

THESIS FOR THE DEGREE OF DOCTOR OF PHILOSOPHY

Activity Linking in Industrial Networks

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Abstract

The ways in which industrial activities are undertaken and linked have profound implications for organizational performance. The linking of activities is therefore a phenomenon which, in various shapes and forms, has been of ample concern to both academic scholars and industrial practitioners. Recent developments of practice, such as just-in-time deliveries and build-to-order production, make activity linking increasingly significant. In addition, owing to enhanced outsourcing, activity linking increasingly crosses firm boundaries. The purpose of this thesis is to explore the basic principles for activity linking in the current industrial context.

The framework of the study builds on the Industrial Network Approach, distinguishing between three layers of business life: activities, resources and actors. The research questions derived from this approach concern (i) the interrelatedness between activity interdependencies and adjustments, (ii) the roles of enabling and object resources in the linking of activities, (iii) the roles of action, reaction and interaction in the linking of activities, and (iv) how interaction can be used in the analysis of the interplay between the actions and reactions of individual actors.

Empirically, the thesis consists of a single case study from the construction industry, with three embedded cases. The linking of activities in the cases is illustrated and investigated in terms of three central activity dimensions: activity configurations, activity structures and activity patterns. On the basis of this analysis, a conceptual scheme for the analysis of activity linking is developed. The tools in this scheme explore the connections between activities, resources and actors, as represented in the research questions. The scheme takes the individual activity as well as the links between activities into account, and applies both a structural (linking in space) and a dynamic perspective (linking in time).

The concluding discussion applies the tools in the conceptual scheme in order to analyse how adjustments propagate among activities in industrial networks. It thus discusses activity linking in both space and time, and in relation to resources and actors.

Keywords: Activities, activity links, activity linking, interdependencies, adjustments, interaction, networks, propagations

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1 Introduction

This thesis concerns the linking of industrial activities: how individual activities relate to each other, and what implications follow from this relatedness.

Section 1.1 describes this phenomenon and offers an initial tentative definition of activity linking. The two subsequent sections illustrate the relevance of activity linking in both practice and theory. In section 1.4 the overall purpose of the thesis is formulated.

1.1 Activity linking

Industrial activities are never undertaken in isolation, but in a context of the other activities with which they are linked. Cox and Goodman (1956, p.36) illustrated how firms undertake and link activities in relation to the construction of a house (author's highlights).

"The physical substance of a house is a pile of materials assembled from widely scattered sources. They undergo different kinds and degrees of processing in large numbers of places, require many types of handling over periods that vary greatly in length, and use the services of a multitude of people organized into many different sorts of business entity."

"For any given house, the parts of the process must be well enough performed and coordinated so that in the end all the separate pieces come together. These pieces must arrive at reasonably acceptable times, in a tolerable sequence, and at bearable prices upon the particular small piece of ground where a builder and his contractors combine them into a house."

The highlights in this quote all concern facets of activity linking. The phenomenon thus implies the ways in which activities are undertaken to assemble, process, handle, organize, coordinate, sequence and combine individual materials, entities, parts and pieces to create meaningful wholes. As made apparent in the quote, the construction of a house requires many joint and conscious efforts by the firms involved. The activities of each firm are thus interrelated with those of many others. As such, they affect each other in multiple ways.

Not just in construction, but in *business life* in general, activities need to be related to each other to facilitate the production, exchange and use of industrial products and services and related processes. Activity linking concerns how this relatedness is achieved and maintained.

1.2 Activity linking in practice

The illustration of activity linking in practice is complicated by the complex and dynamic nature of business life. If industrial activities are used as a metaphor to describe what is undertaken in business life, then activity linking may be seen as covering almost all the aspects of it. Although this sweeping statement does not describe the specific intentions in the exploration of the phenomenon, activity linking in practice is seen to involve a wide range of continuous challenges and opportunities.

To help focus the discussion in this section, the relevance of a study of activity linking is considered in connection with a number of identified industrial 'trends'. These are first presented and then discussed individually. Their association with activity linking is argued at the end of the section.

Firms are increasingly specializing their activities, a process also known as vertical disintegration. In line with such efforts, they outsource selected activities and processes. Related outsourcing initiatives often also imply "offshoring", outsourcing to foreign markets, usually developing countries. This is related to increasing globalization, where technological advances improve the possibilities for firms to act on global markets, as both customers and suppliers. Demand for customization also requires firms to differentiate and direct their offerings towards individual counterparts. Build-to-order is one such production strategy. Firms are also, to a greater extent than previously, coordinating their activities across firm boundaries. The adoption of Just-In-time and Supply chain management regimes illustrates such developments. All these trends are connected, and thus support each other.

With specialization, firms focus their manufacturing activities (Brush and Karnani 1996). This trend is related to the principle of the division of labour, first introduced by Adam Smith (1776). Division of labour allows workers to exploit their comparative advantage and improve their skills, as well as increasing the efficiency of firms (ibid.). With the support of

Smith's initial ideas about specialization within a firm, many scholars have approached the notion of specialization also among firms (e.g. Young, 1928; Stigler, 1951).

A strategy of specialization is accompanied by the outsourcing of selected activities to preferred counterparts. As argued by Weigelt (2009), firms are increasingly relying on outsourcing activities previously undertaken within the boundaries of the firm. One example is given by Parker and Anderson (2002), who describe how a large manufacturer of consumer products outsources the majority of its design and manufacturing activities to a number of dedicated suppliers. In light of this initiative, the firm has also been required to change its supply chain management strategy with the subsequent need to coordinate production development, marketing, production, and logistics across firm boundaries (ibid.).

Many outsourcing initiatives involve firms in developed countries sending work to firms in developing nations (Leavitt, 2007). This is related to offshoring, when outsourcing initiatives cross national boundaries, often to nations with lower direct production costs. The access to specific resources and capabilities might support such offshoring decisions. In consequence, the industrial structures faced by a firm become more complex, for example with regard to the number of counterparts involved and the locations of individual facilities (Meixell and Gargeya, 2005).

The continuous striving for customization means that the ability to adapt to the needs of individual customers is emphasized as firms struggle to differentiate their offerings (Natarajan, 2004). In light of such developments, production strategies such as build-to-order (BTO) have increased in popularity (Gunasekaran and Ngai, 2005). Firms which aim to adopt a true BTO strategy need to meet customer demands efficiently, which stresses the need for flexibility with products, processes and volumes (Holweg and Pil, 2001). The PC producer Dell is a well-known example of BTO, linking customer information to production control and from there to assembly operations (ibid.). The assembly plant receives a new set of orders every few hours and can build those computers within a day.

An increase in inter-organizational activity coordination is exemplified by production strategies such as just-in-time (JIT). Rather than producing goods and supplying customers from stock, JIT processes focus on the production of precise quantities delivered exactly

when customers require them. It aims to reduce inventory levels and associated costs through coordination of supply and demand (Sakakibara et al., 1997). There are difficulties with such an approach, such as minimized inventory levels that make firms sensitive to interruptions and unforeseen events related to production and delivery. This places higher demands on the synchronization of the respective firms' internal production activities (Larsson, 2002).

These industrial 'trends' emphasize different aspects of the relevance and intricacies of activity linking. Firms undertake industrial activities in a coordinated fashion. Thus the activities of a firm are linked. In addition, these internal firm activities are linked with activities undertaken by their counterparts, their suppliers and customers. Specialization means that a firm tends to undertake fewer individual activities and to assign selected activity undertakings to others, identified as new or existing counterparts who are believed to have the appropriate capabilities. The activity links between previously internal activities then need to be reorganized. Often the counterparts are located far away, both spatially and culturally. This distance between firms is experienced not only in direct connection with the outsourcing of formerly internal activities, but also between a firm and several of its counterparts.

Thus in the pursuance of specialization, outsourcing, offshoring, globalization, customization and inter-organizational activity coordination, the activity linking of a firm is challenged in various ways. To be able to undertake fewer activities and handle boundary-crossing activity links to disparate counterparts and in different ways, firms need to interact more closely. As a consequence, the distinction between internal and external activity links becomes blurry and the main activity-linking difficulty of a firm seems to be the management of its boundary-crossing activity links.

1.3 Activity linking in theory

The relatedness of industrial activities has concerned many researchers in various research traditions. Several scholars in the organizational and social sciences and business economics, for example, have acknowledged interdependencies among activities. These interdependencies in turn require the coordination of activities. As stated by Thompson (1967): *"if we wish to understand organization structure, we must consider what is meant by*

interdependence and by coordination, and we must consider various types of these” (p.54). He explored the coordinated action between interdependent elements in the technical core of an organization. Galbraith (1977), an organization theorist influenced by the works of Thompson, also explored the coordination of interdependent subtasks, understood as resulting from the division of labour.

Other scholars, such as March and Simon (1958), Penrose (1959), and Van de Ven et al. (1976) have also explored the relatedness between the activities of a firm. March and Simon (1958) spoke of synchronization of activities and recognize the complex economic processes in which a firm is involved. Penrose (1959) highlighted the need for coordination through plans and arrangements, and assigned such coordinative actions to the management of a firm. In comparison, Van de Ven et al. (1976) argued the need *“to integrate or link together different parts of an organization to accomplish a collective set of tasks”* (p. 322).

These scholars approach the exploration of interdependencies and coordinative requirements of activities primarily from an intra-organizational perspective. Although the ‘environment’ of a firm is acknowledged to influence its activity undertakings, it is distinctly separate from the internal activities of the firm. Thompson (1967) distinguished between the technical core and the boundary-spanning units of a firm. The former, according to his distinction, has to do with coordination, while the latter has to do with adjustment to constraints and contingencies not controlled by the organization. March and Simon (1958) also approached the outside of a firm when arguing that the complexity considerations which influence the structuring of a firm can originate either from the internal processes of the firm or from environmental conditions.

Richardson (1972) questioned the analogy of firms as *“islands of planned co-ordination in a sea of market relations”* (p. 883). He went on to say that *“this now seems to me a highly misleading account of the way in which industry is in fact organised”* (ibid., p. 883). Instead, he claimed the existence of intermediate forms, distinguished by cooperation and affiliation, thus opposing the reigning dichotomy between firm and market. While he referred to such cooperation as a distinct and alternative mode to coordinate economic activity, as compared with internal direction and market coordination, he also recognized the difficulty of distinguishing between these separate modes. Instead, he argued for a *“continuum passing*

from transactions, such as those on organised commodity markets, where the co-operative element is minimal, through intermediate areas in which there are linkages of traditional connection and goodwill, and finally to those complex and inter-locking clusters, groups and alliances which represent co-operation fully and formally” (ibid., p. 887).

Several researchers examine such cooperative aspects of business life. Håkansson and Snehota (1995) point out the importance of inter-firm relationships and claim the need to develop conceptual frameworks appropriate to describe and explain them. In addition, they specify activity links, resource ties and actor bonds as the three substance dimensions of a business relationship (ibid.). Axelsson and Easton (1992) speak of industrial networks as *“a model or metaphor which describes a number, usually a large number, of entities, which are connected...The entities are actors involved in the economic processes which convert resources to finished goods and services to be consumed by end users whether they are individuals or organizations”* (p. xiv). Such models of industrial networks allow for the identification of extended patterns of interdependent activities (Håkansson et al., 2009). These patterns include the activity undertakings of several firms, connected through business relationships.

Following a suggestion for further research made by Dubois (1994), this thesis aims *“to further explore what is done within and among firms and how these activities are interrelated, as this may yield new insights into the dynamics firms are subject to and cause of”* (p. 160).

1.4 Overall purpose

The linking of industrial activities thus concerns scholars in various research fields. The focus of their research initiatives is a result not only of their separate agendas, but also of the dynamic nature of business life. Supported by the industrial ‘trends’ presented in section 1.2, it is argued that business life is increasingly characterized by specialization and inter-firm coordination. With this in mind, the overall objective of the study at hand is formulated as follows.

The purpose of this thesis is to explore the linking of industrial activities.

This chapter has only provided the reader with an initial tentative definition of activity linking. Further specification of the phenomenon is needed, and this will be addressed in the upcoming frame of reference, as well as in the subsequent analysis.

1.5 Structure of the thesis

With this purpose in mind, Chapter 2 suggests a theoretical framework for the exploration of activity linking. This framework, the Industrial Network Approach, distinguishes between three analytical dimensions for the analysis of industrial networks. In addition to activities, resources and actors are identified. The three dimensions are related to the phenomenon of interest. In addition, the notion of interaction is used to describe the cooperative behaviour of firms. Therefore, this concept is also related to activity linking. The chapter ends with the formulation of four research questions.

Chapter 3 discusses the methodological considerations. To facilitate this discussion, the chapter is divided into two main parts. The first part describes the actual process of research, i.e. the ways in which the research has been directed and redirected in search for a match between theory and reality. This description is then used as input to the second part of the chapter, which argues the scientific nature of the research process just described.

The fourth chapter is the empirical inquiry on which the analysis and conclusions of the thesis build. The data collection started with a specific construction project, and narrowed in on two selected material deliveries. These allow for the identification of the activity undertakings of three focal firms, which are then discussed further.

Chapter 5, the case analysis chapter, structures the information in the empirical inquiry in accordance with three analytical scopes. It also describes a number of distinct change initiatives recognized in the empirical inquiry. When applicable, the chapter uses and expands upon the conceptualizations in the frame of reference. As such, it facilitates the upcoming development of a scheme for the analysis of activity linking.

The sixth chapter analyses activity linking in space and time. Activity interdependencies and related concepts represent the analysis of activity linking in space, whereas activity adjustments describe activity linking in time. The chapter revisits and expands upon notions

from the frame of reference as well as from the case analysis chapter in order to develop a conceptual scheme for the analysis of activity linking.

The seventh and final chapter of the thesis, the concluding discussion, discusses activity linking in industrial networks. Special emphasis is placed on the activity linking of actors who are part of these networks. The chapter illustrates how the tools of the scheme presented in Chapter 6 aid the understanding of how relatedness is achieved and maintained in business life.

2 Frame of Reference

In this frame of reference, the identification and analysis of concepts related to activity linking enable the subsequent formulation of research questions. The phenomenon itself also requires further specification, and therefore the tentative definition presented in the introduction is developed upon in this chapter.

The theoretical abode of this thesis is provided by the Industrial Network Approach (INA), which suggests a network representation of business life. The INA is introduced in section 2.1. This description centres primarily on the existence of business relationships and the industrial networks of interdependent relationships created by them. In section 2.2, the ARA model is introduced. This introduction includes not only an overall presentation of the model, but also of its dimensions. The section concludes with some reflections on activity linking and the ARA model, with the aim of further developing the definition of activity linking. Section 2.3 then presents alternative scopes for activity analysis. These scopes represent plausible and complementary ways in which to approach and delimit an analysis of activity linking.

Section 2.4 discusses activities in space and time. The distinction between structural and process characteristics in the analysis of industrial networks enables the identification of activity interdependencies and adjustments, as well as of the interrelatedness between these concepts. Here, activity interdependencies are specified in a somewhat different way compared with previous typologies. Given the connectedness of the individual dimensions of the ARA model, both resources and actors are deemed relevant for the exploration of activity linking. Sections 2.5 and 2.6 therefore discuss resources and actors in relation to the activity dimension. Section 2.7 highlights interaction in relation to activities and discusses the importance of interaction for the enabling of boundary-crossing activity linking. Finally, section 2.8 presents the four research questions of this thesis.

2.1 A network representation of business life

Within the Industrial Marketing and Purchasing (IMP) tradition, initially developed in response to a pan-European study in the 1980s, business exchange is characterized by the existence of relationships between firms. The study resulted in the Interaction Approach

(Håkansson, 1982), and research in this tradition later also developed into the Industrial Network Approach (INA).

The INA is the chosen theoretical framework of this thesis as it offers a rich set of concepts for the analysis of inter-organizational issues related to industrial production and exchange (central references in this approach include Håkansson, 1987; Håkansson and Snehota, 1995; Ford et al., 2003; and Håkansson et al., 2009). The assumptions regarding how firms interact and form business relationships presented in the INA make it a suitable framework for the analysis of a variety of inter-organizational issues.

With regard to activity linking, the framework offers several distinct benefits. With the acknowledgement and exploration of activity interdependencies, it conceptualises the relatedness of activities, both within and across firm boundaries. The analysis of this relatedness is further supported by the identification of resources and actors with which activities are associated. The network metaphor for business life allows for the recognition of both direct and indirect activity interdependencies which span organizational boundaries and assign specific meaning to the notion of a firm's 'environment'. Stability and change coexist in these networks (Gadde and Mattsson, 1987). Concepts for the analysis of dynamics related to the phenomenon are thus also identifiable in the INA. Such concepts are crucial in order to be able to analyze how activity relatedness is achieved and maintained. In addition, according to the INA: *"the most important business processes are not those within companies but those between companies"* (Håkansson et al., 2009, p. 47). The framework is therefore believed to be well suited for analysing inter-firm coordination and for scrutinizing the cooperative behaviour of individual firms.

Business relationships and networks

Within the INA, relationships are understood as important mechanisms of industrial production and exchange. Instead of *"treating complex relationships as exceptions, these are in the network view something that characterizes business life"* (Håkansson and Waluszewski, 2002, p. 14).

A business relationship is defined as a *"mutually oriented interaction between two reciprocally committed partners"* (Håkansson and Snehota, 1995, p. 25). Instead of regarding

such relationships as an intermediate governance form to markets and hierarchies, as done by Williamson (1985) when using transaction cost theory for the analysis of economic exchange, they are understood as a natural way of organizing business life (Torvatn, 1996). In the INA these relationships are filled with very specific substance, represented in the ARA model (Håkansson and Snehota, 1995).

Research has emphasized extensive longevity with specific buyer-supplier relationships (e.g. Håkansson, 1982). In line with this, the INA argues the existence of stable and durable inter-organizational relationships among firms engaged in economic exchange (Easton, 1992). Firms make relationship specific investments and adapt to each other in ways that necessitate both interaction and a long-term focus. By investing and adapting to the prerequisites of specific suppliers and customers, various economic benefits are realized (Håkansson and Snehota, 1995). At the same time, when investing and adapting in certain directions, other possibilities are sometimes neglected or even complicated, which is why a firm continuously needs to examine its current relationships.

Håkansson (1989) identifies a number of general features of relationships. According to him, relationships are characterised by continuity, complexity, a low degree of formalization, symmetry in resources and initiative, adaptations, the concurrent presence of cooperation and conflict, and certain connectedness. Here, the notion of adaptations, which is of focal interest further on in this frame of reference, relates to the adaptations two parties make in order to function better vis-à-vis each other.

All relationships display these features to some extent and the variation among relationships, in terms of degree of involvement and continuity is discussed by Gadde and Håkansson (2001). Not only does this vary, it is even argued to be of strategic importance for a firm to be able to handle a variety of such 'strong and weak' relationships (Gadde and Snehota, 2000).

The conceptual notion of business networks is a foundation for all research related to the INA. It implies the analysis of the industrial system, i.e. the production, distribution and use of industrial goods and services from a network perspective (Axelsson and Easton, 1992). Extended connections between business relationships create networks of interdependent

relationships. Mattsson (1983) pointed out the difference between loosely and tightly structured networks, depending on the strength of the individual connections.

Thus, individual relationships act as building blocks of networks (Håkansson and Snehota, 1995). By definition, a network is *“a set of two or more connected business relationships, in which each exchange relation is between business firms that are conceptualized as collective actors”* (Anderson et al., 1994, p. 2). The principal unit of analysis is thus the network, which consists of actors connected through the activities they undertake and the resources they utilize. As such, it is argued that *“actors, activities and resources together form a system in which heterogeneous demands are combined with heterogeneous supply”* (Håkansson, 1987, p. 17).

The INA stands in sharp contrast to the conventional view of a firm’s economic development, which emphasizes the activities and resources developed and utilized internally within the firm (Wedin, 2001). Such an internal perspective is represented in the resource-based view of the firm (see e.g. Penrose, 1959). Penrose (1995, p. xiii) even states in the foreword to the third edition of her seminal book, that *“in the development of the theory of growth of firms the influence of the ‘environment’ was put on side in the first instance in order to permit concentration on the internal resources of the firm”*. In the INA, this ‘environment’, however, is considered crucial to the exploration of a firm’s economic development. Håkansson and Waluszewski (2002) argue that it is through interaction with its counterparts that a firm exists and develops.

With the adoption of a network perspective, a firm’s networking entails the utilization of other firms for the realization of its own goals, done by relating its own resources and activities to its direct and indirect counterparts in the network (Wedin, 2001).

2.2 The ARA model

A business network is characterized and analyzed in the dimensions of activities, resources and actors¹, conceptualized in the network model (Håkansson, 1987), also referred to as the

¹ Frequently identified as *firms*, addressed in the discussion of the actor dimension of the ARA model.

ARA model. According to Håkansson (1987), the three dimensions can be understood as the basic elements of industrial structures.

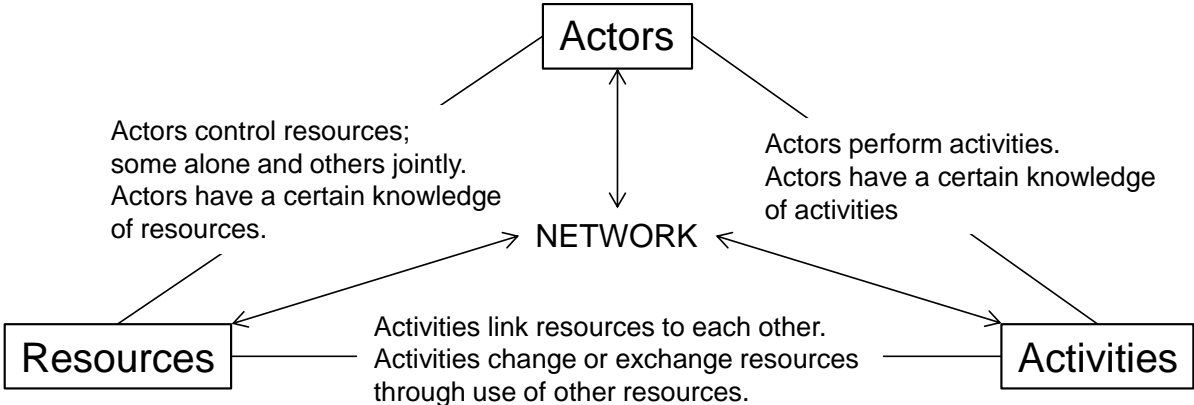


Figure 2.1 The network model (Håkansson, 1987, p. 17).

As is evident in Figure 2.1, there is interconnectedness between the three dimensions. *“Actors are defined as those who perform activities and/or control resources. In activities actors use certain resources to change other resources in various ways. Resources are means used by actors when they perform activities. Through these circular definitions a network of actors, a network of activities and a network of resources are related to each other.”* (Håkansson and Johanson, 1992, p. 1).

After discussing each dimension in isolation, this section revisits the phenomenon in light of the conceptualisations provided in the ARA model.

2.2.1 Activities

According to the specification in Figure 2.1, activities are undertaken² by actors (Håkansson, 1987). In connection with these activity undertakings, resources are activated (ibid.).

Depending on analytical intentions, activities can be identified and separated in a number of ways. For example, Dubois (1994) distinguishes between transformation (production) and transaction (exchange) activities. Transformation activities are identified as activities undertaken by individual actors, whereas transaction activities are undertaken between

² The original reference speaks of activity *performance*, instead of activity undertaking. As the word performance is considered to indicate also some implicit ‘value’ associated with the outcome of the activity, the word undertaking is instead used throughout this thesis (with the possible exception of quotes).

actors (ibid.). In contrast, Holmen (2001) distinguishes between transformation and transfer activities, where transformation activities are activities through which resources used for the activity are changed in some way or another, whereas transfer activities are activities in which control over resources is exchanged between actors (ibid.). Both authors thus relate activity undertakings to the other two dimensions of the ARA model, where Dubois (1994) is concerned with the ways in which activities relate to actors, while Holmen (2001) relates primarily to the resource dimension.

How industrial activities are organised and undertaken influences the efficiency of a firm and has been a fundamental theoretical concern in previous research. As stated by Håkansson and Snehota (1995, p.50); *“activities performed and the way they are carried out are determinants of the costs and revenues of a company”*. More specifically, Holmen et al. (2005, p.1244) argue that *“by linking activities, firms may capture efficiency gains by coordinating which...activities are carried out for whom, when and for what amounts of time”*.

The undertaking of industrial activities can thus be focused on from different but related perspectives. The first quote in the paragraph above indicates a primary interest in the undertaking of the activities of a firm, while the second emphasizes the linking of activities, i.e. how activities are undertaken in combinations and across firm boundaries. In essence, Dubois and Håkansson (1997) argue that one of the key problems in industrial firms is that their activities have to be related to those of others.

Whereas the ‘linking of activities’ mentioned by Holmen (2005) is not necessarily identical to activity linking, it relates to it. This is discussed further in section 2.2.4. The activity dimension of the ARA model is addressed throughout this frame of reference, each time in relation to specific concepts deemed relevant for the exploration of activity linking.

2.2.2 Resources

Just as with activities, the identification and separation of resources rests upon the specific intentions with which it is done.

Håkansson and Snehota (1995) argue that the identification of resources should rest upon their known use. They stated: *“whether an element is to be considered a resource depends*

on the known use for it. [...] No element without known use is a resource and the value of resources lies, of course, in their use potential” (Håkansson and Snehota, 1995, p. 132). In addition, Snehota (1990) argues that *“it is the meaning that makes elements to resources and that underlies their value”* (p. 105). In relation to these statements, Holmen (2001) asks whether potential use and value should also be a factor for the identification of resources, not merely realized use.

A commonly used classification of resources in the INA is the “4Rs model” (see e.g. Baraldi et al., 2001; Håkansson and Waluszewski, 2002). This model distinguishes between four basic resource types: products, facilities, business units, and business relationships (Baraldi, 2002). Products are identified as the artefacts exchanged between firms, facilities are the tools applied to products and information, business units are the competence, routines, know-how and reputation organized inside a firm, whereas business relationships represent the “quasi-organization” that emerge from repeated interactions between firms (ibid.). Products and facilities are identified as physical resources, with clear physical properties (Håkansson and Waluszewski, 2002). In contrast, business units and business relationships have clear social properties (ibid.). In addition, *“all four types of resources have critical economic features along with their physical and social features”* (ibid., p.38).

Håkansson and Waluszewski (2002) specify some of the critical aspects of the four resource types. The features of a product result from the interaction between the buyer and the seller. These features have certain duration in form and function, which result from the duration of the “sets of products” of both the buyer and seller (ibid.). In this respect, facilities can be regarded as an attempt at “freezing” some of these features to make them more durable. Through interaction between business units, some features of one business unit will become embedded into those of its counterpart(s) and vice versa (ibid.). For this reason, relationships are an essential resource in networks as they provide individual actors with both opportunities and restrictions. Thus all four resource types are formed in interaction processes involving multiple actors.

The features of a resource are never given (Baraldi, 2002). Instead, features are shaped and defined by “interacting” socially, economically and technically with other resources (Håkansson & Waluszewski, 2002). This implies that the activated quality of a resource

presents a limited picture of its history (ibid.). A key issue thus seems to be how certain features of these single or combined resources are developed and embedded into each other through interaction (ibid.). Three concepts are highlighted in relation to this discussion: heaviness, variety and versatility. These relate to the characteristics of individual resources and display themselves in resource interfaces. Heaviness is the strength of a resource interface (Baraldi, 2002). As a result of socio-technical heaviness, resources can be contrived into an apparent state of rest (Håkansson and Waluszewski, 2002). However, there is always a potentially open space for unforeseen features to emerge in each resource (ibid.). The concept of variety targets the open-ended nature of a resource interface (Baraldi, 2002). In addition, resources at any given moment display only parts of their variety, identified as realised versatility (Torvatn, 2001). Versatility is thus related to the flexibility of a resource, which indicates the ease with which it can be recombined with other resources (Hulthén, 2002).

One of the principal assumptions in the INA is resource heterogeneity (Håkansson and Waluszewski, 2002). Instead of the classical economic homogeneity assumption, resources are treated as variables whose value or utility depends on the other resources with which they are combined (Holmen, 2001). This notion of resource heterogeneity is inspired by the works of Penrose (1959) and Alchian and Demsetz (1972). Penrose (1959) argues that a firm's uniqueness and development can be explained by how it combines heterogeneous resources with regard to certain activities. In addition, Alchian and Demsetz (1972) stress that a firm's ability to utilize the heterogeneity of its resources is closely related to its efficiency. As argued by Håkansson and Waluszewski (2002), the latter reference *"emphasizes further that efficient production is a result not of having better resources, but of knowing more accurately the relative productive performance of those resources"* (ibid., p. 32).

Both Penrose (1959) and Alchian and Demsetz (1972) adopt an intra-organizational perspective to explain a firm's economic development. In line with this, they also assume that resource heterogeneity stops at the boundary of the firm (Holmen, 2001). This 'implicit' assumption is questioned in the INA and represents a distinct difference in the way in which

the concept is understood and explored in relation to these original references (Wedin, 1998).

In the INA *"the heterogeneity of resources is mainly considered in terms of interactive effects"* (Håkansson and Waluszewski, 2002, p. 32). Thus, the INA seems to argue resource heterogeneity on two principal levels. First, the heterogeneity of resources is related to the different ways in which their features are used in different combinations (Holmen, 2001). Second, some kind of interaction between resources takes place when they are combined (ibid.). This notion of interaction rests on the conceptualization of resources as embedded in multi-layered "resource networks" (Baraldi, 2002). Thus, *"by being embedded into other resources in a new way, or by being activated in a new way, an established resource can exhibit new features"* (Håkansson and Waluszewski, 2002, p. 32).

This section has addressed some of the principal aspects of resources. In addition, how these resources relate to activities is relevant to the analysis of activity linking. This relatedness is therefore discussed in section 2.5.

2.2.3 Actors

In the analysis of industrial networks, actors hold a central position. Actors undertake activities and activate resources. Furthermore, the internal activities and resources of an actor are linked and tied to the internal activities and resources of its counterparts. Although there is extensive research on the structure and dynamics of business networks, there is relatively little discussion of the form and type of actors (Elo and Möller, 2007).

In the identification of actors, Håkansson and Johanson (1992) specify a number of common characteristics. First of all, actors can act. Their possibilities for action, as well as reaction and interaction, are conditioned by the relations between activities, resources and actors. Furthermore, actors develop relationships through exchange processes, whereby they gain access to the resources of their counterparts. Actors base their activities on control over resources. Whereas direct control is achieved through ownership, indirect control is achieved through relationships. Given their individual perspectives, actors also have differential, bonded knowledge of activities, resources and other actors in the network. Finally, actors are both goal oriented and subject to bounded rationality. Given their

individual perspectives and their goal orientation, actors also have conflicting, common, and complementary interests.

In much INA-related research, the firm is the principal actor (see e.g. Håkansson and Snehota, 1995). It is, however, argued that management decisions arise at the individual, group, business unit, or firm level and that these levels are interrelated (Ritter et al., 2004). With regard to the activation of resources, Håkansson and Waluszewski (2002, p. 38) state that: *“whether it is a physical resource, such as a product or a facility, or a social resource, such as a business unit or a business relationship, its features are interpreted, developed and preceded by individuals”*. Thus, while firms conduct relationship activities, it is the human actors who synchronize them all (Medlin, 2002).

Gummesson (1999) criticizes the tendency to focus on the “pure” company and argues the importance of considering hybrid forms such as franchising systems and alliances. A similar view is put forward by Möller et al. (2005), who say that the traditional view of the firm as a monolithic actor is not sufficient in today’s networked world, where strategic alliances and business nets are increasingly present. There are thus alternative approaches when it comes to the identification of actors in industrial networks.

For example, a purchaser might primarily identify its suppliers through their respective sales departments. With a multinational enterprise, consisting of multiple businesses at different geographical locations, it is unlikely that all the counterparts view this enterprise as a single actor. The boundaries of an actor will thus be drawn differently depending on whom you ask. As a result, counterparts may see different units or departments in a firm as distinct actors with separate identities.

Specific counterparts may draw the boundaries of an actor differently, but they do so for reasons. A firm can be seen as a complex network of internal relationships among individuals, groups and business units, which provides the basis of its ability to develop and implement strategies (Ritter et al., 2004). This view also has implications for the direction of firms. Instead of viewing firms as centrally directed, they are seen as complex interacting sets of relationships.

“Companies are actors because the identity of actor is attributed to them by those with whom they interact” (Håkansson et al. 2009, p. 190). This statement highlights the importance of the network context of an actor. In light of the uniqueness which characterises the individual relationships of an actor, its *“capacity to cope with a variety of relationships in different ways has a profound impact on performance”* (Gadde and Snehota, 2000, p. 305). It is therefore critical to analyze an actor in light of its business relationships at a network level of analysis.

In light of these actor-specific features, section 2.6 discusses the relatedness between actors and activities.

2.2.4 Activity linking and the ARA model

With this introduction of the individual dimensions of the ARA model, the phenomenon of interest is now revisited. Here, the further development of the definition of activity linking is supported by a scheme proposed by Håkansson and Snehota (1995) in which the three dimensions are identified as separate substance layers in a business relationship specified as activity links, resource ties and actor bonds (ibid.).

To capture the factors which affect the development of the substance profile of a business relationship, three functions are distinguished as follows: the function for the single actor, for the dyad, and the network (ibid.). The combination of these two dimensions results in a scheme for the analysis of business relationships, see Figure 2.2.

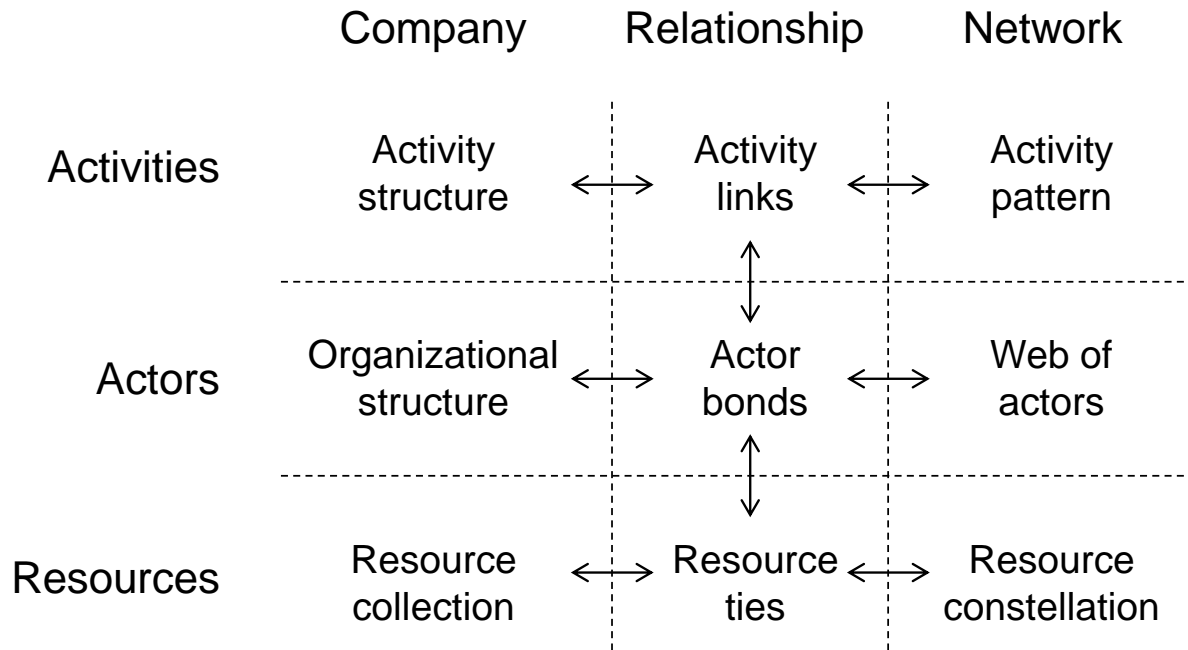


Figure 2.2 Scheme for the analysis of business relationships (Håkansson and Snehota, 1995, p.45).

With this identification of functions, the scheme distinguishes among alternative, and complementary scopes for the analysis of each substance dimension in relation to a business relationship. It thus frames the ways in which the individual dimensions can be analysed, as well as highlighting their interrelatedness. The scheme is considered valuable in connection with the exploration of activity linking. In relation to the identification of activity links, however, an important conceptual reinterpretation is made.

In Figure 2.2, Håkansson and Snehota (1995) identify three substance dimensions of a business relationship: the activity link, the resource tie and the actor bond. All these dimensions are explicitly related to the business relationship. For example, an activity link is not merely a connection between two activities; it is a connection between the activity structures of two companies involved in a business relationship. As such, it targets the relatedness of the activity undertakings of these companies.

For the purpose of this thesis, the concept of an *activity link* is, however, defined as a direct connection between two activities. Activity links thus exist among all directly connected activities, regardless of what company(-ies) undertake(s) the activities. This revised concept is only a slight variation of the initial definition of an activity link proposed by Håkansson and Snehota (1995), but it allows for the analysis of activity links without the explicit analysis of

business relationships, identifying links (and subsequently also linking) as activity concepts, regardless of organizational boundaries. This reinterpretation of activity links is in line with the concept of Håkansson et al. (2009).

Activity links are thus identifiable in relation to each of the functions represented in Figure 2.2. Not only are the activities which are part of an activity structure linked, but the activities of different actors involved in business relationships are linked as well. In relation to these activity links, the phenomenon of activity linking targets the connecting of individual activities. As such, it represents a process element of the activity dimension depicted in Figure 2.2.

The frame of reference has thus far primarily emphasized the importance of analysing activity linking from an inter-organizational perspective. This initial inter-organizational focus is a result of the specific characterisations of business life put forward in the introductory chapter, focusing especially on specialization and inter-firm coordination. However, supported by the separate scopes for activity analysis derived from the individual functions in Figure 2.2, activity linking is understood as a phenomenon relevant both within and across firm boundaries, and as such important in principle to all activity undertakings in business life.

2.3 Scopes for activity analysis

The connectedness of activities means that activity analysis needs analytical boundaries. A number of such “scopes for activity analysis” are suggested in the INA. In accordance with the functions in Figure 2.2, Håkansson and Snehota (1995) distinguish between activity structures, activity links and activity patterns. The internal activities of a firm are conceptualized as an activity structure (see e.g. Håkansson and Snehota, 1995; Gadde and Fredriksson, 2004). In contrast, activity links “*regard technical, administrative, commercial and other activities of a company that can be connected in different ways to those of another company as a relationship develops*” (Håkansson and Snehota, 1995, p. 26). Activity links thus connect the activity structures of different firms. In addition, the connectedness of relationships means that what is produced in a relationship can have effects on other relationships, and thus also on other firms than those directly involved (ibid.). Activity patterns result from the direct and indirect links of the activity structures of individual firms,

illustrated in Figure 2.3. The analysis of activity patterns thus indicates a network level of analysis.

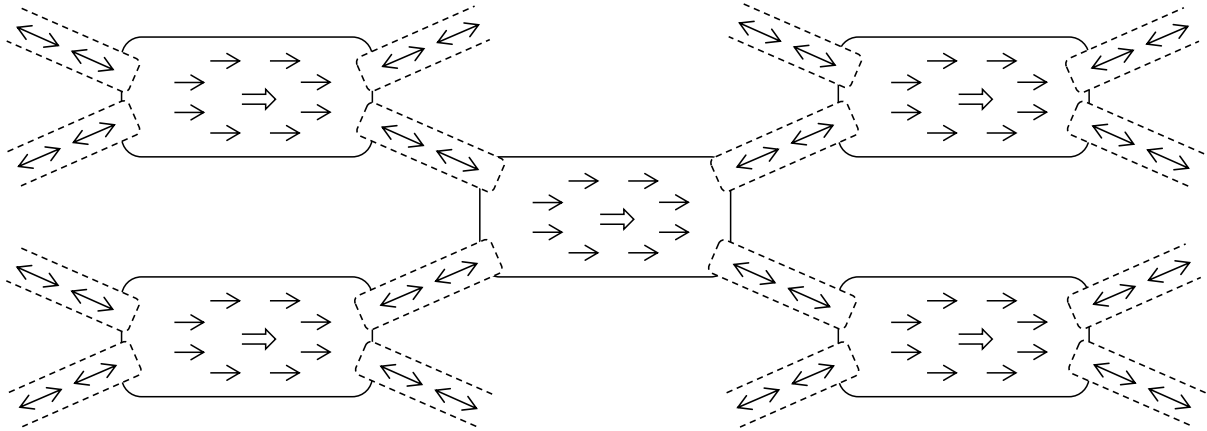


Figure 2.3 Activity structures, links and pattern over five companies (Håkansson and Snehota, 1995, p. 29).

An additional scope for activity analysis is presented by Dubois (1994). The end product related activity structure includes all activities undertaken for the creation of an end product, se Figure 2.4.

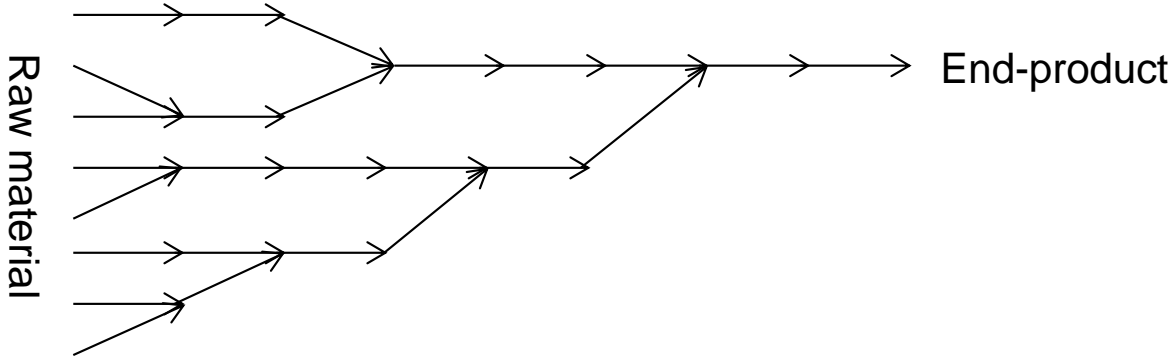


Figure 2.4 An end product related activity structure (modified from Dubois, 1994, p. 29).

Figure 2.4 relates to what Alderson (1965) identifies as a transvection, which comprises all prior actions necessary to produce an end product placed in the hands of the final consumer. In addition, Håkansson et al. (2009) identify activity configurations, which include all activities underlying the production of a specific end product. These end product related activity structures, transvections and configurations include the activities of several actors, and so they involve parts of activity structures, links and patterns. Here, the interpretation of

activity configurations³ implies that these are identified in relation to the discrete production and delivery of specific end products. As such, they only represent single activity undertakings. The identification of configurations thus differs in principle from the more continuous nature of the activity undertakings of structures, links and patterns.

As indicated in this section, there are several alternative scopes for activity analysis, believed to complement each other in the exploration of activity linking, which is why they are used to frame the phenomenon in the analysis below.

2.4 Activities in space and time

In the analysis of industrial networks, structural and process characteristics can be distinguished between. Whereas ‘structural’ characteristics can be identified at a certain point, ‘process’ characteristics must be traced over a period of time (Holmen, 2001). Håkansson et al. (2009) suggest a descriptive model of business interaction which offers concepts related to time and space with regard to the analysis of activity patterns, resource constellations and actors webs. This model is presented in Figure 2.5.

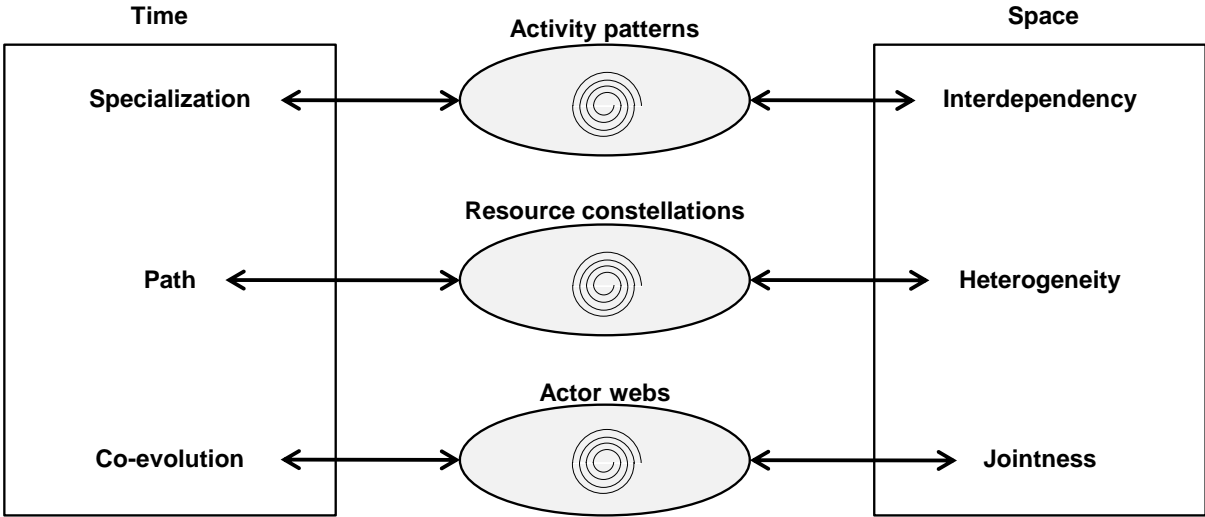


Figure 2.5 A model of business interaction (Håkansson et al., 2009, p. 41).

The model suggests two concepts for the analysis of activities in space and time. All activities in business life are interdependent and “even if some of these activities may appear to be

³ Activity configuration is the activity concept chosen to target activities undertaken in relation to a specific end product.

independent, they are always connected to others in a variety of ways” (ibid., p. 42). Interdependency is thus a special dimension of activity patterns. In addition, each activity and the activity pattern of which it forms part evolve over time. This evolution is referred to by Håkansson et al. (2009) as a process of specialization⁴. This process, *“involves making activity adjustments, many of which are step-wise changes in order to successively reduce costs in daily business”* (ibid., p. 43). Activity adjustments are thus identified as the means by which specialization is achieved. They therefore constitute the building blocks of change in activity patterns.

Space represents a structural activity dimension with extended interdependencies among activities (Håkansson et al., 2009). These interdependencies exist between all activities that are part of an activity pattern. This means that not only activities directly linked with each other are interdependent. Extended interdependencies also link activities undertaken seemingly far from each other, for example undertaken by firms which have no direct contact or even knowledge of each other. Such, to some extent ‘hidden’ activity interdependencies emphasize the potentially far-reaching network effects of interdependencies among individual activities.

Time targets how these structural relationships develop as business prerequisites change. The analysis of activity adjustments allows for the identification of such developments (Håkansson et al., 2009). In principle, adjustments are made to improve the joint performance of activities (ibid.), so activity links are established and developed through adjustments. Activity links are here identified between all directly connected activities, regardless of whether these are undertaken by the same actor or by different actors. This notion is in line with Håkansson et al. (2009) as discussed above. Furthermore, the interest in structural change does not imply an interest to describe actual change processes, but to find representations of change which can be used to analyze the continuous change of structural relationships among activities.

⁴ Here, specialization is defined differently from the definition given in the introductory chapter where it referred to the vertical disintegration of a firm’s previously internal activities, associated primarily with the outsourcing of selected activities and processes. Here a more conceptual meaning is used, targeting the change process related to activity patterns.

Just as adjustments are made in response to existing activity interdependencies, adjustments of activities also create interdependencies (ibid.). The interdependencies among activities therefore both come from and result in activity adjustments. This dual cause-and-effect relationship between interdependencies and adjustments is illustrated in Figure 2.6.

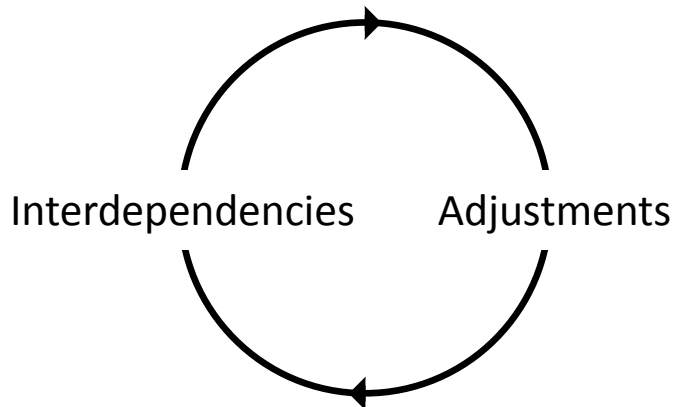


Figure 2.6 The interrelatedness of activity interdependencies and adjustments.

Interdependencies and adjustments are central concepts for the analysis of activity linking. Whereas interdependencies specify activity links, adjustments target their change. These concepts are therefore addressed individually in sections 2.4.1 and 2.4.2, respectively. In addition, they are included in the first research question of this thesis, presented in section 2.8.

2.4.1 Activity interdependencies

Three interdependency typologies are presented and related in this section.

The work of Thompson (1967) has, despite its intra-organizational focus, been extensively used in relation to the INA (see e.g. Håkansson and Jahre, 2004; Håkansson and Persson, 2004; Bankvall et al., 2010). Research by Richardson (1972) has also proven useful for the development of the conceptualization of the INA (see e.g. Dubois, 1994; Gadde and Håkansson, 2001). In addition, the state of the art ambition of the work of Håkansson et al. (2009), where, influenced by Thompson and Richardson, they suggest an alternative typology for activity analysis in industrial networks, is also represented in this section.

Thompson (1967) discusses the existence of internal interdependence among parts (possibly business units) which belong to a complex organization. As such, he does not focus specifically on activity interdependencies. *“To assume that an organization is composed of interdependent parts is not necessarily to say that each part is dependent on, and supports, every other part in any direct way”* (ibid., p. 54). He continues with the identification of a “pooled interdependence” between parts of an organization which *“render a discrete contribution to the whole (i.e. the organization)⁵ and each is supported by the whole”* (ibid., p. 54). The substance of the particular interdependence is not specified; instead it is the relationship between two parts belonging to the same organization that conditions the interdependence. Take, for example, two different business units in the same parent organization. Although they have no direct contact and might not even know of each other’s existence, they both contribute to the same organization. As a result, if one of the units performs poorly, this can have an adverse effect also on the other.

In addition, a “sequential interdependence” represents direct interdependence between certain parts, with a specified order (ibid.). All parts that have sequential interdependence also have pooled interdependence. In the identification of sequential interdependencies, Thompson refers to the inputs and outputs of individual organizational parts, thus implicitly targeting the activities these parts undertake and the outputs that result from these undertakings. Sequential interdependence is, for example, identified between two business units in an organization if they are in direct contact and one of them provides the other with input for its operations.

Reciprocal interdependence refers to a situation where two parts of an organization penetrate each other; i.e. *“the outputs of each become inputs for the others”* (ibid., p. 55). All parts that have reciprocal interdependence also have sequential interdependence. The interdependency types thus display an increasing level of contingency. Reciprocal interdependence can be exemplified by an organization that operates and maintains a vehicle fleet. The use of the vehicles calls for repairs, which in turn enable their further use. More specifically, the output from the transport unit is, among other, vehicles that need to

⁵ my insertion

be serviced. These vehicles are in turn input for the service unit. The output from the service unit is vehicles that have been serviced for further use.

Richardson (1972) develops a framework for the analysis of coordination among activities. Interdependencies between activities are thus explicitly focused on in the exploration of distinct coordination forms, and thus 'the organization of industry'. The framework consists of two principal interdependency types. Having identified these types, Richardson (1972, p. 887) aims to provide an *"explanation of the principle of the division of labour between firms and markets and of the roles within a capitalist economy of planned and spontaneous co-ordination"*. The first is labelled complementarity and exists among activities *"representing different phases of a process of production and require in some way or another to be coordinated"* (ibid., p. 889). The output of one phase is thus input for another. Consider, for example, the different stages of a production process, in which each successive stage delivers an output which becomes input for the next stage. The coordinated need then originates from the realization that the second stage is dependent on the first for receiving its required input. At the same time, the first stage is dependent on the second for directing its delivered output.

In addition, close complementarity is identified if there is a need to *"match not the aggregate output of a general-purpose input with the aggregate output for which it is needed but of particular activities"* (ibid., p. 891). The activities have the same input-output related interdependence as described in complementarity, but they are also directed specifically towards each other. Consider the same production process as above, only this time the different stages of production are coordinated to deliver a final output customized with regard to all these stages. Thus the stages together facilitate the customization, and all the individual stages are undertaken specifically with it in mind.

The second type of interdependence is labelled similarity and exists among activities that require the same capabilities for their undertaking (ibid.). The notion of capabilities in turn derives from the recognition that *"activities have to be carried out by organizations with appropriate knowledge, experience and skills"* (ibid., p. 888). Although that the notion of capability is somewhat vague, it is still believed to have analytical use. As argued by Richardson (1972, p. 888): *"the capability of an organization may depend upon command of*

some particular material technology, such as cellulose chemistry, electronics or civil engineering, or may derive from skills in marketing or knowledge of and reputation in a particular market”.

Inspired by these two classifications, Håkansson et al. (2009) distinguish between three types of interdependence. Serial interdependence is present in situations in which *“a specific activity cannot be performed until another one has been completed”* (ibid., p. 105). All sequential manufacturing and distribution processes have this type of interdependence between the individual activities. Each activity requires input and delivers output. The input is in turn delivered as output from an upstream activity, whereas the output is required as input for a downstream activity. This type of serial interdependence is synonymous with complementarity as specified by Richardson (1972).

Dyadic interdependence is present in situations in which *“the output from one activity serves as input for the other activity and vice versa”* (Håkansson et al., p. 106). They exemplify this with the *“interaction for the provision of business services where production and consumption activities occur more or less simultaneously”* (ibid., p. 106). They also put forward a less direct type of dyadic interdependence which corresponds to Thompson’s (1967) definition of reciprocal interdependence.

Finally, joint interdependence *“occurs when the performance of one activity is dependent on another, because both of them are related to a third activity”* (ibid., p. 107). This can be exemplified with two suppliers who supply the same production process. The activities of each of these suppliers are serially interdependent with the activities of the production process. As a result, the activities of these suppliers also affect each other. *“If the activities of one of the suppliers are not adequately performed, this affects the activities of the other since the processes of the customer, to which both suppliers are related, are disturbed”* (ibid., p. 107). The activities of these suppliers are thus interdependent through the joint direction of their outputs.

These three frameworks were developed with different purposes in mind and therefore have both commonalities and differences. It is acknowledged that the divergent purposes with which the individual frameworks were developed inevitably result in differences which

are not weaknesses in the individual frameworks. It is, however, relevant to reflect specifically upon the commonalities they represent in the context of this thesis.

First, the typologies all recognize serial (sequential) interdependence and they all acknowledge that a process of production is separable into individual activities which need to be undertaken in a certain order. This order is conditioned by the input requirement and output delivery of individual activities. Two activities are thus seen to depend on each other as a result of one of the activities delivering output required as input for the other. As such, there is an input-output related interdependence between them. In addition, two further specifications of this interdependence are identified. The first recognizes an input-output related interdependence between activities which are specific to each other and not general. The second identifies a mutual input-output related interdependence between two activities in that they require inputs and deliver outputs reciprocally.

The joint interdependence identified by Håkansson et al. (2009) connects activities which have a joint direction to their individual outputs. This is also described by Thompson (1967, p. 54) when he specifies that *“each part renders a discrete contribution to the whole”*. In light of the input and output of individual activities, two activities are thus identified as connected when they both deliver outputs required as input for a common third activity. In addition, Thompson (1967, p. 54) states that *“each is supported by the whole”*. This indicates interdependence between two activities which have a joint input, that is, which both require input delivered as output from a common third activity.

In addition, this notion of being *‘supported by the whole’* relates to Richardson’s (1972) definition of capabilities. Capabilities are the knowledge, experience and skills of an organization, which are activated when the activities of the organization are undertaken. The activity undertakings are thus enabled by these specific capabilities. As such, this type of interdependence is separate from the input and output related interdependencies discussed above.

In relation to the three activity interdependency typologies, this section suggests four principal ways in which activities display interdependence. These are merely indicated to guide the upcoming case analysis, where they are matched with the information presented

in the empirical inquiry. The four types constitute the activity interdependency framework of this frame of reference and are given in table 2.1.

Description	Definition	Relatedness with previous typologies
Input-output related	<i>An activity delivers output, which is required as input by another activity*</i>	Sequential, reciprocal (Thompson, 1967) Complementarity, close complementarity (Richardson, 1972) Serial, dyadic (Håkansson et al., 2009)
Joint origin of inputs	<i>Two activities require inputs which are outputs from a common third activity</i>	Pooled (Thompson, 1967) Similarity (Richardson, 1972)
Joint direction of outputs	<i>Two activities deliver outputs which are inputs to a common third activity</i>	Pooled (Thompson, 1967) Joint (Håkansson et al., 2009)
Shared capabilities	<i>Two activities require the same knowledge, experience and skills for their individual undertaking</i>	Pooled (Thompson, 1967) Similarity (Richardson, 1972)

Table 2.1 The suggested types of activity interdependence of this frame of reference (*this type of interdependence includes two additional specifications, in accordance with the discussion above).

2.4.2 Activity adjustments

Although many researchers have approached and discussed the issue of adaptations⁶, very few explicit definitions have been suggested (Awaleh, 2008). In the INA, the concept is usually used without related clarification or specification. Instead only typologies which serve very specific purposes have been presented in previous research. From existing definitions it is concluded that adaptations are primarily identified with regard to specific buyer-supplier relationships (see e.g. Brennan and Turnbull, 1999; Canning, 1999). One

⁶ initially seen as synonymous with adjustments

example is Canning (1999), who defines adaptations as modifications at the individual, group or corporate level carried out by one or both parties in an exchange relationship in order to suit new needs or conditions, and initially designed for that specific relationship. In addition, Canning and Brennan (2004) approach the network level of analysis by concluding that numerous firms that are part of the same network make adaptations with the intention of making the network itself more efficient. This is also a notion presented and explored elsewhere in the field of supply chain management. Brennan et al. (2003) approach a higher level of analysis in the specification of environmental and market adaptations, in addition to relationship specific dyadic adaptations. For example, a firm might adapt to changes in relation to the broader marketing environment, the competitive environment and consumer preferences (Jain, 2000).

The first issue when researching adaptations is to ask what they actually entail or, in the words of Holma (2009), what their content is. A recent literature review by Hagberg-Andersson (2007) offers some guidance. As evident in this review, several classifications show considerable resemblance. One of the more extensive classifications is the one suggested by Håkansson (1982). This contains the categories of product specification, product design, manufacturing process, planning, delivery procedures, stockholding, administrative procedures and financial procedures. Brennan et al. (2003) take their point of departure in this classification and suggest two additional categories: information provision and organization structure. In light of this, adaptations are made to either the elements exchanged or to the process of exchange (Håkansson, 1982). In relation to the activity interdependency types suggested in section 2.3.1, the elements exchanged are identified in the inputs and outputs of individual activities while the process of exchange is related to the knowledge, experience and skills of individual firms. As such, it concerns in what ways activities are undertaken.

Gadde and Håkansson (1993) distinguish among technical, administrative and knowledge-based adaptations. Technical adaptations concern products and production facilities. Material adaptations are common in this category (Håkansson, 1989). Administrative adaptations concern, for example, stockholding, information provision and time of delivery (Brennan and Turnbull, 1998). Finally, knowledge-based adaptations concern, for example,

the improvement of the knowledge of each other's production processes and products. Administrative and knowledge-based adaptations relate to the process of exchange, whereas technical adaptations concern both the elements exchanged (products and materials) and the process of exchange (facilities).

A few researchers approach the issue of adaptations in relation to the conceptual dimensions of the ARA model. Holma (2009) identifies adaptations as adjustments in activities, resources, and actors, seeing adaptations as an umbrella term, while adjustments are related to the individual ARA-dimensions. Håkansson and Snehota (1995) argue that adaptations are made to combine the positive scale effects of standardized activities with the effective customer solutions of adapted activities. Thus adaptations relate to the standardisation and customization of activities. Some activities are the same for several counterparts, whereas other activities are differentiated and unique with respect to specific counterparts (ibid.). A related distinction is made by Dubois (1994), who separates general from specific activities, based on how they relate to a certain end product. With these references, both the nature of the output of the activity and the process in which it is undertaken are in focus.

In line with changing business prerequisites, activity adjustments are made to improve the joint performance of activities (Håkansson et al., 2009). For example, long-term business relationships are usually associated with continuous adjustments of the internal activities of the respective firms. This notion has been addressed by several researchers in the INA. These have primarily explored the concept of adaptations, whereas this thesis focuses on adjustments. In most of the references presented above this distinction is not made and the concepts are used interchangeably. However, Håkansson et al. (2009) distinguish between adaptations and adjustments. In accordance with their concepts, adaptations are related to the resource dimension of the ARA model, while adjustments are related to activities. This distinction is upheld in this thesis.

The analysis of adjustments requires entities to which to assign the actual adjusting. This is also illustrated in several of the references above, which speak of elements, processes, products, facilities, customers and end products, to mention a few. Here, the analytical dimensions of the ARA model aid the identification of these entities. It is believed that

activity adjustments influence both resources and actors in specific ways. In addition, the interrelatedness of interdependencies and adjustments suggest that the inputs, outputs and capabilities identified in the previous section also bear relevance for the identification of adjustments. These beliefs guide the discussion below as well as the specification of activity adjustments in the analysis.

2.5 Resources and activities

The three analytical dimensions of the ARA model are interrelated. The interest in activity linking is therefore not seen as an interest directed solely at the activity dimension. Instead, the activity focus of this thesis implies the analysis of activities by means of resources and actors. Thus to facilitate the analysis of activity linking, both resources and actors need to be discussed in relation to the activity dimension. This section focuses on resources and activities, and section 2.6 deals with actors and activities.

Several researchers have conceptualized the nature of resources in inter-organizational settings (see e.g. Baraldi and Bocconcelli, 2001; Wedin, 2001; Håkansson and Waluszewski, 2002). In accordance with the network model, activities link resources to each other (Håkansson, 1987). More specifically, activities *“change or exchange resources through the use of other resources”* (ibid., p. 17). Furthermore, *“in activities actors use certain resources to change other resources in various ways”* (Håkansson and Johanson, 1992, p. 1). Thus, resources are distinctly related to activities and actors, and the identification of resources can derive from these two other dimensions of the ARA model.

According to Håkansson (1987), activities change and exchange resources through the use of other resources. In light of this specific relatedness between activities and resources, resources can be separated and identified to allow for their classification. For example, Holmen (2001) distinguishes between resources that are material, such as e.g. equipment, facilities, manpower, raw materials and financial resources, and resources that are immaterial, such as skills, knowledge, trust, and goodwill. Dubois (1994) also speaks of the refinement of materials for the creation of end products. With regard to the resources used for the change and exchange of other resources, Hulthén (2002) identifies *“transformation resources”*, which can be either ‘fixed’ or ‘connecting’. Those of the fixed type include facilities, factories and warehouses, whereas those of the connecting type are, for example,

trailers and trains (ibid.). Hulthén (2002) also identifies three types of ‘objects’: conglomerate resources, transformation outputs, and end products. These objects are changed and exchanged through the use of transformation resources and are identified from the transvections according to Hulthén’s activity analysis. By definition, “*conglomerate resources and transformation outputs are resources used as inputs in transformation activities. These resources come out of the transformations with new features, as transformation outputs*” (ibid., p. 33).

Resources are crucial to the analysis of activity linking. This section has discussed some of the critical features of resources in industrial networks and suggested ways in which resources can be identified and separated. As made evident in previous sections, and stressed further here, resources and activities are interrelated. The specification of this interrelatedness aids the further exploration of activity linking. The notion of activities that change and exchange resources through the use of other resources is drawn upon. Not only is this distinction recognizable in the previous research presented in this section, it can also be related to the types of interdependence suggested in section 2.4.1. This relatedness is discussed in detail in the case analysis chapter.

An activity requires certain inputs and delivers certain outputs which, according to Hulthén, (2002) is identified as object resources, or the objects on which the activity is undertaken. As such, the outputs represent a processed version of the inputs. The inputs and outputs are thus changed and exchanged by the activity. In addition, some kinds of resources are required to facilitate this changing and exchanging, referred to in this thesis as enabling resources. These are resources used to change and exchange inputs into outputs, which enable the activity undertakings. Enabling resources can, for example, include facilities, manpower, knowledge and skills, i.e. everything required to undertake an activity. With regard to the activity interdependency types specified above, the notion of capabilities is interpreted as the enabling ‘resources of an activity’⁷. To support the further exploration of activity linking, a basic illustration of the suggested relatedness between activities and resources is presented in Figure 2.7.

⁷ The ‘resources of an activity’ denote the input(s), output(s) and enabling resource(s) directly related to this activity.

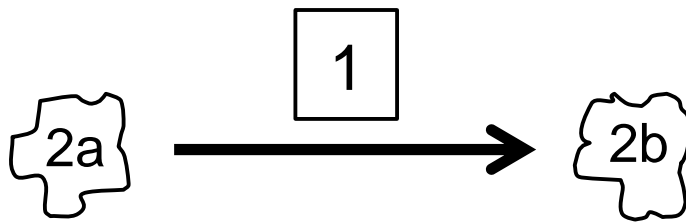


Figure 2.7 An activity connected to enabling (1) and object (2a-b) resources.

An activity is thus related to two types of resources; object (2) and enabling (1) resources. The object resources are, in turn, divided into inputs (2a) and outputs (2b), depending on whether they are required for, or the results of, the activity undertakings. With this specific relatedness in mind, resources are suggested to play a distinct role in the linking of activities. This belief motivates the formulation of the second research question of this thesis, presented in section 2.8.

2.6 Actors and activities

As activity patterns involve the activities of multiple actors, they are not created, controlled, operated or owned by a single actor (Ford and Redwood, 2005). This means that the structure and performance of a network is co-produced by the actions of all these actors (Ritter et al., 2004). But one part of a whole, an actor is simultaneously enabled and restricted by a network (Ford et al., 2002). An actor therefore needs to analyze its position with respect to its specific counterparts. This has implications for the change of the position of an actor; as such change can only be achieved through the network.

As evidenced in much research, stability and change co-exist in networks (e.g. Gadde and Mattsson, 1987; Freytag and Ritter, 2005). For an actor, it is important to understand network dynamics and develop capabilities for coping with it (ibid.). On the face of it, an actor has multiple opportunities for change, but is restricted at the same time by the present structure of the network (Håkansson and Ford, 2002). Given that change is possible only through the network, this also means that actors have to accept that this has primarily to be accomplished within established relationships.

Despite the influence of the network on an actor, and the restrictions that this network imposes upon it, it is important to note that each actor has the ability and intent to act. This is true even in cases where it is difficult to attribute causality between specific managerial

actions and related results (Håkansson et al., 2009). Management is considered important as relationships and networks can be influenced by the single actor (ibid.). It thus becomes an issue of management *in* networks, where an actor operates as one of many who influences the structure and functions of the network (Ritter et al., 2004). This notion ties into the “second network paradox”; which states that relationships are developed and defined by actors, but that actors are also developed and defined by relationships (Ford et al., 2002). Actors are thus conditioned by their relationships, but are at the same time able to make choices with regard to them, for example with reference to relationship investments and adaptations (ibid.).

Such choices are made based on the specific network picture of an actor. Network pictures are understood as the subjective interpretations of individual actors with regard to the world around them and the interactions which take place in it (Håkansson et al., 2009). These subjective interpretations form the basis for an actor’s decision making, concerning how it wants to change its current network position. The concept of interaction has been proposed in the INA, to capture such initiatives, for instance. From the perspective of an individual firm, interactions are constant processes of actions and reactions, which involve activities and resources as well as other actors (Håkansson and Ford, 2002).

Through interaction, a firm is able to influence the activity undertakings of its counterparts. A firm interacts through its established business relationships, which is why managerial action is considered a process of working with others within these relationships (Håkansson et al., 2009). Interaction is as much about being manageable as it is about managing, making management an issue of the management of interactions with others, rather than the management of others (Ritter et al., 2004).

In light of this, the notion of management of networks, for example individual firms that determine the activity undertakings of their counterparts, is seen as unrealistic. Instead, management *in* networks is a more relevant concept, which involves notions of interaction and networking, processes instead of outcomes (Freytag and Ritter, 2005). This process perspective also implies that there is no optimum goal towards which to strive. Instead, the context dependent nature of interaction makes it a continuous challenge.

In conclusion, actors are highly relevant for the analysis of activity linking. As actors are the ones who undertake activities, they are also the ones who make activity adjustments. The ways in which individual actors act, react and interact are therefore crucial to the exploration of activity linking. According to Håkansson and Johansson (1992), the possibilities for action, reaction and interaction are not only important characteristics of actors; they are also conditioned by the relationships among activities, resources and actors. For these reasons, the actor perspective on activity linking is represented in the third research question of this thesis, presented in section 2.8.

2.7 Interaction and activities

The conceptual interpretation and the relevance of interaction are two of the cornerstones of the INA. Still, as Medlin (2002) states, interaction is rarely defined in specific terms. He explains this conceptual uncertainty as primarily having to do with the actor dimension of the ARA model, and proposes that the multiple definitions of actors mean that the specific interpretation of interaction changes with context (ibid.).

Nevertheless, interaction has a key role in the life of an actor and is directed towards its counterparts (Håkansson and Waluszewski, 2002). According to Håkansson et al. (2009), interaction is: *“a process that occurs between companies and which changes and transforms aspects of the resources and activities of the companies involved in it and the companies themselves”* (p. 27). The actors, activities and resources of business are thus defined in terms of interaction (ibid.).

Interaction is more than a dyadic process. All companies simultaneously interact with several others and interaction between any two companies in this way affects their interactions with others (Ford et al., 2008). Thus no company ever interacts with only one counterpart.

While identifying interaction as a process developed over time (Håkansson and Waluszewski, 2002), the differences between individual interaction processes are immense (Håkansson et al., 2009). Individual processes evolve through more or less continuous episodes. These deal with particular issues and are identified through the notion of interaction and time, see Figure 2.8.

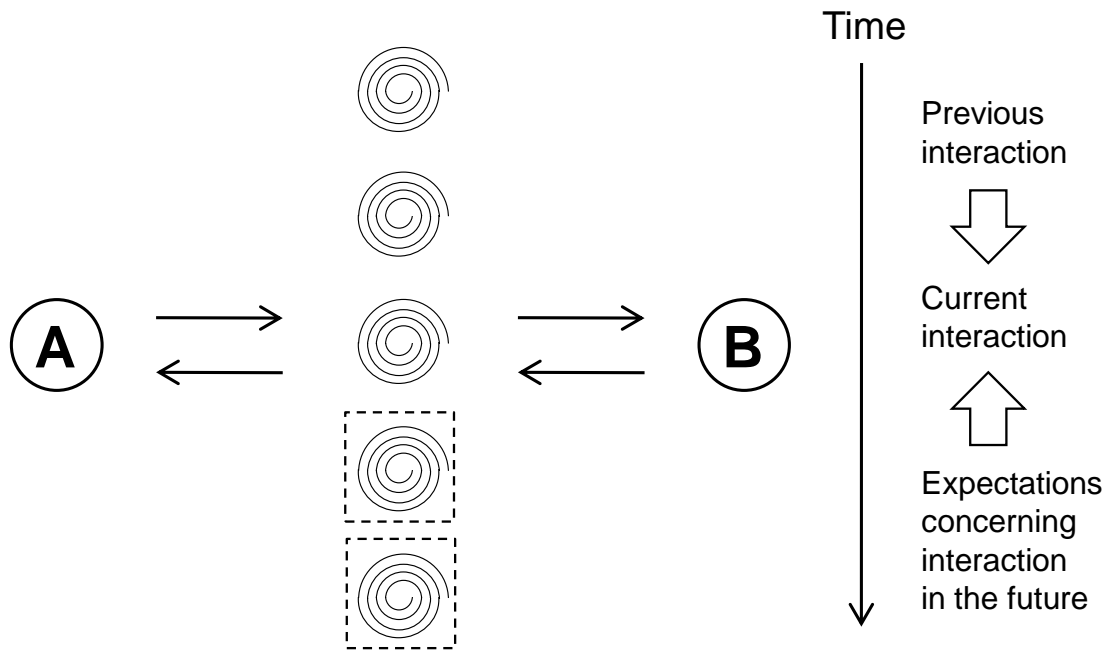


Figure 2.8 Interaction and time (Håkansson et al., 2009, p. 35).

In contrast, interaction in space concerns the fact that actors are continuously involved with multiple counterparts (ibid.), illustrated in Figure 2.9.

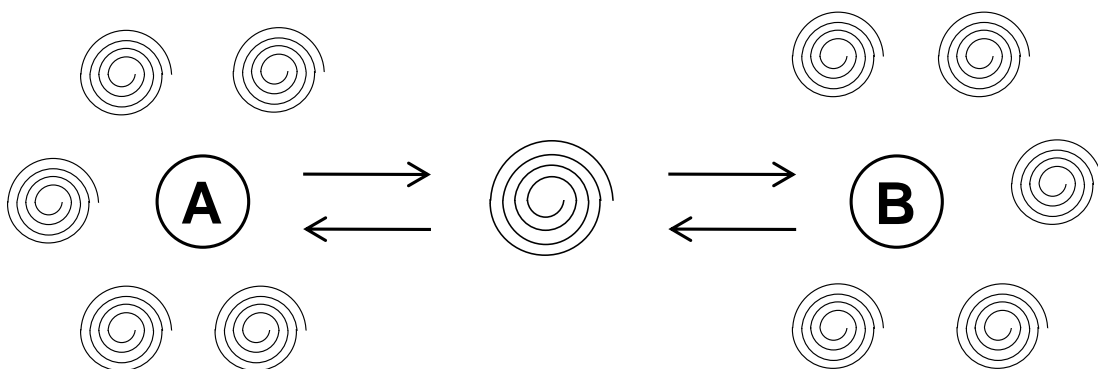


Figure 2.9 Interaction in space (Håkansson et al., 2009, p. 38).

This distinction between time and space is also highlighted by Jahre et al. (2006), who distinguish between interaction episodes in two specific contexts. The first concerns the current situation of a particular interaction episode, thus relating to interaction in space. The second concerns previous episodes and expectations about future interaction, thus relating to time.

Through these interactions, the benefits of resources and activities flow between actors and into the companies in the network (Ford et al., 2008). As it is only when resources and activities are related to other resources and activities that economic value is gained, that the interaction process is vital (Håkansson and Waluszewski, 2002). Interaction is thus identified as a means of utilizing the activity undertakings and resource activations of an actor's counterparts. As a result, the actor's internal activities and resources are developed through such interaction (Håkansson, 1994).

Interaction between two companies *“unfolds over time as the companies act, react and react to that reaction, all as part of the complex dealings within their relationship”* (Ford et al., 1998, p. 6). The outcome of an interaction process is thus affected by the acting and reacting of both parties (Håkansson et al., 2009). However, it is often difficult or even impossible for these parties to untangle the individual actions, re-actions, and re-reactions of each actor or to trace their causes, effects and outcomes (Ford et al., 2008). In other words, the embeddedness of networks means that it is difficult to separate the specific elements of one interaction from others (Medlin, 2002).

Interaction processes are not only associated with benefits. Besides revenues, they also involve significant investments and costs (Håkansson et al., 2009). Some of these are associated with *“interactive effects”* on an actor's goals and means (Håkansson and Waluszewski, 2002). These goals and means change as a result of the interaction, as does the relationship as such (ibid.). For example, the specific characteristics of an actor's resources confront the characteristics of other resources through interaction, and thus they develop as a result of it.

In addition, through interaction the individual actor makes adjustments. A typical development of an interaction process involves multiple adjustments (Håkansson et al., 2009), which usually take place within long-lasting exchange relationships (Håkansson and Waluszewski, 2002). The individual actor, and the actor's actions, are only one part of a relationship. The actor also has to react to the actions of its counterpart. Such reactions often involve adjustments, which are a crucial aspect of the characteristics of business relationships.

All actors undertake activities, some of which are linked to activities undertaken by other actors. The processes between actors condition the nature of such intra- and inter-organizational activity links, as well as their development. Therefore, interaction is crucial to the exploration of activity linking.

Interaction is specific in both time and space. At certain points in time, an actor interacts with several counterparts. From an activity perspective, interdependencies specify the nature of these activity links. In addition, with regard to each of these counterparts, current interactions relate to both previous interactions and expectations for the future. Activity adjustments capture how these interactive episodes develop over time.

Through interaction, the activities and resources of an actor are related to those of its counterparts. Interaction is therefore recognized as a vehicle for activity linking. As such, it requires further exploration, which is why it is presented in the fourth research question of this thesis.

2.8 Research questions

This frame of reference provides the upcoming analysis with conceptual building blocks to enable the further exploration of activity linking. The chapter therefore introduces and discusses several concepts related to the INA. This section summarises these concepts and relates them to individual research questions in light of the current understanding of activity linking. With these research questions in mind, the empirical inquiry is then presented and analysed in the later chapters of this thesis.

In the introductory chapter, activity linking was emphasized primarily from an inter-organizational perspective, targeting how the relatedness of the activities of different firms is both achieved and maintained. In this chapter, the understanding of activity linking has been further developed, supported by the revised definition of activity links presented above. Activity linking is identified as a phenomenon which concerns all activities, regardless of whether these activities link within or across firm boundaries. In addition, the phenomenon is positioned in relation to the scheme for the analysis of business relationships proposed by Håkansson and Snehota (1995). In relation to this scheme, activity linking is seen as a process element of the activity dimension of the ARA model. In light of

the functions presented in this scheme, the chapter also suggests alternative scopes for analysing activity linking. These scopes are drawn upon in the upcoming case analysis chapter.

The identification of space and time-related concepts enables the analysis of industrial networks. Whereas activity interdependencies represent structural characteristics, identifiable at a certain point in time, activity adjustments target process characteristics traced over periods of time. The first research question of this thesis aims to explore the interrelatedness between activity interdependencies and adjustments.

*How do activity interdependencies and adjustments interrelate
in the linking of activities?*

The industrial network analysis rests upon the three substance dimensions of the ARA model. For this reason, both resources and actors are discussed in relation to activities. Here, the concept of interaction speaks of the process that occurs between actors and which influences their respective activities and resources. As such, interaction is of particular relevance for the exploration of inter-organizational activity linking.

With regard to resources, the undertaking of an activity is related to two principal resource types; object and enabling resources (illustrated in Figure 2.7). Here, the object resource is further separated into inputs and outputs with regard to the individual activity. These resource types are part of both existing activity links and the adjustment of these links. The second research question of this thesis aims to explore the role of these resource types in relation to the linking of industrial activities.

What are the roles of enabling and object resources in the linking of activities?

Actors undertake and adjust activities. They also influence the activities of their counterparts. A distinction between action, reaction and interaction is suggested for the exploration of activity linking. The third research question thus aims to explore how this action, reaction and interaction can be related to the linking of activities.

What are the roles of action, reaction and interaction in the linking of activities?

The process of interaction involves the actions and reactions of the two actors that form a business relationship. It thus targets the existence and development of boundary-crossing activity links. As the INA emphasizes inter-organizational aspects of business life, the concept of interaction has received a great deal of attention in previous research. For the purpose of this thesis, interaction is seen as a vehicle for activity linking. With this in mind, the fourth and final research question aims to explore activity linking from the perspective of interaction.

How can interaction be used in the analysis of the interplay between the actions and reactions of individual actors?

3 Methodological Considerations

The structure of this thesis does not represent the process through which it was generated. Instead, the structure is a result of an ambition to present the outcomes of the study in a pedagogical way. The understanding of the reader is best facilitated by the description of a successive research process with distinct phases. In reality, however, the process looked somewhat different.

This chapter has two principal and related aims. First, it describes the research process not as mirrored in the structural outline of the thesis, but closer to reality. Second, it argues the scientific qualities associated with such a process, even if it appears at first sight to be less structured than the outline of the thesis might imply.

3.1 The research process

During the work with my master's thesis, I was introduced to the works of the Division of Industrial Marketing at Chalmers University of Technology. Prior to the actual start of my PhD work, I was therefore aware of, and interested in, the specific theoretical representation of industrial 'markets', identified as the Industrial Network Approach, which connects much of the research undertaken at the Division. At the same time, I was only partly aware of the substance underpinning this specific approach.

Starting out with a general interest in industrial purchasing, one of the empirical focus areas of the Division, I needed a specific empirical context in which to collect data. By focusing on the construction industry, several points were made. Often referred to as the second largest industrial sector in Sweden after health care services, construction has a major impact on the economic and social development of society. At the same time, the construction industry is frequently accused of poor performance, among other things owing to a conservative approach towards technological and organizational development and innovation. The construction industry has also not attracted much research attention, compared with, for example, the automotive industry, at least not with regard to industrial purchasing. There were thus distinct reasons for the direction of my initial empirical interest in the construction industry.

In addition, at the time of the initiation of the study, several industrial initiatives were being taken by some of the largest Swedish main contractors. These indicated an increased interest in and awareness of issues related to industrial purchasing. Such initiatives make sense considering the extensive use of subcontracting and large amounts of purchased materials in the industry.

Thus, with the INA and my overall interest in purchasing strategy, I commenced data collection in the construction industry. The first interview round, initiated in late 2005, consisted of 14 semi-structured and personal interviews with purchasing representatives at as many firms. The choice of firms was equally guided by convenience and the nature of the individual firms. Often argued as displaying a high level of fragmentation, the construction industry is still characterized by a few large main contractors. Therefore, I considered it important to include them in the first interview round. They have a major influence on developments in the industry, and many of the purchasing initiatives indicated above were associated with them. In addition to these national, some even international, firms, several regional main contractors also characterise the industry, and were therefore included in the interview round. By tradition, large parts of the work associated with a specific construction project are sub-contracted to specialised firms. Such sub-contractors are therefore crucial to the completion of a project, and so they were also important to interview.

In addition to the firms undertaking activities at the construction site, many other firms are also part of the industry in different ways. Material suppliers produce the materials to be installed at the construction site, and distributors are responsible for warehousing and transport activities, among others. In addition, a construction project is initiated by a client, associated with the use of the finished construction, whether it is a private property developer, a municipality, or a firm in need of additional office space. Thus, in the end, the first interview round consisted of four national and five regional main contractors, a national sub-contractor, a kitchen furnishings producer, two distributors, and a client.

The semi-structured interviews focused on change processes of the purchasing function in the construction industry. They aimed not only to cover issues related to the current structure and perceived importance of the purchasing function of each firm, but also to what changes had been made in recent times, as well as what changes were anticipated for the

future. For this reason, firms were approached that were thought to have some kind of strategic dimension to their purchasing work. This was primarily judged as an issue of size.

These interviews provided an overall notion of the current state of purchasing in the construction industry. I wrote a few conference papers in conjunction with this data collection, describing purchasing developments in the construction industry. The empirical information received in this initial interview round was not directly used in the empirical inquiry of this thesis; it did, however, have a profound impact on the overall development of the thesis, and so it is also part of this research process description.

In parallel with the initial interview round, theoretical developments were also made. The activity dimension of the ARA model, part of the INA, made it possible to target what these individual firms were doing and how they were doing it. My initial theoretical focus area was therefore to explore activities. Here I came across the works of Thompson, especially his well-known book from 1967, in which he describes the interdependencies, and subsequent coordinative requirements, of organizational parts. Despite Thompson's intra-organizational focus, I believed that many of his principle notions could also be of use for my somewhat vague inter-organizational interests. This belief was also supported by previous research in which concepts of Thompson (1967) were used to elaborate on inter-organizational issues.

After finalizing the initial interview round, a possibility for further empirical data collection revealed itself. I was offered to take part in a research project involving one of the larger Swedish regional main contractors. The project concerned IT implementation in the construction industry, and at first I considered this quite far from my specific research ambitions. However, because the aim of the project was to build up an Internet-based platform to facilitate project-related inter-organizational interaction, my research interest became a valuable complement. In connection with the development of such technical platforms it is crucial to also address the nature of and prerequisites for such interaction.

In an effort to target inter-organizational aspects of activity interdependencies, while at the same time adapting to the specific empirical context of interest, I decided to begin the second round of data collection by identifying a specific construction project since a great deal of the work in the construction industry is project-specific. Thus, to identify inter-

organizational activity interdependencies, it was considered suitable to use such a project as the point of departure.

Partly influenced by supply chain management, a field related to inter-organizational activity interdependencies, two complementary material deliveries were chosen for further inquiries. The first material, plasterboards, was characterized by a fairly high degree of standardisation. It is not a material of immediate concern for the end user, but one of the structural features of the finished building. In comparison, the second material, kitchen furnishings, was characterized by a high degree of customization. It is very visible to the end user, which implies certain challenges associated with end user preferences.

Taking the empirical point of departure in the delivery and installation of the two materials, production activities associated with each of these deliveries were traced backwards. This implied the identification of several firms involved in the production and transport of the two materials. This approach led to the description of two partial “supply chains”. The identification of “supply chains” was not a conceptual framing of the thesis in accordance with any SCM paradigm, but was only a methodological approach used to facilitate data collection. Thus I ended up with a number of firms connected through their individual contributions to the production and delivery of plasterboards and kitchen furnishings to the construction project in focus.

In total, this second round of interviews consisted of 12 semi-structured personal interviews with representatives of six firms. These interviews were initiated in late 2006. They concerned the activity undertakings in direct association with the focal material deliveries, as well as those related to other activity undertakings of the respective firms.

In line with these empirical inquiries, the theoretical scope was somewhat broadened, concerning not only inter-organizational activity interdependencies, but activity interdependencies as a whole. Acknowledging that the most intricate aspects of activity interdependencies reveal themselves among activities undertaken by different firms, it was important to approach the issue of activity interdependencies in a more principled way, allowing the individual activities centre stage. Somewhere at this point in the research process, the notion of activity coordination was also introduced. By the focus on

coordination, the need to actively relate individual activities to each other was highlighted. While activity interdependencies represented a way in which the relationship between two activities could be expressed, coordination targeted the efforts that underlie these activity interdependencies. However, how the concepts were to be suitably related was still somewhat unclear.

The empirical “supply chains”, initially conceptualized as end product related activity structures, and later referred to as activity configurations, were supplemented with two other theoretical concepts: activity structures and activity patterns. Activity structures were related to the internal activities of a firm, while activity patterns also included the activities of the firm’s counterparts.

The third interview round consisted of a number of follow-up interviews, conducted during late 2007. A total of five interviews were made, three of which were face to face and two conducted on the telephone. Having reviewed the empirical material provided by the second interview round, a number of clarifications and additions with regard to the activity undertakings of individual firms were needed. Moreover, two site visits were carried out to follow the actual delivery of kitchen furnishings to the construction site. These visits revealed extensive activity interdependencies present on the construction site, requiring continuous rescheduling and compromises.

In the theoretical developments, the activity interdependency concepts of Thompson (1967) were successively replaced by alternative conceptualizations, for example the classification of activity interdependencies by Richardson (1972), directly associated to the INA by Dubois (1994). Despite several attempts, it had proven very difficult to make fruitful use of Thompson’s (1967) concepts. Not least the increasing level of contingency associated with his suggested concepts made it difficult to distinguish between them in relation to my empirical inquiry.

Moreover, the notion of activity coordination needed further development. A review of literature related to the coordination concept was conducted to increase the knowledge of the ways in which the concept had been used in relation to previous research. This review revealed a concept which held differing and somewhat ambiguous meanings, a confusion

emphasized by the everyday usage of the word. Thus, instead of continuing the study of coordination, another related concept was used to target the efforts that underpin activity interdependencies. This concept, adjustments, was introduced and related specifically to the activity dimension of the ARA model by Håkansson et al. (2009). In addition, Håkansson et al. (2009) also specified a number of types of activity interdependence, influenced by the work of Thompson (1967) and Richardson (1972). I began to work with these suggested activity concepts (this was done prior to the formal publication of their book, as I received a working copy of it).

The Håkansson et al. (2009) reference also gave me something else. As I read, it soon became apparent that there had been certain developments of already established activity concepts. One such development helped me to specify the phenomenon in which I was actually interested: the connection of activities. I wanted to describe these connections as specific activity interdependencies, and I was also interested in understanding the connecting of these interdependencies. I had, however, not come across a concept suitable for targeting this connecting. By revising an established concept in the INA, the activity link, I found what I was looking for. When initially defined, the activity link represented one of three substance layers in a business relationship (Håkansson and Snehota, 1995). It was thus originally used to characterise individual business relationships and not activity connections per se. However, over time the use of the concept had been successively developed. This became clear to me when I read Håkansson et al. (2009), and it provided me with the activity concept I was looking for. Instead of associating activity links only to the business relationship, I began to see them as specifying the connection between two activities. Thus they no longer implied two activities undertaken by different actors. What might seem like an interpretive detail had a much larger meaning to me. Not only could I approach the notion of activity links without relating them specifically to the business relationship, I also became aware of the dynamic nature of existing concepts.

In line with these new insights, activity connections were designated activity links and the connecting of activities was interpreted as activity linking, identified as the establishment and development of activity links. Together, the exploration of activity links and activity linking facilitated not only a structural analysis, but also an analysis of structural change.

As a consequence of these insights, I undertook a fourth round of interviews. Given my previous decision to scope my activity analysis in accordance with activity configurations, structures and patterns, I focused on three of the firms I had previously interviewed. The individual activity undertakings related to the activity configurations were no longer identifiable, and so it was now considered of interest to further address the activity structures and patterns of each firm. In particular, it felt relevant to try to specify some of the structural changes associated with the activity undertakings of each firm. The previous empirical material had primarily concerned the respective firms' existing activity structures and patterns. This was seen as a result of a previously somewhat vague approach to the issue of activity linking, made apparent in connection with the specification of the concept.

The three firms chosen for further empirical data collection all represent distinct production processes. The fourth interview round contained a total of five semi-structured personal interviews. In addition to conducting interviews with the three firms of interest, I also made a follow-up interview with the main contractor responsible for the construction project of initial focal interest. From these interviews I was provided with information concerning a number of distinct change initiatives, which had changed the activity structures and patterns of the individual firms. With this additional information I was able to address not only the existence of activity links, but also aspects of activity linking. I concluded my data collection with this fourth round of interviews.

With the empirical information I received and with the previously identified theoretical activity concepts, a period of activity analysis followed. During this period, I made several attempts at analysis, finding it challenging to approach the phenomenon in a structured way. The eye-opener came as I started to include the resource dimension of the ARA model in the analysis more explicitly than in my previous attempts. Initially, I was working with the hypothesis that it should be possible to analyse the activity dimension without explicitly including the resources with which the activities are associated. I also found support in the activity interdependency concepts presented in Håkansson et al. (2009). However, when implicitly trying to avoid the resources with which specific activities were associated, I experienced difficulties in pinpointing the underlying content of the activity linking phenomenon in which I was interested. Not until I began to further investigate the specific

connections between activities, resources and actors more precisely with regard to activity linking was I able to specify this content. I was then able to assign specific meaning to my concepts of interest. From these insights, I also became more aware of the problems with my previous attempts at analysis. The use of concepts originally developed for other purposes had made it difficult for me to pinpoint my phenomenon of interest. At the same time, without the growing knowledge of what my phenomenon actually entailed, among other provided to me through these conceptual developments, I had never been able to subsequently specify activity linking in the way presented in this thesis.

The most critical empirical and theoretical developments of the research process are outlined in the timeline in Figure 3.1.

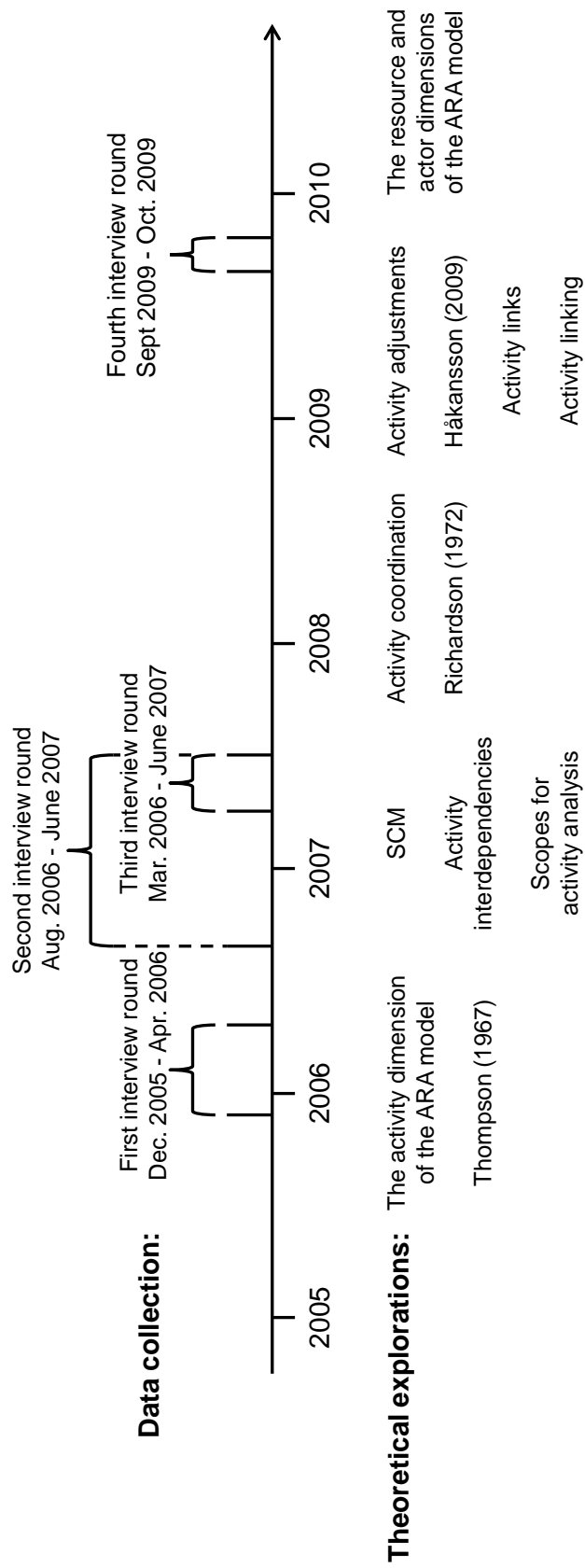


Figure 3.1 Outline of the research process.

3.2 The scientific nature of the research process

As revealed in the research process description above, there is little linearity to the way in which my research has been conducted. Such linearity is primarily associated with a deductive research design, which explains its absence here. Abductive research logic better describes the unfolding research process in this thesis. The rationalities associated with an abductive approach are therefore discussed in this section. As this research logic is related to the methodological approach of this thesis, the implications of conducting case study research are addressed prior to the discussion of abduction in general, and systematic combining in particular.

These discussions highlight the interconnectedness between theory, method and empirical phenomena, as illustrated in Figure 3.2. As stated by Dubois and Gadde (2002, p. 555); *“theory cannot be understood without empirical observation and vice versa”*. Furthermore, *“methodological choices cannot be divorced from theoretical positions nor can theories be regarded as method-neutral”* (Dubois and Araujo, 2007, p. 171). Acknowledging this connectedness is also in line with the main objective of any research, which, according to Dubois and Gadde (2002, p. 555), is *“to confront theory with the empirical world”*.

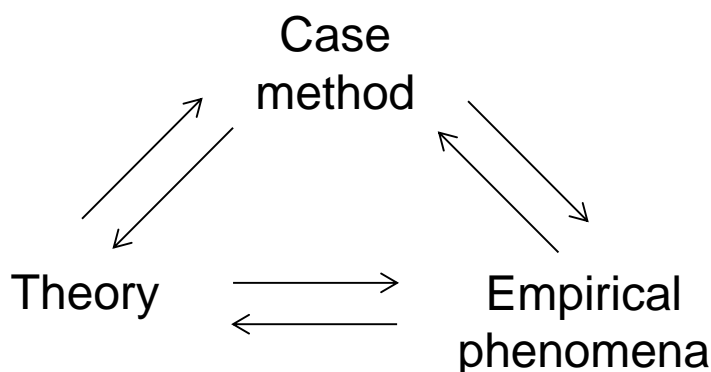


Figure 3.2 Three dimensions of research (Dubois and Gibbert, 2010, p. 129).

Starting at one end of Figure 3.2, it is clear that with this research comes an ambition to develop theory. As the decision of a specific research design rests on the intentions on which the research is based, this ambition addresses several of the methodological issues brought up in this chapter.

With regard to this thesis, the cornerstones of the INA have served as a reference point throughout the research process. At the same time, the ambition to contribute to development of the concepts in the INA means that this theoretical framework has been more than a mere tool to allow for a structured analysis of an empirical inquiry. It has also framed my explorative intentions by directing the analysis and providing a conceptual frame against which to reflect suggested research outcomes. The theoretical search and discovery process described in section 3.1, and highlighted in Figure 3.1, is the manifestation of this ambition.

3.2.1 Case study research

Case study research has long been a favoured methodology among researchers interested in the industrial network paradigm (Dubois and Araujo, 2004; Halinen and Törnroos, 2005), and it is probably the most popular research method among industrial marketing researchers (Easton, 2010). One of the reasons for this is that *“networks present researchers with a challenge since they do not constitute a closed bounded and clearly delineated system”* (Piekkari et al., 2010, p. 109). The specific nature of the phenomenon under study makes case research in this area different (ibid). In addition, *“although the links between theory, empirical phenomena and method are crucial in all methodological approaches, they seem to be of particular importance in case research owing to the variety of ways in which case research can be conducted”* (Dubois and Gibbert, 2010, p. 129). With regard to case research, these ‘links’ need careful scrutiny.

Case research enables the investigation of *“contemporary phenomena within their real-life context, especially when the boundaries between phenomena and context are not clearly evident”* (Yin, 2003, p. 13). Taking this understanding one step further, Dubois and Araujo (2004, p. 210) acknowledge that often *“neither the phenomenon nor its context are necessarily known prior to starting the research”*. Instead, empirical network studies often have fairly vague beginnings with loosely formulated concepts or ideas (ibid.). The research process description presented above exemplifies this. As a result, the identification of the phenomenon of interest is to some extent the outcome of the study, rather than being an initial decision taken prior to conducting the study (Dubois and Araujo, 2004). This is also represented in the research process described above. In essence, the identification,

delimitation, and conceptualization of activity linking is the primary contribution of this thesis.

Here, a case study research approach has enabled the contextualisation of activity linking, not only acknowledging the presence of a context, but also highlighting its active participation in the exploration of the phenomenon. In addition, the possibility of investigating contemporary phenomena in their real-life contexts is also stressed for purposes of theory development. As stated by Dubois and Gadde (2002, p. 555), case study research is considered an appropriate methodological approach when *“developing theory by utilizing in-depth insights of empirical phenomena and their contexts”*. In line with such theory-developing ambitions, Eisenhardt (1989) emphasizes the potential of case studies to capture the dynamics of the studied phenomena.

According to Yin (2003, p. 31), *“theory development does not only facilitate the data collection phase of the ensuing case study. The appropriately developed theory also is the level at which the generalization of the case study will occur”*. Here, Yin (2003) distinguishes between statistical and analytical generalizations. The former concerns generalizations made to populations or universes, which require the enumeration of frequencies. The latter concerns generalizations to theoretical propositions, which enables the expansion and generalizing of theories. Case study research is only considered suitable in relation to analytical generalizations, which is also the aim of this thesis.

Literature on case research usually differentiates between single and multiple case studies. Such distinctions relate to the notion of what a case actually is. According to Ragin (1992, p. 217), *“the biggest obstacle to clear thinking about ‘What is a case?’ is the simple fact that the term ‘case’ is used in so many different ways”*. How to approach the actual ‘case’ of this thesis thus seems partly a matter of interpretation. The successive and related development of the empirical inquiry of this thesis supports the identification of a single case study. However, the further focus on three selected firms, and the subsequent empirical development of their respective activity structures and patterns, also allows for the identification of three embedded cases. The successive identification and conceptualization of activity linking has not required any cross-case analysis with regard to these embedded

cases. Instead, they have been analytically separated in accordance with the analytical scopes: activity configurations, structures and patterns.

3.2.2 An abductive research approach

Case study research is seen as a specific research strategy which can involve both deductive and inductive elements (Yin, 2002).

Induction and deduction are often referred to as alternative, and to some extent opposing, research approaches. In essence, induction starts with reality and deduction starts with theory (Alvesson and Sköldbberg, 1994). An inductive research approach is thus more open-ended and exploratory than a deductive approach, which relies more heavily on existing theory. However, induction and deduction should not be understood as exclusively alternative research approaches. Instead, abduction enables the identification of a research approach which contains both inductive and deductive elements (ibid.). With regard to the research presented in this thesis, the inductive elements are more emphasized than the deductive ones. At the same time, theoretical prerequisites and existing concepts have influenced the process in a very specific way. Thus, an abductive approach which involves the successive development of both the empirical inquiry and the theoretical framework seems to best describe the research process of this thesis.

Systematic combining

With the ambition of targeting the abductive logic associated with case research, Dubois and Gadde (2002) coined the notion of systematic combining. This case study approach is considered suitable, for example, when conducting explorative research using the industrial network paradigm, with a special emphasis on theory development. It therefore falls close to the desired research process of this thesis.

Systematic combining is characterized by a continuous interplay between theory and empirical observations (ibid.). Through direction and redirection of both theoretical concepts and data collection, a final match between theory and reality is achieved, see Figure 3.3.

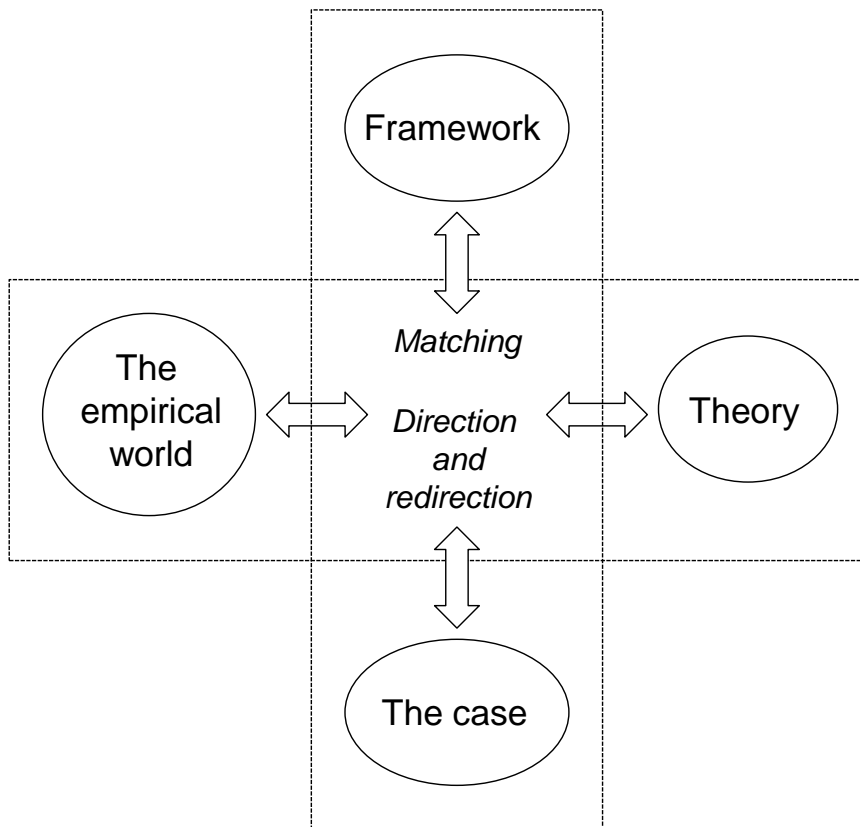


Figure 3.3 Systematic combining (Dubois and Gadde, 2002, p. 555).

In light of the research process description in section 3.1, continuous direction and redirection are identified. The theoretical concepts developed as a result of evolving theoretical knowledge and also in response to the information from the empirical data collection. This was highly affected by the identification of theoretical concepts in general and analytical attempts founded on these concepts in particular. Acknowledging the difficulty of distinguishing between individual redirections, the research process description enables the identification of a few such redirections, supported by an increased empirical focus, together with conceptual development. These redirections also assured a final match between theory and reality.

The first redirection followed initial theoretical investigations of the activity dimension of the ARA model and the information from the first interview round. This redirection was primarily identified as a focusing act which gave guidance to the research process. The empirical field for data collection was made specific through the identification of two selected material deliveries to a specific construction project. Theoretically, focus was placed primarily on inter-organizational activity interdependencies.

The second redirection followed the analysis of the second and third interview rounds. This redirection had primarily theoretical consequences, as it emphasized the context of the activity interdependencies which were of initial conceptual interest. The notion of activity coordination was used to target the need to actively relate individual activities to each other. The theoretical efforts which followed from this notion could be divided into several individual redirections, although this was not done in relation to this description. Instead, these theoretical developments are all seen as part of one connected and evolving process of conceptual search and discovery. This resulted in the identification of activity adjustments, as well as activity links and activity linking, supported by the concepts of Håkansson et al. (2009).

The fourth interview round resulted in the third fundamental redirection of this research process. This interview round was undertaken as the interest in adjustments and linking made it relevant to try to specify structural change associated with the activity undertakings of individual firms. Following this interview round there was a period of analysis. This resulted in the explicit introduction of the resource and actor dimensions of the ARA model in the analysis of activity linking. Through these redirections and the matching attempts they represent, I believe a final match between theory and reality has been achieved. The description also highlights the dual nature of the evolving case, which is, in accordance with the principles of systematic combining, both a “tool” and a “product” of the research process.

3.2.3 Data collection

Several sources of data are connected to case study research. Yin (2003) mentions for example documentation, archival records, interviews, direct observations, participant observations and physical artefacts. Usually a case study method combines several of these sources (Eisenhardt, 1989), as they are seen as highly complementary. The opportunity to use different sources of evidence is considered a major strength of case study data collection (Yin, 2003). At the same time, single sources of evidence can be and have been the sole basis for entire studies (ibid.). It is thus not necessarily a matter of combining as many sources of data as possible in a single study, but of acknowledging the potential benefits of multiple sources of evidence.

The process of data collection was described in section 3.1. Here I present some of the underlying notions which influenced and guided the data collection process. For the purpose of this study, interviews were the single most important data collection method. Interviews are widely regarded as one of the most important sources of case study information (ibid.). In this thesis, the interviews were of an open-ended nature, although they became successively more focused in line with an increased research focus. Following a logic suggested by Rubin and Rubin (1995), the interviews had a consistent line of inquiry, while the actual stream of questions was fluid rather than rigid. As a result, the interviews appeared to be guided conversations rather than structured queries (following the arguments of Yin, 2003). Not only did this approach allow me to cover contexts of events, it also opened up for a snowball effect with regard to the future direction of the data collection.

During the actual interviews, notes were taken. These were then transcribed as soon as possible following the finalizing of the specific interview. The transcripts were then sent to the interviewees for approval. Usually, such approval was obtained without any further clarifications or discussions of the interview topics, although there were exceptions. When in doubt, I therefore went back to the interviewees for clarification. This was also one of the main reasons why I conducted the third round of interviews.

At the start of each interview I was careful to introduce myself and explain my overriding purpose with the interview. I also made it clear that no information would be used without the interviewee's consent and that he or she would be given the possibility to read and comment on a transcript of the interview.

Kvale (1997) discusses quality criteria as well as qualifications of an interviewer. The criteria he uses to assess the quality of an interview are the extent of spontaneous, specific, and relevant answers from the interviewee, the length of questions in relation to answers, the extent to which the interviewer pursues and clarifies relevant aspects of the received answers, the extent to which the interview is interpreted by the interviewer during the course of the interview, the verification of interpretations of answers during the course of the interview, as well as the "self-communicative" qualities of the interview.

With regard to these quality criteria, the unfolding of the individual interviews in this thesis was highly dependent on the answers of the interviewees. Therefore, preparations were made to be able to adjust the interview to the preferences of the interviewees, for example, with less articulate interviewees, more follow-up questions were prepared. The nature of the interviews also made them more like structured discussions than distinct sessions of questions and answers. This is well in line with the criteria proposed by Kvale (1997), emphasising the importance of making concurrent interpretations while interviewing.

Kvale (1997) also speaks of certain criteria related to the qualifications of an interviewer. He stresses the importance of knowledge of the topic, the adoption of a structured approach, clarity of individual questions, a friendly approach towards the interviewee, active listening, receptivity to aspects of the interview of specific importance to the interviewee, guiding the interview in an appropriate way, a critical attitude to the responses given, an interpretative approach, and a well developed memory.

Kvale (1997) argues the benefits of practical experience for becoming a good interviewer, i.e. it is only through interviewing that you learn how to make good interviews. Here, the separate interview rounds of this thesis successively sharpened my ability as an interviewer. The results of the first interview round are not used in the empirical inquiry. In addition to enabling subsequent empirical focus, it thus also served as a trial run, both to get acquainted with the empirical area and the interview situation. As such, it strengthened many of the qualifications mentioned above.

The interviews conducted for this research are divided into orientation and project-specific interviews. The orientation interviews were conducted between 2005 and 2006 and involved a total of 14 personal interviews. These are presented in table 3.1. With regard to the interview rounds referred to in the previous discussion, these orientation interviews constituted the first interview round. They were conducted over a time period of four months and ranged between one to three and a half hours. The individual interviews are presented in accordance with the time at which they were conducted.

Firm:	Type of firm	Position(s) of interview object(s)
Granova	Regional main contractor	Purchasing manager
NCC	National main contractor	Manager
SBS Entreprenad	Regional main contractor	Purchasing manager
Tuve Bygg	Regional main contractor	Project manager
Fristad Bygg	Regional main contractor	CEO, Project manager, Purchasing manager
Wäst-Bygg	Regional main contractor	Project manager
Sjögrens	Distributor	CEO, Business area manager industry, Business area manager construction
Ahlsell	Distributor	Director of purchasing
Skanska	National main contractor	Director of purchasing
Peab	National main contractor	Director of purchasing
Egnahemsbolaget	Client	CEO
Bravida	National sub-contractor	Purchasing manager, purchasing coordinator
JM	National main contractor	Director of purchasing
Ballingslöv	Kitchen furnishings producer	Sales manager, Seller

Table 3.1 Orientation interviews; purchasing developments within the construction industry.

The project-specific interviews were conducted between 2006 and 2009 and involved a total of 22 interviews, of which 20 were personal and two by telephone (the latter were follow-up interviews). They ranged between one and two hours and were held during several interview rounds, as described in section 3.1. These interviews are presented in table 3.2, discussed in section 3.1, and addressed further in the upcoming case analysis chapter. The project-specific interviews began with the identification of a construction project in Ytterby, near Gothenburg. Wäst-Bygg were the main contractor and Mjölby were the client. To describe the delivery of plasterboards, both a plasterboard producer, called Knauf Danogips, and a distributor, Norrby, were interviewed. In contrast, the description of the kitchen furnishings delivery relied on interviews made with a kitchen furnishings producer, Vedum,

and a kitchen cupboard producer, Formidabel. In table 3.2, the individual interviews are presented in accordance with the time at which they were conducted.

Firm:	Type of firm	Position(s) of interview object(s)
Wäst-Bygg	Regional main contractor	Purchasing manager, Consultant
Wäst-Bygg	Regional main contractor	Purchasing manager
Norrby	Distributor	Financial manager
Wäst-Bygg	Regional main contractor	Kitchen responsible
Mjöbäck	Client	Project manager
Knauf Danogips	Plasterboard producer	Regional seller
Vedum	Kitchen furnishings producer	Sales manager
Wäst-Bygg	Regional main contractor	Cost estimator
Knauf Danogips	Plasterboard producer	Sales manager
Knauf Danogips	Plasterboard producer	Logistics manager
Wäst-Bygg	Regional main contractor	Site manager
Formidabel	Kitchen cupboard producer	CEO, Production manager
Knauf Danogips	Plasterboard producer	Sales manager
Norrby Trä	Distributor	Financial manager
Knauf Danogips	Plasterboard producer	Logistics manager
Vedum	Kitchen furnishings producer	Sales manager
Vedum	Kitchen furnishings producer	Purchasing manager
Knauf Danogips	Plasterboard producer	Sales manager
Vedum	Kitchen furnishings producer	Purchasing manager
Formidabel	Kitchen cupboard producer	CEO, Production manager
Wäst-Bygg	Regional main contractor	Business developer
Vedum	Kitchen furnishings producer	Sales manager

Table 3.2 Project-specific interviews (the highlighted lines separate the interview rounds).

In addition to conducting interviews, the data collection also involved making two direct observations (during early June 2007) of the delivery of kitchen furnishings to the construction project site in question. According to Yin (2003), direct observations cover events in real time as well as contexts of events. These two site specific observations facilitated an increased understanding of the intricate activity interdependencies at the construction site.

Moreover, a variety of documentary information was collected in connection with the Ytterby project, for example project and material specifications, as well as e-mail communications. Documents concerning the operations of the individual firms were also studied including, for example, marketing materials and annual reports. This material was primarily used to prepare interviews and validate the specific outcomes of them.

In the fourth chapter, the empirical inquiry, the firms in table 3.2 are presented by their official names to enliven the empirical description and connect it with the data collection process described in this section. In the subsequent chapters, however, the firms are identified by their respective functions with regard to the Ytterby project in order to permit conceptual focus and take a distance from the specific empirical context. In chapter five and onwards, Mjöbäck are thus referred to as the client, Wäst-Bygg as the main contractor, Knauf Danogips as the plasterboard producer (PBP), Norrby as the distributor, Vedum as the kitchen furnishings producer (KFP), and Formidabel as the kitchen cupboard producer (KCP).

3.2.4 Research rigor

This section uses the notion of trustworthiness, as defined by Lincoln and Guba (1985), to discuss the rigor of the research. They posit that the trustworthiness of a research study is a way of evaluating its worth (ibid.). Or, as they ask: *“how can an inquirer persuade his or her audience that the findings of an inquiry are worth paying attention to, worth taking account of?”* (ibid., p. 290). To establish trustworthiness, four criteria are suggested: credibility, transferability, dependability and confirmability (ibid.). They also describe a number of techniques that can be used to conduct qualitative research in accordance with these criteria. As will become apparent below, not all the techniques of each criterion were used with regard to this thesis. However, I believe that the overall trustworthiness of the research is established.

Credibility

With regard to credibility, Lincoln and Guba (1985, p. 301) suggest a variety of techniques to *“make it more likely that credible findings and interpretations will be produced”*. These are prolonged engagement, persistent observation, triangulation, peer debriefing, negative case analysis, referential adequacy and member checks. As this thesis did not use negative case analysis as a method for assuring credibility, this method is not discussed below.

Prolonged engagement concerns the investment of sufficient time in the empirical world to assure a thorough appreciation and understanding of the context in question (ibid.). As suggested by Lincoln and Guba (1985, p. 302): *“it is not possible to understand any phenomenon without reference to the context in which it is embedded”*. My understanding of this context grew over a period of several years. The initial interviews were made in late 2005, while the fourth and final interview round was held in late 2009. In addition to the actual interviews, some time was spent with the focal actors. Thus there was a prolonged, if not intensive, engagement in the context. The lack of empirical intensity was compensated for by continuously taking part in construction-related discussions, both with academic scholars and practitioners. I therefore feel well acquainted with the specific context of activity linking. One of the benefits associated with prolonged engagement is also the opportunity to build trust. Trust is defined by Lincoln and Guba (1985, p. 303) as: *“a developmental process to be engaged in daily: to demonstrate to the respondents that their confidences will not be used against them”*. As I made several interviews with the same interviewees, always stating my intentions and providing them with transcripts, I believe that a sufficient level of trust was built over time.

According to Lincoln and Guba (1985, p. 304): *“if prolonged engagement provides scope, persistent observation provides depth”*. Depth thus targets the identification of the characteristics and elements in the situation that are most relevant to the problem or issue in focus (ibid.). The description of the research process in section 3.1 speaks of the matching between data collection and theoretical development. As such, it indicates persistent observation with regard to the subsequent identification of the phenomenon of interest. Thus, the ‘depth’ should be assessed in relation to the discovery and subsequent

specification of this phenomenon. Through this process, the essentials of the empirical world were extracted with regard to the specific interests of the researcher, assuring a final match.

Triangulation usually refers to the use of multiple sources of data to be able to cross-check information and receive coherent accounts of the phenomenon of interest. With regard to this research, however, the use of multiple sources was primarily a matter of revealing a variety of aspects concerning the same principal phenomenon. This ambition agrees with the argument of Dubois and Gadde (2002), who deem the identification of new aspects previously unknown to the researcher as the most important aspect of triangulation. Nevertheless, sometimes multiple sources of data were also used to shed light on a specific topic, thus allowing the researcher to question potentially divergent accounts of the same situation. Few such inconsistencies were identified, however, which argues in favour of the credibility of the research.

Peer debriefing is *“a process of exposing oneself to a disinterested peer in a manner paralleling an analytical session and for the purpose of exploring aspects of the inquiry that might otherwise remain only implicit within the inquirer’s mind”* (ibid., p. 308). While several disinterested peers have been identified throughout the research process, no structured peer debriefing process was ever initiated. However, the continuous exposure of semi-finished ideas and conceptual developments at internal and external seminars, workshops and conferences helped advance the research. Not only did it provide useful comments and valuable suggestions, it also forced the researcher to reflect on the current state of the research in a variety of different ways.

To be able to test the adequacy of the research, Lincoln and Guba (1985) propose the concept of referential adequacy. This involves the keeping of referential material which can be used by potential sceptics to *“satisfy themselves that the findings and interpretations are meaningful by testing them directly and personally against the archived and still “raw” data”* (ibid., p. 313). This research cannot claim to facilitate such referential adequacy. However, the specific interpretations of the empirical material are presented to the reader through the descriptions in the empirical inquiry and the subsequent focus of the case analysis chapter. The inclusion of data in the empirical inquiry which is not explicitly used for analysis is not seen as a desire to enable referential adequacy, but to provide context for the focal

phenomenon. Still, this 'rawness' of the empirical inquiry opens it up to alternative interpretations.

According to Lincoln and Guba (1985, p. 314): *"the member check, whereby data, analytic categories, interpretations, and conclusions are tested with members of those stakeholding groups from whom the data were originally collected, is the most crucial technique for establishing credibility"*. Here, the sharing of transcripts with the interviewees, and clarifying follow-up interviews assured the credibility of the information received with regard to individual interviews. The more analytical ambitions of the thesis were, however, not exposed to any of the interviewees. Instead, the 'members' who have checked the analytical interpretations were my supervisor and academic colleagues who, in turn, are identified as the 'stakeholding group' of this aspect of the thesis.

Transferability

As argued by Lincoln and Guba (1985, p. 316): *"whether descriptions hold in some or other context, or even in the same context at some other time, is an empirical issue, the resolution of which depends upon the degree of similarity between sending and receiving (or earlier and later) contexts"*. To facilitate transferability, a qualitative case researcher therefore relies on *"the thick description necessary to enable someone interested in making a transfer to reach a conclusion about whether transfer can be contemplated as a possibility"* (ibid., p. 316).

Does this research provide such a thick description? My descriptive intentions aside, this will by definition be assessed by the reader. I believe that the empirical inquiry provides the reader with a fair account of the specific context in question, and so facilitates such potential assessment. The issue of transferability should also be regarded in light of the theoretical development of the thesis. This relates to what Yin (2003) denotes as analytical generalization. The theory developing ambitions of the thesis are not constrained to the construction industry, as the case is only an example used to illustrate and explore activity linking. The fundamental understanding of activity linking is thus argued also to be relevant in other empirical contexts, especially those characterised by the production and exchange of physical products. The validity of these claims, however, can only be assessed in light of future research initiatives.

Dependability

Dependability is established by determining whether the research process was applicable to the research undertaken and whether it was applied consistently (ibid.). The concept is thus related to the description of the research process in section 3.1. In that section, several methodological challenges are described, as are the ways in which these were faced. Through this description, the reader is able to follow the empirical and theoretical twists and turns the research process has taken. Arguments for each methodological choice were also provided to indicate the researcher's considerations throughout the research process. In relation to dependability, Lincoln and Guba (1985) speak of the role of an auditor, which is to examine both the process of the inquiry and the final product. With regard to the examination of the dependability of this thesis, the reader plays this role of auditor.

Confirmability

The final trustworthiness criteria proposed by Lincoln and Guba (1985), confirmability, results from assessments of the consistency of the different part of the thesis. This concept is closely related to dependability, but focuses specifically on the coherence of the data, findings, interpretations and recommendations (ibid.). The abductive process of systematic combining can, from this perspective, be understood as an elaborate exercise in achieving this confirmability. The continuous direction and redirection of data collection and theoretical developments enabled the final match between the framework and the case. As a result, focus was attained both with regard to the empirical inquiry, the proposed concepts of the analysis and the concluding discussion. As such, a balance between research depth and width was also achieved.

In conclusion, this chapter argues the trustworthiness of the research process and the findings of this thesis. It is, however, acknowledged that the judge of research rigor is always the reader. I therefore hope that this methodological description has provided all readers with a fair and coherent account of the research.

4 Empirical Inquiry

The information in this empirical inquiry facilitates the further exploration of activity linking. Acknowledging that there are multiple alternatives for how to structure an empirical investigation, one such alternative is presented and argued for here.

The frame of reference presented different analytical scopes for activity analysis. Activity configurations, structures, and patterns are recognized as alternative ways to delimit the exploration of activity linking. By representing these alternative analytical scopes in the empirical data collection, the phenomenon is approached from different angles. These complementary approaches are, for the purpose of this empirical description, identified as different descriptive layers.

To begin the collection of data with the identification of a specific construction project allows for the identification of empirical “supply chains” (conceptually associated with the notion of activity configurations). These “supply chains” involve the activities undertaken by several firms involved in the production and delivery of selected material types. In this empirical inquiry, two material types were chosen for further exploration: plasterboards and kitchen furnishings. The first descriptive layer thus involves the exploration of activities undertaken for the production and delivery of plasterboards and kitchen furnishings. Not all activities associated with these two material types are described, nor is such completeness in the data collection pursued. This layer, however, allows for connecting the activities of different firms to a specific construction project-related material delivery.

The second descriptive layer targets the internal activities of three firms involved in the undertaking of activities included in these empirical “supply chains”. By exploration of internal activities (conceptually recognized as activity structures), the specific project delivery is put in context. It is recognized that only some of the internal activities of a firm are undertaken in relation to a specific project delivery. Each firm is thus involved in several activity configurations, both concurrently and over time.

The third descriptive layer concerns the suppliers and customers of these three firms (indicating activity patterns). A firm undertakes its activities in relation to these

counterparts, which is why it is considered relevant to place the internal activities of a firm in such an activity context.

Empirical information concerning these three layers is collected during the same interview rounds as described above (in the methodology chapter identified as the second and third interview rounds). Thus, the different perspectives of the three descriptive layers are comparable in that they offer complementary views to concurrent activity undertakings. These three layers approach the phenomenon from a primarily structural perspective, more focused on existing activity connections than on how they were established and developed.

To complement these structural representations, a process perspective on activity linking is specifically targeted in the developments of each firm. Here, an additional interview round allows for changes to the structures and patterns described above. The nature of the previously identified “supply chains” does not allow for recognition of developments associated with them, as they only concern individual activity undertakings related to the production and delivery of specific end products. These changes thus target the internal activities of each firm, as well as the activity undertakings of selected suppliers and customers.

Figure 4.1 illustrates the three descriptive layers and the developments identified in the final interview round.

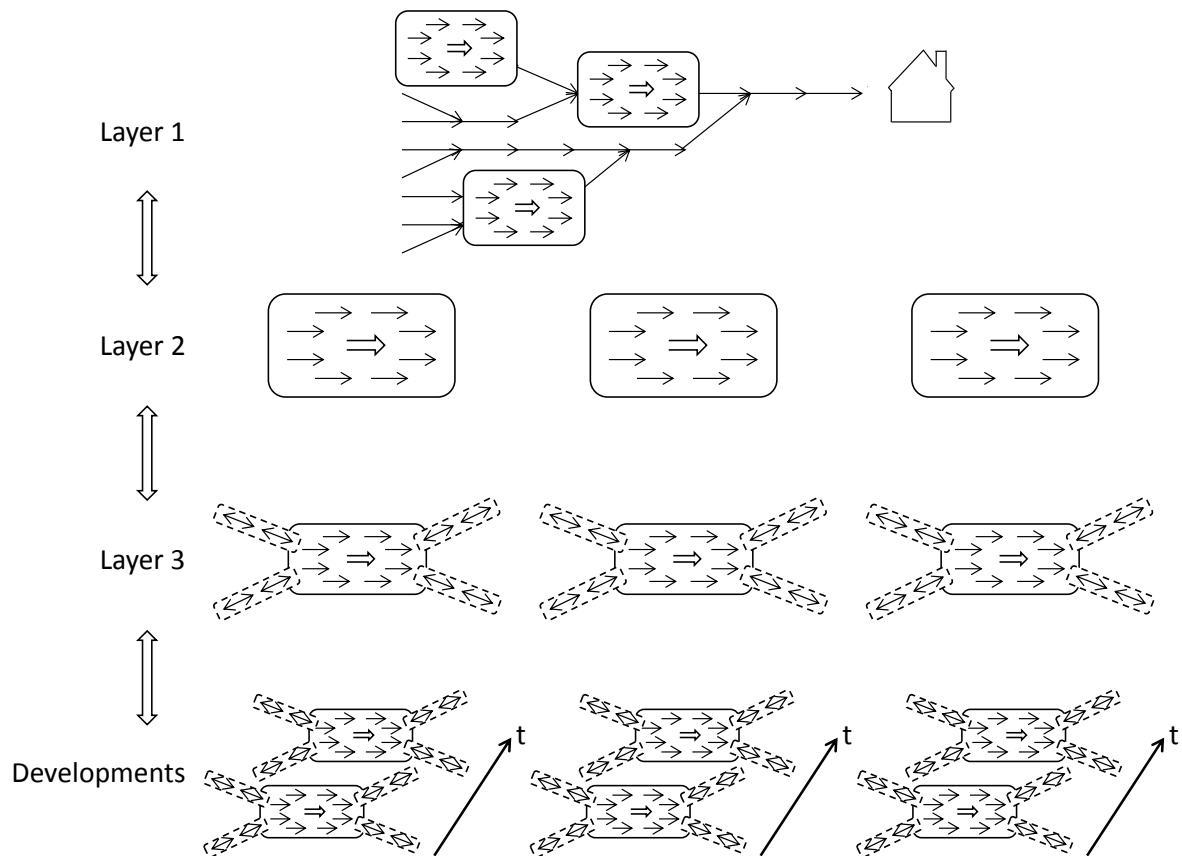


Figure 4.1 The three descriptive layers of the empirical inquiry. The development of the activities of each firm is related to layers 2 and 3.

4.1 The Ytterby project

The Ytterby project involved the construction of two multi-family houses outside Kungälv, near the city of Gothenburg, Sweden. Construction began in May 2006, and the initial move-in date was set for July the next year. After several delays, the final move-in date was specified as September 1, 2007.

The project was initiated by a regional builder of single-family houses called Mjöbäck, in cooperation with the municipality of Kungälv. The client hired a main contractor called Wäst-Bygg, made responsible for all construction-related activities of the project. This included the involvement of sub-contractors, ordering materials, and construction work on site.

Of the materials required for the construction, two types were chosen for further examination, plasterboards and kitchen furnishings. They display differences in principle, among others with regard to the needs for standardization and customization; hence they were considered suitable for further analysis. They were also recognized as two material

types of importance to the project. Plasterboard ordering is traditionally associated with extensive negotiations regarding prices and delivery terms while kitchen furnishings are important owing to their relatively high prices and visibility to the end users.

An initial aim of targeting the supply of the respective material types resulted in the identification and exploration of the activities of the suppliers of each of these types, in addition to those of an associated distributor and one supplier’s supplier. Figure 4.2 shows these involved firms and how they connected through information and material flows with regard to the Ytterby project.

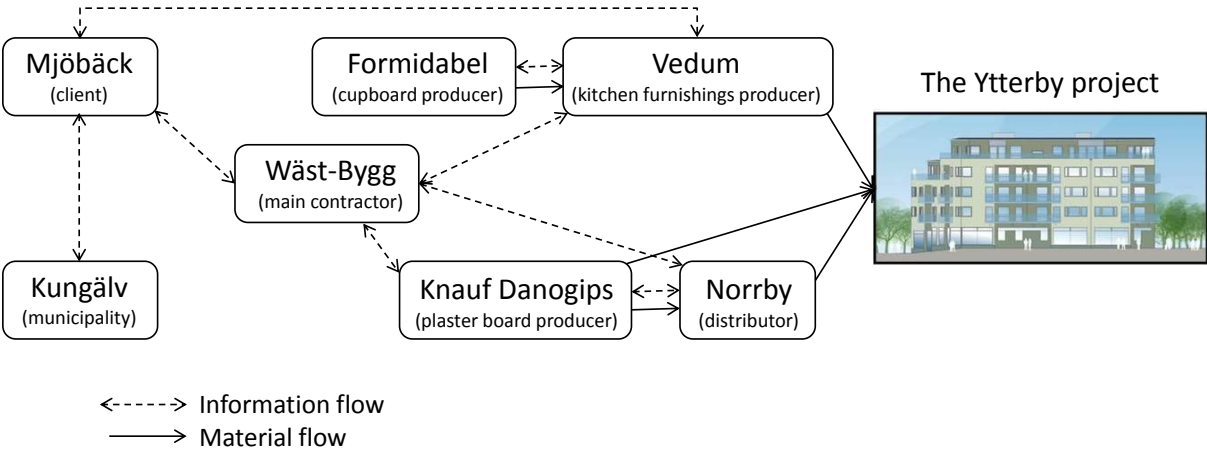


Figure 4.2 The material and information flow of the focal firms in the Ytterby project.

4.1.1 Initiation of the project

A previous relationship between Mjögäck and the newly appointed head of the built environment in the municipality of Kungälv led to discussions of upcoming construction initiatives in the municipality. As a result, Mjögäck were offered the opportunity to build two multi-family houses in Ytterby, outside Kungälv. This offer was qualified, however, resulting in the creation of a “three-dimensional property formation”⁸ which allows for the establishment of tenant ownership in combination with traditional rental flats. All in all, 26 tenant owner flats and 18 rental flats were planned for, in two separate buildings. Figure 4.3 illustrates the business relationship between Mjögäck and the municipality of Kungälv.

⁸ This enables the separation of properties in height and depth, allowing for floors and installations in the same property to have different owners.

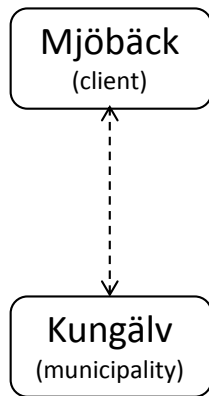


Figure 4.3 Mjöbäck and municipality of Kungälv, initial partners in the discussions regarding Ytterby.

Mjöbäck are part of a larger family-owned business group with a number of production units and associated brand names that build single-family houses in a factory-like environment. Although synchronization between production units is limited, the existence of the group allows individual production units to offer customers products originally contracted by other units. For example, if a customer is interested in a kitchen brand not contracted by the production unit building their specific house it is possible to exchange, as long as the other brand is under contract with another production unit. The box below provides some general information about Mjöbäck. This type of firm description is used throughout the chapter.

Mjöbäck are a family-owned group founded in 1970. With a turnover in excess of 500 million SEK and several subsidiaries it is one of the largest construction firms in Sweden. Under the brand name of Mjöbäck's Villan, the firm produces and sells single-family houses. In addition, under the brand name of Mjöbäck's Entreprenad AB, the firm acts as a client in the production of multi-family houses. The group is also associated with such brand names as Väst kustStugan and Borohus, all known for their individual styles of single-family houses. The group also has a real estate firm called Solidhus. The subsidiaries are operated more or less independently, with no coordinated purchasing, production or sales activities. This is attributable, for example, to the division of ownership within the group, where one of the two brothers in the family is always in charge of each individual subsidiary.

Before Mjöbäck (which in this empirical description actually refers to Mjöbäck's Entreprenad AB) began contracting Wäst-Bygg as the main contractor for its multi-family housing developments, the firm worked primarily with NCC and Midroc.

Initially, Mjöbäck were unsure about the financial potential of this project proposal, primarily because of the location of the building next to the Ytterby railway station. One primary problem with the proximity to the railway was the noise levels and the need to make sure that they did not exceed specified legal limits. In addition, the high ground water levels of the area meant that the projected basement needed water-proofing, another expensive and technically challenging procedure. The requirement of building rental flats caused them to hesitate, as they are generally less profitable than tenant ownerships. These doubts were lessened when Mjöbäck noted that the neighbouring plot was being projected by a competing construction firm, HSB. Mjöbäck therefore felt confident enough to initiate the project. After the start, the doubts raised above, in addition to a number of new ones, led to many delays.

Despite their extensive experience of building single-family houses, the construction of buildings higher than two stories was beyond the competence of Mjöbäck. Buildings more than two stories high require, among other things, a lift. Therefore, once Mjöbäck had decided to accept the offer to build the two multi-family houses in Ytterby they approached the main contractor Wäst-Bygg. Rather than being responsible for the actual construction activities, Mjöbäck were instead in charge of contacts with architects, municipalities, banks and realtors, the latter, in turn, being responsible for marketing the project to potential end users. To move the project forward, Mjöbäck were dependent on positive responses from all of these actors; not least the bank, which provided the project with needed loans. Responses from prospective end users were also collected through various promotional campaigns. In Figure 4.4, the different actors involved in the early phases of the project are presented.

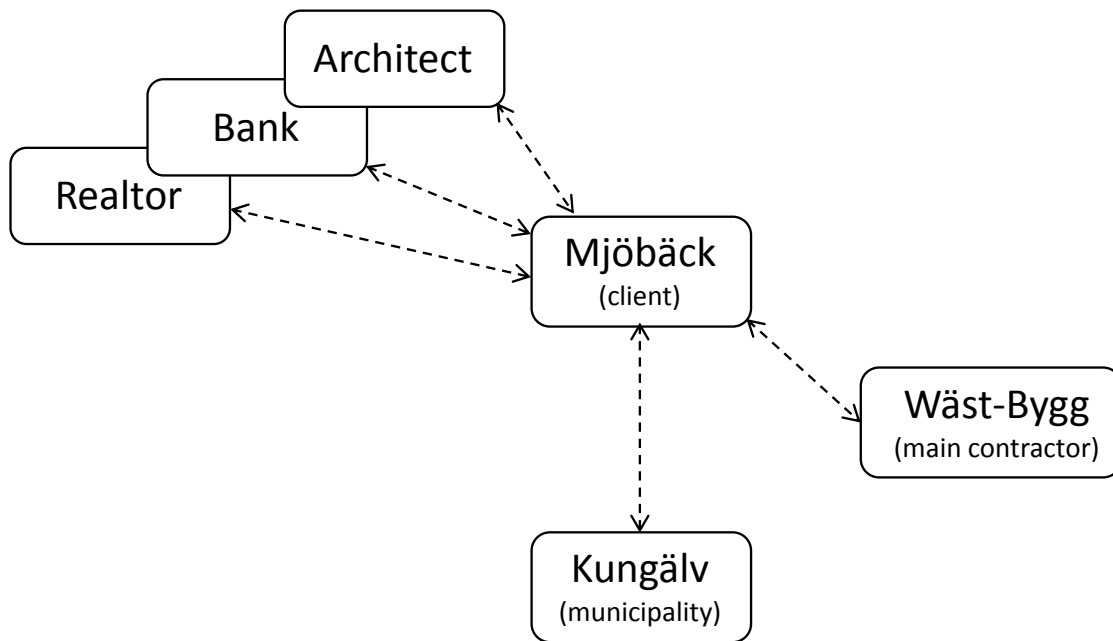


Figure 4.4 Mjöbäck contracted Wäst-Bygg, following discussions with architects, banks and realtors.

Once Mjöbäck felt secure about the responses from all the parties involved, much of the remaining responsibility for the project was transferred to Wäst-Bygg. Mjöbäck did not influence the actual construction process; although a move-in date was specified, for which Wäst-Bygg were held accountable. Project delays were not considered serious as long as the final deadline could still be met. This final deadline, the move-in date for the end users, needed to be guaranteed at the latest three months before move-in. In the end, the delays beyond this date resulted in various costs for Wäst-Bygg. To some extent these costs were negotiated among the parties depending on the cause of the delays.

As indicated above, the cooperation between Mjöbäck and Wäst-Bygg had begun a few projects prior to the Ytterby project. At that time, the two firms had never before worked together, although they had met on several occasions to discuss the possibility of future joint projects. It finally happened in a project on which several potential main contractors had been invited to bid. After assessments, Wäst-Bygg, who are smaller than their main competition, were considered the most competitive alternative. In addition to having the best price, Mjöbäck were also interested in working with a firm of equivalent size. Many of the other potential main contractors had stronger national, or even international, profiles.

This first project was considered a success, not only concerning the cooperation with Wäst-Bygg, but also with regard to the demand for the flats they were building. As a result, the two firms continued working together. Their next project came as a direct result of the first one. In the marketing efforts for the first project they had come to the conclusion that demand was higher than expected, but also that many of the prospective customers were looking for flats somewhat outside the city centre of Borås (where the first project was located). Following this realization, a new project was initiated, located at some distance from the city centre.

All in all, the two firms jointly initiated a handful of construction projects before the start of the Ytterby project. At the time of the Ytterby project, they were also planning for several upcoming projects, supported by a strong general economic upswing. The tradition of the industry, however, led Mjögäck to continuously challenge the bids from Wäst-Bygg, and to ask for reference prices with other potential main contractors. Completed, ongoing and future construction projects in collaboration between Mjögäck and Wäst-Bygg are illustrated in Figure 4.5.

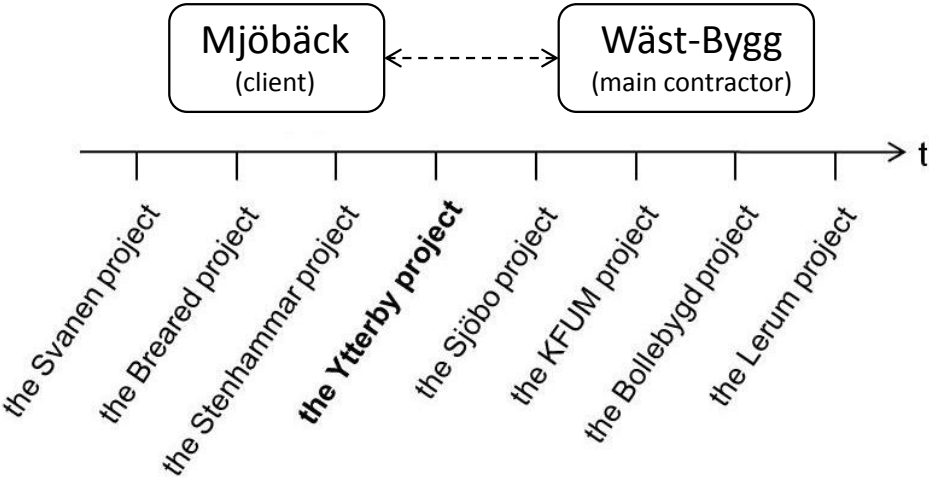


Figure 4.5 Completed, ongoing and future projects of Mjögäck and Wäst-Bygg (with their unofficial project names).

Wäst-Bygg are one of the larger family-owned construction firms in Sweden. The firm was founded in 1981 and has a turnover in the region of 1 billion SEK. The firm has a strong regional presence, although its projects are carried out all over the country. Certain standardized structures, such as warehouses and retail stores, are aimed at the national market. The construction of multi-family houses is a quite new business area for Wäst-Bygg, who were previously more focused on commercial construction projects. In addition, Wäst-Bygg have ownership interests in real estate firms, a car dealership, a mail-order firm, and a firm providing financial services. Thus, Wäst-Bygg are a highly diversified group.

The group has a fairly limited organization in relation to its turnover, resulting from extensive sub-contracting in individual projects, which was also the case in the Ytterby project. For example, most of the concrete work was done by sub-contractors, as were installations such as electricity and ventilation.

With regard to the Ytterby project, Wäst-Bygg took contracting responsibility for everything from initial calculations to final installations. These responsibilities involved, among other things, finding a plasterboard and a kitchen furnishings supplier. Plasterboards were bought from a firm called Knauf Danogips and were sourced through a regional distributor, called Norrby, with which Wäst-Bygg had a long history of collaboration. In previous projects, a large number of products were sourced through them. The box below provides some general information of Norrby, while Knauf Danogips and the kitchen furnishings producer Vedum are presented in subsequent firm-specific sections.

Norrby are a regional distributor that stores, refines and supplies a wide range of construction related materials. The firm approaches both end users and professional customers, such as for example Wäst-Bygg. Previously unassociated, it is now part of a chain of approximately 100 independent distributors called XL-Bygg. Norrby have had a longstanding relationship with Wäst-Bygg as they supply their regional construction projects with several materials. The firm is also closely related to specific suppliers of construction materials. For example, plasterboards are exclusively sourced from Knauf Danogips.

Compared with plasterboards, kitchen furnishings are a more complex product to source. In their first project with Mjörbäck, Wäst-Bygg turned to a kitchen furnishings producer with which Norrby had prior contact. However, as it turned out, another kitchen furnishings producer, Vedum, was more or less pre-determined by Mjörbäck, and so that firm was chosen instead. Mjörbäck used Vedum for their other operations, building single-family houses, and thereby thought it would be sensible to use them also for these multi-family housing projects. Using Vedum was also considered valuable in the organization of the “list of extras”. This list specified the different materials available to the end users, allowing them a certain freedom of choice in customizing their individual kitchens.

In general, Mjörbäck tried not to be too prescriptive about specific materials and suppliers, not wanting to restrain competition in the contracting work of Wäst-Bygg. As Wäst-Bygg were given the actual construction responsibility, it was also considered unsuitable for Mjörbäck to interfere too much with material and supplier choices. The decision to use Vedum was an exception motivated by the importance attached to the choice of kitchens for attracting and acquiring end users. Mjörbäck also pre-determined which kitchen appliances were to be used.

As indicated above, the choice of kitchens can make or break the success of a specific housing construction project. Therefore, some level of customization must be allowed, enabling individual end users to put their personal touch on the kitchen of the flat they are about to buy. This is made possible through the list of extras. The work associated with specifying this list, presenting it to potential end users, and organizing the resulting choices (and second thoughts and special requests) was taken care of by Wäst-Bygg in cooperation with Vedum. The majority of all the work that went into the kitchen ordering had to do with this list of extras, containing options of wood, countertops, cupboard designs and handles. Each end user requesting a solution not included in this list represented a cost, and so it was very important to specify the list in accordance with the needs and demands of the end users buying the flats. Sketching potential kitchen layouts was the responsibility of Vedum, taking the views and opinions of Wäst-Bygg into account.

The project-specific relationships of the Ytterby project are illustrated in Figure 4.6.

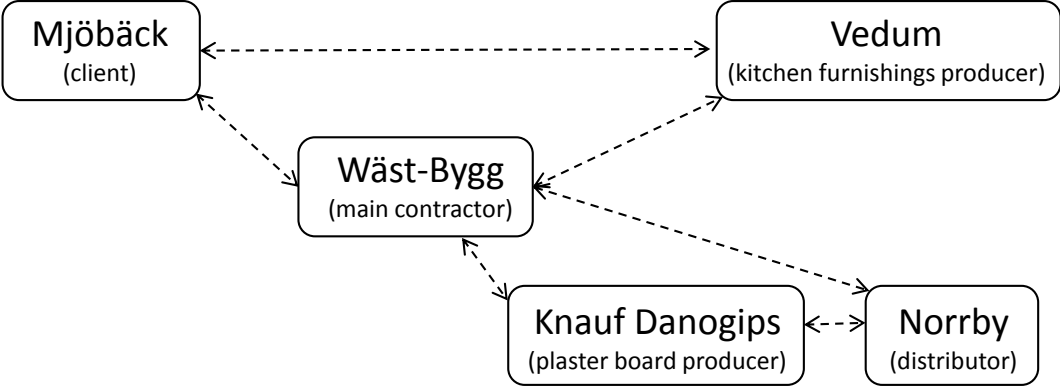


Figure 4.6 The relationships between the focal firms with regard to the Ytterby project.

4.1.2 The plasterboard order

The plasterboard order for the Ytterby project was initiated when the site manager of Wäst-Bygg started a tendering round involving three different possible suppliers. Focus was on the lowest price per square metre, which has become the norm for distinguishing between plasterboard suppliers. Wäst-Bygg already have a tradition of sourcing their plasterboard needs through Norrby, who used Knauf Danogips. This was also the firm that was contracted for the Ytterby project in the end.

Norrby received the initial plasterboard call for tenders from Wäst-Bygg on September 6, 2006. In it, approximate volumes were specified, as were the lengths and widths of the individual boards. The majority of deliveries to the Ytterby project were customized in this way, resulting in a minimum of returns to the production facility of Knauf Danogips. Upon receiving the order, Norrby made contact with the regional sales office of Knauf Danogips and the two firms together submitted a tender on September 14. After this date, neither Norrby nor Knauf Danogips heard from Wäst-Bygg for a few months. At that point in time, it was still unsure whether the delivery responsibility for the Ytterby project would fall on them or one of their competitors. Usually, the regional sales office of Knauf Danogips receives information from the site manager regarding the overall time plan of the project. They are then allowed to plan their possible plasterboard production so that they can be ready for delivery. This was not the case in the Ytterby project, however, largely due to the working procedures of the site manager in charge. In the middle of November, Wäst-Bygg

finally got back to the two firms with a subsequent order of approximately 6000-7000 square meters of plasterboards, equivalent to 60-70 tons. Not until this time was the delivery responsibility of the plasterboards formally decided - opening up for further discussion.

All three firms, Wäst-Bygg, Norrby, and Knauf Danogips were involved in the specification of the content of the actual order. In these discussions, Knauf Danogips were interested in showing alternative products and installation solutions. Their impression was, however, that Wäst-Bygg were primarily interested in the price. In the Ytterby project, price negotiations were the responsibility of Norrby, acting as an agent for Wäst-Bygg. After price levels and volumes had been negotiated, logistic solutions and delivery terms followed. In these discussions, Norrby only received late and unsatisfactory information from Wäst-Bygg. Having little insight into the overall project plan, it was difficult for Norrby to act proactively, for example with regard to coordination of their other deliveries to the project site. Norrby were responsible for the delivery of numerous products to the Ytterby project beside plasterboards, for example, doors, windows and insulation.

The actual call (for the plasterboards) came from the construction site on January 8, 2007. Norrby then, on January 11, sent this call to Knauf Danogips, as the majority of the boards were to be delivered directly from their production facility in southern Sweden. Norrby immediately received an order confirmation from Knauf Danogips, who had divided the order into seven separate deliveries in accordance with previous discussions with Wäst-Bygg. Each delivery contained customized plasterboards. In addition, the deliveries were specified as to what flat the plasterboards were to be installed in. The individual deliveries showed the different flats in separate rows, specifying the plasterboard dimensions in respective columns. Together with the plasterboards, the necessary steel profiles were also delivered, as is customary.

Initially, the individual deliveries of plasterboards and adjacent steel profiles were planned for in weeks four and five of 2007. Half of the total plasterboards were to arrive at the end of each of these two weeks. Accordingly, two trucks arrived from Knauf Danogips at the end of week four. As it turned out, the construction site had difficulties in absorbing the amounts delivered, as it could not handle or install the boards at the pace originally scheduled. The reason for this was simply an overly ambitious project plan. As a result, two thirds of the

remaining deliveries had to be postponed. These plasterboards were instead delivered in week eight, three weeks later than originally planned. The undelivered boards had to be kept in the storage area of Knauf Danogips. This additional storage came at no extra cost to Wäst-Bygg, although it did cause some difficulties for Knauf Danogips. Not only did the latter have a limited storage area for finished products at its production facility; it is also desirable to handle plasterboards as few times as possible, given their fragile nature. As the deliveries for week five had already been contracted, Wäst-Bygg had to pay an additional delivery fee to the logistics provider.

All deliveries arrived at the construction site in the afternoon. This involved a small additional fee, but was considered to be outweighed by the convenience of having deliveries made after the installation work of the day had been finished. The firm contracted to carry the plasterboards into specific flats was then able to do this work without interrupting other ongoing work. In addition to the deliveries arriving directly from the production facility of Knauf Danogips, supplementary deliveries were made from Norrby's storage area. In the case of Ytterby, these supplementary deliveries were fairly few, as a result both of the entire order being customized, and the fact that the Ytterby project was located almost next to a competing distributor, from whom last-minute material needs were primarily sourced. The critical deadlines for the plasterboard order are illustrated in Figure 4.7.

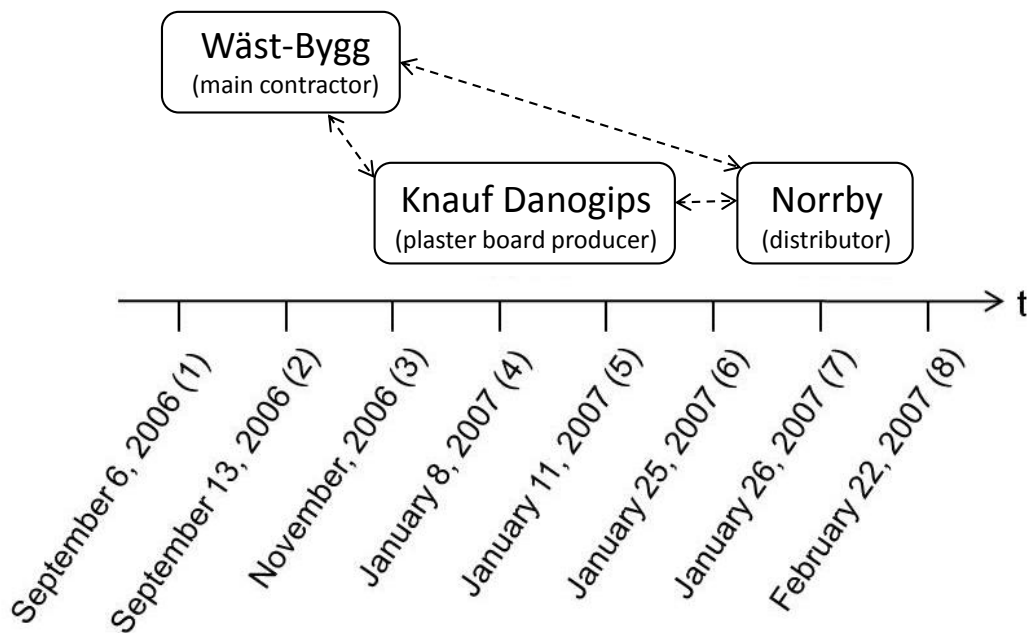


Figure 4.7 The critical deadlines for the plasterboard order.

The critical deadlines for the plasterboard order were as follows; (1) Initiation of tendering round with specification of plasterboard request, sent from Wäst-Bygg. (2) Response to request, made by Norrby and Knauf Danogips. (3) Subsequent order from Wäst-Bygg. (4) Delivery call from the construction site to Norrby. (5) Call transferred from Norrby to Knauf Danogips. (6) Initial deliveries of plasterboards to the construction site. (7) Postponement of upcoming deliveries by Wäst-Bygg. (8) Execution of postponed deliveries after storage at Knauf Danogips.

4.1.3 The kitchen furnishings order

Wäst-Bygg, Mjöbäck, and Vedum were all involved in the kitchen furnishings order. Mjöbäck were, as mentioned above, responsible for prescribing the use of the specific kitchen furnishings producer, in addition to the decision to use a certain manufacturer of white goods. For this reason, Wäst-Bygg only invited tenders from Vedum, neglecting to undertake any real price comparisons during the tendering period. This was not a traditional tender, which aims to distinguish and decide among potential suppliers. It was instead directed towards facilitating the upcoming list of extras.

The tender was sent in autumn 2005. The site manager of Wäst-Bygg was responsible for sending it to Vedum. The sales representative of Vedum submitted a quotation within two

hours and it to the site manager. No real price negotiations followed, resulting in the price of the initial tender also coming very close to the final purchasing price of the kitchens, approximately 1.7 million SEK.

Once Wäst-Bygg and Vedum had reached a price agreement, representatives of the two firms sat down to discuss the specific order content for each flat during the summer of 2006. Existing plans are quite commonly revised in a construction project, but it is considered crucial to be able to settle certain aspects of the construction, even with regard to the kitchen furnishings. This was one of the main reasons for discussing each flat in detail during the summer. After this meeting, the sales representative of Vedum reserved production capacity in their production process. This was initially planned for April 2007, allowing certain flexibility until the end of 2006.

The tender entailed 14 different kitchen views. This is considered a fairly large number for a project of this size, a result partly of the combination of rental flats and tenant ownerships. The standard of the rental flats was somewhat lower than the tenant ownerships, the former being equipped with white-painted cupboards, whereas the latter were equipped with more expensive veneered cupboards. The tender involved the same type of cupboards used in a previous construction project, cupboards produced by a kitchen cupboard producer called Formidabel (this firm is described in section 4.4). Formidabel also delivered a number of other products besides the veneered cupboards focused on in this description.

Much of the work associated with the kitchen furnishings order revolved around the list of extras. Each end user, who had purchased one of the flats under construction, had to make certain choices with regard to his or her specific kitchen such as alternative materials and designs of countertops, cupboards, and handles. To facilitate such choices, a list of extras is constructed. In the Ytterby project, this list of extras was finalized in November 2006, just before the initiation of the actual sale of the flats. The list was used not only by the realtor when selling the flats, but also by the kitchen administrator of Wäst-Bygg, whose task it was to meet with all end users to specify their respective kitchen choices. All these meetings were held at the construction site in Ytterby during early 2007.

It is considered important to clearly specify the options extending beyond this list of extras. This involves choices that can be made regardless of the list, and at what cost these choices come. There will always be end users interested in special solutions not on the list; for example, some end users might want to have cabinets along the floor, instead of ordinary skirting-boards. The list of extras used for the Ytterby project mainly captured the requirements of the end users, and only approximately ten percent of the end users had requests that extended beyond it, compared with the usual 20 percent. Once the list of extras for each flat was completed, the final order confirmation was sent from Wäst-Bygg to Vedum. This confirmation had to be submitted at least eight to ten weeks before the planned initial delivery, which was accomplished.

It was the responsibility of the site manager to plan the actual deliveries to the construction site with regard to batch sizes and delivery times. There was no standard for the size of individual batches; instead this depended entirely upon the preferences of the site manager. He was also responsible for making sure that each delivered batch was complete, even if this was in practice done by a foreman. With regard to the Ytterby project, no returns were recognized. Otherwise, potential returns are assessed individually to establish the problem and assign subsequent responsibility.

Once delivered, the kitchens were installed by Wäst-Bygg's own personnel, using a blueprint that arrived with each kitchen unit. After installation, all kitchens were inspected to make sure that each individual kitchen was in line with the agreed specifications. Once the kitchen furnishings were put in place, some additional installations were needed before the kitchen could be considered finished - among other things, plumbing, installation of white goods and tiling. To minimize wear, the kitchens were installed from the top down, starting with the upper floors.

The Ytterby project involved numerous delays, some affecting the kitchen furnishings order. Fifteen weeks before the first planned delivery, the sales representative at Vedum contacted the site manager to agree upon the specifics related to the initial delivery. He was then informed of delays at the project site, necessitating the postponement of the kitchen deliveries. These deliveries were subsequently postponed several times, ultimately resulting

in a two-month total postponement of the entire kitchen order. The first kitchen deliveries arrived at the project site in week 20 of 2007.

These delays resulted in a need to store the finished kitchen furnishings before sending them to the project site. Given the limited storage area of Vedum, the kitchens were stored in a storage area of the logistics provider, contracted for transportation of the kitchens from the production facility to the construction site. The cost associated with this additional storage was covered by Wäst-Bygg. The critical deadlines for the kitchen furnishings order are illustrated in Figure 4.8.

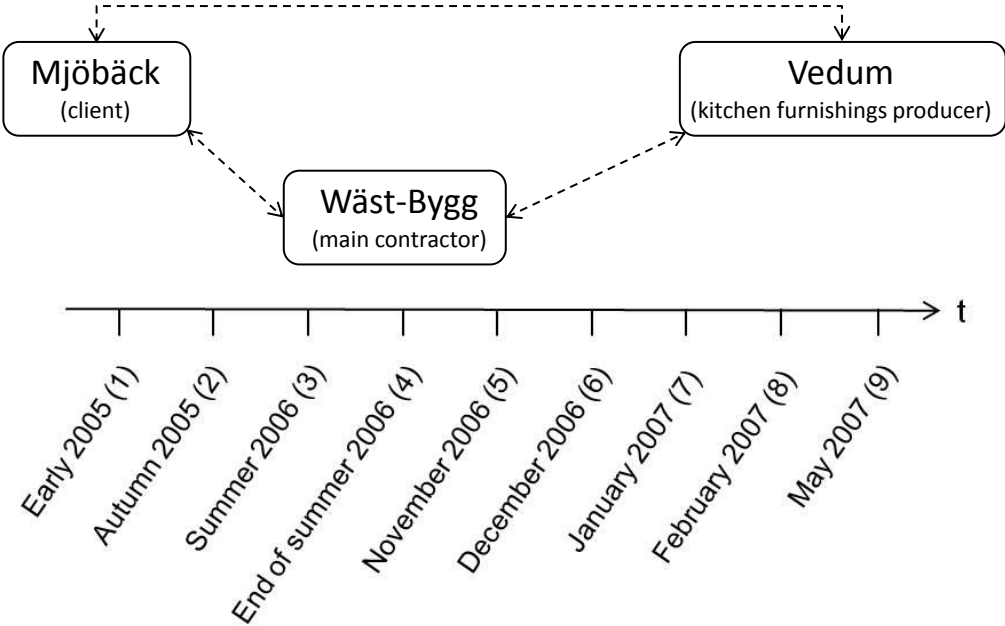


Figure 4.8 Critical deadlines for the kitchen furnishings order.

The critical deadlines for the kitchen furnishings order are as follows; (1) Decision to use Vedum, made by Mjöbäck. (2) Request for a quotation sent from Wäst-Bygg to Vedum, with an immediate response. (3) Discussions of the specific order content for each flat. (4) Reservation of production capacity in the production process at Vedum; initially made for April 2007. (5) List of extras finalized. (6) The sales representative of Vedum was informed of delays at the construction site, requiring the postponement of planned deliveries. This was the first of several subsequent postponements. (7) Kitchen administrator met end users. (8) Delivery confirmation from Wäst-Bygg to Vedum. (9) Initial deliveries of kitchen furnishings to the construction site.

4.2 The plasterboard producer

This section describes the activities of the plasterboard producer, Knauf Danogips, with a brief background to the firm, description of its products and production process, as well as a discussion with regards to its suppliers and customers. Some developments of Knauf Danogips are also highlighted, captured in interviews that took place approximately two years after the initial interview round.

4.2.1 Firm background

Knauf Danogips are a medium-sized firm that produces primarily plasterboards, as well as a wide range of other plaster-based products. The firm has one production facility in southern Sweden, built in 1978. It also has a total of five regional sales offices covering the different geographical areas of the country.

Knauf Danogips have, since 1992, been a wholly owned subsidiary of an international, privately owned conglomerate, called Knauf. In total, Knauf have over 100 production facilities all over the world, including at least one in each Nordic country. In addition, Knauf own approximately 60 plaster stone mines, which supply these production facilities with raw materials.

In 2005, in connection with Knauf buying another plasterboard producer active on the Swedish market, Norgips, a change process was initiated at Knauf Danogips. It was decided centrally that the two firms needed to approach different ends of the market. Knauf Danogips were to develop and offer customized systems rather than standardized volumes. This change resulted in the firm also prioritizing differently among its current customers, with more focus on individual construction projects and main contractors, instead of wholesalers and retailers. These were to be approached by Norgips, with more standardized products. The position of Knauf Danogips in relation to Knauf, Norgips and the identified customer groups is illustrated in Figure 4.9.

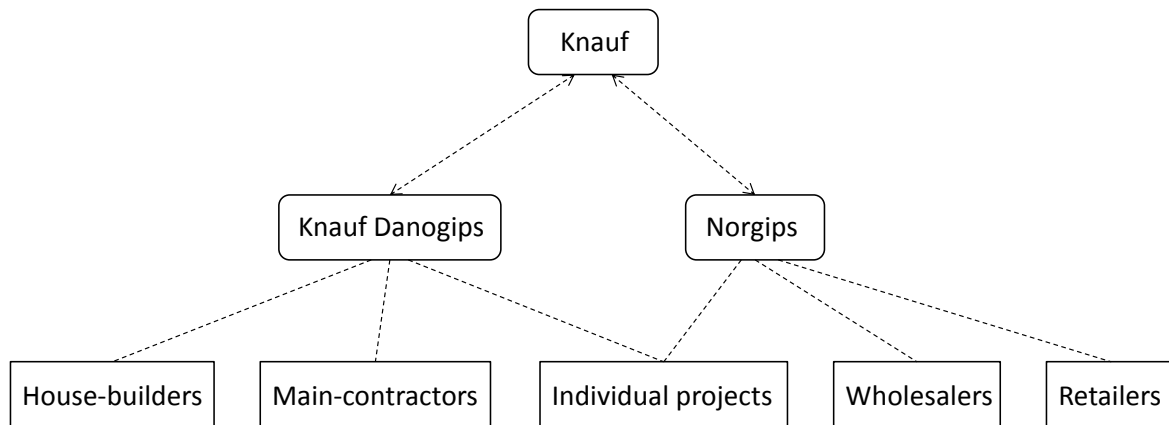


Figure 4.9 Knauf Danogips, part of Knauf, with focus on specific customer groups.

The positioning of Knauf Danogips along these lines was recognized as a long-term process involving major changes, not just internally, but also in relation to customers and suppliers. The storage of finished products and the changeover times of the production process represent only two of several areas that would be affected by this change in strategy. To become a systems supplier also involved working with individual customers in a new way.

The main product of Knauf Danogips is plasterboards, produced in a number of standardized dimensions. This standardization relates primarily to the lengths of the boards, which are cut in intervals of ten centimetres. The widths also vary, although not to the same extent, owing to the specific widths of the rolls on which the cardboard is delivered. In addition, the firm produces plaster pulp of different qualities, resulting in plasterboards with different properties. For example, if fibreglass is added to the plaster pulp the strength of the board increases.

Some specific plasterboards, for example fireboard, are not produced by the firm; but by other subsidiaries of Knauf, and subsequently delivered to the production facility of Knauf Danogips. In the same vein, some products produced by Knauf Danogips are exported to subsidiaries in other countries. The costs associated with transporting plasterboards are quite high, so efforts are made to produce specific boards domestically as soon as the regional demand is high enough.

In the development of new products, the firm often collaborates with selected customers. One such example is the development of a new system for gluing instead of nailing the boards in place. Another example is the development of a cement-based solution for use in

wet areas, known as “Aquapanel”. In accordance with its ambitions of becoming a system supplier, Knauf Danogips are also increasingly customizing plasterboards, with regard to lengths and widths, in close cooperation with relevant customers.

The main ingredient in the production of plasterboards is plaster stone. This stone arrives from the suppliers with a diameter of two to three millimetres. It is then stored in the raw material storage area. From there, it goes through a number of integrated processes. First, the plaster stone is pulverized in a number of mills. After this, it is calcinated to remove all the water. The resulting dry powder is then combined with water, allowing for the control of just how much water is added. The high water content of finished plasterboards makes them suitable from a fire safety point of view. When adding water, other additives can also be added, depending on the desired properties of the finished boards. Adding additives, for example fibreglass or retardant, has to be done cautiously. Too much retardant can, for example, result in adhesion problems when the plaster pulp is attached to the cardboard.

The resulting plaster pulp is then sandwiched between two sheets of cardboard and transported on a 250 meter long conveyor belt, before it has dried enough to be able to be cut. After this, the boards go through a large drying chamber. Heating up the drying chamber represents the largest single expense in the production process. Upon leaving the chamber, the boards are cut again, this time more exactly, before being stored in the storage area as finished products. If the customers need the widths of their boards adjusted, this is done with a cutting machine located at the end of the production line. The boards can also be bundled in plastic to allow customers to distinguish batches going to different houses or flats. The production process is outlined in Figure 4.10.

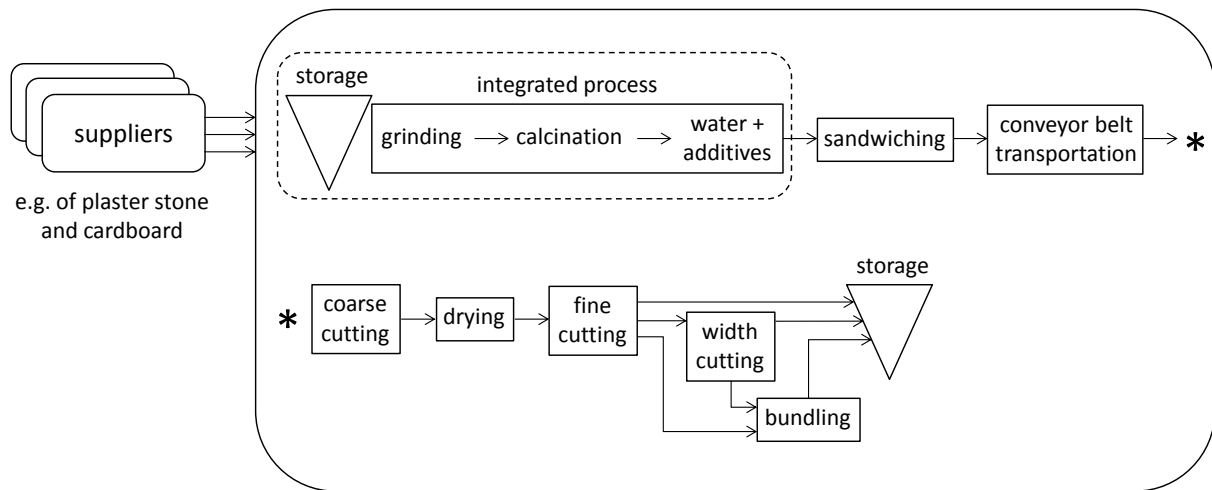


Figure 4.10 Outline of the production process of Knauf Danogips.

This production process normally runs in three shifts, although a maximum of five shifts can be planned if demand is high. Standardized and customized boards are produced on different days of the week. Customized boards demand more frequent changeovers and adjustments during the production process. The standardized boards are produced to be stored in the storage area, while the customized boards are always produced on demand from specific customers. As a result, the turnover in the storage area is approximately 25 turns per year, while the most frequently sold standardized plasterboards are turned over more than twice as fast.

Coordination of the production process is the responsibility of an assigned production planner. Changeover times and production volumes are decided based on demand and current storage area levels. To validate these decisions, the production planner makes use of an IT system that specifies all levels, as well as support systems that are activated at certain critical production and ordering points. With increasing customization, larger numbers of changeovers are called for, resulting in greater complexity associated with the coordination of the production process. The changeover times for different types of standardized plasterboards are usually approximately 30 to 45 minutes, whereas changeovers for production of customized board can take up to 1.5 hours.

4.2.2 Suppliers

The majority of the plaster stone needed to produce the boards comes from an open-cast mine in Spain owned by Knauf. It arrives by boat several times a week, which explains the

strategic position of the production facility of Knauf Danogips, located by a harbour in southern Sweden. All the plaster stone that arrives from this open-cast mine is natural plaster, and accounts for approximately 90 percent of the firm's total need for plaster stone. The additional ten percent is industrial plaster, supplied by a nearby power plant. Industrial plaster is a by-product in the purification of flue gases and is of no real use to the power plant, so it is sold to Knauf Danogips and delivered by truck. This is the main reason why many European producers of plasterboard are located close to power plants. Handling costs for industrial plaster are somewhat higher than for natural plaster, and these costs are offset by a lower direct purchasing price. The quality of the two plaster types is very similar. In addition to natural and industrial plaster, some unpolluted returns are also reused by re-introducing them into the production process.

To produce the plasterboards, cardboard is also required. As the cardboard represents the actual strength of the board, the quality is central to the properties of the finished plasterboard. Cardboard is primarily produced on rolls at Knauf's Swedish cardboard production facility. A number of standardized sizes are delivered by truck to the production facility of Knauf Danogips. Some cardboard is also purchased from a German producer, and it is of a somewhat different quality than the Swedish equivalent. These German deliveries are primarily made by train.

Plasterboards are delivered together with the steel profiles on which they are to be mounted. These profiles are produced by a firm located in southern Sweden. Their product range of steel profiles is synchronized with the standardized boards of Knauf Danogips. The steel profiles are stored in Knauf Danogips storage area until they are shipped together with the plasterboards with which they are associated. Besides various dimensions of steel profiles, there are also profiles for outdoor use and for indoor use, which can be stored differently, either inside or outside.

As mentioned above, a number of products are also bought from other subsidiaries of Knauf. In general, these are low-volume products which can be ordered as demand for them arises. The supply setup of Knauf Danogips is illustrated in Figure 4.11.

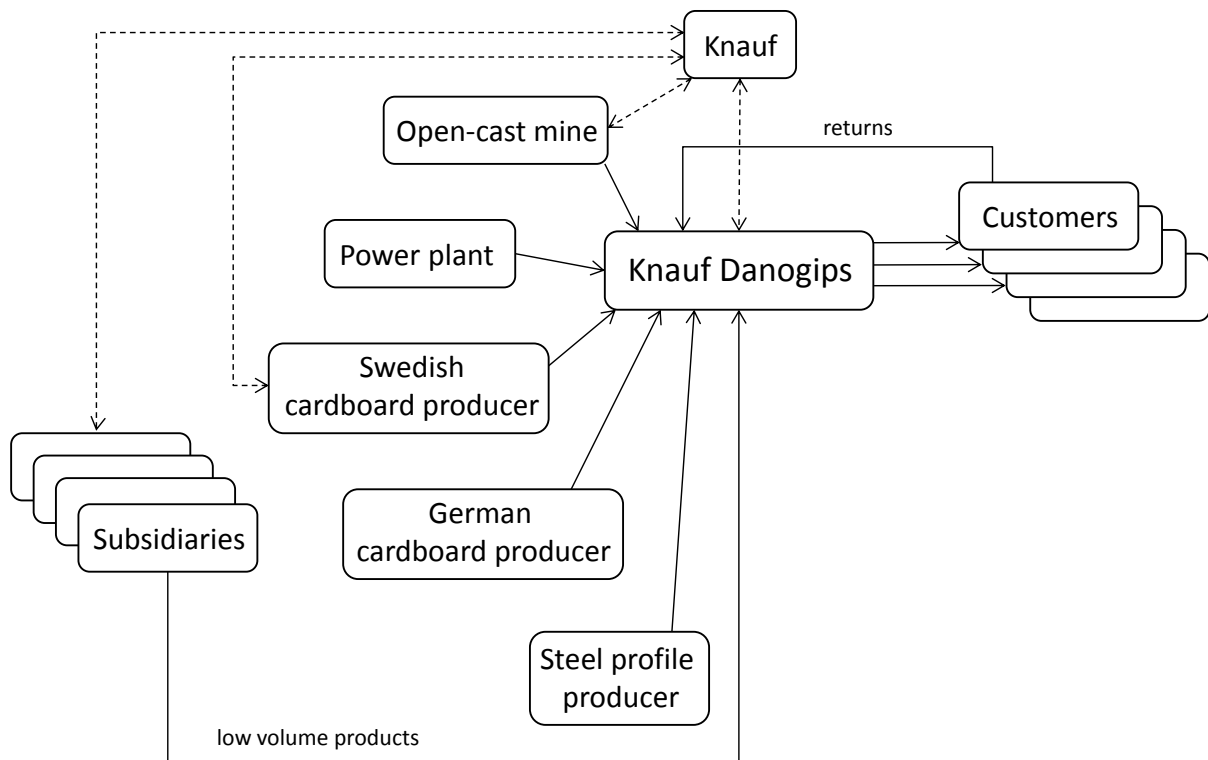


Figure 4.11 The supply setup of Knauf Danogips.

4.2.3 Customers

Previously, Knauf Danogips sales were primarily directed towards larger wholesalers, retailers, and main contractors. Over time, with an emphasis on system supplies, direct contact with main contractors has become increasingly important, bypassing many of the wholesalers and retailers to whom the products were previously delivered. In addition, house builders have become a more important customer group, recognized for their need of customized packages of plasterboards synchronized with their standardized house types.

To an increasing extent, Knauf Danogips enter into framework agreements with selected main contractors. Main contractors are thus increasingly deciding to single-source their plasterboard needs, which results in framework agreements with selected producers. This development has led to Knauf Danogips entering into framework agreements with two of the three largest Swedish main contractors. As a result, the firm today receives blueprints very early in the construction process, and can plan for customization of needed boards. In addition to these national main contractors, Knauf Danogips also prioritize their relationships to a number of regional main contractors, among other the main contractor of the Ytterby project, Wäst-Bygg.

The sales manager of Knauf Danogips is responsible for written agreements with all major customers and the regional sales representatives are responsible for the majority of the customer contacts. The sales representatives contribute their product knowledge, including not only the specific properties of individual products, but also suggestions concerning delivery planning with regard to specific projects. For this reason, it is considered crucial for Knauf Danogips to be involved in the early phases of a construction project, and not to be reduced to a mere supplier of standardized production volumes. This is generally recognized as a problem when plasterboards are considered, since it is a product often treated by customers as standardized and non-strategic. One way the firm aims to change this notion is by assigning personnel to work exclusively with architects, which influences them to prescribe specific materials and construction solutions for their designs. The firm is also quick to contact the site managers of all new construction sites to offer them their products and services. A recent change in the firm is the employment of a person exclusively responsible for all negotiations and contracts with the industrial house builders.

During the last couple of years Knauf Danogips have entered into framework agreements with a large number of industrial house builders, one of which is Mjölback. These customers have grown in importance as they request customized plasterboard solutions for their standardized house offerings. The strategic direction of Knauf Danogips has attracted several of these house builders, and Knauf Danogips now supply eight of the ten largest house builders, compared with only one a few years ago.

For these house builders, Knauf Danogips produce exact quantities and dimensions. This minimizes the need for adjustments on site; these are made at the production facility. This is recognized as a major time and money-saver. The additional costs associated with the customization of the boards are considered less than the cost of having to adjust them on site. In addition, with standardized boards there is considerably more waste to take care of. Given that all house builders have their own needs concerning the dimensions of plasterboards, which all diverge from the standardized dimensions of Knauf Danogips plasterboards, frequent changeovers are called for in the production process.

In addition to prioritizing framework agreements with selected main contractors and house builders, the tradition of the industry also requires a strong project focus. Construction

projects need to be addressed individually for several reasons. Not only are framework agreements rarely exclusive, but for historical reasons, suppliers are often changed at the last minute.

4.2.4 Incoming and outgoing deliveries

The production of plasterboards involves considerable transportation. As mentioned above, incoming materials arrive both by boat and by truck (see Figure 4.12, numbers 1-5). Both plaster stone and cardboard are delivered several times a week, whereas steel profiles arrive daily. On rare occasions, primarily in case of delays and supplementary orders, steel profiles are delivered directly from the steel profile producer to the construction site, not passing through the production facility of Knauf Danogips (number 6). But usually the benefit of combining the fairly heavy and voluminous plasterboards with the thin steel profiles is the most advantageous type of delivery.

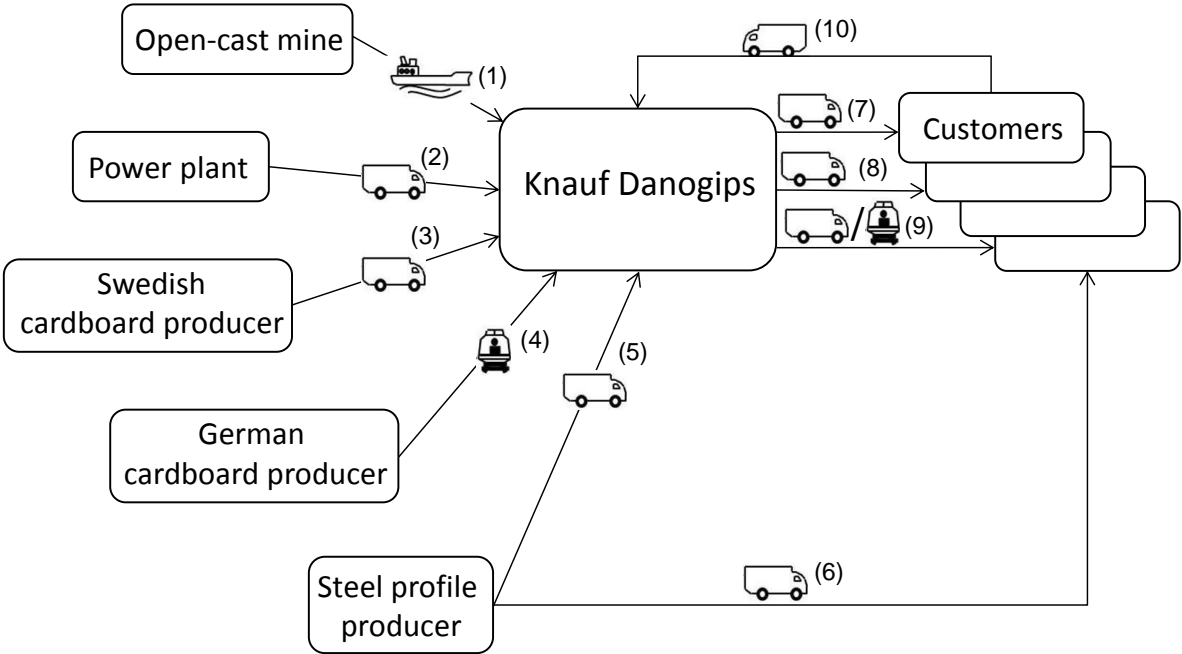


Figure 4.12 Incoming and outgoing deliveries of Knauf Danogips.

Customers expect short delivery times for plasterboards, ranging from a few days to a couple of weeks. Standardized boards are produced for the storage area, why these deliveries ordinarily take only three to four days, the time it takes for delivery planning and execution. In contrast, the delivery time for customized boards is up to ten days. It is also possible to customize standardized boards from the storage area.

During economic upswings, delivery times are restricted by the possibilities of contracting transportation services. Availability of trucks is a bottle-neck. Therefore, Knauf Danogips have increased the use of trains for their outbound deliveries.

The Knauf Danogips loading area holds up to four trucks with trailers. Two parallel queues lead up to the loading docks, one of which is dedicated to drop-offs and smaller loads, which takes less time than loading large trailer trucks. Transportation services are contracted in two principally different ways. First and foremost, the firm uses a number of trucks (7) not owned by Knauf Danogips, but by independent hauliers who drive primarily for the firm. The priority given to Knauf Danogips by these hauliers enables them to plan their routes without considering other obligations. In addition, because these hauliers are so experienced, they are usually given the most difficult loads and customers, as they are considered both knowledgeable and dependable. They are also used for deliveries from the cardboard producer, as well as for collecting returns at construction sites. Deliveries not made by the independent hauliers are mainly contracted at one of the big national logistics firms (8), leaving it up to them to coordinate deliveries and fill-rates.

For deliveries to the north of Sweden, “combined traffic” is used (9). This involves delivering the plasterboards by train to certain drop-off hubs, where trucks take over and deliver them to their final destinations. There are a number of benefits with train transport, not least that it increases flexibility in the loading and unloading of the plasterboards. In addition, from mid-Sweden and north, it is also considered cheaper than hauling the entire distance by truck.

Usually, deliveries are specified for a certain day, although more exact deliveries are also possible, for example if a construction site needs the materials in the evening after all the other work is finished. There is an additional cost for more precise deliveries, as it complicates delivery planning for Knauf Danogips.

Knauf Danogips have a well-developed policy for managing returns and waste from construction sites. Knauf Danogips offer to buy back unused boards for 90 percent of the original purchase price. Returns considered waste are collected in large containers and transported back to the production facility (10). Most of it is then reintroduced into the

production process, by adding it to the untreated plaster stone. This is possible only if there are no nails or other contaminants in the returns. An estimated five percent of the plaster stone raw material is made up of returns.

4.2.5 The developments of the plasterboard producer

Revisiting a few years after the initial interviews shows that certain changes were made and new initiatives taken. Most of these originated from a continued striving towards customization and system supply. As a result, storage levels had decreased somewhat, in line with decreased standardization. The amount of returns coming back from building sites was also less.

The firm had increased its product range further, for example with new floor products and specialized plasterboards, positioning itself as a customized producer of plasterboards with a comparably high service content. Most of these new products are not made at the production facility, but come from other subsidiaries of the parent company. Aiming to become a specialist, the firm is moving away from standardized large volume sales. This is considered appropriate not just to avoid direct competition with the other national plasterboard producer of the parent company, but also in view of the general increase in volume competition from foreign producers.

The above-mentioned Aquapanel exemplifies a new way of achieving customization. The Aquapanel is made out of concrete, and thus needs to be cast in forms. The limited number of forms of the German subsidiary producing the panels means that it cannot be customized to the same extent as ordinary plasterboards. Standardized sizes are thus bought and shipped to Sweden. A specialized saw is needed to customize the concrete. Instead of Knauf Danogips buying such a saw, as they have no need for its full capacity, one of its customers, a national house builder that uses the Aquapanel in various constructions, made this investment. This saw is used not only for the house builder's own constructions, but also to customize Aquapanel sold by Knauf Danogips to their other customers. Through this cooperation, the resource utilization of the saw is increased.

In line with increased customization, the firm has continued to prioritize among its customers, with a clearer focus on larger main contractors and house builders. As far as

possible, the customers no longer prioritized by Knauf Danogips have been transferred to the other Swedish subsidiary of the parent company, with more focus on high volumes and standardization. Closer cooperation with selected main contractors has also resulted in more wholesalers being bypassed. One response of these wholesalers has been to organize into larger purchasing cartels. For Knauf Danogips, this means a need to negotiate with these cartels, representing substantial purchasing volumes, rather than with individual wholesalers.

One important new customer is a large main contractor with a strong regional focus, primarily active in the Stockholm region. To allow for quick deliveries to this new customer, as well as to increase competitiveness in the region, Knauf Danogips have established an intermediate storage area, sourced by train. As a result, the lead times have decreased from 24 hours to only four hours. Besides decreasing the delivery times in the region, this solution also allows for more environmentally friendly transport, compared with sourcing the region with trucks directly from the production facility. A calculated drawback, however, is that the additional storage is a more costly solution than sourcing all customers from the storage area of the production facility.

Another large change was the establishment of a vendor-managed inventory (VMI) for steel profiles. This VMI is managed by a new supplier of steel profiles, following a recent change. The storage area is monitored daily by the personnel of Knauf Danogips, who report current storage area status to the steel profile producer, who, in turn, has to fill up the storage, guided by negotiated minimum and maximum levels. The benefit of the VMI solution for Knauf Danogips is decreased tied-up capital, whereas the steel profile producer benefits from increased options for coordinating the storage area levels with their own production process. The reasons for changing suppliers of steel profiles were several. One of the main ones was that Knauf Danogips developed a new steel profile that replaced two different types of profiles, both a standard one and one with special acoustic properties. Knauf Danogips then wanted their previous steel profile producer to begin producing this new, patented profile, but they were not interested, so Knauf Danogips decided to change suppliers. One consequence of this change is that Knauf Danogips have decreased the number of independent haulier trucks they use to deliver finished plasterboards to their

customers. With the previous steel profile producer, Knauf Danogips were responsible for collecting steel profiles at the production facility and they therefore needed one truck to pick up steel profiles on a daily basis. As this is now the responsibility of the new steel profile producer, delivery coordination is somewhat easier.

4.3 The kitchen furnishings producer

This section aims to describe the activities of the kitchen furnishings producer, Vedum. This includes background information about the firm, a description of their products and production process, and a discussion of their suppliers and customers. Some developments at Vedum are also highlighted, as captured in interviews that took place approximately two years after the initial interview round.

4.3.1 Firm background

Vedum are one of the largest Swedish producers of kitchen and bathroom furnishings. The firm is privately owned and has experienced strong growth in sales during the last couple of years. On average, the firm has grown by 10 percent annually since it was founded, always showing a profit.

Kitchens and bathrooms are the two main business areas. The kitchen area is approximately twice as large as the bathroom area, considering turnover. Kitchens are divided into two main customer categories: showrooms/house builders and projects. The former involves, for example, the client in Ytterby, when purchasing kitchen furnishings for their single family houses. But it also involves end users purchasing individual kitchens at the firm's showrooms, located in several of the largest Swedish cities. To separate the two customer categories, any purchase exceeding ten kitchens automatically falls into the category of projects. Considering turnover, projects is the larger category, although showrooms/ house builders has better margins. Both categories grow more or less evenly. The business areas and customer categories of Vedum are illustrated in Figure 4.13, together with the ways in which these relate to Mjöbäck and Ytterby project.

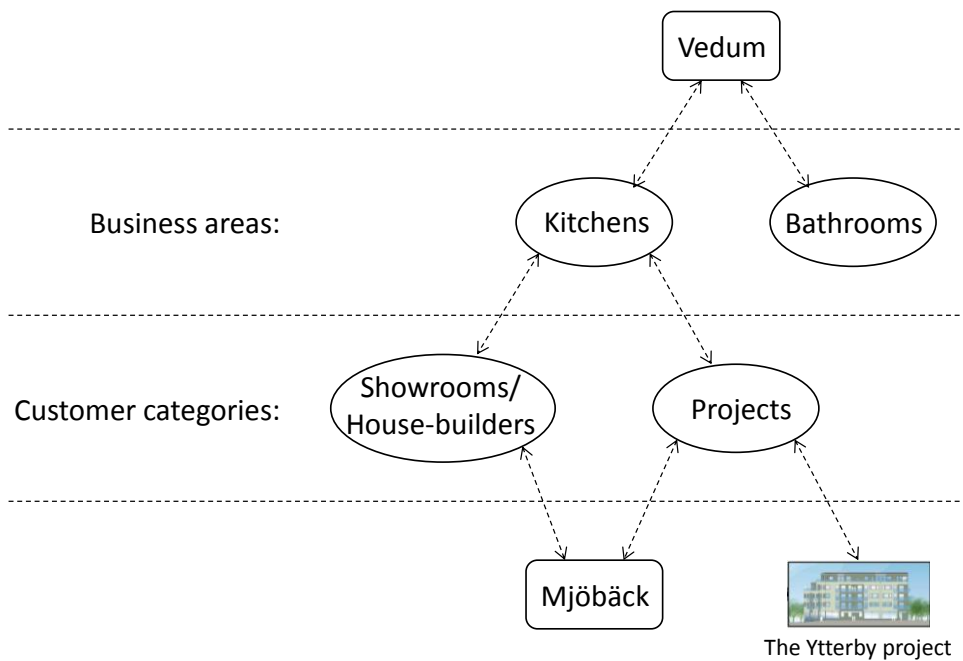


Figure 4.13 Illustration of the business areas and customer categories related to Mjöbbäck and the Ytterby project.

Physical growth of the production facility of Vedum is limited by its location, between a railway track and a nature reserve. As a result, the firm operates with very limited storage areas. One possible solution to this problem is to establish an external logistics centre, something currently being discussed at the managerial level of the firm.

Vedum offer its customers a wide variety of kitchen types and possible layouts. It is possible to combine elements of a kitchen in countless ways, choosing between styles, materials, extras and finishes. All their kitchen furnishings are wood-based, whether solid, veneered, or painted cupboards are preferred. The white goods usually bought in connection with each new kitchen are not the responsibility of the firm, although combined offers can be made for interested customers, primarily end users interested in buying an entire kitchen as they have seen it in one of the firm's showrooms.

The materials used for production of kitchen furnishings consist primarily of board materials and cupboards, in addition to smaller products, such as fittings, hinges and handles. Materials are kept in storage for two to three weeks before being entered into the production process. Some materials, however, are stored for a maximum of one week, depending on what safety margins are considered necessary.

The total production process takes three to four weeks, depending on the type of kitchen furnishings in question. During that time period, the board materials are refined in a number of sequential production stages. First, the board material is cut into specified dimensions. Incoming boards usually have the dimensions of 2,400 by 3,600 millimetres. After being cut, the edges are milled and polished. Then the boards are painted, often twice. Next, the boards are combined with fittings and hinges before being assembled, packed and placed on pallets, awaiting delivery. Each stage is manufactured in weekly volumes; for example, all boards which are to be delivered the same week are cut at the same time, before they continue collectively to the next downstream production stage.

Between the stages, there are minimal intermediate storage areas, with the possible exception of the painting stage, where boards sometimes have to be stored for longer period of times, as they are painted several times. Most boards are painted twice, once with a base coat and then with a top coat. As the changeover times for the painting machine are fairly extensive, each batch is usually painted twice before the next batch is painted. This means that the painting machine is stopped while batches are drying.

The storage of finished products represents only a few days of production owing to the above-mentioned small storage area, in combination with the fact that assembled kitchen furnishings are fairly voluminous. This limited storage area is possible thanks to the customer order-based production strategy of the firm, allowing for individual orders to be continuously shipped. As this is not the case for the firm's bathroom furnishings, this storage area has to be much larger, serving approximately 400 wholesalers and retailers all over the country. The production process of Vedum is outlined in Figure 4.14.

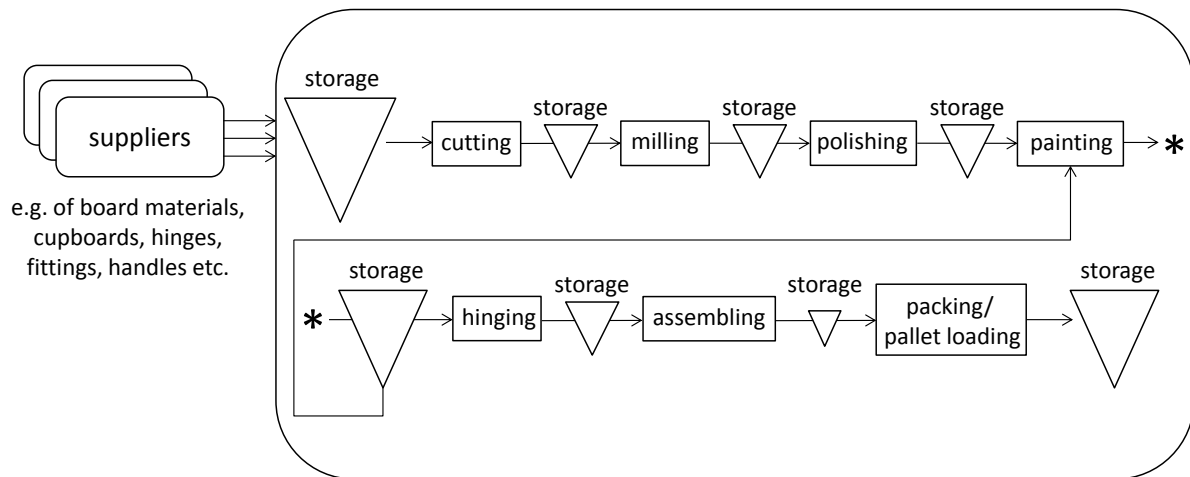


Figure 4.14 Outline of the production process of Vedum.

4.3.2 Suppliers

Purchasing has a very central position at the firm, and many of the purchasing strategy initiatives are rooted in storage area limitations. Despite the fact that their turnover has increased constantly during the last couple of years, the firm's storage area has not increased at all. This means, for example, that today they are unable to purchase materials with the same safety margins as previously, resulting, among other things, in more frequent supplier contacts and smaller incoming batches of material.

To solve these purchasing-related problems, the purchasing department at Vedum has quite recently grown to four people, from only one a few years ago. This is not only a reflection of the firm's general growth, but also a result of a more conscious strategic purchasing focus, which involves a centralization of previously decentralized purchasing responsibilities. As of now, each purchaser has a number of product areas in which he or she is specialized, resulting in different purchasers occasionally having contact with the same supplier.

The purchasing department is responsible for purchasing supplies for both business areas. As the two areas are sourced differently, the complexity related to material purchases increases. Kitchen furnishings normally have a delivery time of approximately six weeks, whereas bathroom furnishings are expected to be delivered within only three days. As a consequence, the firm has to store all materials needed for the bathrooms, with just time to assemble them as orders come in. Because the storage areas for kitchens and bathrooms are, for reasons of space, located on opposite sides of the production facility, coordinated

deliveries cause some difficulties. Personnel then have to transport the bathroom furnishings through the entire facility to allow for the different products to be shipped in the same delivery.

Another complexity related to purchasing is the firm's dual focus, since they have both individual end users and larger projects as customers. As a rule, individual end users demand more variety than project customers, resulting in the need to purchase some materials in low volumes. Whereas project customers are often very price-focused, end users experience other values as more central for making a purchase.

An individual purchase can be initiated in three principally different ways. Either the firm's material planning system, which calculates critical storage volumes, alerts the purchasing department that a purchase needs to be made, or else, since this system does not consider forecasts and marketing campaigns, internal orders can come from the marketing department. These internal orders are always seen as "deviations" from the regular purchasing routines, meaning that they are initially questioned and thus need to be properly justified. Questioning all material purchases is considered of particular importance owing to the limited storage areas at the firm. Finally, day-to-day operations, with sales personnel continuously feeding the material planning system with new orders, also result in continuous material purchases.

In general, Vedum consider their supply situation as advantageous. There are several potential suppliers for each material type and Vedum have good knowledge of the products of the respective suppliers. At the same time, Vedum find it difficult to switch between suppliers on short notice, given that their products usually show slight differences in quality, differences that risk affecting the firm's production process in a negative way. High, even quality is crucial so as not to interrupt the production process, which is one of the main reasons why it is fairly complicated to start buying from the increasing number of foreign suppliers on the Swedish market. In addition, Vedum are a fairly large firm, and require large volumes from their selected suppliers.

When the business economy is weak, Vedum are often contacted by potential suppliers, offering their products and services. During economic upswings the situation is reversed -

the purchasing department has to actively seek out new suppliers. The latest economic upswing resulted in considerable difficulties in securing supplies. For example, the firm's suppliers of particle board had difficulties in sourcing the necessary raw materials, as they were also being used to fuel power plants, so suppliers had trouble supplying Vedum on time. Thus during times of economic upswing, purchasing efforts are more directed towards securing deliveries, than actually negotiating the terms for them.

In one situation with a temporary capacity limitation of a supplier of cupboards Vedum solved the problem by, instead of buying the cupboards with a base coat, buying them raw. Vedum then had to both base coat and top coat the cupboards. With this change, capacity was freed up at the supplier's, who managed to deliver on time. Vedum had enough capacity at its paint shop to facilitate this change, and was also able to buy the products at a discount.

The firm's suppliers primarily consist of producers of board materials, for example particle board and MDF (Medium Density Fibreboard). Vedum currently use four different suppliers for these products, two of which account for 70 percent of the total purchased volumes. Of these two, one is Swedish and the other is Finnish. For foreign suppliers, Vedum deal with a Swedish wholesaler, who stores the materials and negotiates delivery terms. Storage arrangements are considered crucial, since Vedum have such limited storage area.

In addition to board materials, purchases of cupboards are also fairly substantial. Some cupboards are bought already finished; the supplier having processed and painted them. This concerns primarily veneered cupboards, which are not painted. Other cupboards arrive merely primed, in which case Vedum are responsible for processing and painting them. For all cupboards, the firm is responsible for putting on the hinges, fittings and handles.

One of Vedum's most important suppliers is the kitchen cupboard producer used for the Ytterby project. This supplier, Formidabel, is specialized in the production of veneered cupboards, but also produces a number of other products needed for a kitchen. The two firms have worked together for several years and the volumes and value of the products supplied have increased steadily. The relationship between the firms is described in the dedicated section below, which reflects its central importance in this empirical inquiry.

Smaller products, such as fittings, hinges and handles, are primarily bought from foreign suppliers, in Europe and China. Although these products represent smaller purchasing values, compared, for example, with board materials and cupboards, they are important for the final impression of a kitchen. For this reason, the firm aims to use suppliers not used by any of their chief competitors. The supply setup of Vedum is described in Figure 4.15.

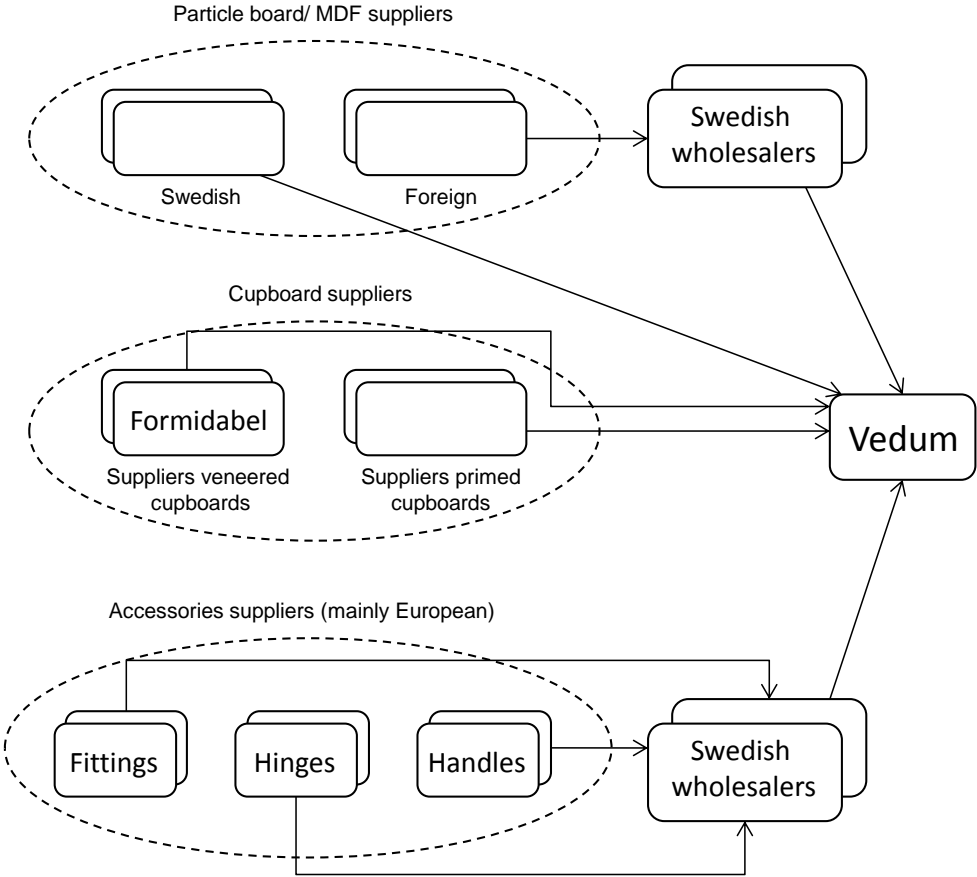


Figure 4.15 Illustration of the described supply situation of Vedum.

The firm continuously evaluates its current suppliers, with the aim of improving products, prices and delivery terms. The purchasing manager has developed an evaluation form with which most suppliers are assessed. This assessment is seen as one way of working long-term with suppliers, supporting them to improve their operations, and pressuring them to change in line with Vedum’s requirements. The suppliers are categorized as A, B, and C. All suppliers that deliver materials to a value exceeding half a million SEK are in the A category. The B and C categories are smaller suppliers, where the B category contains suppliers whose products

are considered of great importance to the impression of the final kitchens. In the C category are simply the rest of the suppliers, for which no individual assessments are made.

Formidabel have been recognized for several years as one of Vedum's most important suppliers. Among other things, they deliver most of the veneered cupboards to Vedum, which are among the most difficult and also most expensive parts to produce.

Over time, Formidabel's delivered volumes have increased and they have been requested to start delivering a number of products previously supplied by Vedum's other suppliers. Such initiatives almost never come from Formidabel - they only respond to the requests from Vedum. Instead of suggesting new products, Formidabel are active in finding and assessing new materials, which they suggest to Vedum without any specific product in mind. For example, Formidabel recently proposed the use of a new type of coloured MDF, processed for one of their other customers.

Vedum want to avoid individual suppliers becoming too dependent on their business, so they encourage Formidabel to develop other customer relationships, although not with any other producers of kitchen furnishings.

Formidabel have made several investments in equipment intended specifically for the products delivered to Vedum. Other adjustments have also been made; for example, Formidabel have changed the varnish on some of their products as recommended by Vedum. In addition, a new pallet system has been put in place to facilitate the delivery of products between the two firms. Formidabel now sort all outgoing products in accordance with the specific customer orders from Vedum. Previously, all products were mixed. This change not only saves time for Vedum, it also reduces the risk of damage to the products, thanks to less handling.

A new logistics provider has been contracted to handle deliveries between the firms. This change decreased the delivery time by up to one full day. The new logistics provider delivers directly, instead of, as with the previous one, cross-docking all its deliveries in a nearby logistics centre. In principle, Formidabel have developed their production in accordance with the needs of Vedum, for example delivering entirely customized products in small weekly batches.

The two firms have regular personal meetings every second week, and daily contact. Given the high number of products being delivered, there is always something in need of discussion. These regular contacts, and the developed personal relationships among the personnel in both firms, are considered essential to ensure efficient information flow and timely deliveries. Vedum have had a number of previous experiences of unsatisfactory suppliers, where the lack of regular contact and personal relationships has played an important part.

4.3.3 Customers

The sales department of Vedum consists of both internal and external sales representatives, who regularly receive tenders from customers, to which they have to be prepared to respond. Depending on the project in question, either the architect or the sales representative is responsible for drawing the kitchen designs. Increasingly, this responsibility is placed on the sales representatives, which requires them to interact closely with their customers, among other things to specify suitable standards. When building tenant ownerships, the sales representatives are responsible for the list of extras. As described in the Ytterby project, this list of extras constitutes a major part of the work associated with a kitchen order. Usually, it is the responsibility of the external sales representatives to manage and fill in the list of extras in consultation with customers. The internal sales representatives are responsible, at a later stage of each project, for releasing the actual order into the production system, as well as for managing returns and complaints.

Within ten weeks of planned initial delivery, the customer has to pay an additional fee for all changes. The order is released into the production system five weeks prior to delivery. The site manager at the construction site and Vedum's purchasing department are then informed of the upcoming delivery. This five-week delivery time means that, in theory, this is the latest point at which an order can be put into the production system. In reality, the lead times are often longer, requiring the sales representatives to reserve production capacity in advance. It is possible to reserve capacity five to ten percent above the calculated full capacity of the production line. This is usually resolved as orders get cancelled before delivery; otherwise it is handled by temporarily adding a work shift in the production process.

Vedum have two main customers that purchase kitchens for large construction projects: one main contractor and one client. Although Vedum have entered into framework agreements with both these firms, none of them are exclusive. It is instead the expressed strategy of Vedum to avoid exclusivity, and therefore also dependence, while they aim to be the primary supplier to both of these customers, sharing delivery responsibility with at least one other kitchen furnishings producer. This strategy is in part in conflict with the development of most of the large main contractors, which aim for exclusivity among their suppliers.

One of the greatest advantages with writing framework agreements is otherwise seen as the possibility of becoming involved at an early stage of each construction project. This early involvement facilitates production planning and purchasing activities, and also limits expensive and time-consuming price negotiations.

The firm's third largest customer is Mjöbäck, the client in the Ytterby project. Vedum are involved at an early stage of project development also in relation to Mjöbäck, usually drawing all kitchen designs. At times, Mjöbäck discuss with other kitchen furnishings producers, something which they then inform Vedum of. Through Mjöbäck, also Wäst-Bygg have become an important customer to Vedum.

4.3.4 Incoming and outgoing deliveries

Incoming materials are delivered approximately once a week, usually by specialized logistics providers. It is the responsibility of the respective supplier to contract these transportation services, while it is the responsibility of Vedum to deliver the finished kitchen furnishings to individual construction sites. This is done by contracting one of the larger national logistics providers, with which the firm has a long-term agreement. Occasionally, regional logistics providers are also used. To coordinate all outgoing deliveries, Vedum have a transportation coordinator, who communicates with internal production, as well as with the logistics providers and customers. This coordination is important in order to utilize the capacity of the production process in a good way, while also allowing for the specific delivery needs of individual projects. The transportation coordinator concurrently manages the deliveries of kitchen and bathroom furnishings, the latter going out to 400 wholesalers and retailers all over the country.

With most deliveries, the responsibility for carrying the kitchen furnishings from the trucks into the individual flats where they are to be installed is the customer's. In Stockholm, Göteborg and Malmö, however, it is also possible for customers to have their kitchen furnishings unloaded and carried into the flats, a service then contracted by Vedum from an external carrier firm, and subsequently paid for by the main contractor.

One major challenge associated with the distribution of kitchen furnishings is the standardized delivery times requested by customers. Customers expect the same delivery times regardless of which kitchen type they have purchased. The lack of acceptance for differentiated deliveries causes problems for Vedum – because they are not able to store all the products in their storage area nor can they transfer this demand for standardization in deliveries to their respective suppliers.

4.3.5 The developments of the kitchen furnishings producer

One major trend is the increased use of framework agreements, usually negotiated for three years. With smaller suppliers and customers, Vedum are usually able to negotiate quite favourable conditions, for example for price levels and delivery terms. Larger suppliers and customers are usually less interested in making such adjustments; instead Vedum then have to adjust to their preferences concerning volumes and delivery times. Suppliers are generally interested in delivering large volumes, planned in advance, while customers want deliveries in small batches, ordered at the last minute.

Framework agreements are not only written to limit the number of suppliers a given customer uses, but also to enable suppliers to become involved early in the development phase of each new project. For Vedum, this means taking more responsibility for calculations and kitchen designs, a task they feel well equipped to handle. Certain cost savings also result from an increased use of framework agreements, reducing the need for tendering processes and the price negotiations involved.

Because Vedum have a long-term focus, most of their customers are the same as a few years ago. However, the recent financial crisis has meant some changes in individually purchased volumes. For example, one of the kitchen furnishings producer's main customers, a main contractor with a focus on building tenant ownerships for the high-end market, experienced

a dramatic downturn in demand and had to dismiss close to one fourth of their employees. Vedum, too, felt the consequences of the recession, downsizing production by approximately 20 percent as compared to a few years ago. For this reason, most of the personnel had to temporarily decrease their working hours, as the firm was trying to avoid layoffs. The purchasing department and the sales representatives, in contrast, have had to work even more: work associated with individual orders does not decrease in proportion with decreasing volumes; instead changes in demand drive their work, considering the need to continuously rebalance storage levels.

Vedum still have no written framework agreement with Wäst-Bygg but they supply approximately 90 percent of Wäst-Bygg's total kitchen needs. The reason an agreement has not been entered into is that Vedum are unsure whether they will be able to deliver the future volumes required by Wäst-Bygg. Nevertheless, the two firms work closely together, allowing Vedum to be involved early in new developments.

In addition to writing framework agreements, another key to financial success is limiting the work associated with the list of extras. Kitchens will never be entirely standardized. Depending on how materials and layouts are chosen, end users will want to make changes. End users are, for example, increasingly interested in cupboards painted white, traditionally primarily installed in rental flats. If the list of extras then only presents veneered and solid wood cupboards, which are more expensive and usually installed in tenant ownerships, several additional changes will have to be made as end users insist on having white kitchens. This potential problem is handled by Vedum by becoming involved earlier in the process, thus leaving less kitchen-related choices to the main contractor. Vedum are then able to draw upon their showroom experience, where they meet end users on a daily basis.

A general strategy of the firm is to limit the number of suppliers and materials purchased. Unfortunately, this strategy is counteracted by the developing trends among end users, who demand variation and options. In addition, the firm is challenged by the width of its sales, focusing on large construction projects and individual end users at the same time. Variation in demand can also be found with regard to individual construction projects, where a mix of tenant ownerships and rental flats results in different cost and design priorities. Thus, at the

same time as there is a strength related to a well-diversified customer base, it also means that the firm's purchasing activities become increasingly complex.

To take this complexity further, the purchasing department is now also involved in handling customer reactions, such as complaints. The material knowledge at the department helps not only when deciding upon the legitimacy of incoming complaints, but also when considering the resulting right to compensation.

4.4 The kitchen cupboard producer

The aim of this section is to describe the work of the kitchen cupboard producer, Formidabel, giving a background to the firm, describing its products and production process, and discussing their suppliers and customers. Some developments of the firm are also highlighted, as captured in interviews that took place approximately two years after the initial interview round.

4.4.1 Firm background

Formidabel were founded in 1995 by four people previously employed with a competing firm. When they started the firm, they took over several customers from their previous employer, which gave them an initial customer base. In their first years of operation, they primarily produced reception desks.

Today Formidabel have 26 employees and two partners. Their turnover has developed favourably and is currently more than 30 million SEK. One of the main reasons for the firm's rapid expansion has been the recent acquisition of a nearby carpentry firm. Through this acquisition, Formidabel obtained an additional customer, a large national producer of bed frames.

Formidabel specialize in customizing wooden interiors, primarily for industrial customers. They pride themselves on being able to do almost anything wood-related, and they are also interested in becoming involved at an early stage of development, suggesting designs and production methods. Starting with the production of reception desks, they now have three basically different legs to stand on. They produce cupboards and other related products for Vedum, they produce bed frames for a bed frame producer, and they also do customized work for smaller customers, such as interior decorators. Currently, they only work with

veneered products, and not solid wood, acknowledging the different competencies that the two material types require.

Four different types of wood are used in Formidabel's products: oak, birch, walnut, and cherry. Uncertainty regarding what type of wood will be most in demand during a certain week is one of the main reasons for storing large amounts of raw materials. Despite large variations in weekly demand, sixty to seventy percent of all orders are for oak, resulting in the decision to gradually phase the least popular wood type, cherry, out of the product range.

The firm has two separate manufacturing facilities. At the larger one they produce all orders related to Vedum and the bed frame producer. The more specialized work, which consists of many one-off assignments, is done in the smaller facility. At the larger facility, the workforce is specialized in making either kitchen products or bed frames. This separation avoids conflicts of interest and is supported by the establishment of two separate production lines. The basic setup of the production processes at Formidabel is outlined in Figure 4.16.

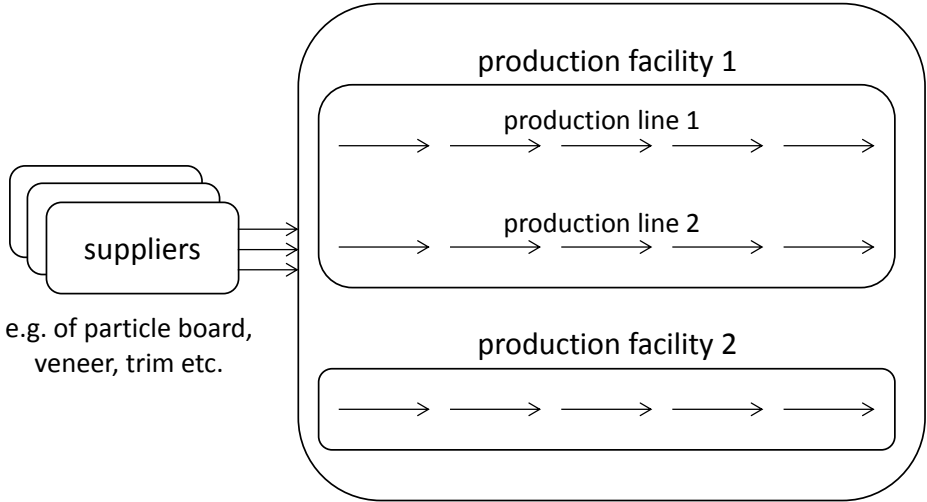


Figure 4.16 Outline of the basic production setup of Formidabel.

4.4.2 Suppliers

Formidabel have a large number of suppliers of various sizes. For example, veneered cupboards are an important product ordered, for instance, by Vedum for the Ytterby project. To produce these cupboards, three main materials are needed: particle board, trim for the edges, and veneer. Particle board is purchased from one of the leading board distributors in

Sweden, who produce a large variety of different board types, both from solid wood and various composites. There are fairly few potential Swedish suppliers of particle board and Formidabel also buy boards for several of their other products from this distributor. Trim is bought from a smaller regional firm, located close to Formidabel’s production facilities. Since the trim for this particular cupboard is refined in production, it needs to be at least three millimetres thick. A thinner trim, used for most other cupboards, is bought from an international supplier. Veneer is bought from a supplier active on the Nordic markets. Veneer is by far the most expensive component of a cupboard and its quality is very much dependent on how it is produced, i.e. how it is sewn. For this reason, changing veneer suppliers is difficult. There can even be problems if the individual employee who has previously sewn the veneer is replaced.

4.4.3 Customers

The firm’s customers are, as indicated above, divided into three main categories, representing more or less equal turnover. Their single most important customer (and category) is Vedum. The relationship between these two firms is elaborated further in the section below. Formidabel also produce approximately 600 adjustable bed frames for a bed frame producer who carries 24 different brand names. With this bed frame producer, Formidabel are also involved in product development, making test versions of bed frames under development. Finally, the last category consists of specialized work for interior decorators, smaller carpentries, designers, and architects. These customer categories are represented in Figure 4.17.

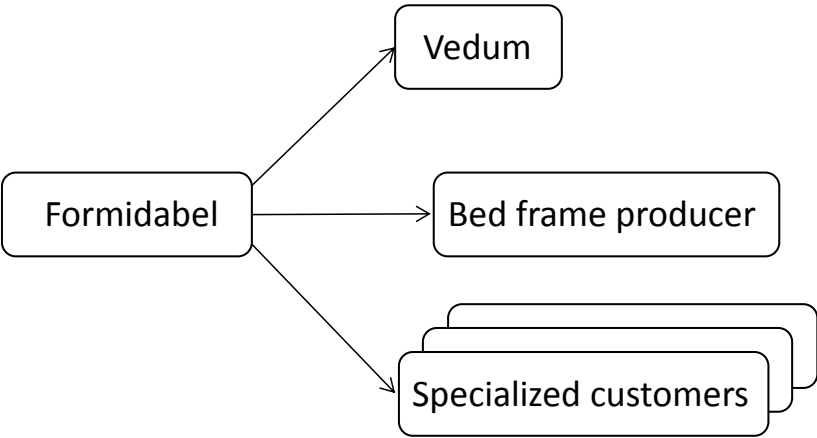


Figure 4.17 Formidabel’s customer categories.

To decrease dependence on their two main customers, Formidabel actively seek to expand the volume of specialized work in the smaller production facility. Formidabel have therefore approached several architects and designers, to offer their services. Formidabel have also recently entered into an agreement to deliver interiors to seven new restaurants, part of an international restaurant chain. Approximately 90 percent of their current specialized work relates to customers in the Stockholm region.

Customers are increasingly requesting painted cupboards, in line with the recent trends on the market. This is not a favourable development for Formidabel, who focus solely on veneered wood products, with a wooden finish. Today, this is only a possible future problem, as they have more than enough work via their current customers.

The relationship between Formidabel and Vedum was initiated approximately five years ago, when Vedum were looking for a new supplier of a specific veneered cupboard. The current supplier was using a veneer of poor quality and, despite a number of complaints nothing had changed. Vedum found Formidabel through a regional purchasing organization of which they were a member.

Initially, Formidabel supplied only one product to Vedum, the veneered cupboards used for the Ytterby project, to one construction project. For this specific project, the initial intention was to use both Formidabel and the previous supplier of cupboards, in order to compare them. A last-minute falling out between Vedum and the previous supplier, however, resulted in Formidabel receiving the entire order. They managed to deliver all the cupboards, on time and at the desired quality levels, so the relationship grew. Today, Formidabel deliver more than ten different products to Vedum, ranging from cupboards to bathroom parts and cutlery holders.

Usually suggestions for new products come from Vedum who have, for example, requested deliveries of solid cupboards which, at present, Formidabel do not have capacity to deliver, so they are purchased from a Danish supplier. Formidabel have sometimes also put forward product suggestions such as a veneered cupboard with glass insertions, a product only previously made of solid wood. By using veneer, the product becomes less expensive and the surface can also be made more attractive.

A number of relationship-specific change initiatives have also resulted from collaboration between the firms, such as a new loading pallet that enables the separation of individual customer orders. Previously, all sorting was done by the personnel at Vedum, resulting in several complaints about heavy lifting. By introducing the new loading pallet, in practice the sorting is instead done by the personnel at Formidabel, who agreed to this change to accommodate the needs at Vedum. One identified drawback of this new pallet is that the products cannot be as tightly packed, resulting in somewhat higher delivery costs. Another change originating in the relationship is the use of a new cardboard for packing products for delivery. As there were problems with products being damaged during delivery, discussions were held with a large international packaging producer. The result of these discussions was new, thicker packaging, considerably reducing the damage. The reduction of damage not only results in fewer products having to be re-worked, it also prevents customers having to wait for replacement products.

4.4.4 Incoming and outgoing deliveries

In the interviews, discussions of the distribution setup of Formidabel primarily centred on the firm's relationship with Vedum which explains the focus of this section. Formidabel receive weekly orders from Vedum via fax every Wednesday. Incoming orders are specified according to the individual customers of Vedum. Delivery has been negotiated with a three-week lead-time. On average eight to nine cubic metres worth of products are delivered each week. The products scheduled to be delivered a specific week are varnished on Monday through Wednesday and delivered on Thursday with invoices falling due 45 days after delivery, as compared with the normal 30 days.

Additional orders are common, primarily due to the high number of pieces going into a kitchen. Vedum may have forgotten to order cutlery insets, ventilation grids, or the right amount of shelves. To manage such additional orders, Formidabel have developed a system of fast orders. A fast order involves the customer receiving the product within a time period of seven days. There is a fixed cost associated with fast orders, a cost not always covering the expense of producing it. If the additional order is large, and there are no suitable products in the storage of finished products, then these need to be produced, interrupting the ongoing production process. Then it is often more costly to produce an additional order

than what is paid extra by the customer. If, on the other hand, the needed products have already been produced, ready to be collected from the finished products storage, then the extra cost more than covers the actual cost of the delivery.

These additional orders are one of the main reasons why Formidabel need to have a fairly extensive storage. Another is the need to replace products damaged during delivery, or in their customers' production processes. A third reason is directly related to Vedum. The suppliers of Formidabel usually need four to five weeks delivery time, compared with the three weeks that Formidabel have negotiated with Vedum. For this reason, Formidabel need to make demand forecasts and order certain materials in advance. As a result, the value of the products in the storage is approximately eight times higher than an average weekly delivery to Vedum. In contrast, the negotiated delivery time to the bed frame producer is four weeks, at the same time as the raw materials for the bed frames can be delivered within only a few days, since they are standardized particle board.

The actual delivery is contracted with a regional logistics provider, with direct deliveries by truck each Thursday. This represents a change from the previous setup, where a national logistics provider cross-docked the products at a nearby logistics centre, resulting in a delivery time of two days.

4.4.5 The developments of the kitchen cupboard producer

Compared with two years ago, Formidabel now has a fourth leg to stand on in the form of a new larger customer. Following a realization that the current facilities were becoming too small, the firm started to look for alternative ways to grow. On the neighbouring plot, a firm that produced customized door frames was having financial difficulties. Formidabel were invited to buy the firm - including facilities, personnel and production equipment. In doing so, Formidabel acquired production equipment too expensive to buy separately, for example for the production of veneer. Formidabel also took over the door frame producer's chief customer, a large Nordic door producer.

Initially there were some difficulties in keeping this new customer, owing to several years of decline from the previous supplier. Deadlines and quality levels had not been met and the door producer was therefore just about to change suppliers when Formidabel bought the

firm. After extensive discussions, including quality references to Vedum, Formidabel were given a chance to continue supplying the doors. At the time of writing, the supplied volumes to the door producer have never been larger.

The newly purchased facility is larger than the two previously owned by Formidabel. As a strategy for expansion, it has therefore decided to combine the two largest facilities, located next to each other, and to re-design production flows and shipping arrangements. Compared with the current setup, where the two facilities are at some distance to each other, fewer internal transports will be necessary. Gathering all production in one larger facility also enables Formidabel to utilize equipment and personnel better. This also involves selling some excess equipment which, with the current setup, is needed in each facility. These investments, however, are still in the planning stage, awaiting an economic upswing. Redesigning the production setup also involves quite a lot of planning, not least given that much of the existing equipment is too heavy and complicated to move. Various decisions regarding this expansion remain to be made by Formidabel.

With their newly acquired equipment Formidabel expect to be in a position to purchase less refined materials than before, and to do more themselves. Extending the production process upstream not only increases the value of Formidabel's production process, but also enables them to get hold of raw materials much more easily and at shorter notice. As soon as a material has to be refined by a supplier, delivery times are extended, sometimes even from a few days to several weeks.

In addition to having a new customer in the previously mentioned door producer, Formidabel are also in the early stages of offering products to a few more customers. One of these is a kitchen furnishings producer selling to end users through an established non-Swedish retailer of household appliances. This kitchen furnishings producer is thus understood as targeting a somewhat different end user group compared with Vedum. It has not yet been decided whether Formidabel will continue delivering to this second kitchen furnishings producer, although they have reacted favourably to Formidabel's products. The exact same products are never delivered to both kitchen furnishings producers; there have to be at least some minor differences for reasons of competition. At the same time, although

the two firms target different ends of the market, Formidabel treat them equally, delivering boards of the same quality and price levels.

Another customer who is becoming increasingly important is a national association of “weight centres”, from whom individuals and firms can receive help with diet and exercise regimes. For these centres, Formidabel make wooden interiors. It also acts a kind of decorator, equipping each new centre not only with their wood interiors, but also with carpets and plants. This customer contacted Formidabel through a regional furniture producer, with whom both firms had previously worked.

Formidabel’s deliveries to Vedum have increased continuously. For example, Formidabel are now delivering two different kinds of solid wood cupboards, as well as two painted MDF boards. Both these material types are new to Formidabel, and required investments in new production equipment. Formidabel have also begun purchasing from a new supplier, a carpentry firm providing them with raw materials for their solid wood cupboards.

In the beginning, Formidabel were very hesitant towards producing these new products, especially the solid wood boards. Yet after several requests from Vedum, having tried but always failed to find other suitable suppliers, Formidabel finally accepted.

In contrast to two years ago, Formidabel have now stopped supplying the international restaurant chain for which they had contracted seven restaurant interiors. According to Formidabel, the two firms had difficulties seeing eye to eye on things, and the relationship ended due to differences of opinion.

Minimizing returns and complaints has been a long-term goal of Formidabel, recognizing them as both costly and detrimental to customer satisfaction. This has given the firm something of a reputation within the industry, and they now assess complaints for other firms in the capacity as material experts.

5 Case Analysis

Supported by the concepts in the frame of reference, this chapter structures the information presented in the empirical inquiry. The empirical perspectives in the previous chapter are reinterpreted in line with the scopes for activity analysis presented in the frame of reference. The deliveries of plasterboards and kitchen furnishings represent separate activity configurations. In contrast, the empirical information concerning the three focal actors relates both to their respective activity structures and to the activity patterns of which they form part.

Consequently, this case analysis is structured in accordance with the three analytical scopes. In addition, a number of distinct change initiatives are presented in the empirical material. These concern the activities of the plasterboard producer (PBP) and the kitchen cupboard producer (KCP) and are analyzed in a separate section. The case analysis is supported with a number of figures illustrating the configurations, structures, pattern, and change initiatives under analysis. The principle connectedness between activities and resources, initially illustrated in the frame of reference, is expanded to create the illustrations in this chapter. According to Figure 5.1, an activity is seen to be connected with enabling and object resources.

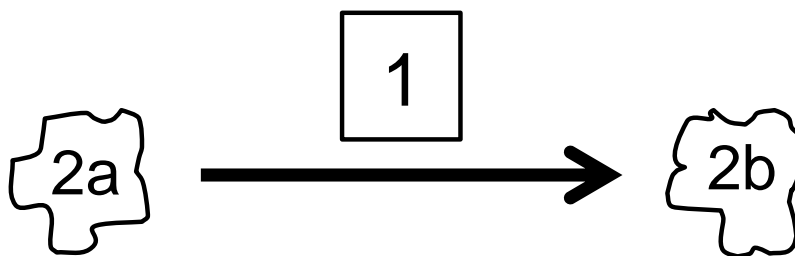


Figure 5.1 An activity connected with enabling (1) and object (2a-b) resources.

When specifying the connectedness between separate activities, such enabling and object resources are recognized as intersecting individual activity links. Each activity link thus allows for the identification of a *bridging*⁹ resource, which intersects the link and is intermediate to it. Enabling and object resources can be bridging resources if they are intermediate to an activity link. The figures in this chapter are thus made up of activities which are linked via

⁹ All concepts in this chapter are italicized when first introduced.

bridging resources. Each configuration, structure and change initiative consists of multiple activities linked in this way. The illustration of activity patterns is made on a more aggregate level, indicating only boundary-crossing activity links. Throughout, actor boundaries are drawn with broken lines. The information presented in the empirical inquiry is used to identify individual activities, bridging resources, business relationships and actor boundaries, and so guides the case analysis.

With regard to the illustrations of activity configurations and structures, these are initially made to include all the identifiable activities in the respective scopes. As a result, the initial illustrations are overall images in which the details are not easily identifiable. When appropriate, the configurations and structures are also divided and presented in two rows, owing to the large number of individual activities and resources. To enable the subsequent identification of individual activity links, highlights are made in each section to focus on selected activities and resources. These activity links are supported by the identification of activity interdependency types given in the frame of reference. The four interdependency types suggested in table 2.1 are thus illustrated and discussed in this chapter (the interdependency type originating from shared capabilities is identified here in the shared activation of an enabling resource, in line with the specification at the end of section 2.5). The interdependency types are revisited in the upcoming chapter, to form part of the scheme for the analysis of activity linking presented there. Figure 5.1 illustrates the four interdependency types in this thesis, using the principle interconnectedness between activities and resources discussed above. In the illustration of two activities that are interdependent through the joint direction of their respective outputs, the bridging resource is divided in order to illustrate the individual output of each activity and the subsequent need to join these outputs to form the input for a common third activity.

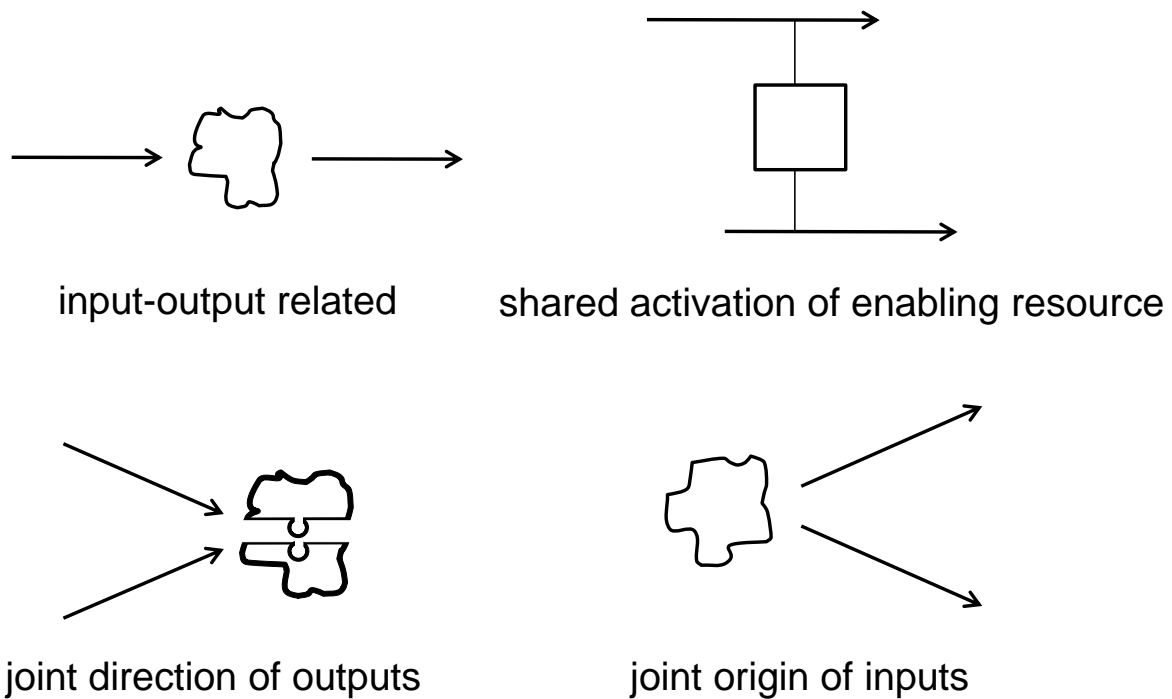


Figure 5.2 Illustration of the four interdependency types.

The role of this case analysis is to exemplify aspects of activity linking, rather than to carry out a comprehensive exploration of the phenomenon with regard to individual analytical scopes. In these examples, the respective scopes allow for somewhat different focus, thus complementing each other. As such, the case analysis facilitates the discussions in the upcoming chapter, which addresses the research questions.

5.1 Analysis of the activity configurations

Two activity configurations are represented in the empirical inquiry related to the delivery of plasterboards and kitchen furnishings. In Figures 5.3 and 5.8, the activity undertakings and resource activations related to each of these configurations are illustrated. Object and enabling resources are identified with regard to each activity, supported by the specified connectedness between activities and resources discussed above. In addition, several actors are involved in undertaking the activities which are part of the configurations, which is why the boundaries of these actors are also indicated. Sections 5.1.1 and 5.1.2 illustrate and describe the activity links associated with each configuration.

5.1.1 Analysis of the plasterboard configuration

The empirical description of the plasterboard delivery, together with more generally oriented information concerning the activity undertakings of the PBP, permits the illustration of the plasterboard configuration in Figure 5.3. As previously indicated, this illustration does not include all activity undertakings in relation to the plasterboard delivery. It does, however, capture those activities related to the plasterboard delivery that are included in the empirical inquiry.

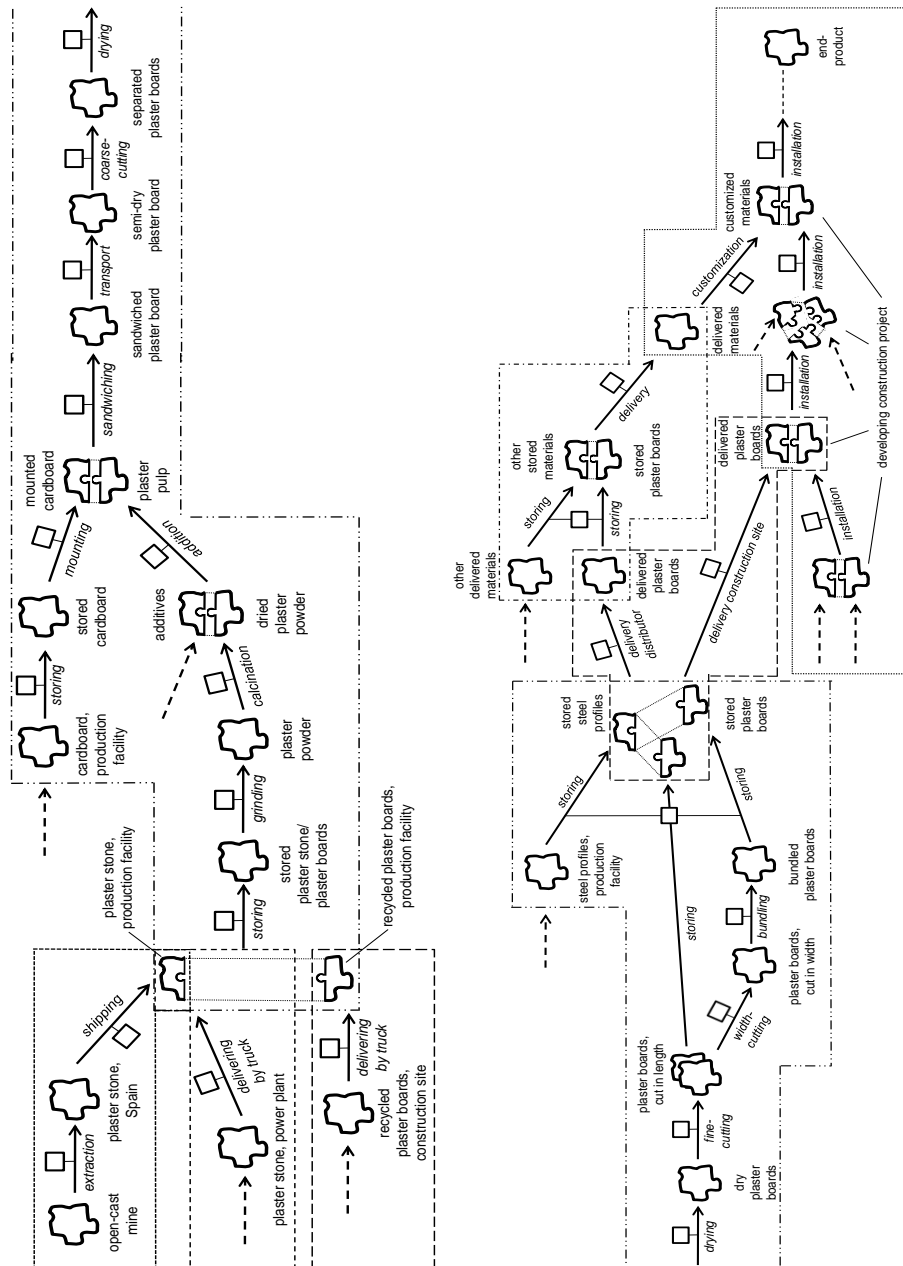


Figure 5.3 The activity configuration of the plasterboard delivery (the configuration is separated and presented in two rows to facilitate identification of individual activities and resources).

Figure 5.3 reveals several input-output related interdependencies between the activities in the configuration. This is explained by the nature of the configuration, linking activities undertaken for the production of an end product. A few of these interdependencies are highlighted in Figure 5.4. At the beginning of the production process of the PBP, the storing activity delivers output, stored plaster stone/recycled plasterboards, which are required as input for the grinding activity. This activity delivers output required as input for the calcination activity. After the plasterboards are produced in the integrated production process, they are cut into different dimensions and also bundled when necessary. Here, the fine-cutting activity delivers output required as input for the storing activity (with regard to the standardized boards which are then subsequently delivered to the distributor) as well as the width-cutting activity. This activity, in turn, delivers output required as input for the bundling activity. These examples thus reveal five separate input-output related interdependencies. In addition, a number of indirect input-output related interdependencies are recognizable, for example between the storing and calcination activities. In principle, an input-output related interdependence results from one activity delivering output required as input for another activity. The first activity thus precedes the second, which is downstream to the first.

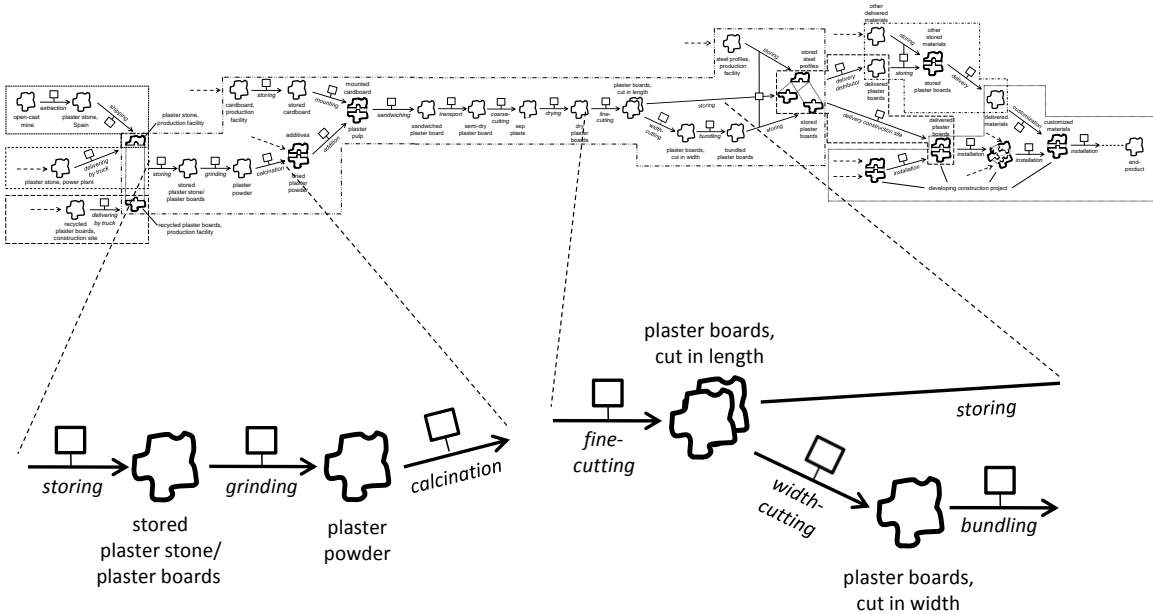


Figure 5.4 Illustration of input-output related interdependence in the activity configuration of the plasterboard delivery.

The illustration of the configuration also reveals a number of activities which are interdependent through the joint origin of their respective inputs. These are exemplified in Figure 5.5. The output of the fine-cutting activity is required by both the storing and width-cutting activities. These activities thus require the same input for their respective activity undertakings. In addition, although different types of boards are delivered to the distributor (standardised) and construction site (customized), both these delivery activities require input that is output from the storing activity for steel profiles. The illustrated activity links are thus interdependent owing to the joint origin of their respective inputs.

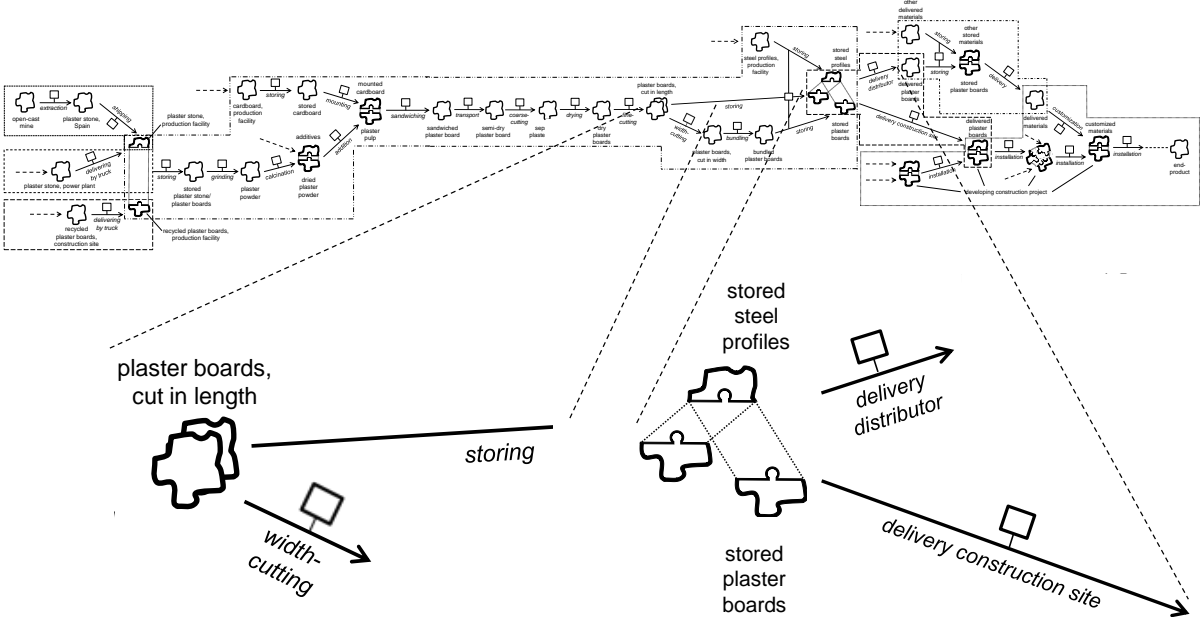


Figure 5.5 Activities interdependent through the joint origin of their respective inputs.

Some activities are also interdependent as a result of the joint direction of their respective outputs. A few such activity links are illustrated in Figure 5.6. The initial storing activity for the PBP receives its input from three different sources: plaster stone both from an open-cast mine in Spain and a local power plant, recycled plasterboards from various construction projects. These individual deliveries have a joint direction for their respective outputs. Also internally, within the production process of the PBP, such joint direction of output can be observed. The plaster pulp is combined with cardboard in the sandwiching activity. The output of the mounting activity of cardboard and the output of the addition activity of

plaster powder and additives thus display a joint direction, serving as input for the sandwiching activity. The illustration below highlights the customized plasterboards incoming to the construction site where they are combined with other materials in an installation activity. Both these materials are thus directed towards this installation activity.

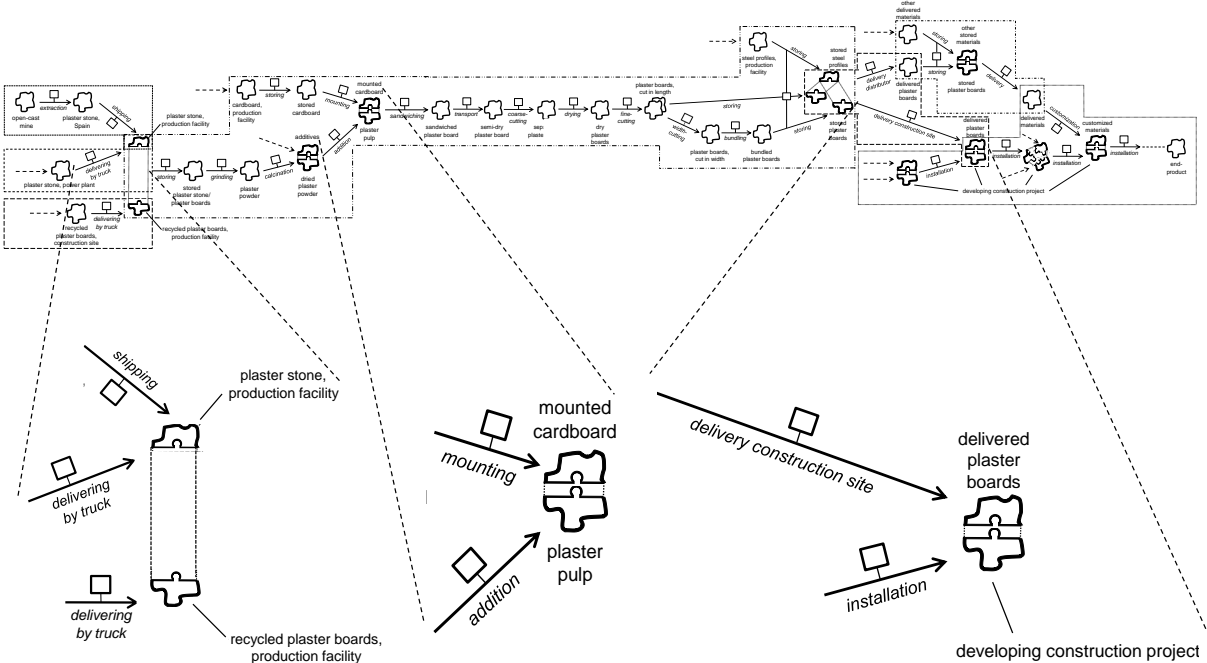


Figure 5.6 Activities interdependent owing to the joint direction of their respective outputs.

Finally, some activity interdependencies in the configuration are recognized as caused by the shared activation of an enabling resource. Both these examples concern storing activities and are illustrated in Figure 5.7. The PBP storage area contains both standardized and customized boards, as well as the steel profiles delivered together with these boards. The distributor’s storage area contains both standardized plasterboards and other construction materials.

All activities which are part of this configuration are subject to input-output related interdependence, some of which are exemplified in Figure 5.9. After the initial production activity for the KFP, the cutting activity, the boards are stored before becoming input for the downstream milling activity. The milled boards are then stored in the downstream storing activity. The other example shows how the output from the hinging activity is required as input for the downstream storing activity. The output from this storing activity is then input for the assembly activity, where the different hinged boards are combined to create kitchen furnishings. These assembled kitchen furnishings are then again stored. As made evident in Figure 5.8 which displays the 'entire' activity configuration, all production activities of the KFP are intersected by storing activities.

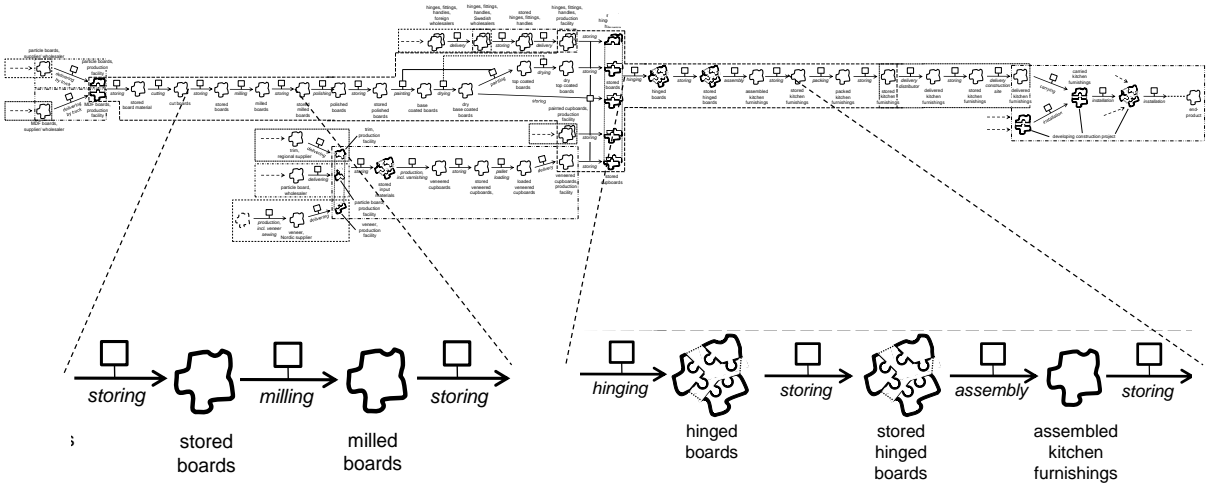


Figure 5.9 Illustration of input-output related interdependence in the activity configuration of the kitchen furnishings delivery.

The nature of the activity configuration does not allow for the identification of multiple activities interdependent through the joint origin of their respective inputs. Instead, converging activity chains are more prevalent. However, one example of joint origin of inputs is illustrated in Figure 5.10. While some boards of the KFP are painted twice, others are only base coated. As a result, some dry base coated boards are input for the second painting activity and others are stored. Both these activities require the same input, dry base coated boards.

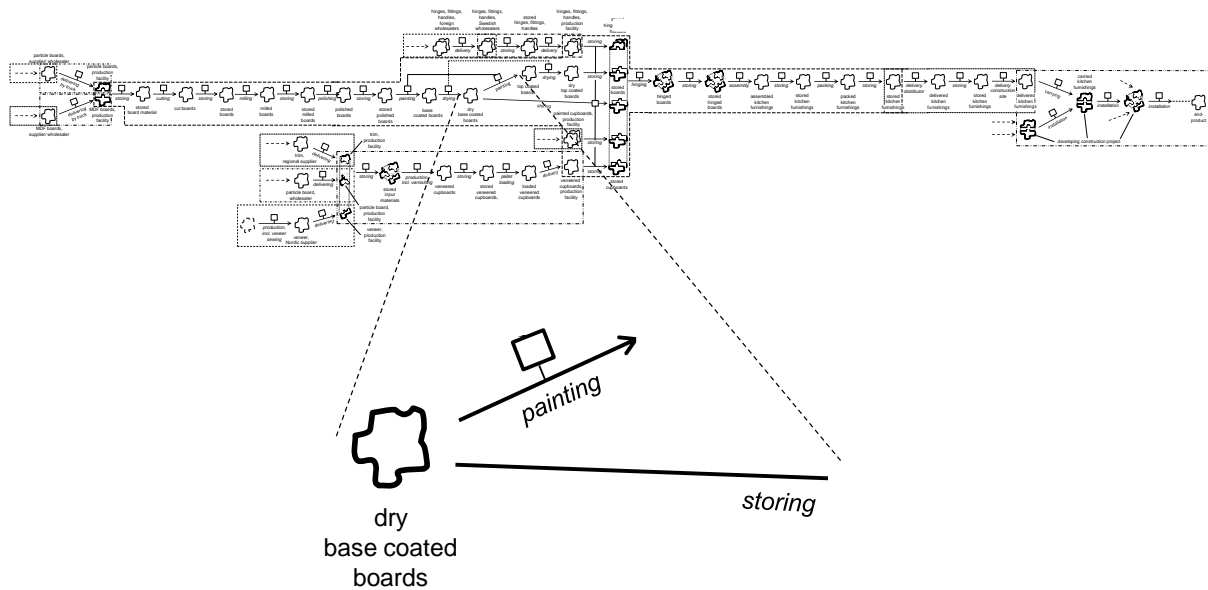


Figure 5.10 Activities interdependent owing to the joint origin of their respective inputs.

The joint direction of outputs is recognized with several activities in the configuration. Three such examples are illustrated in Figure 5.11. The first has to do with the input requirements of the initial storing activity of the KFP. Both particle boards and MDF board are required for the production of kitchen furnishings. The individual delivery activities of these materials are therefore interdependent owing to the joint direction of their outputs. A similar situation applies to the input requirements of the production process of the KCP, who are responsible for the production of veneered cupboards for the Ytterby project. The delivery activities of trim, particle board and veneer are all directed at the storing activity of the KCP. Finally, on the construction site, the kitchens are carried into individual flats at the same time as installation activities progress the construction project. The installation activity of kitchen furnishings is conditioned both by the output from the carrying activity, and by the output of upstream installation activities with which it has an input-output related interdependence. Thus these activities are interdependent owing to the joint direction of their respective outputs.

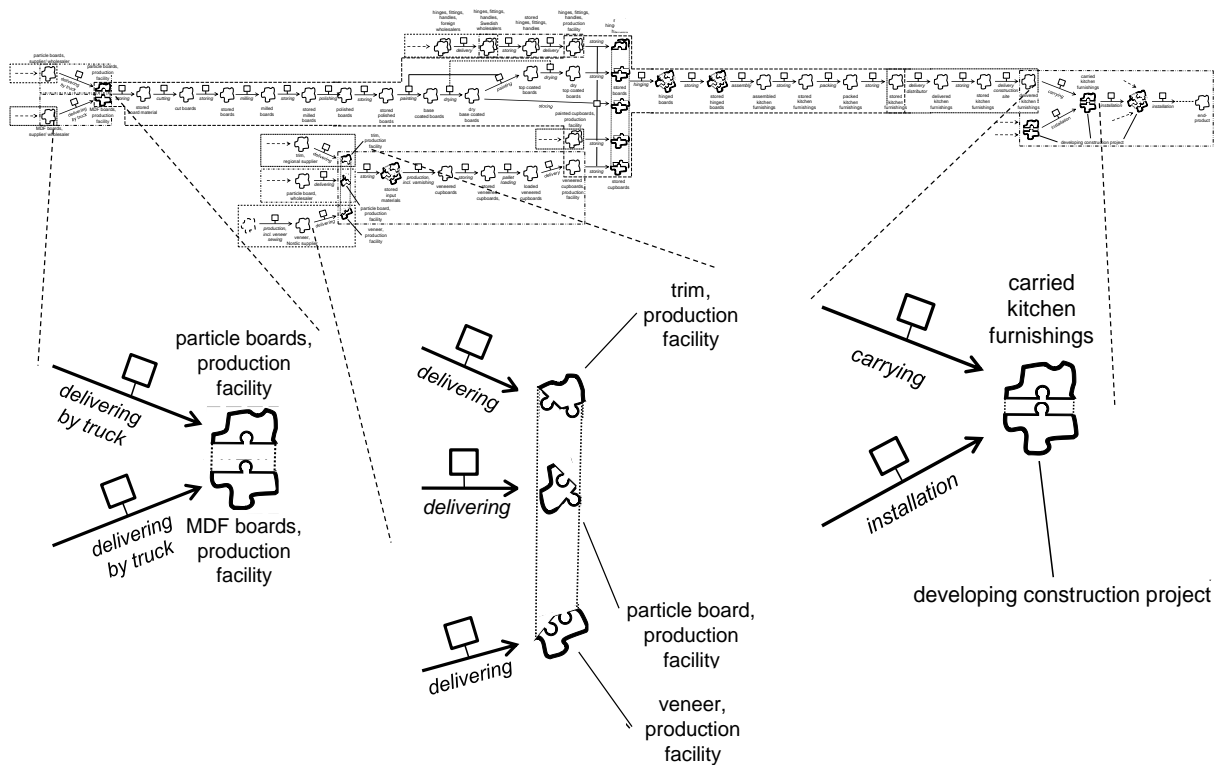


Figure 5.11 Activities interdependent owing to the joint direction of their respective outputs.

The shared activation of an enabling resource is exemplified in Figure 5.12. The painting facilities of the KFP are shared between both painting activities. Individual batches are treated separately. This means that batches which are painted twice activate the painting activities without the interference of any intermediate batches. The storing area of the KFP also contains several board types as well as hinges, fittings and handles. Analytically, the storing activities of all these materials thus activate the same enabling resource.

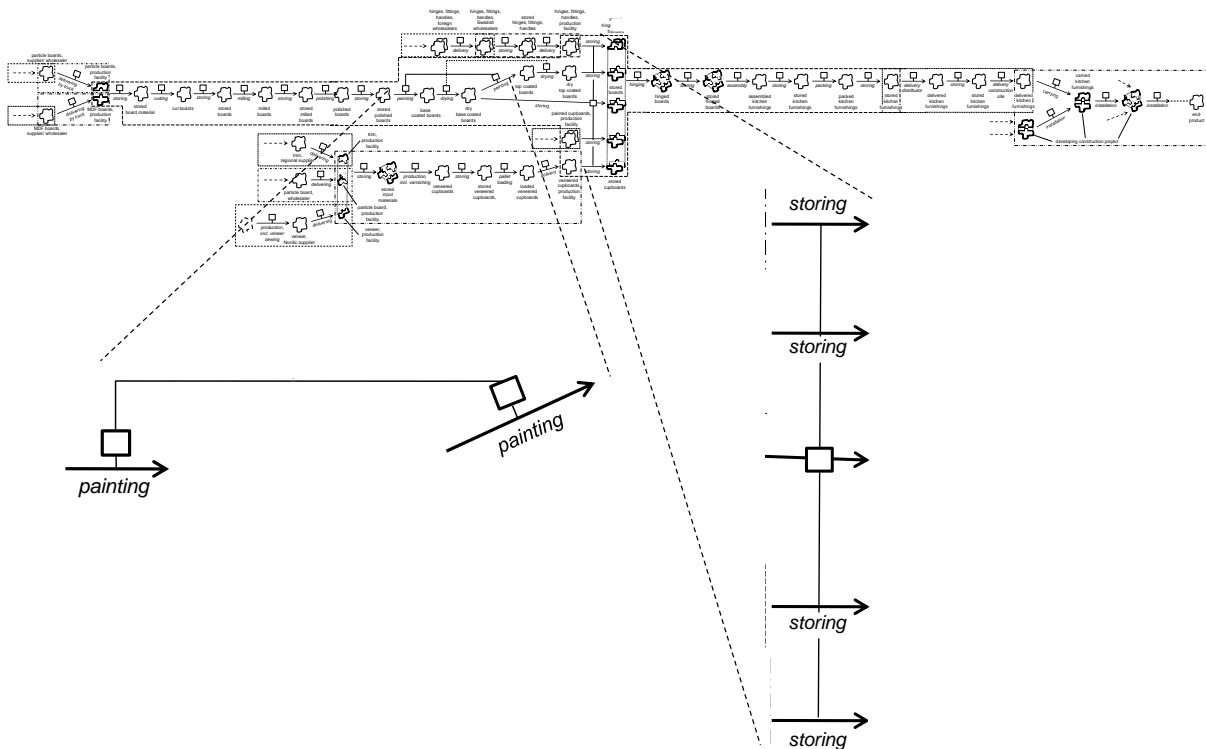


Figure 5.12 Activities interdependent owing to their shared activation of an enabling resource.

5.2 Analysis of the activity structures

In this section, the activity structures of three firms are analyzed. All the firms are represented in the activity configurations discussed above. The analysis does not capture all internal activities of each firm; it does, however, target the firm-internal activities represented in the information in the empirical inquiry.

The illustrations of these activity structures are very similar to those of the activity configurations, but they involve additional activities: activities undertaken by the firms but not part of the specific configurations. In addition, unlike the activity configurations, which capture only single activity undertakings, the activity structures allow for the recognition of the continuous activity undertakings of each firm. As a result, some variety is identified with the resources of individual activities. This variety expresses the flexibility of the undertakings of the activity. An individual activity might, for example, require a variety of inputs to deliver a variety of outputs, while activating the enabling resource in a variety of ways. This ‘flexibility’ is referred to as the *adjustability* of an activity. By definition, adjustability

represents the flexibility of an activity's undertakings, derived from the variety related to its resources. This adjustability is illustrated in Figure 5.13, in which each resource of the activity is changed in three different ways depending on the undertakings of the activity. This figure expands the connectedness between activities and resources suggested in the frame of reference and discussed in section 5.1.

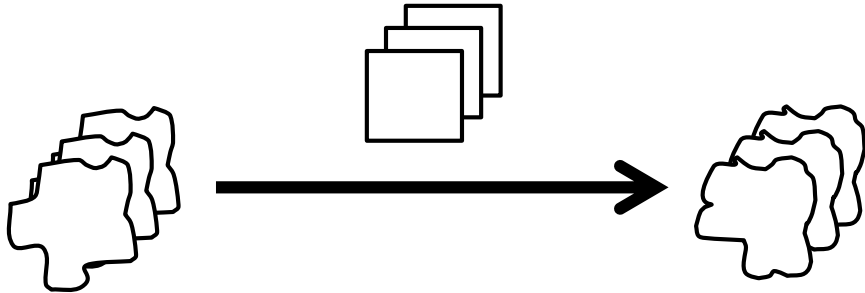


Figure 5.13 The adjustability of an activity.

Acknowledging variety with the resources of an activity also allows for the recognition of variety with the bridging resource of an activity link. This is interpreted as the *linked adjustability* of the activity link, which is also highlighted in this section. This linked adjustability is illustrated in Figure 5.14, in which the bridging resources of the four principal activity interdependency types are changed in three different ways depending on the undertakings of the activities.

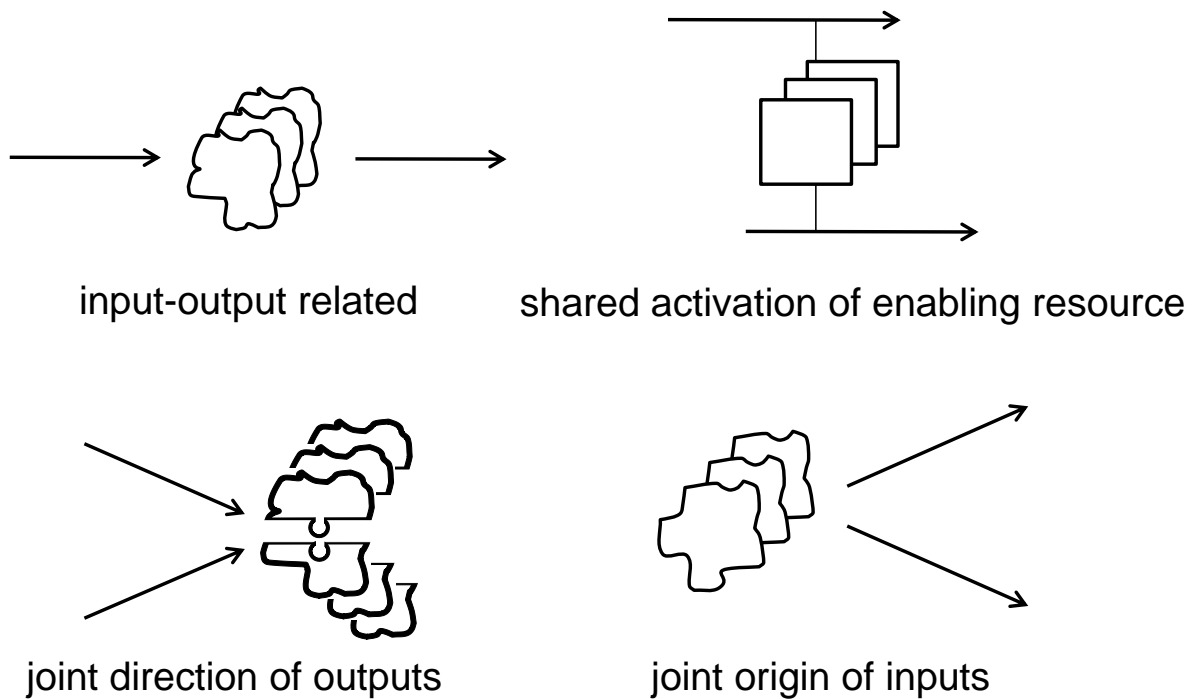


Figure 5.14 Linked adjustability of the four interdependency types.

Thus, whereas the previous section used illustrations of activity configurations to reveal and exemplify principle activity interdependency types, this section has a different but related purpose. Given the identification of activity interdependency types, the adjustability related to individual activities and activity links are exemplified and discussed here. This adjustability derives from the variety of the resources of these activities and activity links.

5.2.1 Analysis of the activity structure of the plasterboard producer

The activity structure of the PBP is a presentation of the activities undertaken within its boundaries. Compared with the activities of the PBP presented as part of the activity configuration of the plasterboard delivery, the activity structure includes a few additional activities. As is also illustrated in Figure 5.15, the activity structure allows for the recognition of variety with individual object resources.

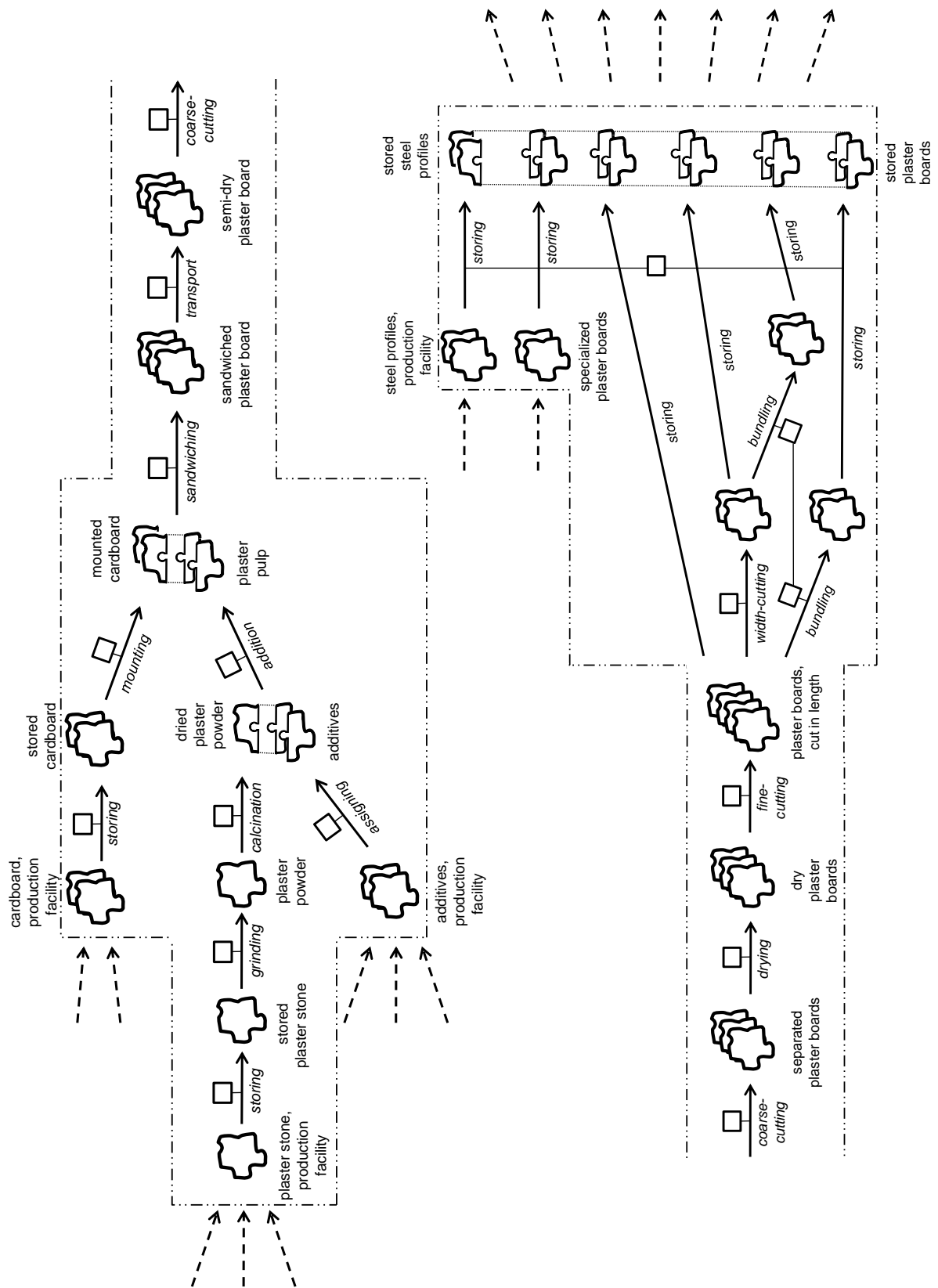


Figure 5.15 The activity structure of the plasterboard producer.

Three parts of the activity structure in Figure 5.15 are highlighted in Figure 5.16. They illustrate adjustability related to the undertakings of individual activities. The first example of adjustability centres on the calcination activity of the PBP. The input for this activity is plaster powder, which is output from the grinding activity. This plaster powder contains an unspecified amount of water, and has to be calcinated before water and other additives can be added in a controlled way. Thus, the output from the calcination activity is dried plaster powder, about which no variety of input, output or enabling resource is identified. Thus the activity does not display any adjustability. As illustrated in Figure 5.16, the calcination activity is one of only a few production activities of the PBP which displays no adjustability with regard to its undertakings.

In contrast, the resources of the sandwiching activity display distinct variety. The inputs consist of mounted cardboard and plaster pulp. The mounted cardboard is delivered in several qualities, and the characteristics of the plaster pulp also vary in accordance with the nature of the different additives to the plaster powder. The variety of the inputs for the sandwiching activity thus equals the variety of the two resource elements of which it consists. Depending on how these elements are combined, the activation of the enabling resource is also affected. The output from the sandwiching activity is a plasterboard with different characteristics. The variety of this output is a reflection of the variety of the input resource elements. Derived from the variety of the resources of the sandwiching activity, this activity therefore displays some adjustability.

The fine-cutting activity of the PBP is also an activity that displays considerable adjustability. The inputs for the fine-cutting activity consist of dry plasterboards, cut to a specific length in the coarse-cutting activity. These boards display various characteristics, which derive from the use of different cardboards and additives. The outputs from the activity are boards cut to different lengths, both standardized and customized. Thus, the variety of the inputs is not merely transferred, but additional variety is also created in the undertakings of the activity. Variety with the activation of the enabling resource facilitates this uneven distribution of variety between inputs and outputs.

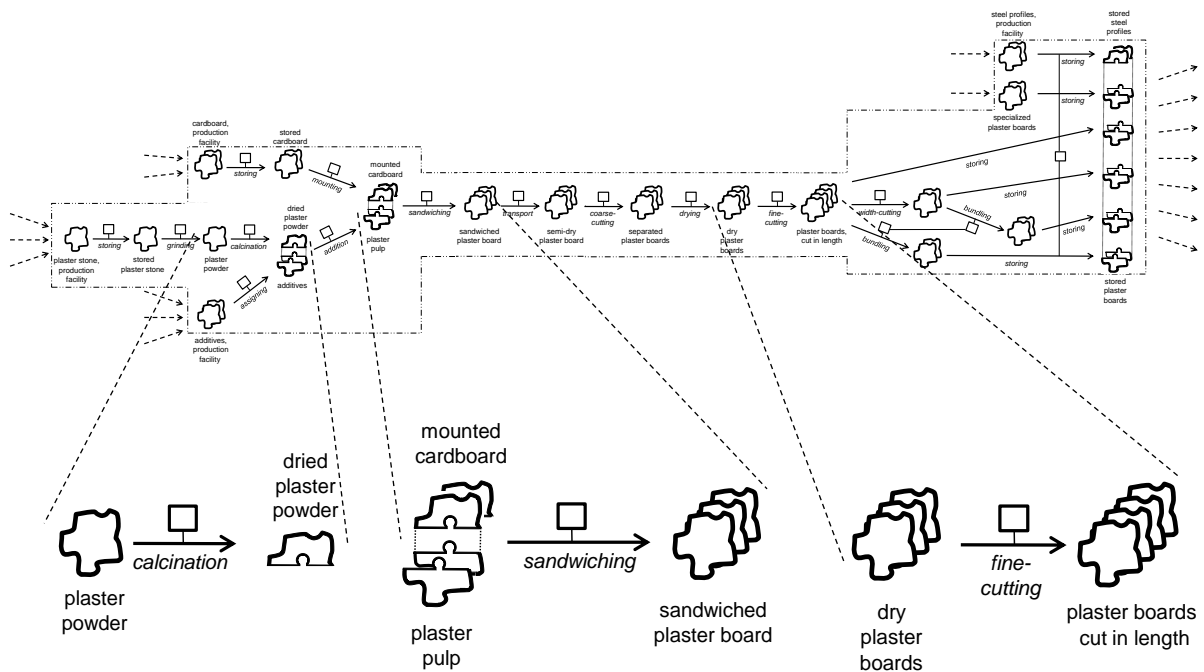


Figure 5.16 Adjustability with three of the activities in the activity structure of the plasterboard producer.

This activity structure not only reveals adjustability with the undertakings of individual activities, it also indicates linked adjustability related to activity links. As is evident from previous discussions, resources intersect activity links. An intermediate resource can thus be identified with each individual activity link. Figure 5.17 illustrates the linked adjustability of a few selected activity links.

Mounted cardboard and plaster pulp are the resource elements of the inputs for the sandwiching activity. The recognition of these resource elements as intermediate resources allows for the identification of three distinct activity links. There is an input-output related interdependence between the mounting and sandwiching activities, as well as between the addition and sandwiching activities. The linked adjustability of these activity links derives from the variety of their respective intermediate resources. The output from the mounting activity displays some variety, equal to the range of cardboard qualities used in the production process. The linked adjustability of the activity link between the mounting and sandwiching activities thus derives from this variety of the intermediate resource. In contrast, the output from the addition activity displays a variety derived from the different additives used. In turn, the linked adjustability of the activity link between the addition and sandwiching activities derives from this variety. In addition, there is a link between the

mounting and addition activities owing to the joint direction of their outputs. The linked adjustability of this activity link is a result of the variety of the outputs of both activities. These outputs are then combined in various ways in the downstream sandwiching activity.

The outputs of the fine-cutting activity, plasterboards cut to different lengths, are intermediate to several activity links. Input-output related interdependence is identified between the fine-cutting activity and three different downstream activities: storing, width-cutting and bundling. The linked adjustability of these respective links is equal to the range of boards that are outputs from the fine-cutting activity and directed at the specific downstream activity. That is, the linked adjustability of the activity link between the fine-cutting and storing activities might be different from that between the fine-cutting and width-cutting activities. This depends on the range of different boards that are inputs for the storing and width-cutting activities.

Through the joint origin of inputs, the plasterboards cut in lengths are intermediate to three additional activity links: between the storing, width-cutting and bundling activities. The linked adjustability of these activity links results from the combined variety of their respective inputs.

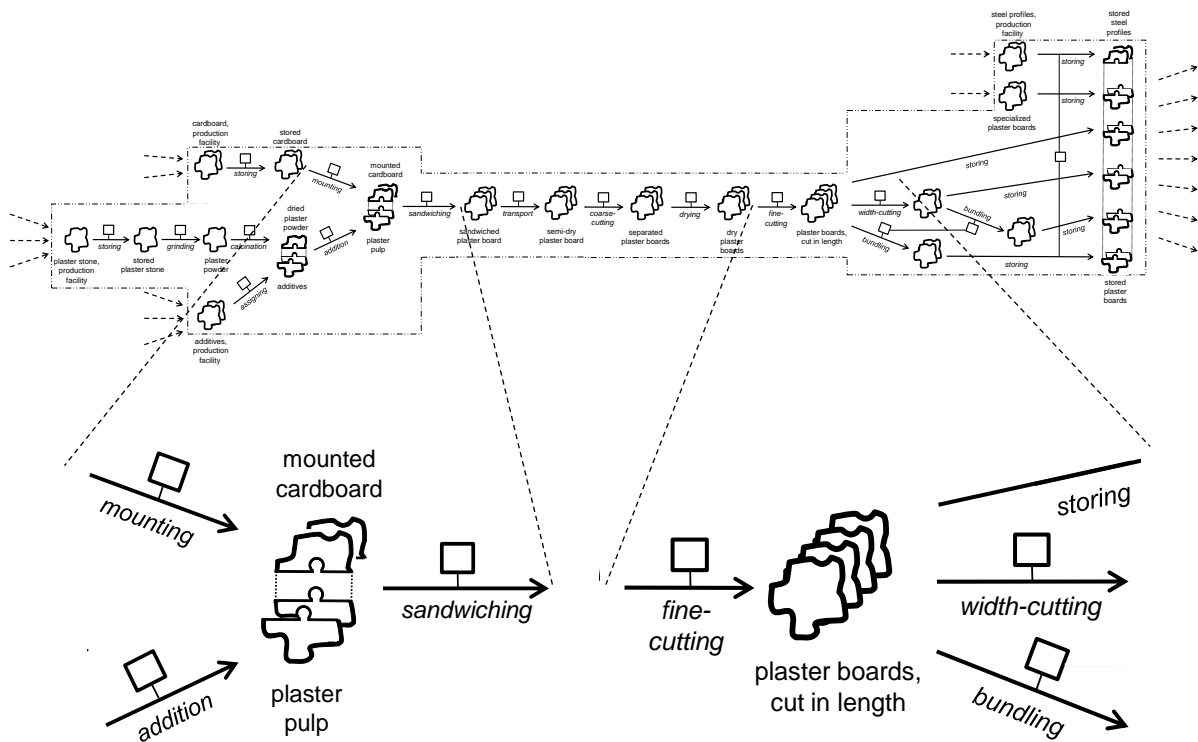


Figure 5.17 Linked adjustability with activity links in the activity structure of the plasterboard producer.

5.2.2 Analysis of the activity structure of the kitchen furnishings producer

The activity structure of the KFP is depicted in Figure 5.18. A number of additional activities are identified compared with the activities of the firm represented in the activity configuration of the plasterboard delivery. Figure 5.18 also illustrates the variety of the individual object resources of the firm.

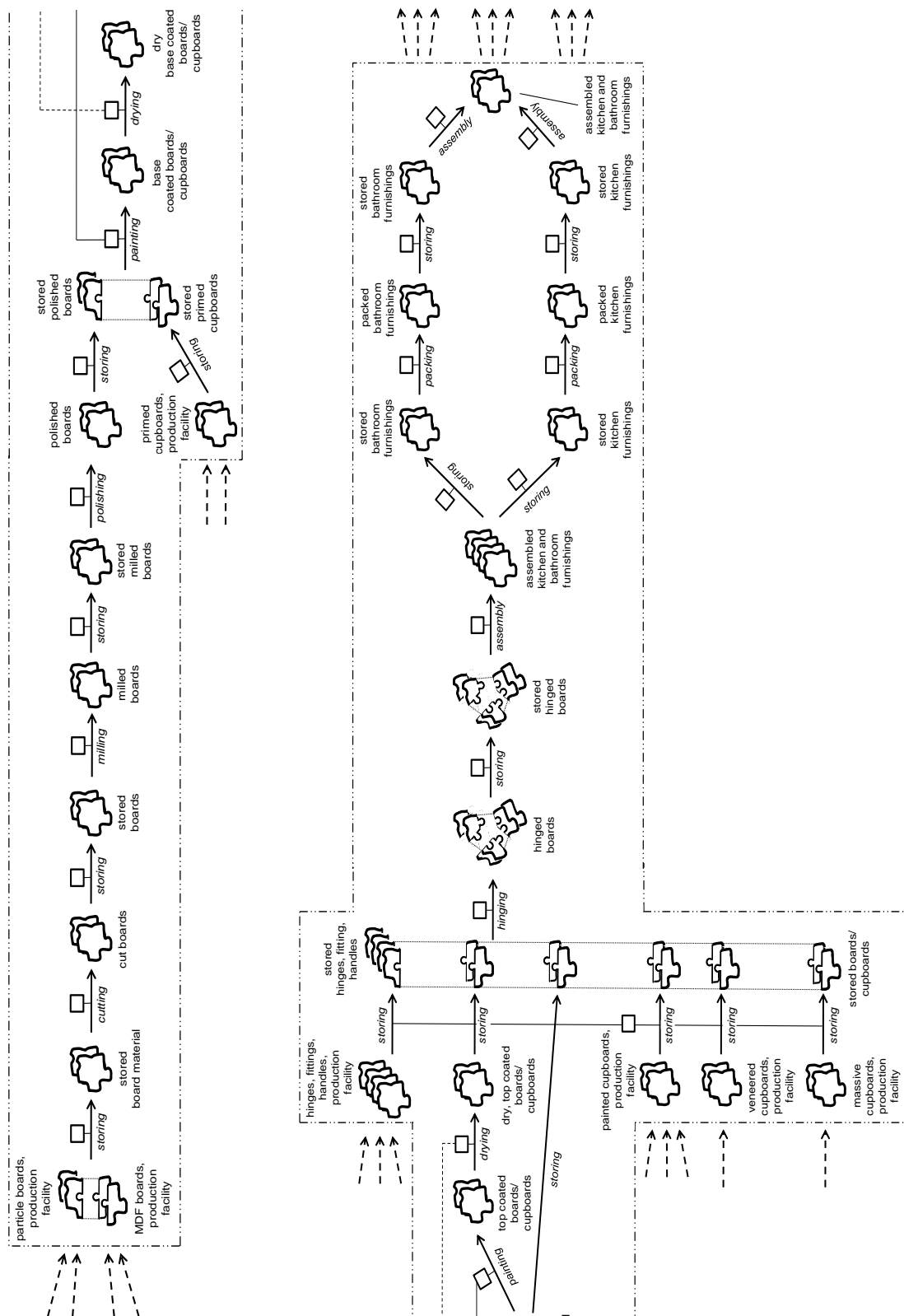


Figure 5.18 The activity structure of the kitchen furnishings producer.

All activities of the activity structure of the KFP display some adjustability. Three of these activities are highlighted in Figure 5.19. The first is the initial storing activity of the firm. The inputs for the activity are particle boards and MDF boards, identifiable as individual resource elements. These boards are of different qualities and dimensions. The inputs for the storing activity thus display a certain amount of variety. This variety is also transferred to the outputs of the activity, i.e. the variety is identified equally with both the inputs and outputs of the activity. The adjustability of the activity is derived from this variety and it allows for the storing of a wide range of different boards.

The adjustability of the painting activity is also derived from the variety of its inputs and outputs. The inputs consist of both polished boards, which have been refined by the KFP, and primed cupboards, purchased from the KCP among others. These two resource elements are painted to produce base coated boards and cupboards. The outputs display a greater variety than the inputs. The boards are painted in different ways, and in different colours, depending on their final destinations. The enabling resource is therefore activated in a variety of ways depending on how the inputs are painted. Thus, in addition to the variety related to the inputs and outputs, the adjustability of the painting activity also derives from variety with the activation of the enabling resource.

The final example of adjustability is the storing activity of hinged boards. Different combinations of boards, cupboards, hinges, handles and fittings are represented by the inputs for the activity. The undertakings of the storing activity do not alter this variety, and so it is identified as equally large as the outputs from the activity.

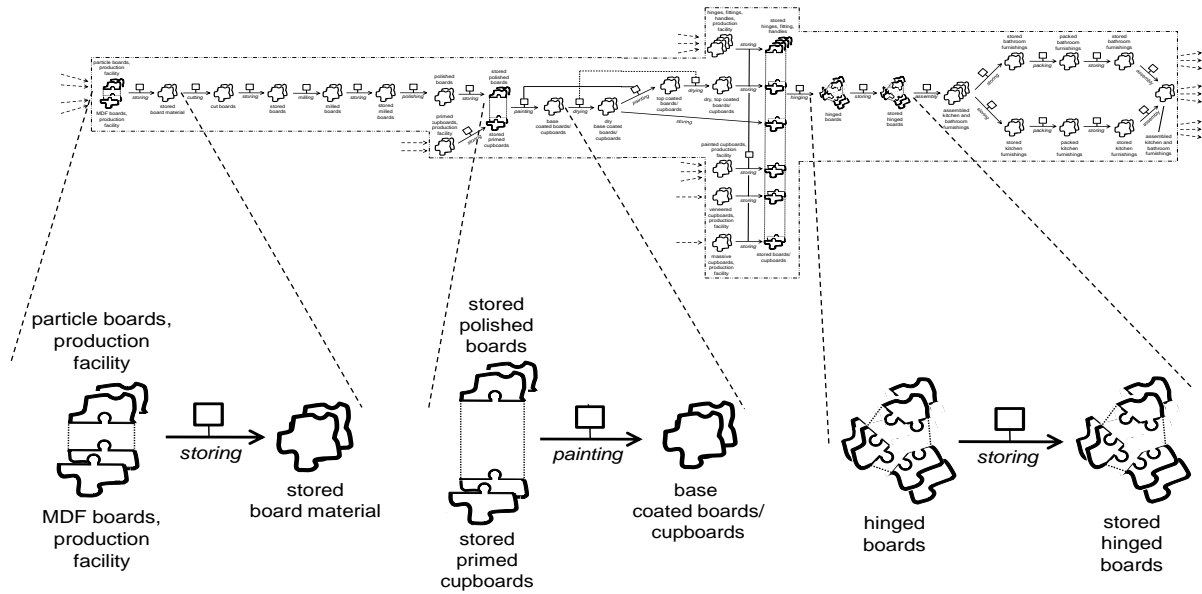


Figure 5.19 Adjustability with three of the activities of the activity structure of the kitchen furnishings producer.

The variety recognized in individual resources allows for the identification of linked adjustability related to activity links. Figure 5.20 illustrates selected activity links and the intermediate resources with which they are associated.

The inputs for the painting activity consist of polished boards and primed cupboards. Both these resource elements display some variety. Each element intersects an input-output related interdependence. The linked adjustability of the activity link between the storing (polished boards) and painting activities derives from the variety of the stored polished boards. In contrast, the linked adjustability of the link between the storing (primed cupboards) and painting activities derives from the variety of the stored primed cupboards. In addition, there is an activity link between the storing activities because of the joint direction of their respective outputs. The linked adjustability of this link derives from the potential combinations of these outputs.

Further downstream in the production process of the firm, the assembly activity links with two downstream storing activities. The assembled kitchen and bathroom furnishings intersect these input-output related interdependencies. The linked adjustability of these links derives from the variety of kitchen and bathroom furnishings, respectively. Here, the linked adjustability of the activity link between the assembly and kitchen storing activities

exceeds that of the assembly and bathroom storing activities. Whereas kitchen furnishings are customized, bathroom furnishings are produced in a number of standard types. In addition, the storing activities link through the joint origin of their respective inputs. The linked adjustability of this link derives from the combinations of their inputs.

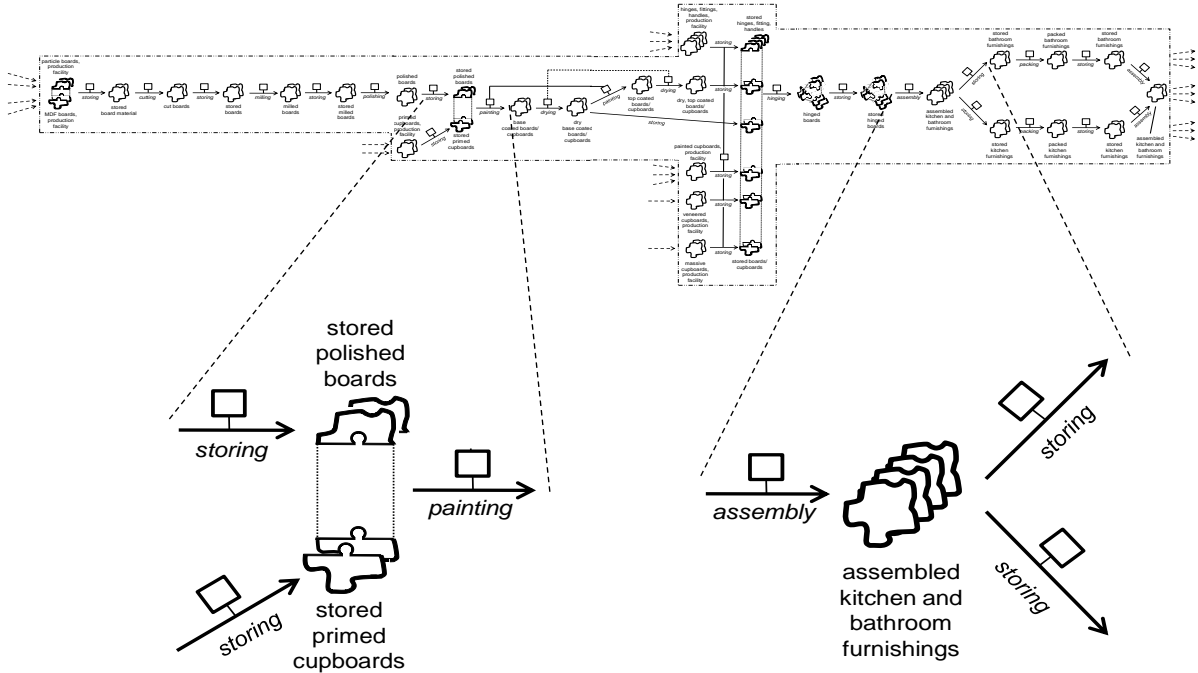


Figure 5.20 Linked adjustability with activity links in the activity structure of the kitchen furnishings producer.

5.2.3 Analysis of the activity structure of the kitchen cupboard producer

The activity structure of the KCP is depicted in Figure 5.21. In comparison with the activities of the firm represented in the activity configuration of the kitchen furnishings delivery, several additional activities are specified. This illustration does not reveal the individual production stages in the production processes of the KCP. Instead the activities are identified on a somewhat different level than the activities in the activity structures of the PBP and the KFP. This is primarily a result of the nature of the information presented in the empirical inquiry.

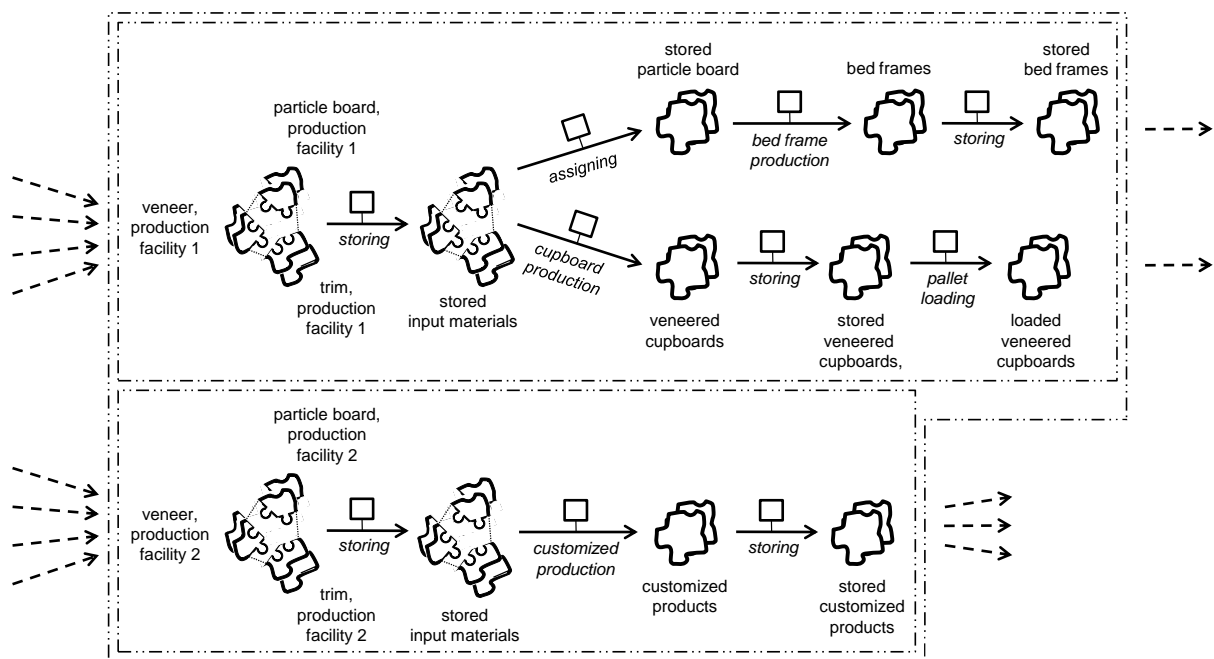


Figure 5.21 The activity structure of the kitchen cupboard producer.

Two activities are highlighted in Figure 5.22. These exemplify the adjustability associated with the internal activities of the KCP. The first activity is the storing activity of production facility 2. This facility only produces customized orders and prides itself on being able to make virtually anything. As a consequence, the adjustability of its activities needs to be extensive. The inputs for the storing activity consist of particle board, veneer and trim. All these resource elements display variety and the variety of the inputs for the storing activity equals the variety of the three resource elements of which it consists. The variety of the outputs from the storing activity equals that of the inputs. The adjustability of the activity is derived from the variety of the inputs and outputs.

The pallet loading activity is highlighted in the information in the empirical inquiry, and illustrated in Figure 5.22. The inputs for the activity consist of stored veneered cupboards, in accordance with the orders from the KFP. Given the customized nature of these orders, the variety of the inputs is emphasized. Depending on these inputs, the enabling resource is activated in different ways. As a result, the outputs of the activity consist of loaded veneered cupboards which are separated into the individual customer orders of the KFP. The

adjustability of the pallet loading activity thus derives from the variety of inputs, outputs, and the enabling resource.

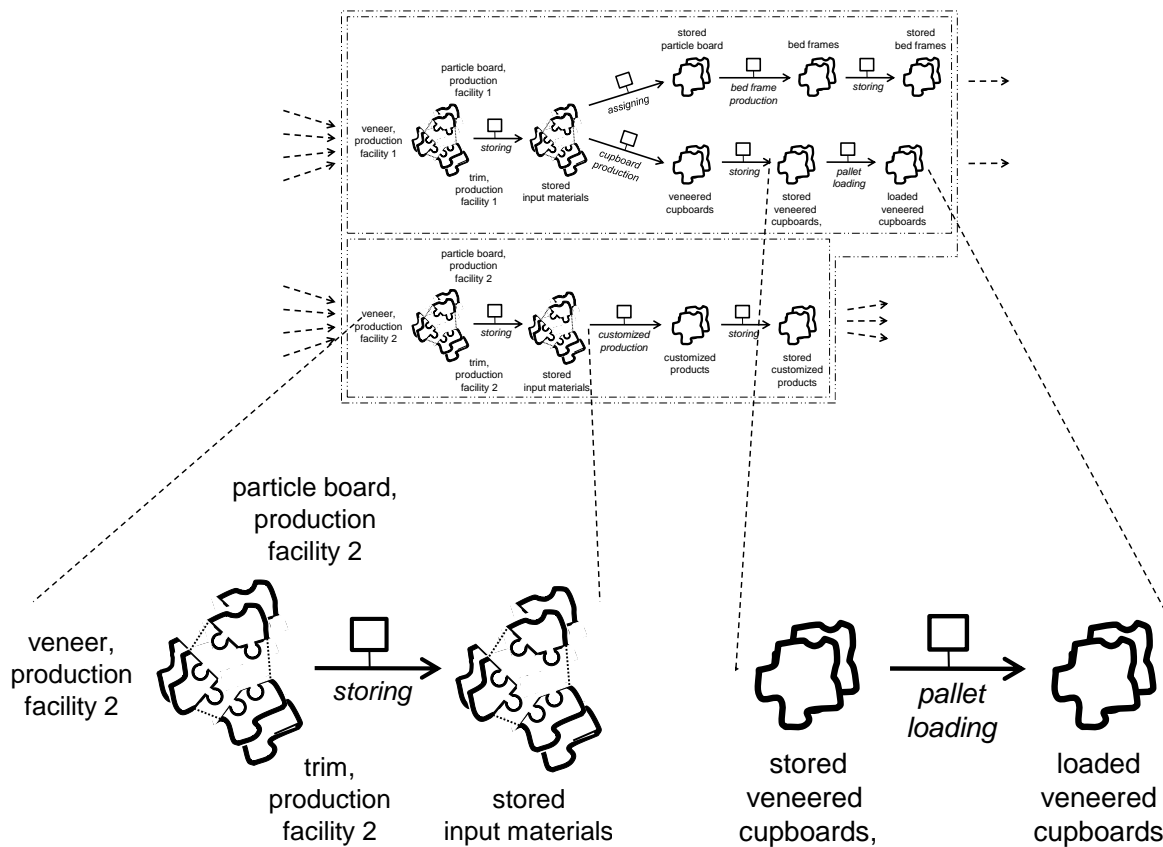


Figure 5.22 Adjustability with two of the activities of the activity structure of the kitchen cupboard producer.

The activity structure of the KCP also reveals activity links. Two such links are highlighted in Figure 5.23. The first represents an input-output related interdependence between the storing and customized production activities at production facility 2. The linked adjustability of this activity link is equal to the variety of the intermediate resource, which consists of stored input materials. The second activity link also represents an input-output related interdependence, this time between the bed frame production and storing activities. The linked adjustability of this link derives from the variety of the bed frames produced.

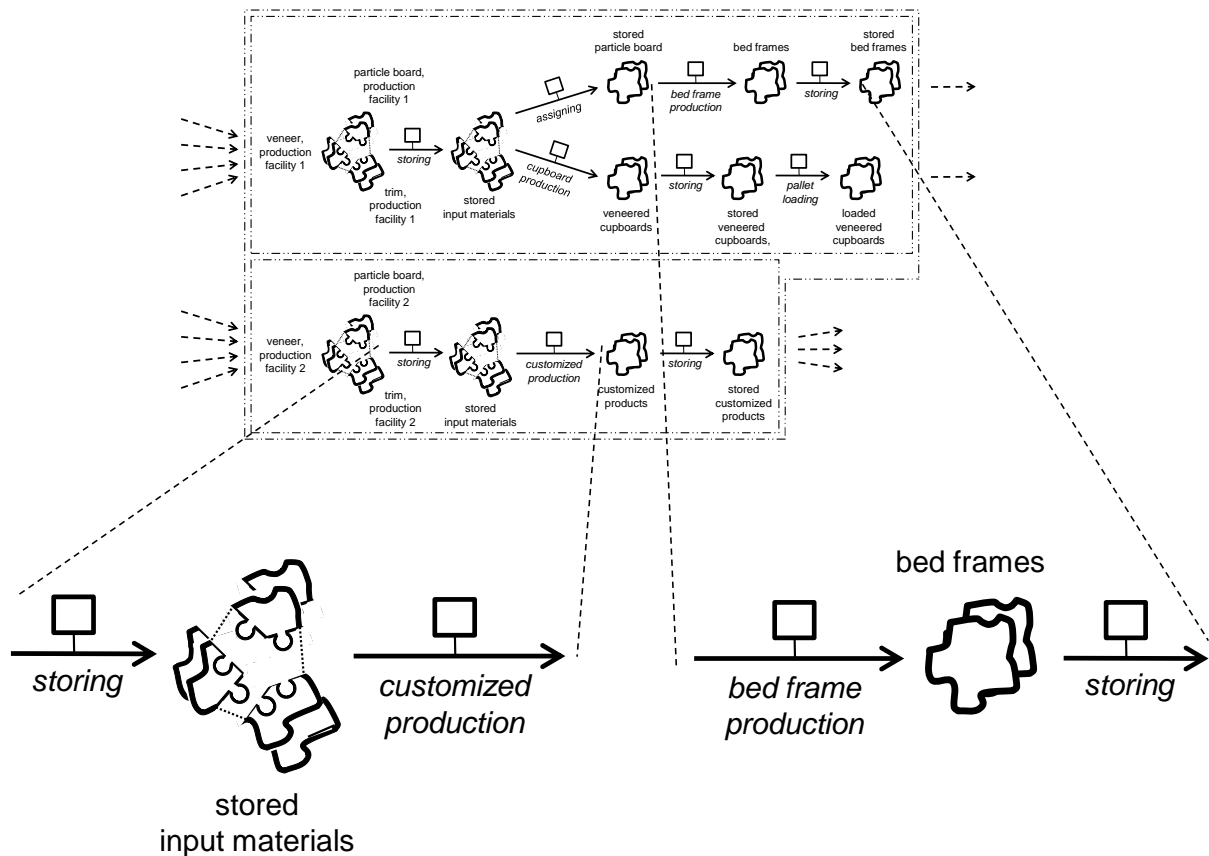


Figure 5.23 Linked adjustability with activity links in the activity structure of the kitchen cupboard producer.

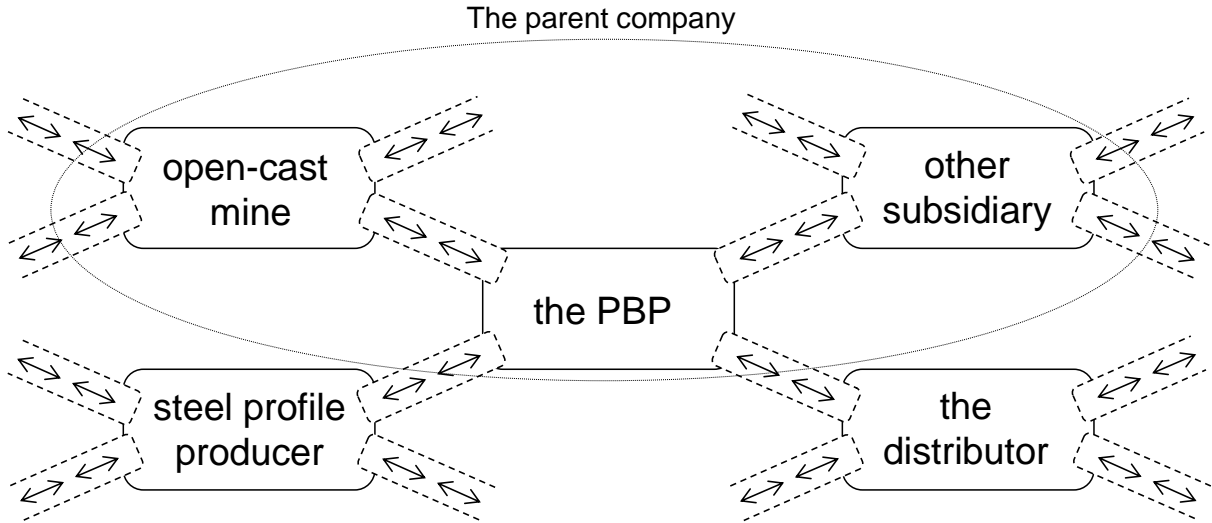
5.3 Analysis of the activity patterns

Each section in this case analysis chapter addresses specific aspects of activity linking. The two previous sections analyzed activity interdependency types and the adjustability related to individual activities and activity links, respectively. In contrast, this section analyses aspects related to the acting, reacting and interacting of individual firms in relation to boundary-crossing activity links. It is related to the information presented in the empirical inquiry as it points out the decision-making of the focal firms and their respective counterparts. Owing to the nature of the empirical information, only selected business relationships of each firm are highlighted.

5.3.1 Analysis of the activity pattern of the plasterboard producer

The information in the empirical inquiry revealed the existence of several business relationships between the PBP and various counterparts. For example, the PBP has two complementary suppliers of cardboard, two suppliers of plaster stone, and one steel profile

supplier. In addition, the firm receives some specialised plaster products from other plasterboard producers belonging to the parent company. On the demand side, the firm has a large number of individual customers. These were separated into categories such as main contractors, house builders, distributors and construction projects in the empirical inquiry. In addition, the firm also delivers certain products to some of the other subsidiaries of the parent company in other countries. The PBP interacts with all these counterparts, some of which for purpose of illustration are highlighted in Figure 5.24 (which draws on the illustration of an activity pattern by Håkansson and Snehota, 1995).



5.24 Selected business relationships of the plasterboard producer, exemplifying the activity pattern of which the firm is part.

The open-cast mine provides the PBP with plaster stone. The two firms belong to the same parent company, which also has a number of European plasterboard producers. The delivery volumes from the open-cast mine are therefore decided by the parent company. The PBP also has an additional supplier of plaster stone, a local power plant. This power plant is operated independently from the PBP, and deliveries are negotiated without the involvement of the parent company. Since plaster stone is a by-product in the production of power, the available volumes depend primarily on the demand for power, and not on the plaster stone requirements of the PBP. The PBP therefore arguably stands a better chance to influence the incoming volumes from the open-cast mine. This requires discussions with the

parent company. To facilitate certain variety of incoming plaster stone volumes, the PBP has a fairly large storing area.

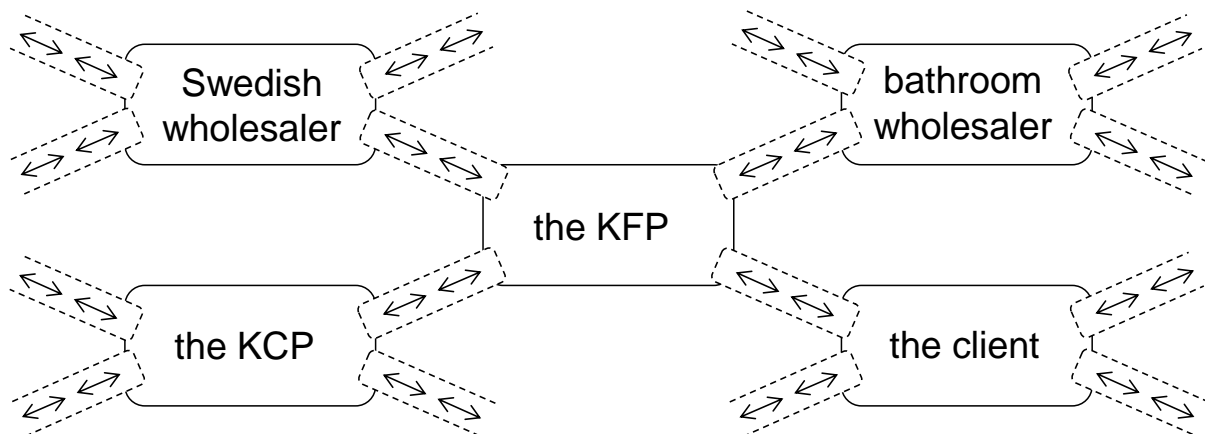
Initially, the PBP purchased steel profiles from a regional steel profile producer. Two different types of steel profiles were bought from this supplier. A product development initiative of the PBP, however, resulted in a steel profile which had the desired characteristics of both these different types and the PBP wanted the steel profile producer to start producing and delivering of this new profile. Since it had been developed by the PBP, the production of the new profile would be on licence. No agreement, however, was made between the two firms, as the steel profile producer found it difficult to fit this new profile into its production process. The PBP then approached a new potential steel profile producer. With this new supplier, the PBP also initiated a vendor managed inventory, VMI.

The other subsidiaries of the parent company, one of which is presented in Figure 5.24, both deliver and are supplied products from the PBP. Guided by the strategic decisions of the parent company, the individual production units make somewhat different products. Low volume products are assigned to specific production units and then delivered to the other units of the parent company. The individual production units are required to communicate not only with the parent company, but also with each other, to make sure that a given product is produced where demand is highest and sent to other units in an efficient way.

With the strategic shift of the PBP, customers are now approached individually. Their specific needs are interpreted into customized plasterboards and system solutions. In general, house builders and large main contractors are more interested in customized solutions than, for example, distributors and smaller main contractors. The distributor in the Ytterby project, illustrated in Figure 5.24, however, remains a prioritized customer of the PBP. In addition to purchasing plasterboard for their own inventory, they also work more or less exclusively with selected main contractors. In order for the PBP to approach these main contractors, the business relationship with the distributor is therefore crucial.

5.3.2 Analysis of the activity pattern of the kitchen furnishings producer

The kitchen furnishings producer has a large number of direct counterparts, both suppliers and customers. The information in the empirical inquiry highlights some of these business relationships, which are also illustrated in Figure 5.25.



5.25 Selected business relationships of the kitchen furnishings producer, exemplifying the activity pattern of which the firm is part.

Particle board is the main component in the production of kitchen and bathroom furnishings. The KFP purchases particle board from a few selected suppliers, all large producers, both Swedish and foreign. With these suppliers, it is crucial to secure timely and accurate deliveries. There have been times when wood chips have been in such high demand, for example to fuel power plants, that the KFP has found it difficult to purchase enough volumes to secure inputs for their production process. This challenge is increased by the limited storing area of the firm which makes it difficult to build up enough buffer stock. The KFP communicates directly with the Swedish suppliers, whereas products from foreign suppliers are purchased through a Swedish wholesaler, as illustrated in Figure 5.25. Given the size of these firms, the KFP is only a small customer. It is therefore difficult to be prioritized during economic upswings, when demand for boards is high.

Hinges, handles and fittings are also purchased through a Swedish wholesaler. This does not, however, mean that the KFP treats the products as if they were standardized and easily replaceable. Instead, these products are considered of strategic importance as they influence the look and feel of a kitchen. It is therefore not only important to find hinges, fittings and handles which have the qualities the KFP is looking for, it is also crucial that they

are not used by any of the firm's main competitors. In addition, the identification and assessment of potential suppliers is aided by the wholesalers, who are in direct contact with a number of different producers.

Cupboards are purchased from a number of medium-sized suppliers. These firms produce cupboards of various types: veneered cupboards are, for example, only purchased from the KCP. This relationship has been so successful that the KFP continuously tries to convince the KCP to start production of other types of cupboards too, for example painted and solid wood ones. The two firms, with emphasis on the KCP, have also made several relationship-specific adjustments. The investments in production equipment, revised working procedures and the establishment of new delivery routines are only a few examples. At the same time, the KFP encourages the KCP to develop other business relationships as well. Not only is it considered problematic if the KCP becomes too dependent on the business from the KFP, there are other advantages for the KFP if the KCP expand their business. It would, for example, give them reason to expand their product range regardless of the demand from the KFP.

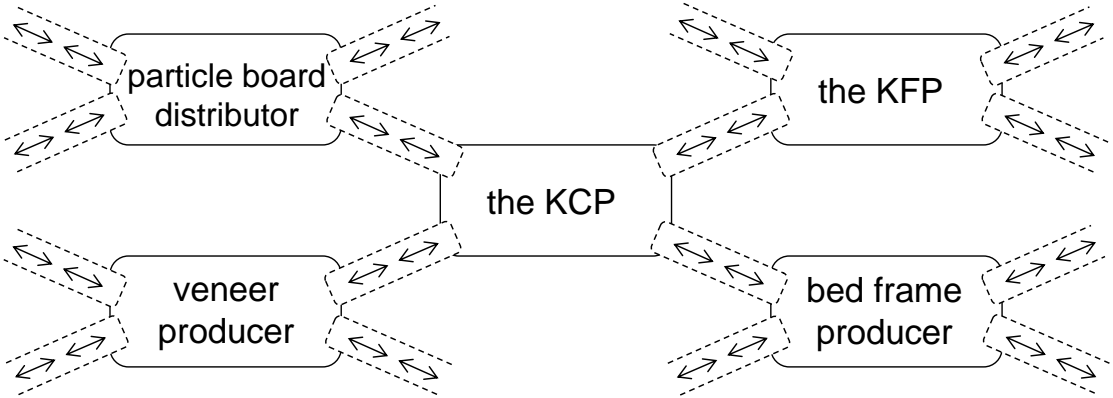
Bathrooms are purchased by wholesalers, who market them to end users. The interaction with these wholesalers is quite different than with the KFP's customers for kitchen furnishings. The wholesalers require immediate deliveries of primarily standardised bathroom furnishings, which requires the KFP to store large amounts of finished bathroom products awaiting delivery. It has proven difficult to change the purchasing strategy of these wholesalers, so the KFP is continuously challenged by the different requirements of the two business areas.

The client in the Ytterby project is the third largest customer of the KFP. Initially only supplying kitchen furnishings to the client's single family housing projects, the relationship has developed successively and now also includes deliveries to most of the multi-family housing projects of the client. This was how the main contractor in the Ytterby project came in contact with the KFP. Since then, the main contractor has expressed an interest in becoming a prioritized customer of the KFP. Owing to the extent of their current engagements, the KFP has, however, been somewhat reluctant to enter into any framework agreements with the main contractor. The relationship between the two firms has evolved in

any case, and the KFP now supplies the majority of all the housing projects of the main contractor.

5.3.3 Analysis of the activity pattern of the kitchen cupboard producer

The empirical inquiry exemplified some of the most important counterparts of the KCP. Figure 5.26 illustrates some of the business relationships between the KCP and these firms.



5.26 Selected business relationships of the kitchen cupboard producer, exemplifying the activity pattern of which the firm is part.

Of the suppliers of the KCP, only a few have been exemplified in the empirical inquiry. With all of them, the KCP has an ambition to work long-term. They rarely replace suppliers unless they feel required to, and they also aim to work with firms located in the proximity of their production facilities. As this is situated in a part of Sweden well known for its furniture industries, there are often local supplier alternatives present. The supplier of particle board, however, is a large Swedish distributor, as illustrated in Figure 5.26. There are few alternative suppliers of particle board, which limits the number of choices. From this distributor, the KCP also purchases a number of other products, so the two firms have a well established business relationship.

Of the purchased materials, veneer is the most expensive. In addition, the quality and characteristics of a certain veneer depends on the specific supplier and even on the individual at the supplying firm who sews the veneer. For this reason, changing veneer supplier is very difficult. It can even cause a problem if the individual is replaced. For this reason, the KCP is very conscious of the need to maintain a good relationship with the

Nordic veneer supplier from whom they are currently purchasing. At the same time, they acknowledge the risk of being dependent on this one supplier. One of the change initiatives in section 5.4 also indicates their future ambition to produce veneer in house.

Their customers are divided into three main categories. Their most important customer is the KFP. The business relationship between these two firms has developed rapidly and involves substantial interaction on an almost daily basis. It was initiated as the KFP was looking for a new supplier of veneered cupboards and has evolved to include a number of different products. In addition, the KFP continuously inquires into the possibilities of extending the product range even further. Whereas suggestions for new products usually originate with the KFP, the KCP is always involved in material choices and technical production issues, which is recognized as their core competence. Given the market knowledge of the KFP and the product knowledge of the KCP, the two firms are often required to work together in the development of new products. The KCP has agreed to several adjustments to cater to the needs of the KFP. One example is the change of loading pallets, which in reality means that the KCP is now undertaking an activity which was previously undertaken by the KFP.

The KCP also work closely with a national bed frame producer. In addition to producing several of their frames, the KCP are involved in the production of test versions that are under development. The production facilities of the two firms are also located in the proximity of each other, which facilitates interaction.

5.4 Change initiatives

The information in the empirical inquiry reveals a number of distinct change initiatives in the activity patterns of the PBP and KCP. These initiatives relate to activity linking in time, thus allowing for the illustration and discussion of adjustments. As recognized here, activity adjustments are associated with the modification of an activity's inputs, outputs and/or enabling resources. A previous section highlighted the potential variety of the resources of an activity. However, under certain circumstances resource changes are made which modify this variety. Such resource modifications increase or decrease the variety of a resource. In light of such modifications, the adjustability of an activity is altered. Activity *adjustments* are thus identified as alterations of the adjustability of an activity, derived from modifications of

its resources. The change initiatives in this section illustrate activity adjustments and thereby enable the activity linking discussion in the upcoming chapter. As clear from this section, activity adjustments are related to both the establishment and development of existing activity links.

5.4.1 Change initiatives related to the plasterboard producer

Three change initiatives related to the activities of the PBP are identified in the empirical material.

The first concerns the customization of Aquapanel. Initially, Aquapanel was only sold in a number of standardized dimensions, since the PBP did not have the equipment to customize individual boards. Instead of the PBP making this investment, it was made by one of their customers. This customer was subsequently responsible for all customization of Aquapanel, not only for its internal requirements, but also for other customers of the PBP. The resulting activity 'chain' is illustrated in Figure 5.27. The production of standardized Aquapanel is done by another company in the group. They are then delivered to the PBP, where they are stored. When ordered by customers of the PBP, they are delivered to the customer responsible for the customization activity. Once this has been undertaken, the Aquapanel are returned to the PBP, unless they are used in the production process of the 'customizing' customer. The PBP then stores them a second time, before they are delivered to their final destinations.

Compared with the initial setup, the change initiative involved the establishment of a few additional activities. In addition to the customization activity, delivery activities are also required to transport the standardized and customized boards to different firms. Moreover, an additional storing activity was established with the PBP. Thus, the change did not primarily involve the development of existing activities and activity links, but instead required the establishment of additional activities, and thus also activity links.

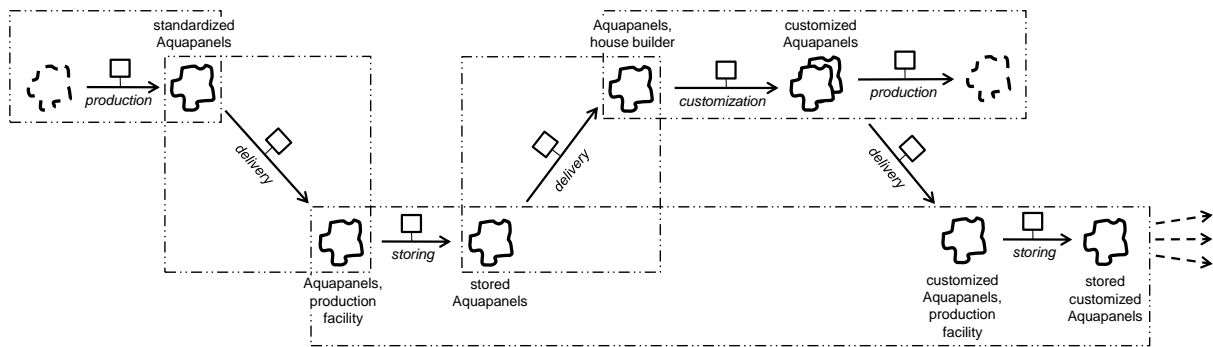


Figure 5.27 The production setup for the customization of Aquapanel.

The second change initiative of the PBP concerns the establishment of a vendor managed inventory (VMI) of steel profiles. With the initial setup, the PBP was responsible for forecasting and purchasing steel profiles for their own inventory. This is illustrated in Figure 5.28, together with the change that followed. Initially, the steel profiles were produced by the steel profile producer and the subsequent storing activity was undertaken by the PBP. For several reasons, the PBP changed steel profile producers. With this change, a VMI solution was also agreed upon with the new producer of steel profiles. In principle, this means that the storing activity is undertaken by the steel profile producer; i.e. they take title to the steel profiles even when they are in the inventory. However, the storing activity is undertaken at the production facility of the PBP, who is also responsible for keeping track of and communicating inventory levels to the steel profile producer.

In contrast to the previous change initiative, no additional activities are established in this example. Instead, the existing activities are relocated between actors, and the enabling resource of the storing activity is activated in a different way. While the PBP is no longer responsible for the actual undertakings of the storing activity as such, they are still very much involved in it. This is illustrated in Figure 5.28, where the enabling resource of the storing activity is divided in two, concerning both actors. The illustration also indicates another change of the delivery setup of the steel profiles. Whereas these were initially produced in two different types, a product development initiative of the PBP means that one type of profile has now replaced the previous two, and the inputs and outputs of the individual activities are changed accordingly.

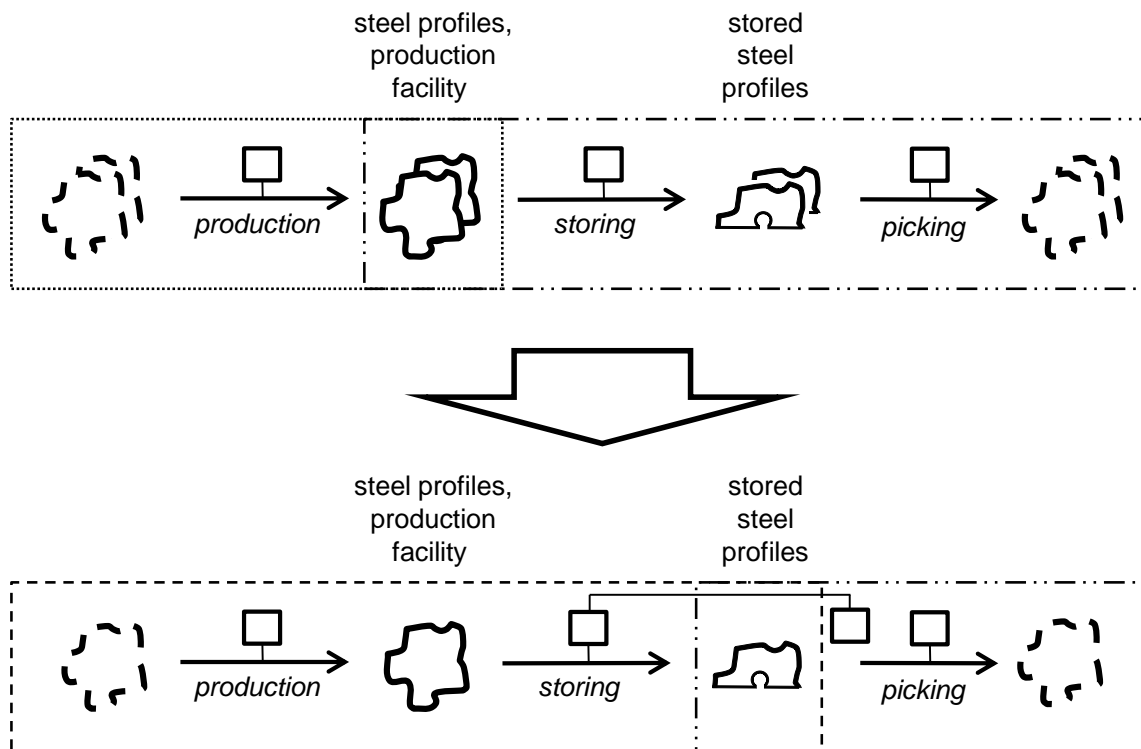


Figure 5.28 The establishment of a VMI for the delivery of steel profiles.

The third change initiative concerns the establishment of a new intermediate storage area. Previously, all plasterboards were sent from the production facility in southern Sweden. Upon request from a large regional customer, an intermediate storage area was established close to Stockholm. It was primarily meant for sourcing the specific customer, but its strategic location makes it interesting with regard to other potential customers working in the region as well. This change is illustrated in Figure 5.29.

The finished plasterboards and steel profiles are picked from the storage area of the production facility of the PBP and sent to the intermediate storage. There, they are stored again awaiting delivery to their final destinations. This change involved the establishment of additional activities undertaken by the PBP, whose activity structure has expanded accordingly. The activities previously part of the activity structure of the PBP were not changed in light of this change initiative.

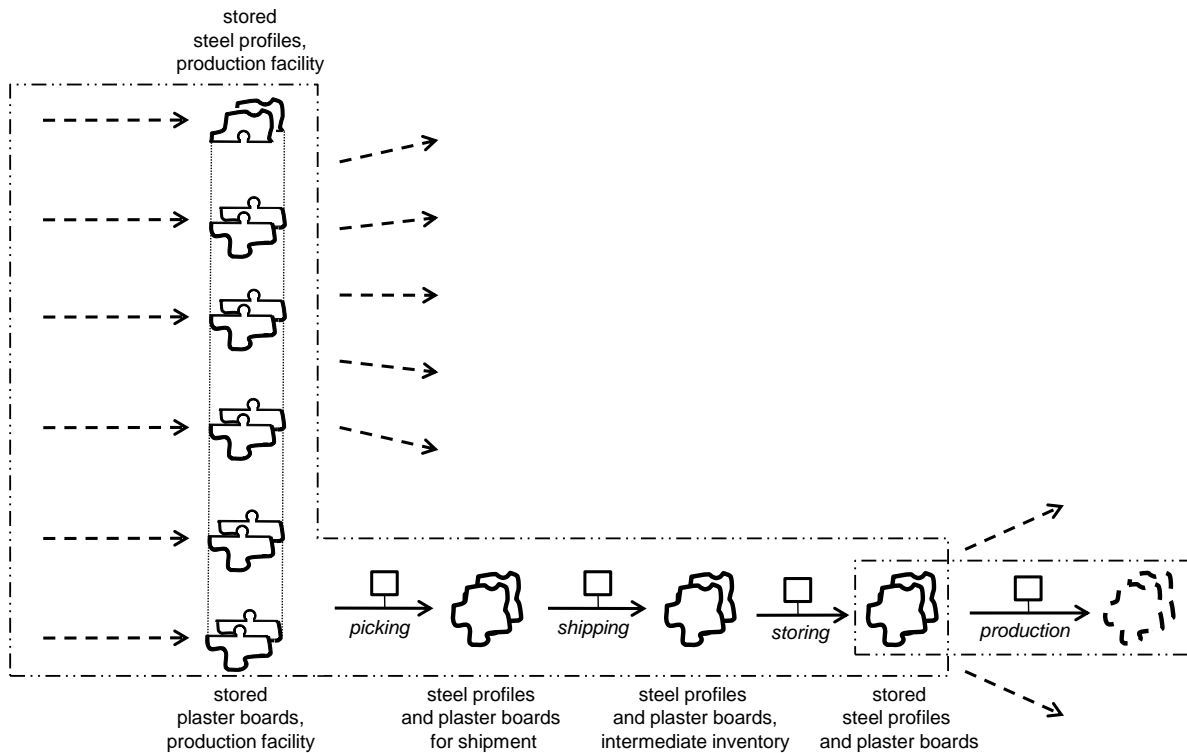


Figure 5.29 The establishment of an intermediate storage area.

5.4.2 Change initiatives related to the kitchen cupboard producer

Three change initiatives related to the activities of the KCP are identified in the empirical material.

The first change initiative concerns the acquisition of a new customer. The KCP acquired a neighbouring carpentry firm, which had run into financial difficulties. Originally, the acquisition was made in an attempt to expand the current production facilities of the KCP, as well as to gain access to valuable production equipment. The decision was later made to bring the individual production lines together. Previously, these had been separated to avoid conflicts of interest and to specialize the workforce, but this had turned out to be at the expense of efficient resource utilization, so it was now desirable to locate all production activities in the same facility. This plan is illustrated in Figure 5.30, where the same enabling resource is activated by all the individual production activities of the KCP.

The neighbouring carpentry firm had an existing customer, a large door frame producer. This customer was taken over by the KCP and as a result they now have a fourth leg to stand on, as illustrated in Figure 5.30. The door frame production activities were previously

undertaken by the neighbouring carpentry firm and are now part of the activity structure of the KCP.

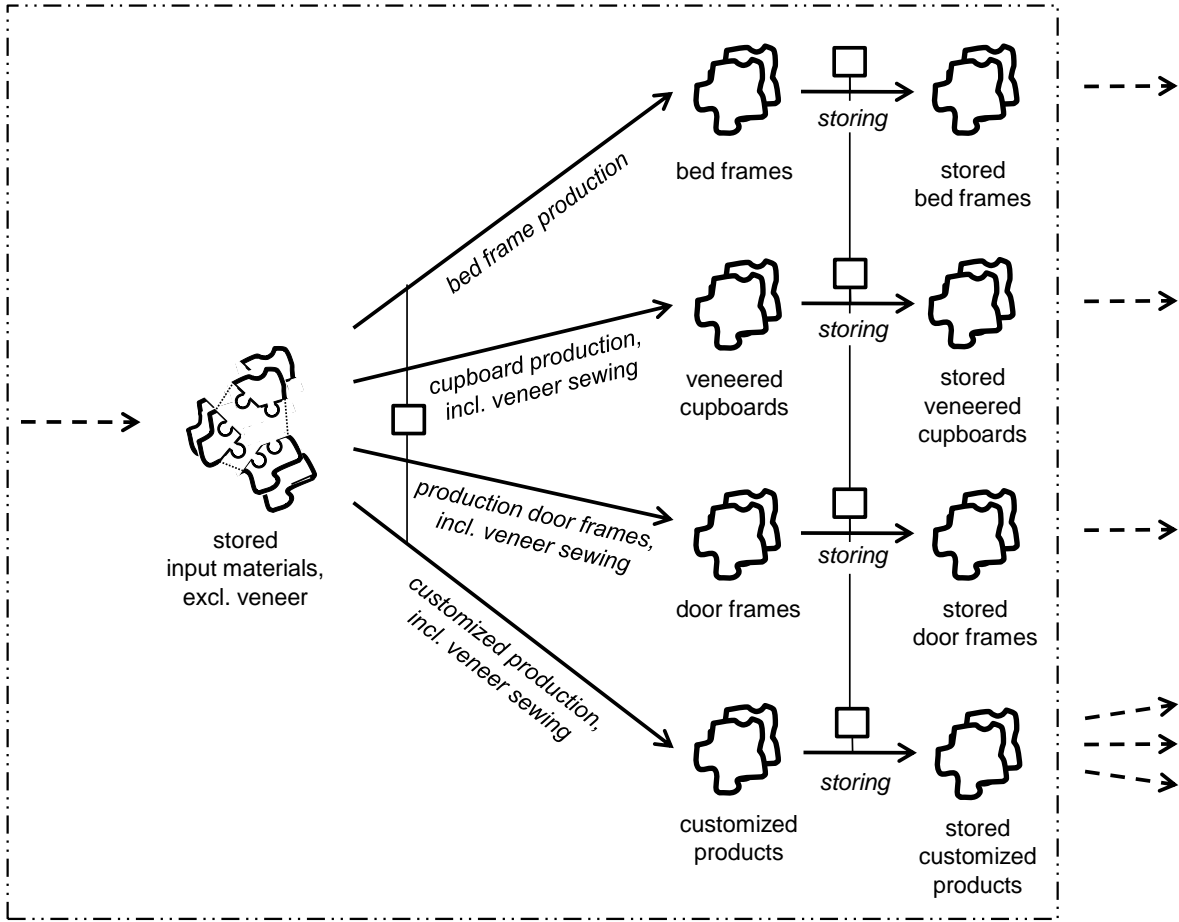


Figure 5.30 The introduction of a new customer, a door frame producer.

The second change initiative, too, concerned the acquisition of a new customer, an additional kitchen furnishings producer. Although the KCP had previously delivered exclusively to the KFP, the opportunity presented itself to deliver cupboards to another kitchen furnishings producer, not in direct competition with the KFP. The KCP is careful not to deliver exactly the same cupboards to both customers; there have to be some small differences. This is illustrated in Figure 5.31, where the cupboard production process of the KCP is divided into three separate activities, one which is the same for both customers, and two which are unique to each customer. In contrast to the previous production setup, the KCP has differentiated their production activities to be able to deliver to both customers. However, the same quality levels and production techniques apply in both cases, so the KCP has been able to improve their resource utilization.

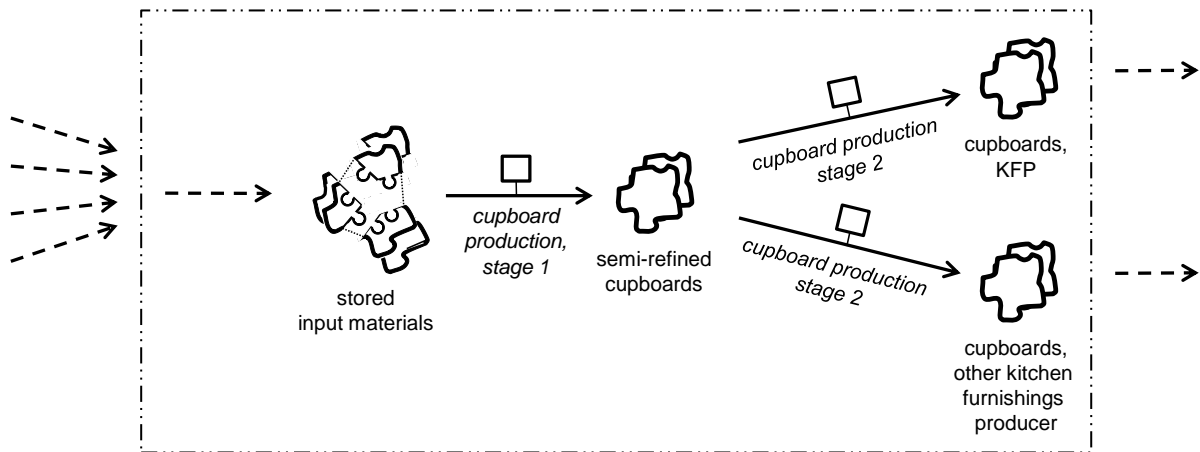


Figure 5.31 The introduction of a new customer, an additional kitchen furnishings producer.

The final change initiative of the KCP concerns extended delivery responsibilities to the kitchen furnishings producer. Previously, the KCP only delivered veneered cupboards. The production of solid wood and painted cupboard was thought to require capabilities the KCP did not possess at the time. However, in line with changing end user demands and requests from the KFP, the KCP eventually decided to broaden their product range. This is illustrated in Figure 5.32. They therefore established a new supplier relationship, with a producer of wooden boards. They also changed the enabling resource of the cupboard production activity, as additional capabilities are required for the production of solid wood and painted cupboards.

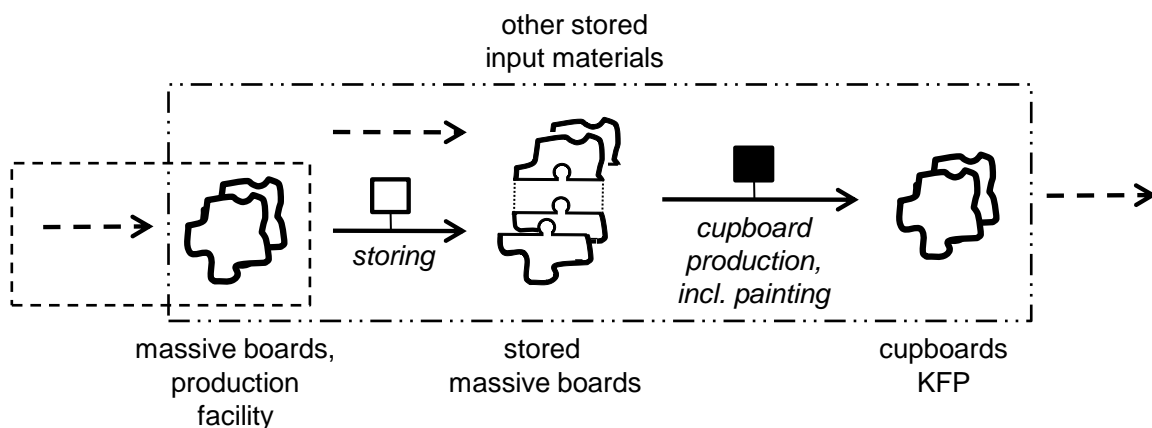


Figure 5.32 The extended delivery responsibilities of the kitchen furnishings producer.

6 Activity Linking in Space and Time

This chapter suggests a conceptual scheme for the analysis of activity linking. Three main analytical concepts are thus developed, supported both by the analysis in the previous chapter and the theoretical discussions in the frame of reference. The first concept relates to the ways in which bridging resources allow for the specification of the structural relationship between activities. The second concerns the change of these structural relationships, made specific with activity adjustments, and the third targets the activity linking of an actor, undertaking activities and activating resources.

This chapter repeats, sorts, relates and expands arguments and notions put forward in the previous chapters in order to present a scheme for the analysis of activity linking. The conceptual building blocks for this thesis were initially presented in the frame of reference. The case analysis chapter then explored selected concepts and introduced additional ones. In accordance with this chapter, bridging resources enable the illustration of activity interdependency types. In addition, adjustability and linked adjustability target the variety of the resources of an activity and activity link, respectively. The actions, reactions and interaction of individual firms were also exemplified, as were a number of adjustments and the establishment and development of existing activity links in which these adjustments resulted.

This chapter returns to these concepts and relates them to each other. The ambition is to present a stand-alone analysis, and so the chapter repeats the concepts and their respective definitions. At the same time, the analysis is structured somewhat differently. Instead of, as in the previous chapter, developing the analysis according to individual analytical scopes, this chapter aims to take an explicit activity focus by emphasising the individual activity and activity link. Space and time are crucial analytical dimensions in this activity focus, and so these are used to separate the analysis.

As evident in previous discussions, the activity focus of this thesis implies the analysis of activities by means of resources and actors. Thus, for the specification of *activity linking*¹⁰,

¹⁰ To facilitate reading, all concepts in this analysis are italicized when first introduced, and explicitly defined. The revised definition of activity linking is, however, not presented until the end of the chapter, supported by the previous concepts.

the activity dimension is defined and analyzed in relation to both resources and actors. This approach allows for the development of a scheme for the analysis of activity linking.

Activities are always undertaken in a context of other activities with which they are directly and indirectly linked. Thus the linking of activities concerns all activities. From the perspective of an actor undertaking activities, they need to be linked both within and across the actor’s boundaries. An aspect of inter-organizational business relationships allows for the analysis of activity linking not only within but also between the boundaries of individual actors.

6.1 The representation of space with activity interdependency types

Industrial activities are undertaken in a context of resources. Activities and resources are thus related. This relatedness can be depicted in different ways. Section 2.4 suggested one such depiction. It is now repeated and explored, with the support of the illustrations and discussions in the case analysis chapter.

According to Håkansson (1987), activities “change or exchange resources through the use of other resources” (p. 17). This specific relatedness between activities and resources allows for the identification of two principal types of resources. The *enabling* and *object resources* from section 2.5 are again illustrated in Figure 6.1.

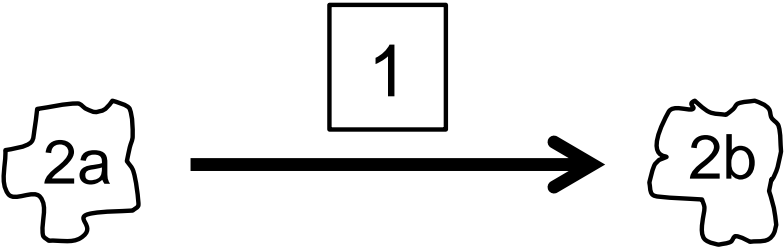


Figure 6.1 An activity connected with enabling (1) and object (2a-b) resources.

An enabling resource (1) is activated for the actual activity undertaking. This corresponds to what Richardson (1972) identified as capabilities. These can be machines, equipment or personnel, while object resources (2) are activated in the activity undertaking, and are the objects of it. Such object resources are primarily raw materials, components and end products, refined through the activity undertaking. In addition, with regard to the individual activity, a further distinction of object resources is made. The object resource input for the

activity (2a) is distinguished from the object resource output from the activity (2b). The output is a refined version of the input. This notion is related to Hulthén (2002), who says that inputs “*come out of the transformations with new features, as transformation outputs*” (p. 33). Most object resources are labelled as both an input and an output, depending on the specific activity to which they are related. For example, the milled boards in the production process of the KFP are outputs from the milling activity, but inputs for the downstream storing activity.

By definition, each ‘*individual activity undertaking*’ is related to only one input, one output and one enabling resource. This was illustrated in the analyses of the two activity configurations. For example, the carrying activity at the construction site of the Ytterby project was only undertaken to carry the specific kitchens into their assigned flats. How the carrying activity is undertaken with regard to other material deliveries is not covered by the scope of the configuration.

However, the resources related to an individual activity undertaking can consist of several resource elements: from the perspective of the activity, its input might be separable into several input elements. The same holds true for its output and enabling resource. Resource elements are thus the distinguishable parts of which an individual resource consists. For example, the input for the sandwiching activity of the PBP consists of both cardboard and plaster pulp. In the same vein, the output from the fine-cutting activity in the plasterboard activity configuration is separable into boards that are stored and boards that are customized in the width-cutting activity. An enabling resource also often consists of several distinguishable parts such as the machines and personnel required for undertaking the individual activities of the production process of the PBP.

An analytical expansion of Figure 6.1 can be used to describe the continuous nature of most activity undertakings. Activities are ordinarily undertaken more than once. The activity structures of each actor points to such ongoing activity undertakings. In contrast, the activity configurations harbour only individual activity undertakings, such as those described above.

When considering the continuous undertakings of an activity, a certain variety¹¹ is identified. This was explored in the analysis of the three activity structures in the case analysis chapter. Again the sandwiching activity provides a good example. The inputs for this activity are cardboard and plaster pulp. Depending on what specific board is produced, different types of cardboard and plaster pulp might be used. As a result, the outputs are also affected, as is the activation of the enabling resources. This does not imply any structural change of the undertakings of the activity, but only a change within an existing range of the ‘resources of an activity’¹². What is understood as the same principle resource type, from the perspective of the individual activity, might thus display some variety. By definition, variety is the change of a resource within an existing range (this does not imply changing the resource itself, which is the case when making activity adjustments). Consider for example most storing activities analyzed in the case analysis. In addition to the elements associated with some of their resources, many of these resource elements also display variety. There are, for example, a number of different types of particle boards and MDF boards input for the storing activity of the KFP. In principle, variety could thus result from changes within the range of one or only a few of the resource elements of which a resource consists.

The variety related to the resources of an activity represents the ‘flexibility’ of the undertakings of that activity. This too was illustrated and discussed in the case analysis chapter. An activity might, for example, use a variety of inputs, while it still delivers the same output(s), or vice versa. This ‘flexibility’ is termed as the *adjustability* of an activity. By definition, adjustability represents the flexibility of an activity’s undertakings, derived from the variety related to its resources. The fine-cutting activity of the PBP receives an input of a standardized length. With this standardized input, the activity delivers outputs with a range of different lengths. Thus, the flexibility of the undertaking of the fine-cutting activity enables it to deliver a variety of outputs, while receiving an input which is standardized in length. As indicated in this example, the variety of the outputs must be matched with the

¹¹ Here, variety is a concept related to the resources of an individual activity. As such, it differs from the definition put forward in section 2.2.2, arguing variety in relation to resource interfaces.

¹² As initially specified in the frame of reference, the ‘resources of an activity’ denote the input(s), output(s) and enabling resource(s) directly related to this activity.

variety of the enabling resource of the activity. That is, to facilitate the cutting of different lengths, the enabling resource must be activated somewhat differently. If there is no variety related to two of the resource types of an activity, variety cannot be displayed with the third resource type either.

With this analytical expansion, not only individual activity undertakings are captured, but the whole range of potential undertakings of an activity. The adjustability is different for different activities. For example, the resources of the calcination activity of the PBP display no apparent variety. The input is a standardized plaster powder, output from the grinding activity, and the output is a standardized dried plaster powder. The enabling resource is activated in exactly the same way with each individual activity undertaking. Thus the calcination activity of the PBP displays no adjustability. In contrast, the assembly activity of the KFP is associated with pronounced adjustability. A variety of boards and cupboards with different hinges, fitting and handles are input for the activity. A variety of assembled kitchen and bathroom furnishings are output from the activity. In addition, the enabling resource is activated in a variety of different ways, to be able to assemble all these different input materials. Variety is thus recognized with all resources of this specific activity.

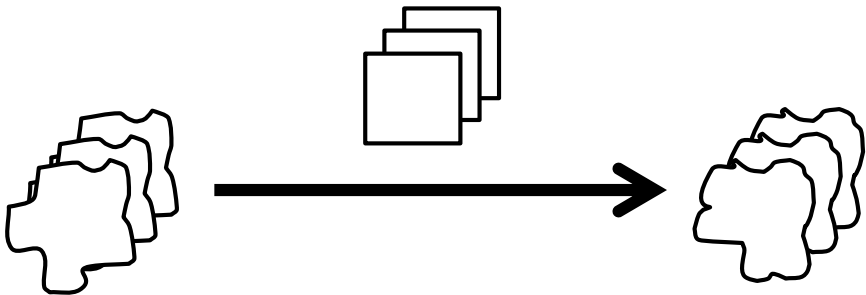


Figure 6.2 The adjustability of an activity.

The illustration in Figure 6.2 shows an activity and its resources. Each resource displays a variety that allows it to be changed in three different ways (“the range”) with regard to the undertakings of the activity. As argued above, the change of an individual resource might involve the change of only one or a few of its constituent resource elements. In relation to the principal argumentation, it is nonetheless identified as a changed resource.

As illustrated in Figure 6.2, and as presented above, the adjustability of an activity is represented in the variety of its resources. The identification of the adjustability of an

individual activity can thus be approached by analysing of its resources. This was highlighted in the previous chapter, where the adjustability of individual activities was discussed as the variety of their respective resources.

With this basic relatedness of activities and resources, the issue of connected activities is approached. The specific relatedness between activities and resources means that activities intersect resource ties, and resources intersect activity links. One dimension thus *bridges*¹³ the connection of the other and an activity links with other activities through its resources.

Activity links are made specific with activity *interdependencies*. In the frame of reference, three interdependency typologies were presented and related. From these, four interdependency types were suggested. These were illustrated in the previous chapter and are now briefly recapitulated and specified in light of the activity-resource relatedness specified above.

Input-output related interdependence is illustrated in Figure 6.3. This figure also highlights an important notion presented above. An individual object resource is often labelled as both an input and an output, depending on the activity to which it is related. Furthermore, this interdependency type represents a kind of structural backbone for activity analysis. As illustrated in the case analysis, all activities are exposed to it and two of the interdependency types presented below derive from this input-output related interdependence between activities.

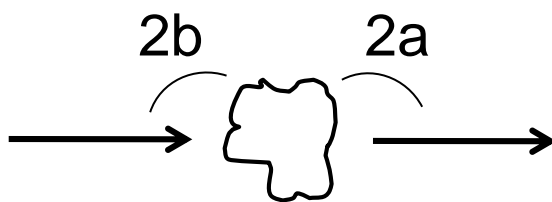


Figure 6.3 An activity link subject to input-output related interdependence. Distinguishing between inputs and outputs in accordance with Figure 6.1, the bridging resource is an output in relation to the first activity (2b), and an input in relation to the second (2a).

¹³ By definition, bridging resources facilitate the connection of two activities.

The definition of joint interdependence given by Håkansson et al. (2009) aids the specification of the second and third activity interdependency types in this thesis. These acknowledge interdependence between activities which have *joint direction of outputs* and *joint origin of inputs*, respectively. Joint direction of outputs exists when two activities (individually) deliver outputs required as inputs for a common third activity. In contrast, joint origin of inputs exists when two activities require inputs which are delivered as outputs from a common third activity. These types of interdependency are illustrated in Figures 6.4 and 6.5. With regard to the illustration of joint direction of outputs, the two resource elements of the bridging resource are clearly identifiable (illustrated as a puzzle with two pieces, as in the illustrations in the case analysis chapter) as they are separate outputs from two different activities.

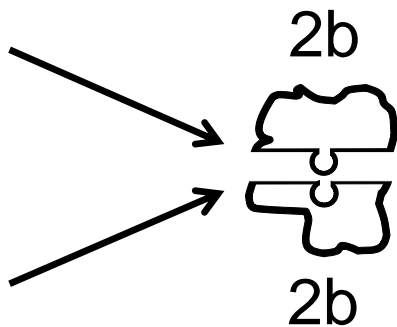


Figure 6.4 Joint direction of outputs (in accordance with Figure 6.1, both elements of the bridging resource are outputs in relation to the two activities (2b)).

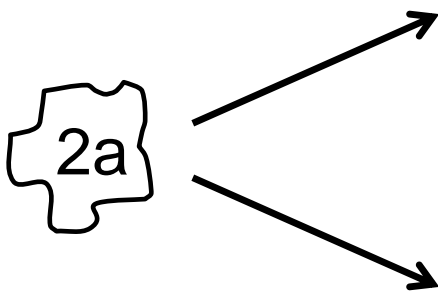


Figure 6.5 Joint origin of inputs (in accordance with Figure 6.1, the bridging resource is an input in relation to both activities (2a)).

In relation to all three types of activity interdependency the intermediate resource is an object resource, but an enabling resource can also connect two activities when they require

the same enabling resource for their undertaking. In section 2.4.1, this was identified as activities which require the same capabilities for their individual undertakings. Here, they are identified in *the shared activation of an enabling resource*¹⁴. This type of activity interdependency corresponds to what Richardson (1972) targeted with his analysis of similarities among activities, and it was also indicated in the specification of pooled interdependence by Thompson (1967). The shared activation of an enabling resource is illustrated in Figure 6.6.

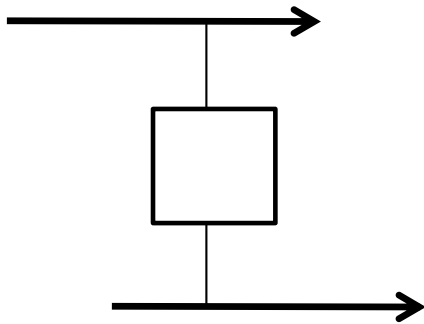


Figure 6.6 Shared activation of an enabling resource.

These four types of activity interdependency represent distinct ways in which activities link. Two activities might link in a way involving several of the interdependency types specified above. If so, they are separated into several individual activity links. An activity can thus have several links to another given activity. In addition, both the frame of reference and the case analysis indicated indirect activity interdependencies. With this typology, such indirect interdependencies can be separated into any combination of the four suggested activity interdependency types, making indirect interdependencies specific and traceable.

Activity interdependencies specify the type of link(s) between two activities. However, they say little about the characteristics of the link(s). To target one aspect of such suggested characteristics, the concept of activity adjustability is related to the activity link.

An activity link is facilitated by a bridging resource. There is variety related to this bridging resource, just as there is variety related to the resources of an activity. With regard to the

¹⁴ Whereas joint origin of inputs indicates the pursuance of economies of scale (through up-scaling of the outputs), shared activation of an enabling resource is related to resource utilization and economies of scope (through common use of enabling resources).

activity link, the bridging resource can be changed in a number of ways without compromising the integrity of the link. In a way, this variety of the bridging resource indicates how ‘flexible’ the activity undertakings of the individual activities are vis-à-vis each other, i.e. how they condition each other’s undertakings. The flexibility of the undertakings of an activity link, derived from the variety related to its bridging resource, is represented with the concept of *linked adjustability*. Such linked adjustability was illustrated in the case analysis chapter and is seen in Figure 6.7, where an activity link subject to input-output related interdependence is depicted¹⁵.

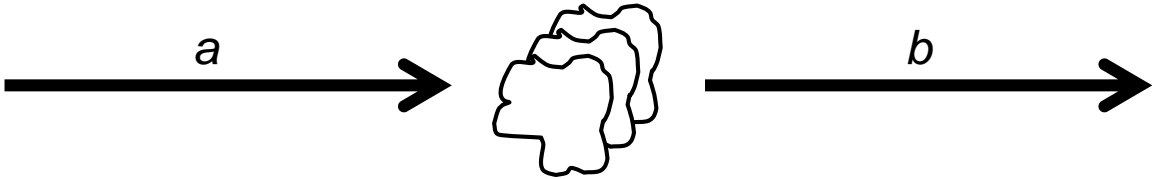


Figure 6.7 The linked adjustability of an activity link.

Linked adjustability indicates the reciprocal nature of the undertakings of the two activities - that is, how the output of activity *a* is changed without compromising the integrity of the link. Activity *b* must then also be able to receive inputs which are changed in accordance with the outputs of activity *a*. By definition, linked adjustability is the flexibility of an activity link, derived from the variety related to its bridging resource.

For example, all bridging resources of the activity structure of the KFP display some variety. For instance variants of board, cupboards, hinges, fittings and handles are combined in the activities downstream of the hinging activity. Each activity link therefore needs to display a certain linked adjustability to allow for this variety without compromising the integrity of the link. In contrast, some of the bridging resources of the PBP display fairly limited linked adjustability. The activity link between the grinding and calcination activities, for example, displays no apparent variety. Instead, the plaster powder that constitutes the bridging resource is entirely standardised. Further downstream in the production process of the PBP, linked adjustability is identifiable through the variants of cardboard and additives introduced

¹⁵ Any of the four principal interdependency types could be used here for illustrative purposes. The argumentation in this chapter is considered valid regardless of activity interdependency type. However, for reasons of coherence, an activity link subject to input-output related interdependence is used for examples throughout the chapter.

into the process. In addition, the finished boards are cut to different dimensions, further increasing the linked adjustability of the relevant activity links.

The concept of linked adjustability is related to that of adjustability, but whereas adjustability is an activity concept, linked adjustability is related to the activity link. Any given activity is part of several activity links. These links display linked adjustability. Thus, the adjustability of an activity is the combined result of the linked adjustability of each of the activity links of which it is a part. To specify individual activity links, the concept of activity interdependencies is thus supplemented with the notion of linked adjustability.

6.2 The representation of time with activity adjustments

The analysis has so far only concerned structural aspects of activity linking. The concepts developed in section 6.1 can aid the analysis of established activity configurations, structures and patterns. However, these configurations, structures and patterns continuously change. The activity configurations underlying the production of a specific end product are refined in the light of new technological advances, revised production processes, changed demand patterns, etc. The activity structure of an actor is also changed as activities are developed or perhaps eliminated, and additional activities are introduced. Change is an inherent feature of business life.

It has already been suggested that there is an adjustability related to activities. This represents the flexibility of an activity's undertakings, derived from the variety of its resources. However, under certain circumstances resource changes are made which modify this variety. By definition, and in relation to the discussion in the case analysis chapter, a modification increases or decreases the variety of a resource. With modifications, the adjustability of an activity is altered. Alterations of the adjustability of an activity, derived from modifications related to its resources, are targeted in the concept of activity *adjustments*.

As evident in section 2.4.2, researchers in the INA have approached the issue of adjustments (and adaptations) somewhat differently. Despite its acknowledged importance for the understanding and analysis of industrial networks, there are differences in conceptual approach. Here, the activity dimension of the INA is of main analytical interest. According to

the distinction of Håkansson et al. (2009), activities are adjusted, whereas resources are adapted. Such adjustments were illustrated with the change initiatives in the case analysis chapter. They were also exemplified with regard to the delivery delays for plasterboards and kitchen furnishings, illustrated in the two activity configurations.

Activity adjustments are illustrated in Figure 6.8. As indicated in this figure, adjustments can involve the expansion and/or limitation of the current adjustability of an activity. This was also discussed in connection with the change initiatives in the previous chapter.

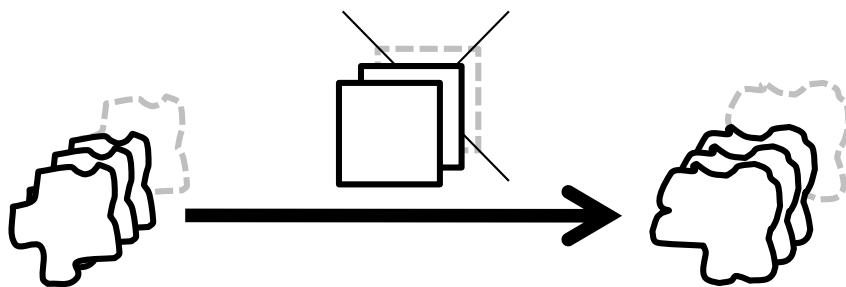


Figure 6.8 Illustration of activity adjustments.

In Figure 6.8, all the resources of an activity are modified. As a result of the modifications in this specific example, both the input and output can be changed in four (instead of three as above) different ways with regard to the undertakings of the activity. In contrast, the enabling resource can be changed in two (instead of three) different ways with regard to the undertakings of the activity. Adjustability is analyzed from a given set of resources; adjustment implies the change of this resource set.

Consider for example the cupboard production activity of the KCP. Originally, this involved only the production of veneered cupboards. In response to requests from the KFP, however, the KCP increased the variety of the resources of this activity. The variety of the inputs was increased to include solid wood cupboards and paint. The variety of the enabling resource was increased to facilitate the production not only of veneered, but also solid wood and painted cupboards. The variety of the outputs was also increased, as the activity now delivers solid wood and painted cupboards in addition to the veneered ones originally focused on. This specific change thus involved modifications which increased the variety of all the resources of the activity.

Activity adjustments not only derive from modifications of the variety of resources, they also cause such modifications. When an activity is adjusted in response to a resource modification, this has an impact on the other resources of the activity. Thus resource modifications both result in and result from activity adjustments.

For example, when delays on the construction site required the additional storing of customized plasterboards with the PBP, the variety of the output of the storing activity was modified to accommodate this change. As a result, the variety of the enabling resource also required modification, as it now had to be activated for this additional storing. As regards the pallet loading activity of the KCP, it was adjusted to separate the individual customer orders of the KFP. The output of the activity was thus modified in response to the requirements of the KFP. The resulting activity adjustment also required the modification of the variety of the enabling resource, as it was increased to facilitate the change.

The notion of resource modifications that both result in and result from activity adjustments is illustrated in Figure 6.9. From the perspective of an individual activity, the variety of any of its three resource types might be modified, in which case this modification alters the adjustability of the activity which, in turn, requires the modification of at least one of the other two resource types.

In line with this argumentation, an activity adjustment can be said to consist of two components: the *incoming* component targets the need to adjust an activity in response to a resource modification, whereas the *outgoing* component targets the need to modify a resource(s) in response to an activity adjustment. In Figure 6.9, the incoming component is illustrated with unbroken arrows and the outgoing component is illustrated with broken arrows. The figure illustrates the principal directions of such incoming and outgoing components: a specific adjustment might involve any combination of these components.

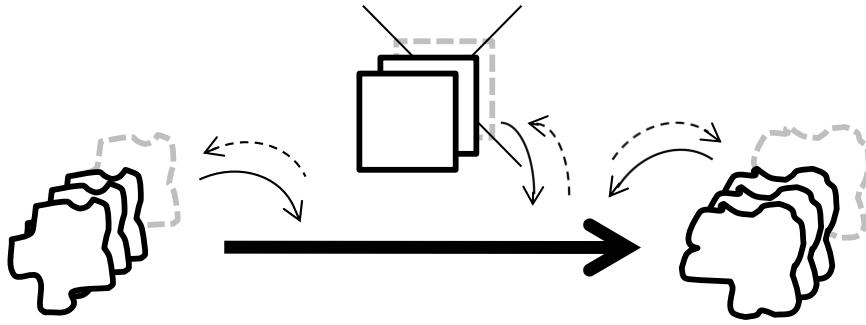


Figure 6.9 The principal directions of the incoming and outgoing components of an activity adjustment.

The separation of incoming and outgoing components of an activity adjustment is primarily made for analytical reasons. Both concern the same principal adjustment, but they target different aspects of it with regard to the required resource modifications.

The previous example of the adjustment of the cupboard production activity of the KCP allows for the identification of such incoming and outgoing components. The introduction of solid wood and painted cupboards was made as a response to the requirements of the KFP, i.e. the KFP requested increased inputs from the KCP. The cupboard production output of the KCP had to be modified to facilitate such a request. The modification of the outputs resulted in an incoming component, which required the adjustment of the activity. The inputs and enabling resource of the activity then had to be modified in response. As indicated in this example, all activity adjustments relate to both incoming and outgoing components. If the inputs and enabling resource of the cupboard production activity had not been modified, neither would the outputs. However, for the analysis of activity adjustments, it is relevant to distinguish between incoming and outgoing components to address the causes and effects of individual adjustments.

Since the alteration of the adjustability of an activity is analyzed using the concept of activity adjustments, such adjustments can also be related to activity links. Activity links are characterized by some linked adjustability. The modification of the variety of a bridging resource involves the alteration of the linked adjustability of an activity link. Figure 6.10 shows an activity link subject to serial interdependence. The bridging resource that facilitates this link is modified. As a result of this specific modification, the bridging resource can be changed in four (instead of three as previously) different ways without compromising the integrity of the activity link. This was illustrated with the modifications of the bridging

resource (plasterboards, cut to lengths) of the fine-cutting and width-cutting activities of the PBP. With increasing customization, the variety of this bridging resource was modified to include an increasing number of different lengths.



Figure 6.10 Alteration of the linked adjustability of an activity link subject to serial interdependence.

From the perspective of an activity link, *developing activity adjustments* are identified. Developing activity adjustments alter the linked adjustability of an activity link. They do not compromise the integrity of the link, but they change its characteristics. A developing activity adjustment is related to the alteration of the adjustability of both activities of an activity link. Most of the previous examples in this section concern such developing activity adjustments. Consider, for example, the activity link between the cupboard production activity of the KCP and the production activities of the KFP. The linked adjustability of this activity link was altered in line with the introduction of solid wood and painted cupboards. The linked adjustability of the activity link between the fine-cutting and width-cutting activities of the PBP was also altered with increased customization.

Incoming and outgoing components are identified also in connection with developing activity adjustments, which concern an activity link. When one of the activities of an activity link is adjusted, this requires modification of the bridging resource. This modification in turn requires adjustment of the other activity of the activity link. This was indicated above, when discussing the adjustment of the cupboard production activity of the KCP in response to the requirements of the KFP, i.e. the production activities of the KFP. Figure 6.11 illustrates the principal directions of incoming and outgoing components with regard to an activity link.

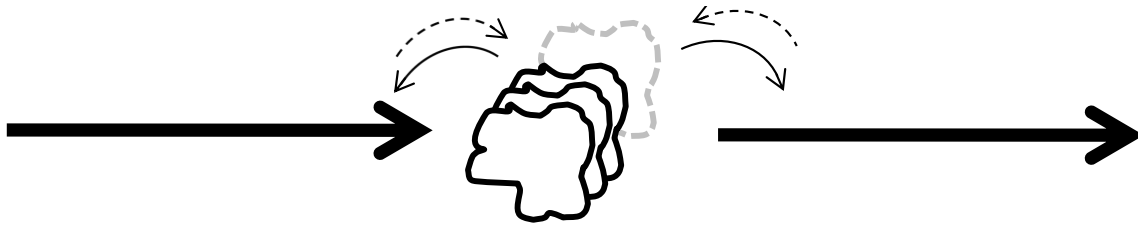


Figure 6.11 The principal directions of incoming and outgoing components of an activity adjustment, with regard to an activity link subject to serial interdependence.

In accordance with the concepts above, change is connected with activity adjustments which alter the linked adjustability of activity links. Such alterations target the dynamic nature of established activity links. However, under certain circumstances an activity is adjusted so as to compromise the integrity of the activity link and the activity adjustment is then not followed by the subsequent alteration of the linked adjustability of the link and the adjustment of the other activity.

In such situations, whether or not the established activity link is broken, the adjustment of the activity is conditioned by the establishment of a new activity link and from the perspective of an activity, *establishing activity adjustments* are identified. These are activity adjustments which result in the establishment of new activity links. Activity links are established when two previously unrelated (or at least only indirectly related) activities become linked. When an activity adjustment is not facilitated within an existing activity link, it needs to be directed towards a new activity link or the activity will not be adjusted. This is illustrated in Figure 6.12.

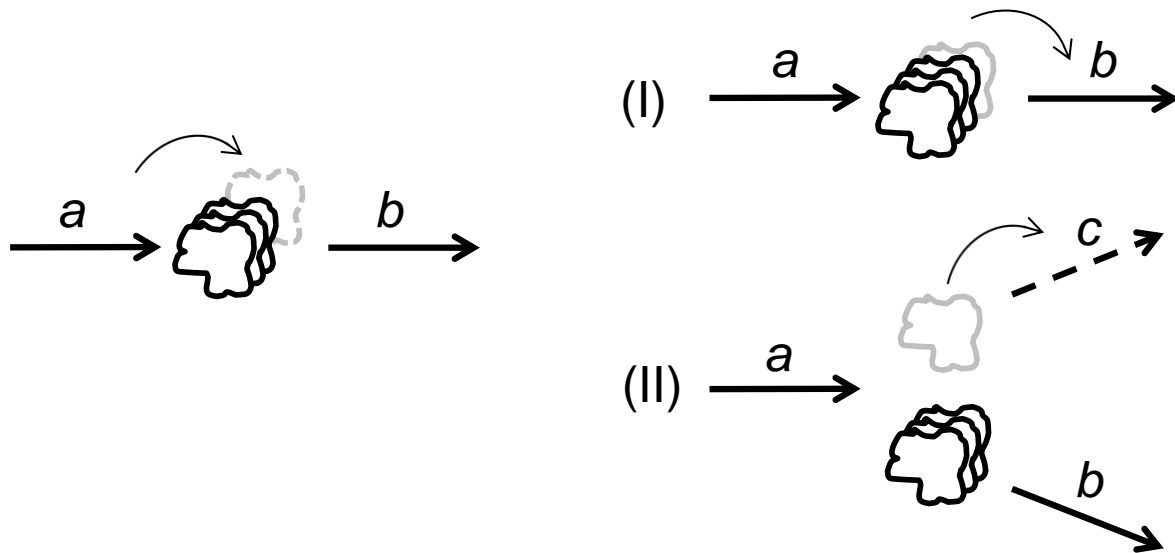


Figure 6.12 An activity adjustment which results in (I) the alteration of the linked adjustability of an established activity link (a-b), or (II) the establishment of a new activity link (a-c).

Activity *a* is adjusted. This adjustment has an outgoing component which requires modification of the bridging resource between activities *a* and *b*. In situation (I), this adjustment is identified as a developing activity adjustment, as it alters the linked adjustability of the activity link between activities *a* and *b*. As a result of the modification of the bridging resource, the adjustment has an incoming component with regard to activity *b*, which subsequently requires adjustment. In situation (II), the adjustment compromises the integrity of the activity link between activities *a* and *b*. The linked adjustability of this activity link is not altered, but the adjustment is identified as an establishing activity adjustment, which results in the establishment of an activity link between activities *a* and *c*. In this situation, the adjustment has an incoming component with regard to activity *c*. In this latter situation, the activity link between activities *a* and *b* remains intact and unaltered although the inability of activity *b* to adjust in line with the component incoming from activity *a* can also result in the activity link being broken.

These two alternative outcomes of an activity adjustment were illustrated in the delays for plasterboards and kitchen furnishings. Whereas the plasterboards were stored for an additional period of time at the inventory of the PBP, the KFP was unable to accommodate the delay of kitchen furnishings in the same way. Instead, the logistics provider had to store the kitchen furnishings. Thus, with regard to the plasterboard delivery, the adjustment was

facilitated within the existing activity links, eventually requiring the adjustment of the storing activity of the PBP. In contrast, the storing activity of the KFP could not facilitate such an adjustment, so new activity links had to be established.

An activity adjustment can involve the alteration of the linked adjustability of an established activity link, at the same time as it requires the establishment of a new activity link. Thus developing and establishing activity adjustments can co-exist as aspects of the same principal adjustment. In addition, in line with the argumentation above, an activity adjustment can result in breaking an established activity link. *Activity linking* is therefore defined as the establishment and development of activity links through adjustments.

6.3 Activity linking from the perspective of an actor

The two previous sections analyzed space- and time-related aspects of activity linking. These analyses were facilitated by the specific interconnectedness between activities and resources. In accordance with the ARA model, actors undertake activities and activate resources. There is therefore a need to analyze activity linking from the actor perspective.

Activities and actors are interconnected. As illustrated in Figure 6.13, an activity is undertaken by a specific actor. In connection with the undertaking of this activity, the actor also activates related resources. Thus, actors are the ones who make business life “tick”.

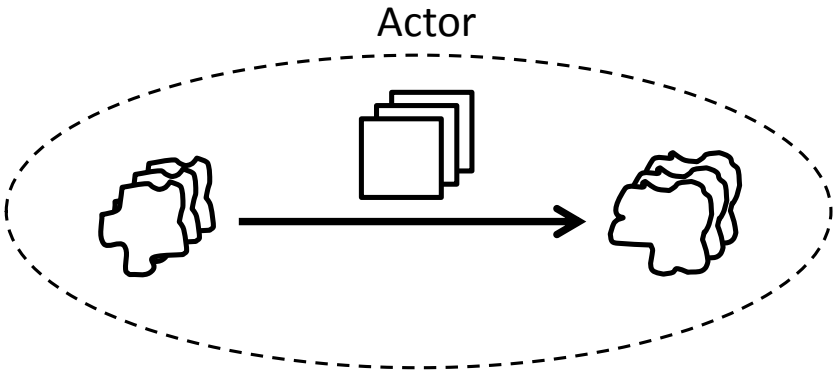


Figure 6.13 An activity undertaken by a specific actor, who also activates the resources of the activity.

An actor undertakes an activity in accordance with the adjustability of the activity. An actor also makes activity adjustments through modifications of the resources of an activity. An actor is thus connected to all the space and time-related aspects of activity linking discussed

above. In line with the discussion in section 2.6, and the examples in section 5.2, an actor is able to act, react and interact. An actor's opportunities for action, reaction and interaction are all conditioned by the relations between activities, resources and actors.

The analytical separation of acting, reacting and interacting is made possible with the notion of incoming and outgoing components of activity adjustments. An actor experiences a need to adjust an activity in response to a resource modification. As the actor makes this adjustment, there will be a need to modify one or several of the other resources of the activity.

Both the *action* and *reaction* of actors can thus be related to activity adjustments. The reaction is related to the incoming component of an activity adjustment, whereas the action is related to the outgoing component. Both action and reaction are part of the same activity adjustment; although they represent different aspects of it. Through this analytical separation, the resource modifications related to an activity adjustment are assigned to either the reaction or the action of an actor. The outgoing components of some activity adjustments do not result in further activity adjustments with other activities; because of the bridging nature of the modified resource(s). For example, the pallet loading activity of the KCP was adjusted to cater to the needs of the KFP. Initially, the outputs of the pallet loading activity were modified in response to an outgoing component from the KFP. The activity was then adjusted accordingly, which then required the adjustment of the enabling resource of the activity. The inputs, however, remained the same, and were not affected by the adjustment. The modification of the enabling resource in response to the activity adjustment did not result in any further activity adjustments, as this resource did not bridge any activity links.

So an activity is undertaken by an actor, and the adjustment of this activity is both a reaction and an action of the actor. With this in mind, the phenomenon is approached. The analysis is again exemplified with an activity link subject to input-output related interdependence.

The two activities which are part of this link can be undertaken either by the same actor or by different actors. These alternatives are represented in Figure 6.14. In addition, incoming

and outgoing components of an activity adjustment are indicated with regard to the specific activity link.

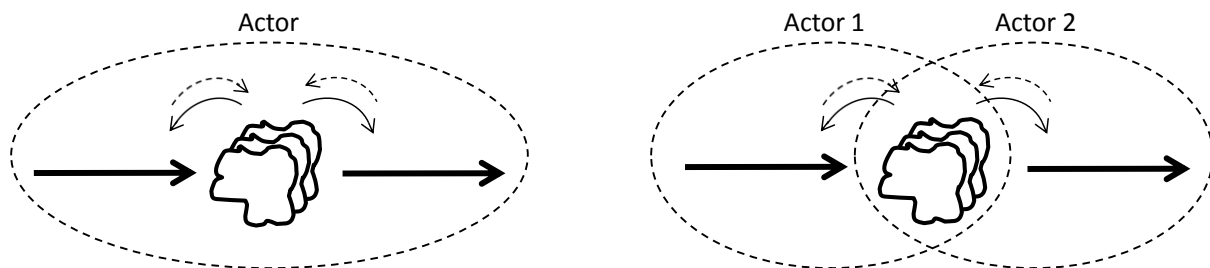


Figure 6.14 An activity link, subject to input-output related interdependence, residing either within the boundaries of an actor, or crossing the boundaries of two actors.

The activity link either exists within the boundaries of an actor, or crosses the boundaries of two actors. The activity link is bridged by a resource which, in the latter case, is activated by both actors. Analytically, the activity links between the activities in an activity structure all reside within the boundaries of one actor. In contrast, the activity links which are part of an activity configuration, or an activity pattern, also cross actor boundaries.

As illustrated in Figure 6.14, the adjustment of one activity creates an outgoing component which requires modification of the bridging resource. The other activity will then need to adjust in response to the resource modification. The separation of action and reaction with regard to the outgoing and incoming components of an activity adjustment thus allows for analysis of activity linking from the perspective of an actor. When considering the activity structure of an actor, and the ways in which these activities link with activities undertaken by other actors, the acting and reacting of an actor always relate to its counterparts. Here, boundary-crossing activity links are identified as a special case of activity links. As all actors experience boundary-crossing activity links, these are crucial to the analysis of activity linking.

In accordance with the INA, actors are involved in interaction processes with other actors. These interaction processes may be separated into the reactions and actions of two firms who are adjusting activities which are linked across their respective firm boundaries. *Interaction* is thus understood as a means of handling boundary-crossing activity linking. This is illustrated in Figure 6.15.

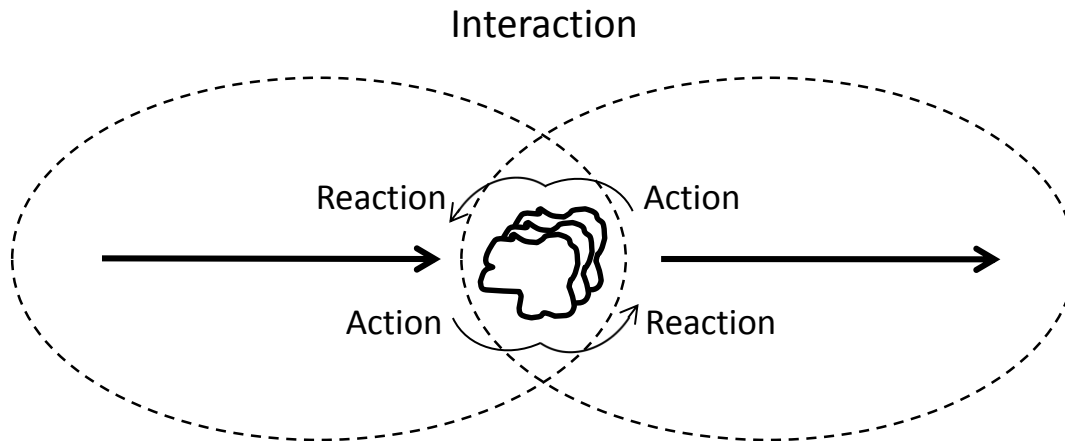


Figure 6.15 Interaction as a means of handling boundary-crossing activity linking.

6.4 A conceptual scheme for the analysis of activity linking

This analysis has identified and discussed a number of related concepts which together enable the analysis of activity linking. These are illustrated in Figure 6.16, which represents the conceptual scheme of this thesis. The concepts are separated in accordance with their individual associations with three analytical dimensions.

	Space	Time	
	Activity-resource		-actor
Activity	<i>Adjustability</i>	<i>Adjustments</i>	<i>Action</i> <i>Reaction</i>
Activity link	<i>Interdependencies</i> <i>Linked adjustability</i>	<i>Establishing</i> <i>Developing</i>	<i>Interaction</i>

Figure 6.16 A scheme for the analysis of activity linking.

All concepts in this scheme explore the relatedness between activities and resources. In space, the resources of an activity allow for the specification of adjustability, as well as the identification of bridging resources which intersect activity links. These activity links in turn represent certain structural characteristics, captured with the concepts of activity interdependencies and linked adjustability.

Over time, activities are adjusted through resource modifications. These modifications result in the establishment and development of individual activity links. Moreover, activity adjustments comprise both the actions and reactions of an actor. Here, interaction targets the process of mutual action and reaction with regard to boundary-crossing activity links, i.e. activity links between activities undertaken by different actors.

7 Concluding Discussion

The previous chapter provided a conceptual scheme for the analysis of activity linking in which the principal concepts in this thesis were repeated and related in accordance with three analytical dimensions. These concepts enable the exploration of activity linking in networks, thus addressing the purpose of the thesis.

The concepts provide substance to the process perspective of the activity dimension of the INA, which is also the main theoretical contribution of the thesis. Activity linking, defined as the establishment and development of activity links through adjustments, targets both the existence of activity links in space and the ways in which they change over time. The phenomenon thus not only entails the actual *-ing* in linking, targeted with activity adjustments, but also the links which precede and follow such adjustments. This is in accordance with the interrelatedness of activity interdependencies and adjustments as addressed in the frame of reference.

This concluding discussion is divided into two main sections. The first addresses activity linking in space involving the combination and reinterpretation of previous activity interdependency typologies, and introduces two concepts which highlight the flexibility related to the undertakings of existing activities and activity links. In the second section, activity linking and time are related to how activities and activity links change through resource modification, as well as how the actions and reactions of an actor influence these changes. At the end of each section there is a brief summary. Throughout this chapter, the notion of activity linking in networks means that the analysis is expanded to involve not only individual activities and activity links, but also the wider network of linked activities of which they are part.

7.1 Activity linking in space

Activity linking in space concerns the characterisation of existing activities and activity links required to enable the subsequent analysis of the process perspective of the activity dimension. Taking the point of departure in previous activity interdependency typologies, an alternative classification was suggested in chapter two, permitting the specification of activity interdependencies through the resources with which individual activities are related.

The separation of three resource types enables the identification of four distinct types of activity interdependence.

In addition, the variety in the activation of individual resources means that some adjustability is related to the undertakings of an individual activity. As this adjustability derives from the variety of the resources of an activity, it is also identified with the bridging resource of an activity link. The linked adjustability of an activity link thus speaks of the variety in the activations of the bridging resource. To characterise individual activity links, the concept of interdependence is therefore supplemented with the notion of linked adjustability. These are the principal concepts used to capture activity linking in space.

These concepts enable the depiction of a network of linked activities, where each activity link displays some linked adjustability. Figure 7.1 illustrates individual activities, linked via bridging resources. These resources are recognized as either object or enabling resources. In addition, from the perspective of an individual activity, an object resource is distinguished as an input or an output. As is clear in this illustration, each resource which is intermediate to two (or more) activities is identified as a bridging resource, in addition to being characterized as either an object or an enabling resource.

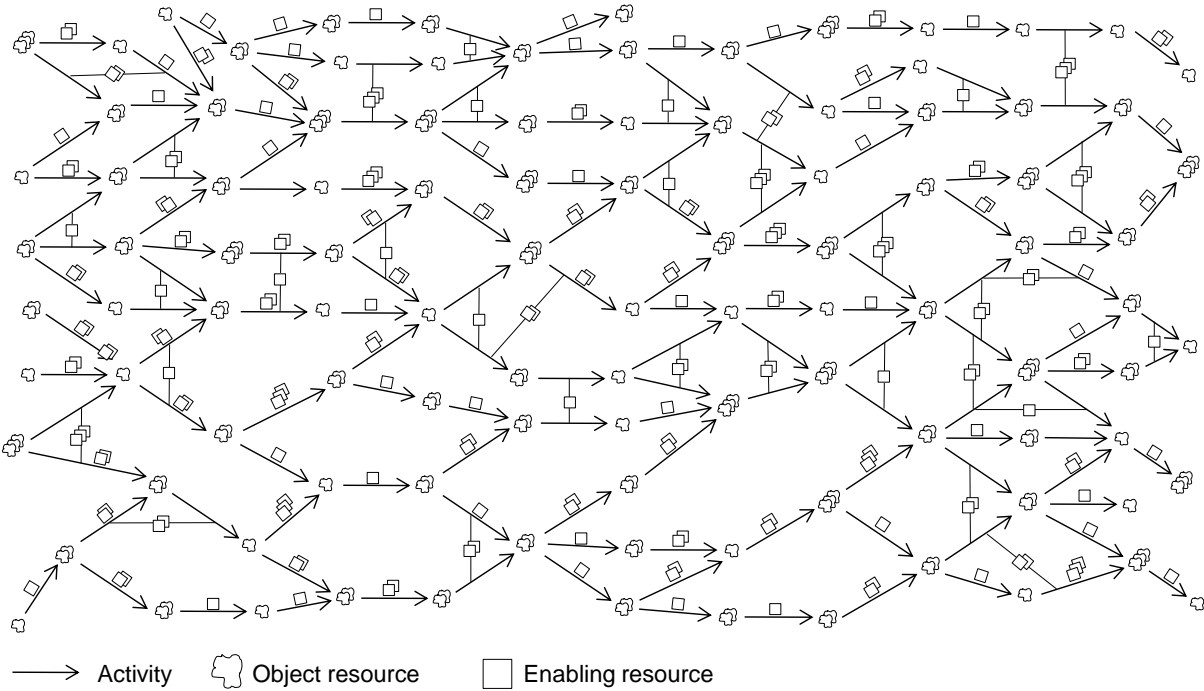


Figure 7.1 A network of linked activities.

In this network, all four types of activity interdependence are presented. In addition, indirect activity links are also recognized among activities which link through other activities. In other words, indirect links are identified through sequences of direct links which specify the interdependence even between activities undertaken seemingly far from each other in the network. Figure 7.1 indicates the different ways in which a specific indirect link can be traced through the network. Activities which have a direct activity link to each other may also link in multiple indirect ways.

This depiction of a network of linked activities forms the basis for the exploration of change processes. Activity links both precede initiatives of linking and follow from them. Although activity linking in space does not include notions of change, one might still use Figure 7.1 to tentatively reflect on the nature of change in a context of multiple direct and indirect activity links. There are several possible ways in which change might affect an individual activity derived from the direct and indirect activity links of which it is part.

So section 7.1 describes a novel way in which the resource dimension of the ARA model is used to explore the structural connectedness of activities. It includes the introduction of an alternative classification of activity interdependency types and specifies a notion of adjustability and linked adjustability to further capture the characteristics of existing activities and activity links. These, in turn, are derived from the variety related to the activation of individual resources. With these concepts, the section enables the exploration and specification of the process perspective of the activity dimension of the ARA model given below.

7.2 Activity linking and time

Taking its point of departure in Figure 7.1, this section introduces notions of change. In industrial networks of linked activities, change is both inherent and continuous. The analysis has suggested concepts for capturing such change relating to both the resource dimension and the actor dimension of the ARA model. This section distinguishes between these time-related concepts, first discussing the ways in which resource modifications require activity adjustments, and then focusing on the acting, reacting and interacting of an actor.

7.2.1 Activity linking and resources

From a resource perspective, activity linking in time concerns the adjustment of activities and the establishing and developing activity adjustments related to individual activity links. Adjustments were defined in the frame of reference, and the specific relatedness of activities and resources developed throughout this thesis permits the identification of activity adjustments through the modification of an activity's resources. The resource dimension is thus used to specify activity adjustments.

In essence, a modification increases or decreases the variety of a resource and alters the adjustability of an activity. Activity adjustments are recognized as such adjustability alterations. Further specification of incoming and outgoing components of activity adjustments is made possible considering the adjustment of an activity in response to a resource modification, as opposed to the modification of a resource in response to an adjustment. Each activity adjustment is related to both incoming and outgoing components. There is thus a dual cause and effect relationship between resource modifications and activity adjustments.

The modification of bridging resources targets how activity adjustments influence existing activity links either by developing them, recognized in the alteration of the linked adjustability of an activity link, or by causing the establishment of new activity links. This is conceptualized as developing and establishing activity adjustments, respectively.

The illustration of linked activities in the previous section is now extended with these change-related concepts in mind. Modified resources cause activity adjustments which, in turn, cause the modification of additional resources. In consequence, activity adjustments propagate from one activity to another and series of adjusted activities can be identified in relation to networks of linked activities. These series of adjusted activities are recognized as propagations. The notion of such propagations relates to Holmen's (2001) identification of a change boundary. Defining the change boundary as the boundary within which something has changed; such changes include new and modified resources, as well as existing resources used in new combinations without being modified (*ibid.*).

Three propagations are illustrated in Figure 7.2 (numbered 1-3). The incoming and outgoing components of individual activity adjustments are also illustrated, highlighting the notion that these components are not only associated with the adjustment of individual activities, but also concern different aspects of developing and establishing activity adjustments. Here, activities introduced to the network of linked activities as part of establishing activity adjustments are represented as broken arrows.

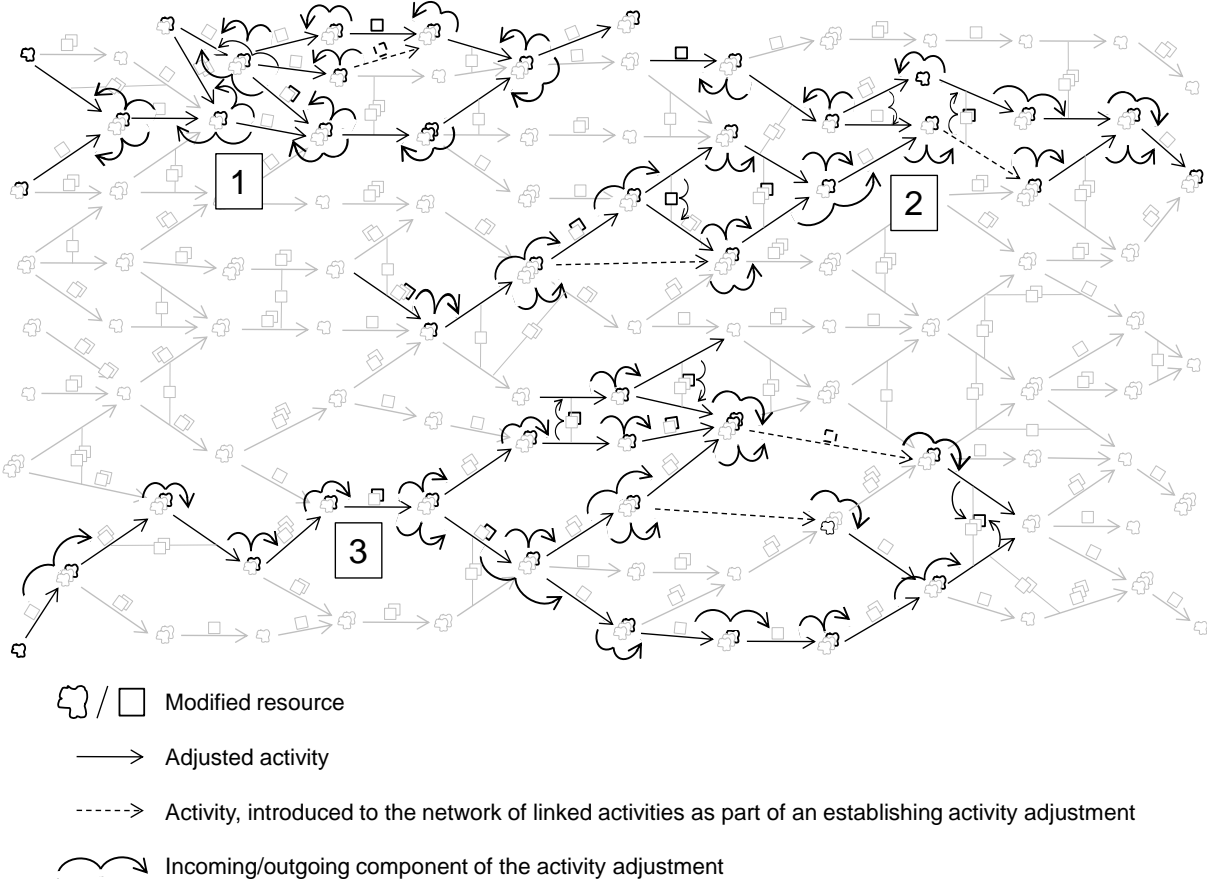


Figure 7.2 Illustration of three series of adjusted activities, recognized as propagations.

In Figure 7.2, three propagations are exemplified in the industrial network of linked activities. From a network perspective, activity adjustments always propagate from one activity to another. This is taken into account considering the modifications made to the resources which bridge individual activity links.

Each propagation has both a start and an end. It starts with a resource modification somewhere in the network. This initial modification may be the indirect result of previous activity adjustments. Whether it is then identified as the start of a new propagation depends

on how the modification in question is related to these previous adjustments. Sometimes a separation between individual propagations can be made for analytical reasons, while acknowledging their inherent relatedness. The start and end of individual propagations is further elaborated upon with regard to the activity linking of an actor in section 7.2.2.

The end of a propagation is also related to resource modifications. Although a specific propagation only has one starting point, it might have several end points. A propagation ends with the modification of a resource which does not bridge any activity links and therefore does not facilitate the further propagation of the adjustments.

The propagations in Figure 7.2 are characterized by their respective direction(s) and reach. The direction of a propagation is identified in relation to the individual activities and activity links of the network. As each activity is related to several resources, an individual adjustment might take several directions with regard to the resources of an activity, and so several end points can sometimes be identified with individual propagations.

The reach, in turn, relates to the final extension of the propagation in the network. That is, how many and which activities a specific propagation includes. This reach differs, as some propagations require the adjustment of only a few activities, while other may be more extensive, for example involving the adjustment of an actor's entire activity structure.

The three propagations depicted in Figure 7.2 all have different direction(s) and reach, to illustrate the individual nature of propagations. In addition, although the network of linked activities stretches from the point of extraction to the point of consumption, individual propagations can take any direction(s). This is also illustrated in Figure 7.2, where the direction of the first propagation is upstream to the underlying network, i.e. the individual adjustments propagate upstream. In contrast, the second propagation is initially directed downstream in the network, although it later propagates in a reverse direction. The third propagation is directed downstream the network.

The consideration of activity adjustments includes an additional realization, that some resource modification might initiate a range of different propagations. It is therefore not a given what direction(s) and reach a specific propagation will have. It is a result of the adjustments made to the individual activities. Each activity part of a propagation is somehow

adjusted. The different ways in which an activity can be adjusted constitute the possible modifications of its resources. In some activity adjustments, the enabling resource remains unmodified and the adjustment only involves transferring the modification between the inputs and outputs, or vice versa. In principle, all such combinations are conceivable, considering that a resource modification of one of the resources of an activity is always matched with the modification of at least one other. A propagation thus ends when a resource modification no longer causes the adjustment of additional activities.

The propagations presented in the illustrations in Figure 7.2 include both developing and establishing activity adjustments. Everything else being equal, developing activity adjustments are recognized as more frequent, while establishing activity adjustments, which require the establishment of new activity links, are less frequent as they require more pronounced adjustments of the activity links in the existing network. When a certain adjustment cannot be harboured within an existing activity link, through the alteration of the linked adjustability of that link, a new link needs to be established. Furthermore, individual adjustments might cause both developing and establishing activity adjustments if they alter the linked adjustability of an existing activity link, at the same time as they require the establishment of a new activity link.

Returning to Figure 7.2, it shows three propagations concerning different activities in the network. However, these propagations can also affect the same activities. They then either support or oppose each other. As a result, the further direction(s) and reach of the propagations are then affected; where one propagation can be more affected than the other. This notion also highlights some of the intricacies of distinguishing between individual propagations, as some adjustments might originate from several other individual adjustments. The notion of supporting and opposing propagations is discussed further in section 7.2.2.

In conclusion, section 7.2.1 uses the interrelatedness of activities and resources to discuss activity linking over time, thus directly addressing the process perspective of the activity dimension of the ARA model. From a resource perspective, activity linking in time concerns the adjustment of activities and the developing and establishing activity adjustments related to individual activity links. From a network perspective, activity adjustments are seen to

propagate from one activity to another, permitting the identification of propagations of adjusted activities. These propagations are characterized by their respective direction(s) and reach. Considering their extension in the industrial network of linked activities, individual propagations can both support or oppose each other.

This section thus specifies the concept of activity adjustments. With this specification, both the adjustment of individual activities and propagations which shape and form networks of linked activities can be analysed. The section contributes to addressing the process perspective of the activity dimension of the ARA model.

7.2.2 Activity linking and actors

Actors undertake and adjust activities. Related to these undertakings and adjustments are the activations and modifications of an activity's resources. The analysis distinguishes between the actions and reactions of an actor, associating them with the incoming and outgoing components of an activity adjustment. In addition, boundary crossing activity links require interaction, as they involve the adjustment of activities undertaken by separate actors. Interaction is thus seen as means of handling boundary-crossing activity linking.

This section discusses the actions, reactions and interactions of an actor. Figure 7.3 illustrates an industrial network of linked activities in which three propagations are depicted, and introduces the boundaries of an actor in the network of which it is part.

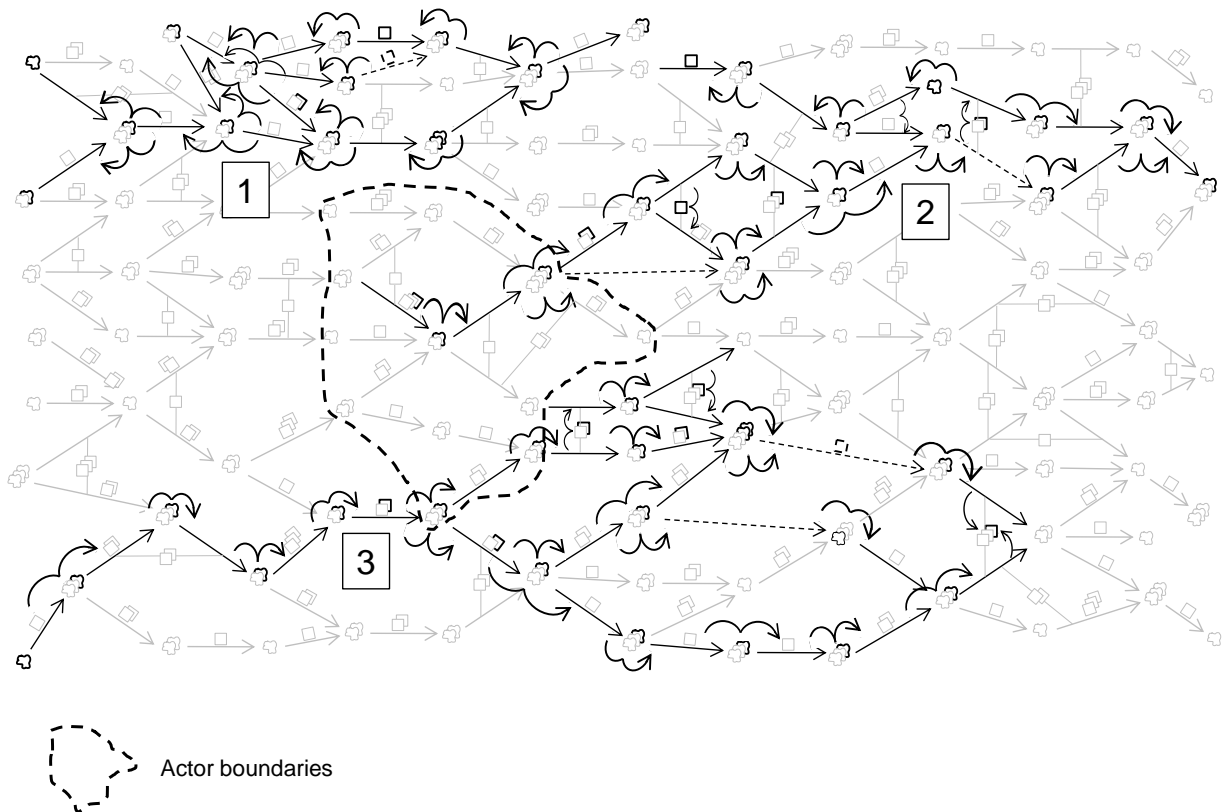


Figure 7.3 The boundaries of an actor in the network of which it is part.

The boundaries of an actor separate internal and external activities and thus represent the perimeter of the actor's direct influence. As illustrated in this thesis, the bridging resource of a boundary-crossing activity link can be activated by both actors in a business relationship. The boundaries of these actors therefore intersect with this bridging resource. This dual resource activation marks the starting point for an actor's indirect influence and is therefore an important element in the analysis of activity linking. Each of the three propagations illustrated in Figure 7.3 is located differently with regard to the boundaries of the actor.

From the perspective of the individual actor, the first propagation starts, propagates, and ends outside its boundaries. As such, it does not concern any of the internal activities of the actor, which need not be adjusted in light of these specific adjustments. In contrast, the second propagation starts within the boundaries of the actor. It thus originates with the actor and then propagates to include activities of its counterpart(s). As such, it crosses the boundaries of the actor. In principal, the reverse situation is also conceivable; where a propagation starts outside the boundaries of the actor and ends within its boundaries. The third propagation neither starts nor ends within the boundaries of the actor. It does,

however, propagate to include its internal activities. The propagation thus crosses the boundaries of the actor twice. Despite the choice to focus solely on the adjustments of the individual actor, it is recognized that the propagations outside its boundaries are enabled by the activity adjustments of other actors, with many of whom the actor is involved in business relationships.

From the perspective of an actor, individual propagations are separable in accordance with these alternatives. Initially, a distinction is made as to whether the propagation originates within the actor, or outside the actor. In the first case it marks the start of a desired development of the actor. It therefore adjusts the activities of its activity structure accordingly, which might involve developing certain activity links and establishing others. When the adjustments propagate across the boundaries of the actor, which they need not do if they are entirely internal propagations, the actor no longer directly influences the further direction(s) and reach of the propagation. It is up to the counterparts of the actor, who in turn experience the propagation as originating outside.

In this situation, it is crucial for the actor that the propagation, which originated from within the actor, is well received. If propagations are initiated which affect the desired inputs and/or delivered outputs of the actor, they must be absorbed by the counterparts, who deliver the inputs and receive the outputs. Otherwise, the propagation will not be possible. As interaction is seen as a means of handling boundary-crossing activity links, it is also the vehicle through which these outgoing components of activity adjustments are handled by the actor. Through interaction, the actor is able to influence and receive information about the desired activity undertakings of its counterparts and can make adjustments which are more likely to be absorbed by them. The actor can also influence them to absorb incoming components of activity adjustments which would otherwise be rejected. This is crucial, as the activities under the direct influence of an actor only account for a limited part of the activities that usually need to be adjusted following an initiative of an actor. This notion emphasizes the importance of interaction for influencing the direction and reach of outgoing propagations.

If a propagation originates outside the actor, it will influence the activity undertakings of the actor only if it is directed towards the actor's internal activities. As such, the first

propagation in the illustration is of no apparent relevance to the activity undertakings of the actor. However, given the notion of extended networks of linked activities, it is highly likely that propagations initially observed at a distance, and as such of no apparent concern to the actor, eventually also require adjustment of the actor's internal activities.

With regard to an incoming propagation, the actor has a choice of how to react. An actor can decide to absorb it, in which case the current direction of the propagation is elongated and its further reach facilitated. If the propagation is also considered beneficial for the activity undertakings of the actor, the actor might even try to amplify it, either through the development and establishment of internal activity links or by interacting with its counterparts to try to influence the adjustments of their respective activities. If the propagation is not considered beneficial, the actor might try to dampen it. This might also involve activities internal and external to the actor. In case the propagation is not at all in line with the desired activity undertakings of the actor, the actor might decide to reject it. This would mean that the counterpart from whom the propagation originated either had to refrain from making the adjustment(s) or find another counterpart who is willing to absorb it.

Thus, as establishing activity adjustments relate to the introduction of new activities in the network, they also allow for the identification of potentially new actors. When the counterparts of an actor are not willing and/or able to absorb an incoming activity adjustment, it needs to be directed elsewhere. The further propagation is then conditioned by the identification of other actors who absorb the incoming adjustment by adjusting one or several of their internal activities. The activities of these actors are then introduced to the network, which is expanded accordingly. The opposite situation can also hold true if an incoming activity adjustment is rejected by an actor and this rejection results in the breaking of an existing activity link.

With all these alternatives, interaction is crucial. Through interaction, an actor is made aware of potential incoming propagations before they reach the actor's boundaries. The actor might also be able to influence these propagations long before they ever require the adjustment of the actor's internal activities. Knowledge of potential incoming propagations also aids an actor in making decisions about what activities to adjust, either to oppose

potential incoming propagations or to support them. Generally, the mere awareness of such propagations enables an actor to make decisions concerning how to react to them once they affect the actor's internal activities. This relates to the notion that individual propagations can both support and oppose each other. With a less interactive approach, fewer propagations that eventually reach the actor's boundaries are anticipated. As argued here, the activity boundary of an actor can thus be expanded through interaction. The activities of the counterparts are influenced and propagations can be anticipated and prepared for. Propagations which move in potentially conflicting directions and risk opposing each other can be predicted and handled.

Whether a given propagation originates from within or outside the actor, there is a choice of how to act or react to it. The internal activities of an actor can be adjusted in different combinations giving the same final result. Some of the internal activities of an actor can be easier to adjust than others, in which case these are preferred for making such adjustments. Some propagations can require the alteration of the adjustability of specific activities, regardless of whether or not these are exposed to several activity interdependencies and considered difficult to change without compromising other activity links. An actor can thus make choices with regard to acting and/or reacting. The range of choices is conditioned by the activity structure of the actor. With a more adjustable activity structure, an actor is able to assign the adjustments to preferred activities, while avoiding other. An activity can also be adjusted only in the sense that it transfers the resource modifications between inputs and outputs but no modification is made of the enabling resource of the activity.

With all these decisions, the time aspect is vital. Decisions concerning how to act and react with regard to specific propagations and counterparts are influenced by previous experiences both of similar propagations and the counterparts in question. In addition, anticipation of future interactions also influences the decisions of the actor, as certain actions and reactions are made to 'invest' in future opportunities.

In conclusion, the concepts in this thesis not only enable the description and analysis of how activity adjustments propagate from one activity to another, they also involve the specification of actors in such networks. These actors act, react and interact in a variety of ways to influence the direction(s) and reach of individual propagations. This way they

influence the dynamics of the industrial network of which they are part and are able to change their current position in the network in a desirable way.

Section 7.2.2 addresses activity linking in relation to actors and interaction. Section 7.2.2 builds on the concepts from the previous sections and explores the interrelatedness of activities and actors. A distinction is made between the actions and reactions of an actor, relating them to the incoming and outgoing components of activity adjustments. When activity adjustments cross actor boundaries, interaction provides a way of handling such boundary-crossing activity linking. This section discusses how such actions, reactions and interactions come about and how they both influence and are influenced by the direction(s) and reach of individual propagations in the network.

This section concludes the exploration of activity linking in networks adds to the process perspective of the activity dimension of the ARA model by the identification of acting, reacting and interacting in relation to individual activity adjustments and the recognition of individual propagations and the ways in which they relate to the activity structure of an actor.

This thesis also has implications in relation to this actor focus. Although this concluding discussion has primarily been concerned with the identification and specification of theoretical concepts, it is clear that an individual actor has multiple choices of how to act, react and interact, and is also restricted by existing activity links. The identification of the adjustability and adjustments associated with individual activities, the interdependency types and linked adjustability of individual activity links, and the developing and establishing activity adjustments which concern these links and result in propagations in the network of linked activities all influence and guide the acting, reacting and interacting of an actor.

The ability to analyse activity linking in both space and time is thus of utmost importance for scholars and industrial practitioners alike, as isolated changes are never possible in industrial networks.

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