

# 4

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## Network Perspective

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The framework of this research project determines that the point of focus should be on network-based product development. The network perspective is interesting in that our study of literature (Eppinger, 1993) (Clark & Wheelwright, 1993) (Coldmann & Price, 1995) (Caffyn, 2000) (Hart, 2001) as well as most of the secondary cases indicated that product development subject to time pressure employed and took place in networks. Thus, the use of network could be the explanation for higher speed in product development. Moreover, networks could also be the explanation for a lowering of speed in product development. Networks can be defined as both physical, internal networks within the business, external networks established together with customers, suppliers and other network partners. Networks can be a mix of internal and external networks both physical, digital and virtual networks. Virtual networks come into existence when needed and when there is a task for the networks to accomplish.

The case examinations left us with the clear impression that there was a tendency for product development taking place in the businesses to move towards a wider and earlier use and interaction with external networks and network participants.

In other words, there was not only a trend towards several functions of the business being involved at an early point in the PD process but also a trend towards the networks of the businesses becoming involved at an early point in the PD process (Case No. 55 ScotIT, Case No. 13 Mayekawa, Case No. 11 Rossflex).

Some of the secondary case businesses also stated that participation of external networks and network partners were a prerequisite for the successful course of a product development process. It seemed that the businesses generally wished to involve in particular the customers and the suppliers in the network at a very early point in time of the product development process. The businesses also claim that network and the handling of networks were

the two main reason for the success of the businesses of the Italian design industry (Verganti 2001). It seemed as if network based product development could add value to product development.

However, there can be many definitions of the concept of network, and in addition, the concept had been the subject of major research during the years up to 2003 (Håkonson, and Håkonson & Johansson, 1985) (Rind, 2000). (Nielsen, 2001).

Generally, I identified three central types of network which do not necessarily conflict but rather showed the different characters of a network. The different kinds of networks apparently allow for various possibilities. The businesses can achieve several synergy effects by combining such different kinds of network not least in relation to high speed product development. The network types included:

1. The physical network perspective – internal and external networks
2. The computer network perspective
3. The virtual network perspective

In the case research I identified 3 characteristics of networks as seen in the Table 4.1 which involved different mixtures of the above mentioned network types.

**Table 4.1** Shape of the network components

The Main Components Context	Characteristics	Example of Networks
Stable networks	Networks mainly based on physical and stable networks often internal and dominated network	Industrial groups, branch groups
Evolving networks	Networks based on a mix and evolving system of networks – Physical networks, ICT – networks, virtual networks	PUIN network group, EU community,
Dynamic network	Networks based on a mix of dynamic networks with high degree of dynamic where network partners constantly comes in and goes out. Often there is no formal network leader.	Virtual network groups, Ambia

## 4.1 Physical Network Perspective

### 4.1.1 Theoretical Approach

In general terms, the network approach implies as shown in Table 4.1 that industrial activities (manufacturing of goods, product development,

marketing, purchasing, etc.) are seen to take place within a network of exchange relationships between producing businesses, suppliers, customers, distributors, research organizations and other types of industrial actors. The members of the network performed complementary, competing or otherwise interrelated activities whereby certain resources are consumed and others transformed into new resources.

*“The actors are linked to one another through various kinds of interaction processes in which resources are exchanged or used in joint activities. The network is thus the arena in which industrial actors compete and cooperate with one another in order to achieve their goals. For the individual actor the surrounding network constitutes an important part of the environment in which it operates. Its freedom to act is very much determined by the characteristics of the network, which give both opportunities and constraints.”*  
(Laage-Hellmann 1989)

Actors, activities and resources were the three main groups of variables in the basic physical network model (Håkansson and Johanson, 1985; Håkansson, ed., 1987).

Actors are defined as those who perform activities and control resources. One can identify actors at several organizational levels, such as individuals, departments, divisions, firms, and groups of firms. Actors control resources of various kinds. Physical assets (raw materials, equipment and other types of goods), information, knowledge, competences, labour and money are some important types of resources used by industrial actors when they perform activities. Some of these activities are carried out under the control and management of one actor. New or improved products and resources were created by combining, refining or changing existing products, resources and competences to develop new products for the future. They were called transformation activities and could either be incremental or radical by character. Other activities involve two or more actors that were exchanging or transferring resources or performing other types of joint activities. They are called exchange activities.

Transformation activities can be manufacturing of goods and Research & development (R&D). The aim of a single R&D activity is to produce new scientific or technological knowledge or to develop new industrial products, processes or applications. These can either be radical or incremental, new products.

In industrial networks each actor's transformation activities are more or less dependent on a number of past or future transformation activities and tacit

knowledge performed and developed by other actors. This dependency can be more or less specific. There is a specific dependency between two actors if at least one of them is dependent on the activities of the counterpart. However, dependency could also be more general in nature, when the dependency is not related to one specific counterpart, but rather to an involvement in the network.

The function of exchange activities is to handle the activity dependency between actors. Commercial exchange serves to link production activities performed by different businesses with the market. Technological exchange serves to link the product development activities of different interdependent firms technically and link R&D performing actors to each other to complement or develop their own resources with external competence.

The stronger the specific dependency between actors, the more they will be inclined to develop and exchange relationship with each other. A relationship can be said to exist when two actors are aware of each other and perceive each other as counterparts or partners in an exchange process. Relationships can be either occasional or short-lived e.g. some types of virtual networks. Such relationships do not lead to any ties or bonds between the interacting parties. Lasting relationships, characterized by a higher or lower degree of stability and closeness can also be the case. The intensity of interaction can vary over time. If the tie is strong enough, a relationship can even persist over long periods without any exchange taking place. The relationship can be said to be “sleeping”; that is the two actors know each other and, if needed, are prepared to recommence the exchange – virtual networks.

Exchange may lead to mutual adaptations and commitments being made by the parties. This leads to a strengthening of the relationship and to a further increase in the specific dependency.

In contrast to transformation activities, exchange activities are never totally controlled by only one actor. The fact is that at least two actors must be involved in order to produce an exchange situation. This does not imply, however, that the influence is evenly distributed. One of the actors may be more powerful than the other and therefore be in a position to exert a higher degree of influence on the exchange process.

All existing industrial actors are normally members of a global, worldwide network of relationships. Each individual actor is not directly linked to every other actor in the global world but each actor will be directly related to a small subset of all potential counterparts. These relationships may be built on business or other types of exchange and imply a larger or stronger dependency among the interacting parties. The industrial network is thus characterized by certain of its members being linked through strong ties, while others are linked

through weak ties. Still others are not directly linked at all, but only related to each other indirectly, i.e., via one or several intermediate actors, or through general dependencies.

This way of viewing the global market means that the interest of the researcher is focused on the structure of the network in network based high speed product development and the pattern of interaction and interplay among the actors when product development is carried out under pressure of time and speed. The network model shortly summarized above provides a set of concepts which can be used when approaching a problem or question from a network perspective.

The network approach has been chosen as a starting point for the empirical research. However, there are certain methodological problems associated with the usage of the network model.

One concerns the delimitation of the network. It is impossible, of course, to consider the entire global network of product development relationships. For all practical purposes, the network has to be delimited given the context and the specific issues or problems of the product development project to be addressed. The focal network in this research is defined as those actors which are tied together in relation to a certain product development project.

Attention is then focused on the interplay which takes place among these actors. What happens outside the network boundary is left aside or treated as part of the general environment.

Another problem has to do with the choice of actor level. The individuals who represent a particular product development organization do not necessarily act "as one man". Each of them have their own personal goals, ambitions and perceptions, and these do not necessarily coincide. Furthermore, different individuals may have contacts with different types of counterparts. For example, the marketing and R&D people may have parallel and more or less separate contacts with a customer firm. Such parallel person-to-person relationships may be strongly connected, but they may also live their own lives without influencing each other too much. The complete exchange relationships which develop between various businesses and organizations in the industrial network may thus contain several more or less independent personal relationships.

In this research such latter relationships are called "informal product development models and processes" based on informal product development networks.

In the empirical part of the research the aims was to verify and document these informal processes and clarify their influence on time and speed in

product development. The focus was mainly on the internal physical informal networks as the external informal networks will demand a much wider research plan. However my hypo these was that these external informal networks have big influence to network based product development.

In this research the focus was on product development in networks. As stated in Chapter 1, there were strong reasons to believe that a very large share of the product development took place within inter-organizational relationships. In Håkansson (ed., 1987, Ch. 1) three arguments were put forward as to why this should be the case. These arguments were related to knowledge development, resource mobilization, and activity coordination respectively (Corso, 2001).

It was well known that product development often emerges at the interface of different knowledge areas. Product development exchange in relationships could therefore contribute to knowledge development by bringing together different bodies of knowledge. Firstly, an “interactive effect” could be obtained when the needs and competences of one business were combined or confronted with the possible solutions known by another business. The second type of effect is related to the fact that new product or process development requires the combination of several different technologies and knowledge of fragmented markets, which is the case in today's product development as stated before in Chapter 1. When two or more actors with complementary competences join forces in order to develop a new product or process a “multi-competence effect” is produced.

The need to mobilize resources is another reason for actors to interact with one another during the innovation process. In order for an invention, e.g. a new product, to be used and turned into an innovation, the actors involved, in the capacities of producers, users etc., have to adapt in different ways. For example, the actors must learn how to use the invention and combine it with other products. The invention also has to be adapted, revised, and redesigned in order to be useful in different applications. The innovation process, thus, has elements of learning, adaptation, and socialization which require the investment of resources.

Here, the interaction among the actors involved plays a vital role in ensuring that enough resources are mobilized. The mobilization process often takes place in a context where the resources are scarce and where other activities compete for the same resources.

The high degree of specialization in industry and fragmentation on the global market required that product development activities in different parts of the network had to be coordinated. The business had to gain a coordinated overview over the possible network activities in all types of network.

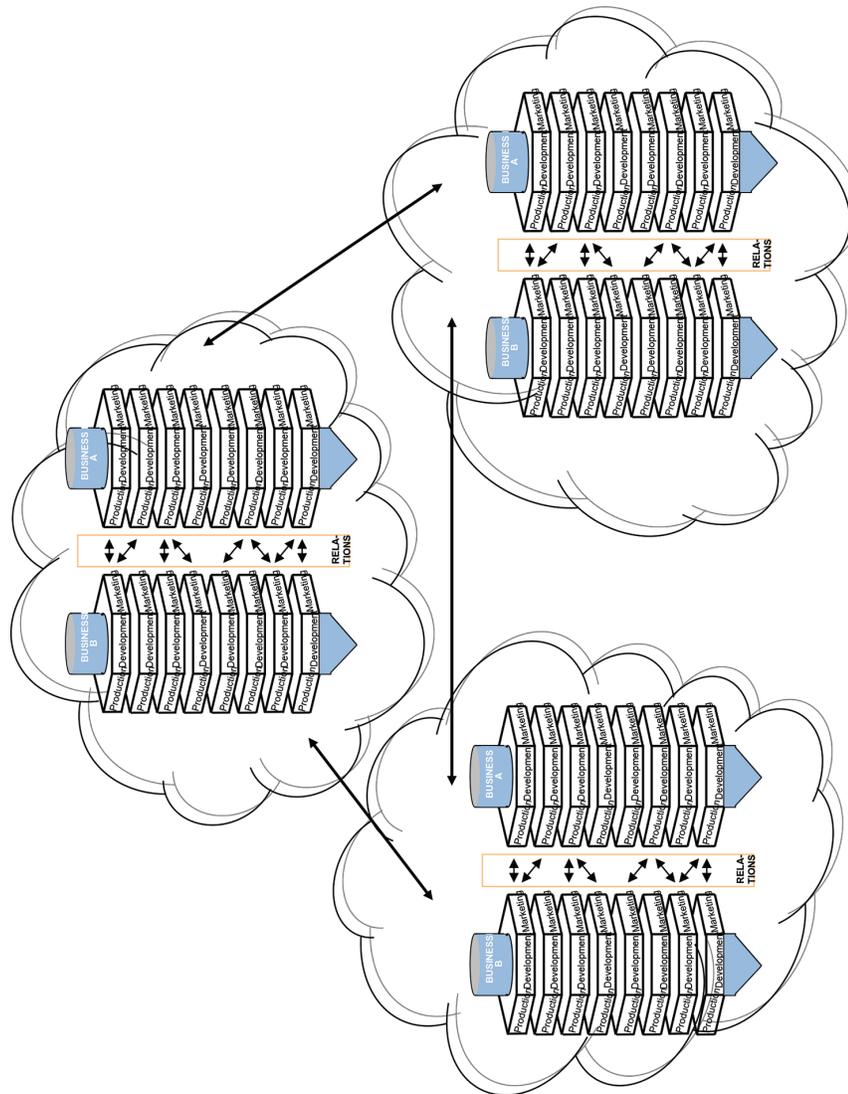
The importance of these phenomena made it fruitful to use a network approach when dealing with questions related to high speed product development. By identifying and examining the relevant network, one could increase the understanding of how high speed product development occurred in a certain product development field. The pattern of product development in a specific network could be characterized in such terms as:

1. What types of actors participate in product development? How are the roles divided? Which actors dominate and control the development?
2. The degree of concentration, i.e. are the Product development resources and activities controlled by a few or many actors in the network? Is the product development concentrated within a few leading actors or does it proceed simultaneously in many different places. Who and how is the product development project managed?
3. The degree of integration and pattern of cooperation are of interest and to what extent are the product development activities integrated with each other? How much of the product development activity is carried out in cooperation between different actors?
4. The direction and content of the product development work. The emphasis is on:
  - process or product development
  - standardization or differentiation
  - incremental and radical product development
  - large-scale or small-scale product development
  - rationalization of existing or development of new techniques
  - revolutionary product development models and processes?

The results and experience from the special study on literature and cases, as well as other empirical studies carried out later on, had therefore been used to further develop the integrated network based product development model. The model is summarized in Figure 4.1. It consists of three main parts: the exchange process; the actors; and the environment. The relationship between the two actors A and B is created by the exchange process (i.e., the interaction), which is affected by the characteristics of the actors and the environment. The three parts of the model will now be described in more detail.

### **The Exchange Process in Network Based Product Development**

The exchange which takes place within a relationship is a key concept in the model. It means that two actors consciously interact with each other in order to transfer resources or to perform some activity together. The most important



**Figure 4.1** Several network partners.

categories of elements which are involved in the exchange between industrial product development actors are physical products, information, knowledge, proprietary rights, and financial assets.

The exchange process between industrial actors is complex and multidimensional in nature especially when more actors are involved to the product development project. Four main dimensions will be distinguished, viz. commercial, technological, social, and financial. These dimensions are not independent of each other, but constitute integrated aspects of the overall exchange process.

Commercial exchange, whereby products or services are transferred in exchange for money or some other form of payment, was the core of business relationships. Commercial exchange itself, in a narrow sense, may require a lot of exchange activities be carried out by the parties, e.g., sales calls, negotiations, technical discussions, delivery of goods, payments, adjustments of claims, and the performance of after-sales services. By definition, technological exchange comprises all those exchange activities which have a bearing on product development. The scope of technological exchange may therefore vary focus within broad limits. It can be anything from a one shot transfer of a small piece of information to an extensive joint R&D project in which both parties invest large resources. In some types of relationships, technological exchange itself can be the primary purpose of the relationship. This is the case when industrial businesses interact with universities, research institutes and development businesses.

Technological exchange can also lead to the establishment of relationships between firms producing similar or complementary products. It should be observed that even though the main focus was on development questions there could also be a commercial dimension in “R&D relationships” of these kinds. This was evident in connection with contract research, technology licensing and the commercialization of independent researchers’ product ideas and inventions by other businesses. Furthermore, commercial goals were the underlying driving force when businesses interacted with competitors, complementary producers or end-users in technology matters.

To summarize, commercial, technological, financial, and social exchange constitute different aspects of the overall exchange process which takes place within a product development relationship. The different types of exchange are linked with and dependent on one another and cannot be seen as separate processes. To understand one type of exchange, for example technological, it is therefore not enough to analyze only that form of exchange. It is also necessary to examine how that exchange dimension is related to other aspects of the overall exchange process.

### **Product Development Exchange**

Keeping in mind that product development exchange is just one of several aspects of the exchange process, the characteristics of the product development exchange are interesting.

Broadly speaking, product development exchange means that two actors interact with each other in a way which affects the product development in either or both of the actors. There are three basic mechanisms whereby this can happen:

1. The actors influence the each other's internal product development activities through exchange of information and knowledge or use of power.
2. The actors get involved in mutual exchange activities whereby R&D resources are transferred between the parties or put at each other's disposal.
3. The actors participate in a joint R&D project. Both parties allocate resources for a common purpose and perform activities together with the partner.

It was the hypothesis that information and knowledge transfer was a vital element – a catalyst to high speed product development.

### **Exchange Process and Degree of Bonding in NB PD Relationships**

An important effect of exchange is that different kinds of ties or bonds are created between the interacting parties: technical, knowledge, organizational/administrative, economic, legal, and social. The degree of bonding in a relationship can be seen as a measure of its strength and long-term stability:

- Technical bonds
- Knowledge bonds
- Organizational/administrative bonds
- Legal bonds
- Social bonds

A bond may sometimes be created through exchange activities taking place within one major episode (e.g. the execution of a big product development project which could be radical to the actors). But more often bonds were created through a series of short episodes – incremental product development projects whereby the bond was gradually, and often relatively unconsciously, built up.

Product development exchange played an important role in the creation of bonds, especially the technical and knowledge-based bonds. Extensive product development cooperation presupposes a certain degree of bonding between the two partners.

### **Interacting Actors in NB PD**

The process of exchange does not only depend on the elements exchanged and the degree of bonding, but also on the attributes of the actors themselves. Four main groups of influencing variables can be distinguished:

- the resources possessed by the actor,
- the transformation activities performed by the actor,
- the organizational structure by which the resources and activities are organized, and
- the objectives and strategies pursued by the actor.

### **Macro Environment**

The interaction between two actors takes place within a wider context, which must be considered in analyzing the relationship. The interaction product development model describes this environment in terms of the market structure, the degrees of dynamism and internationalization, the position in the supply chain, and the wider social system which surrounds the relationship.

Technological exchange may be affected in different ways. For example, in an environment characterized by rapid market, technology, network and business based competence change reliance on a single or small number of development relationships can be risky. To obtain early access to new markets, new technologies, scientific advances, new networks and new competences may require a close and long-term collaboration which can only be maintained with a few counterparts. The degree of dynamism may thus affect the product development exchange within a relationship.

#### **4.1.2 Network Interaction Model for HS PD**

The actors (and the focal relationship) were seen as integrated parts of a product development network of relationships. This means that there is no distinct boundary which separates the actors from the environment. Actors are linked to other members of the network through direct and indirect exchange relationships.

As indicated, the network based interaction in the introduction of the product development model affects the attributes of the actors. In the model these are characterized in terms of resources, transformation activities, organizational structure and objectives/strategies. These characteristics are internal in nature. If the actor is regarded as an integrated part of the network, the position in the network also becomes an important attribute. The position describes how the actor is related to the network through external relationships. It can be defined in the following way:

1. The identity of those other actors with which the focal actor has direct or indirect relationships.
2. The characteristics of these relationships (the existence of different types of exchanges and bonds).

This means that all actors have some kind of unique position in the network. The position is a result of the actor's previous interaction with various counterparts. It is never static but changes continuously as a result of the exchange activities which take place, or do not take place, in the network.

Network position is an important concept for several reasons. Through the involved relationships, position gives the actor access to external resources which can be used as a complement to internal ones. These external resources can be seen as indirectly controlled, in contrast to those resources which are directly controlled through ownership or employment contracts. As a result, an actor's total resource strength, which is the base for its acting in the network, cannot be assessed without considering how it is linked up with other actors.

The network based product development model increase complexity. It makes it possible to include connections in the analysis of relationships and thereby achieve a better understanding of how actors interact with each other. Connection is an important concept.

### **Cooperation and Conflict in NB HS PD**

The network based interaction model is based on the assumption that the two parties have mutual interests in the product development project. The exchange of goods, services, information, etc. which takes place within the relationship is perceived by both parties to be beneficial. Otherwise the exchange would cease.

It is therefore natural for the interaction model to emphasize the cooperative aspects of the interaction process. This is not to deny, however, that conflicts may occur between the parties. That a relationship is old and close

does not mean that the parties always act positively to each other and that everything is fine. The parties can have more or less conflicting goals, which may affect the exchange. Such conflicts can be solved, for example, by finding compromises which are acceptable for both parties.

Certain conflicts arise within the network relationship without any influence from the environment. By extending the model to include three or more actors, the possibility for other types of conflicts is opened up. Here it is the connections between the relationships in the triad which create tension and conflict among the actors.

As a first step, a simple framework for discussing the issue of conflict and cooperation in networks will be outlined below. It is based on the assumption that in all relationships there are both common and conflicting interests among actors. As illustrated in different research, relationships can be classified into more categories depending on the strength of the different interests.

The actors can act relatively independently without considering the consequences for the counterpart. The interests of the two actors are in strong conflict, for example because they are competing for the same customers or the same product development resources.

In a broad sense, cooperation means that two (or more) actors engage in mutually advantageous activities where both actors consciously take each other's interests into consideration.

The relationships are characterized by the existence of both strong common and strong conflicting interests. In this kind of relationship the actors have incentives to cooperate in certain fields and counteract each other in others. For example, within a particular product development relationship knowledge exchange may give rise to a conflict regarding the price or other terms of knowledge exchange. This may lead one partner to start negotiating with an alternative network partner in order to exert pressure on the partner. At the same time the two businesses may be engaged in long-term product development cooperation which is important for both of them.

The last situation is interesting. How does the interplay between the cooperative and conflicting aspects function? How is this interplay affected by connections to other relationships in the network? At the same time, the secondary cases provided by earlier indicated that this situation is not unusual in industrial networks. This does not only hold for supplier-customer relationships. Businesses that are competing in the same market frequently have strong common product development interests. They may, for example, be interested in keeping product development at a certain standard level, which

may result in direct cooperation between competitors. Other common interests may have to do with standardization and technological development.

## **4.2 Computer Network Perspective**

As our work became gradually more computer oriented up to 2003, the information technological need of the various specialisations of an organisation became increasingly accessible across functional barriers both internally and externally. Through the use of network IT it was possible to re-interpret specialist and fragmented information and to exchange such information freely and internally.

Computer networks, however, enable the entire business to receive feedback in the form of opinions and to add individual learning. Until now such knowledge had been stored in archives and in the heads of specific employees and had only been furtively discussed over coffee or had even forgotten. Computer networks encourage the employees to share and remember knowledge if it was designed right. Furthermore, employees/network partners were interested in transferring their knowledge.

Several researches showed that open computer network systems were instrumental in making network participants feel more involved.

A visible and accessible network organisation helped to increase the potential for improved idea and learning relation among network members. This was expected to bring about improved speed, reduced costs, and increased product performance and benefits e.g.:

- By allowing computer networks to expand time and compress space to develop products. Thus, it is not necessary for the network members to be in the same place at the same time in order to have a dynamic exchange. Each participant is able to contribute to the network when it suits him or her, and it is possible to establish relations across different internal and external computer networks independent of the geographical or physical placing.
- By abolishing competition for “transmission time” or “floor space” in computer networks. All network participants can contribute at the exact moment when they want to. Each network participant also has more time to consider his or her contribution to the network and thereby raise the quality of the outcome.
- By reducing the tendency among computer networks participants to keep their opinions to themselves. The influence of “powerful persons” and

“time-wasting persons” can be reduced by changing the facilities of the computer network in a smart and intelligent way. Computer networks can be used to advance learning in network cooperation, in particular “double loop learning” (Bout/Hover, 1996). Double loop learning allows for more flexible ways in which to organise the enterprise. Computer networks tend to loosen stagnate structures which can often be found in traditional organisation models based on the principle of control. Computer networks can also increase amount of data and information.

On the basis of a computer network specific software specifications designed specifically with the object of advancing learning could be established:

- Learning/problem solution databases
- Electronic learning packages
- Software systems designed for the support of individual and collective learning can be included in the network, e.g. personal development systems, catalogues on open learning, live resources etc.
- Product configuration

### **Practical Approach**

The above-mentioned allowed for new network possibilities. The case research (Case No. 60 Holcase; Case No. 61 Dolle) showed that such possibilities were very important to high speed product development. Case 60 showed how the case business can develop for 24 hours a day with product development moving around the global market in a computer network. Furthermore, the case showed how the business can develop simultaneously on sub-tasks in the product development process. This meant that the computer network gave the business several, different high speed effects.

## **4.3 Virtual Network Perspective**

An increasing number of networks were becoming virtual (Coldmann & Price, 1999) (Mackinsey, 2001) up to 2003. The definition of a virtual network is:

*“A virtual network is a network that exist when there is a task for it but does not exist when there is not a task for it”*

The increasing number of virtual networks had not been lessened by the spreading of the Internet or by the tendency to work in networks. However, the virtual network was not a new phenomenon, but the virtual networks became

more advantageous during the years up to 2003 and the advantages of running a network and being a participant in a virtual network had increased. The old and well-known networks and organisation forms – the physical networks – were often too inflexible, not sufficiently agile, and too burdensome in terms of costs. This aspect conflicted with increased market demands for increased speed, improved performance, and less costs as regards the industrial product development.

The physical network and the computer network were often too costly and resource consuming when running continuously. Therefore, the virtual network was interesting where the network was only activated when there was a task for the network.

A virtual network can be defined as follows:

*“Customer-focused and opportunity based, and it must have a clear and agreed upon set of objectives. Through the combination of the core competencies of all its members, it must establish a set of world-class core competencies to meet each opportunity”* (Coldmann & Price, 1999)

Coldmann & Price focused on the core competences of the virtual network and on the drivers and benefits. They also argued that the above-mentioned items would have a major influence on customers’ interest in buying products and achieving integration with the virtual network.

Coldmann & Price emphasized the focusing on customer and opportunities and stressed the importance of the virtual organisation having a common ultimate objective. On the basis of case examinations we were convinced that having a common ultimate objective of the product development task of the virtual organisation was particularly decisive for a virtual network which wished to improve time, costs, and performance. A discussion at the Salsa Group ([www.salsa.de](http://www.salsa.de)) stressed the importance of the tasks of the virtual networks. If the virtual network did not have a task, it did not exist and consequently, there was no need and want for the virtual network.

This imposes certain conditions on the virtual network:

*“The relationship among the partners in a virtual organisation must include trust, open and honest communication, and compatible management styles. The organisation must be able to make decisions quickly and to disband relatively painlessly when the opportunity that occasioned its creation has passed. It must have been organized because no one member could have met the opportunity alone.*

*It may be designed to be joined very easily to operate in distributed mode, to exploit concurrency, or to include competitors.”*  
(Coldmann & Price, 1999)

When it came to the product development process, there were a number of characteristics and advantages connected to the virtual network:

*“The virtual organisation can appear to customers as if it were, and it can act like, a big business because of the access to complementary competencies that it has in a virtual organisation. Look bag and retaining the entrepreneurial nature of being small.”*

*“Regardless of size, the virtual organisation offers to its members access to expanded markets, the ability to combine resources for new markets, and the ability to cut the concept to cash time through concurrency.”*

*“The virtual organisation has the ability to combine a disparate set of core competencies and offer advantages to customers in terms of systems reliability and capability. [...] the combined set of core competencies can exceed the capabilities of the members organisations acting either alone or in a non-integrated network. A virtual organisation of small businesses can collectively take on systematic tasks and be responsible for the manufacturing function of a customer firm.”* (Coldmann & Price, 1999)

At the same time, the virtual network provided the customer with a number of advantages:

*“Access to skills and experience of many different manufacturing approaches (initially and over timer)”*

*“Focus on the system versus components”*

- *higher reliability*
- *better quality and consistency*
- *lower cost for given functionality*
- *lower internal development costs*
- *Flexible access to resources*
- *variable production quantities*
- *pay only for services needed, with backup access as needed*
- *more robust partnering* (Coldmann & Price, 1999)

The major problem or drawback of virtual networks was:

*“The protection of intellectual properties.”* (Coldmann & Price, 1999)

Many businesses deliberated whether to enter into or establish virtual networks these years. The strategic prerequisites for the functioning of a virtual organisation are as a minimum:

1. Sharing infrastructure and risk
2. Linking complementary core competencies
3. Reducing concept to cash time through sharing
4. Increasing facilities and apparent size
5. Gaining access to markets and sharing market or customer loyalty
6. Migrating from selling products to selling solutions

The backbone of a virtual network could be a mix of both a physical and a digital network (Case No. 1 Zara) (Case No. 19 UK Chemicals). Therefore, it was relevant to look into the existence of virtual networks.

#### 4.4 Reflection on Network and High Speed Product Development

The importance of network types to high speed product development was of considerable interest to this project when considering the kinds of network used in product development and the intensity and influence of the network types on high speed product development. Furthermore, it was essential to this project to examine the kinds of network which were used and could be used in the early phases of a product development process to speed the process.

All our cases had therefore been carefully examined on the following points as shown in Table 4.2:

**Table 4.2** Network analysis of cases

Network Type	Idea Phase	Concept Phase					
Participating Functions							
	Product Development	Marketing	Sale	Finance	Production	HR	Management
Traditional Network (Internal)							
Traditional Network (External)							

**Table 4.2** Continued

Network Type	Idea Phase	Concept Phase					
Participating Functions							
	Product Development	Marketing	Sale	Finance	Production	HR	Management
Virtual network Computer Network (E-development)							

The objectives were to identify the involvement of networks and network partners in NB HS NPD.

#### 4.5 Network Perspective and Analytical Framework of Research Project

The network perspective of this research project took Håkonson and Håkonson's network concept as its starting point combined with the concept of the computer based and the virtual network. The network perspective presented network solutions and tools for explaining and substantiating high speed in different product development courses.

The focus of this research project was to identify which internal and external players were performing in the actual product development networks, and to identify the roles such players were performing in order to produce high speed in the product development.

This research project also focused on the kinds of networks which were used in high speed product development.

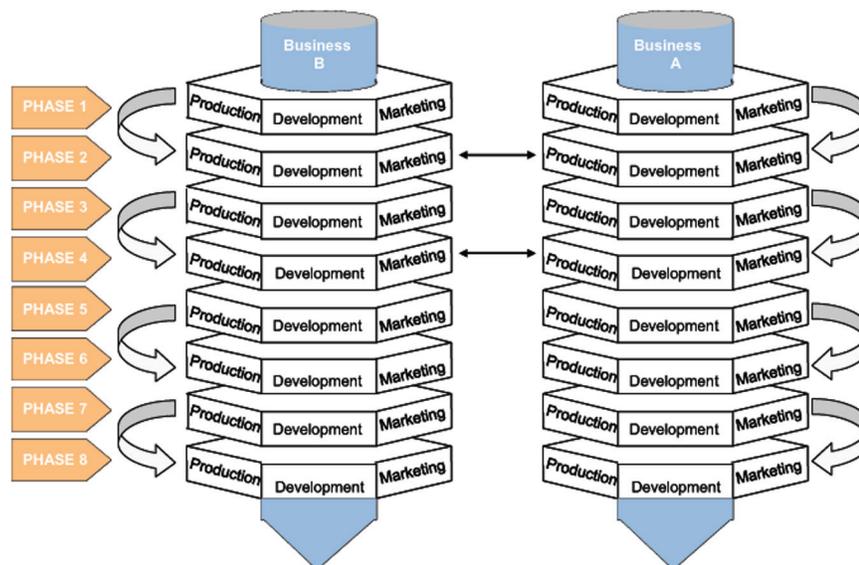
It was of the utmost importance to examine the kinds of networks that were used and the extent to which they could contribute to the explanation of high speed in the product development.

In what way networks could help increase the speed of product development and thereby shorten the product development process?

It was the hypothesis of this project that HS NPD projects were generally characterized by two or more network partners as is illustrated in Figure 4.1.

NPD network partners were only relevant provided that the NB HS PD core prescribes or allows network partners to be included in the product development project. Consequently, this research project focused mainly on the empirical evidence containing and applying networks in HS product development.

It was the hypothesis of this project that a HS PD course could increase speed considerably when network partners were included. It was the hypothesis of this project that it was advantageous to the business to include network partners as early in the course of product development as possible according to Figure 4.2. Furthermore, this project puts forward the hypothesis that the involvement of network partners could influence all success criteria of a product development course.

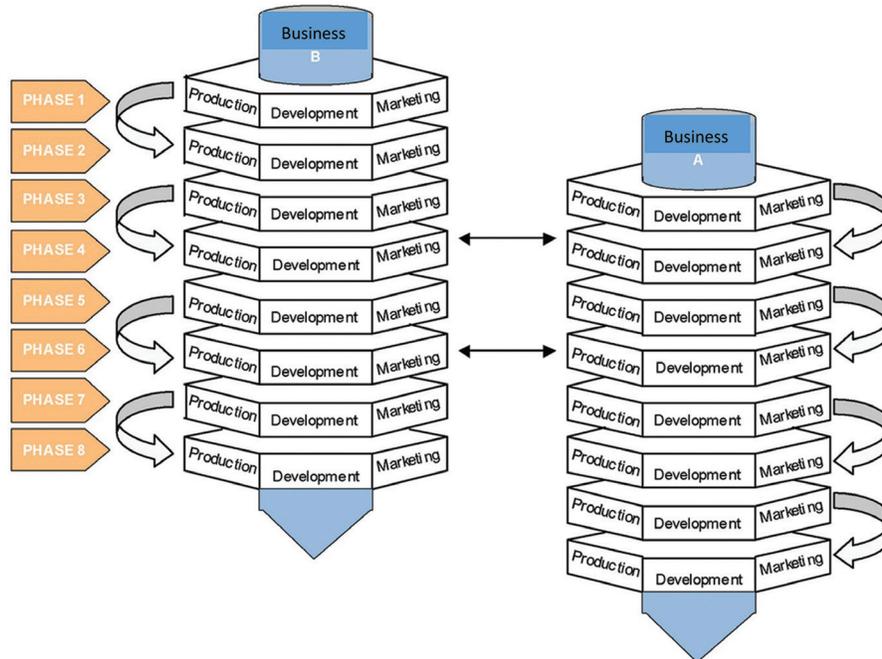


**Figure 4.2** Network partners at identical levels.

It was the hypothesis of this project that the kind of network partners which the business asks to and should join the network and which were actually becoming involved differs and should differ widely depending on:

- product development project
- product development model and process
- the market
- the technology
- the competences of the business

It was the hypothesis of this research project that one of the characteristics of a NB HS PD course was that the individual network partners could be dragged in or dragged out at different stages and gates which meant that the partners did not necessarily have to be at identical stages as illustrated in Figure 4.3.



**Figure 4.3** Network partners at different levels.

This project puts forward the hypothesis that it was critical to businesses product development and speed in product development that they were:

1. able to interfere with networks
2. able to find the right network partners for the situation in question
3. able to be fully aware of the individual differences of the partners in regard to stage and gate levels
4. able to attract and repel the right network partners throughout the project

The above-mentioned paragraphs have dealt with network based product development models and processes in relation to speed in product development. However, this subject also requires an additional discussion of the direction which a business or a network of businesses wish their product development to take, and of the success criteria according to which a product development project must be judged. Such a discussion was vital and necessary to manage high speed product development in 2003 and beyond. Consequently, the discussion is conducted in the following chapter.

## **4.6 Summary**

The objectives of this chapter were to establish the theoretical foundation and the theoretical concepts for my research project. Furthermore, this chapter was meant to delimit and clarify the central areas of my research project.

Thus, it was determined that my research project defines the product concept as a total product in the business-to-business market consisting of tangible as well as intangible elements. Furthermore, I determined that I should take the marketing point of view as my point of departure.

Additionally, I took my starting point in an analytical framework the fundamental structure of which was based on a combination of the stage and gate model and the department stage model. Yet, I also based my work on the hypothesis that not all product development processes could be explained by this model.

I had also taken the product development model – the stage and gate model – as my starting point and had determined that the central point of my research project was to be what Cooper 1986 calls the idea and concept phases together with the ensuing screening phases. My research project also deals with the horizontal and vertical processes which go on in network based product development – i.e. internally between the departments of the business and externally with suppliers and customers. My analysis also treated the use of different kinds of network in high speed product development as a means to increase the speed of the product development process.

The analysis of such processes had as their objective to advance a generic model explaining network based high speed product development. It had become apparent that when preparing such an analysis it was necessary also to address the iterative product development process and the parallel development of several elements and processes during the product development course.

To be able to evaluate the success of a product development course, I had chosen to address three central concepts, viz. costs, time, and performance. Of these three, I centred my attention on time. The dependence of each success criteria had been discussed and alternative success criteria had also been deliberated.

The above definition of concepts had been necessary in order to carry on the empirical study of network based high speed product development as it would otherwise not be possible to describe, analyze, and satisfactorily explain the main phenomena of network based high speed product development.