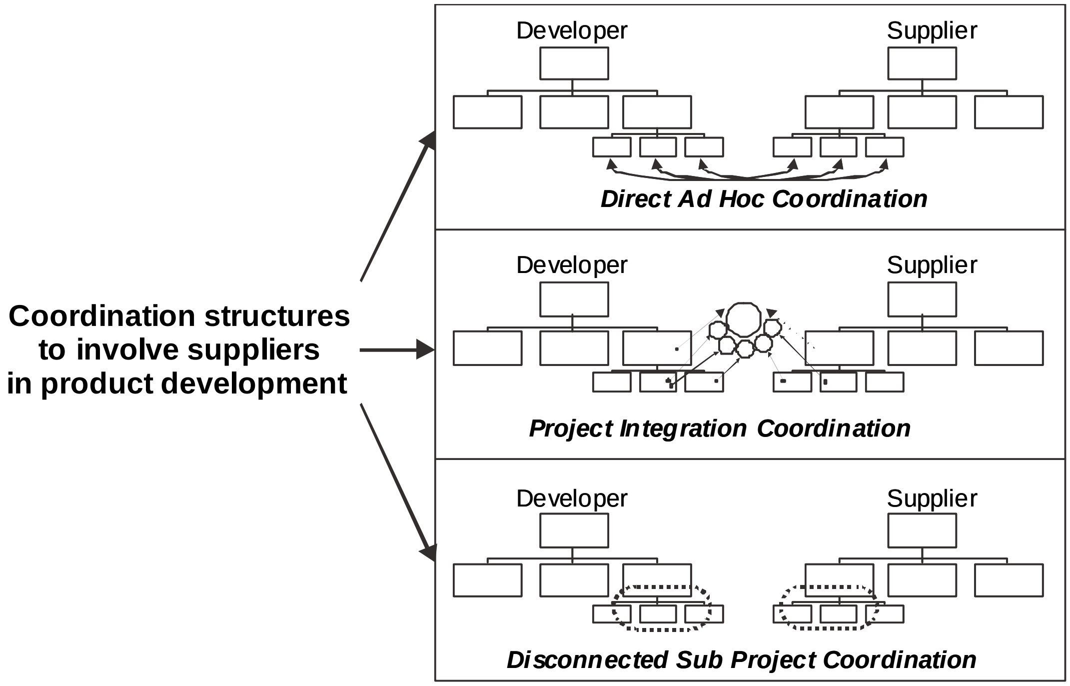

Figure 1 Coordination structures to manage supplier involvement in product development

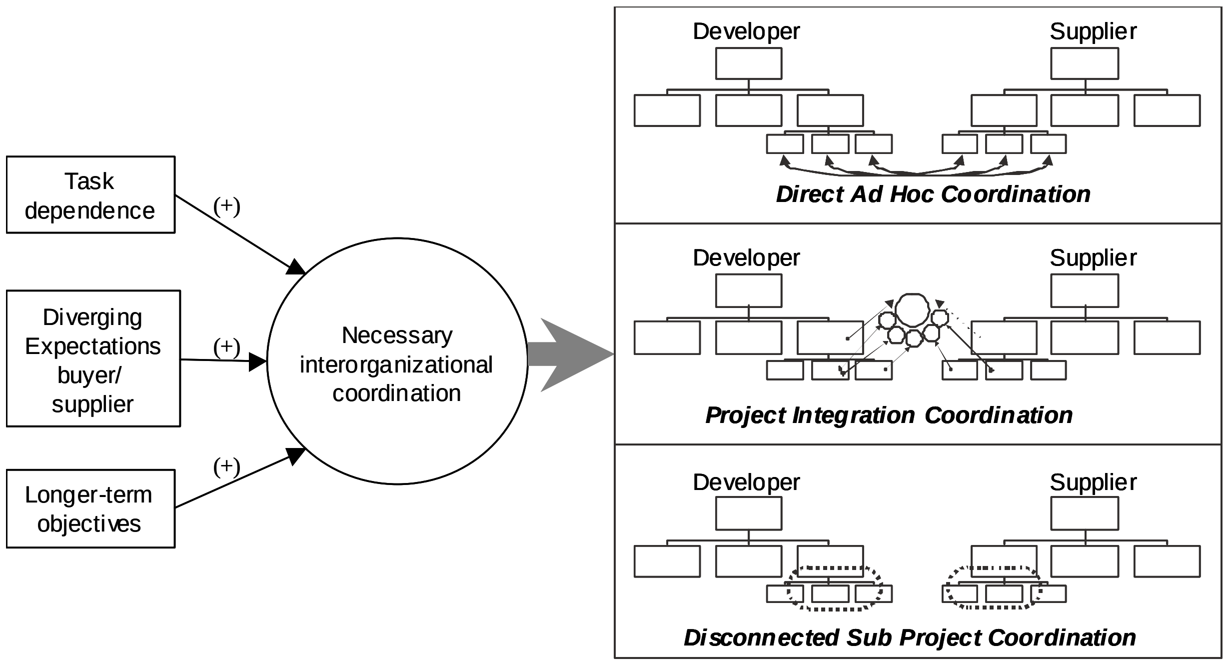

Figure 2 Framework for interorganizational coordination