Inter-organisational infrastructures for competitive advantage : strategic alignment in virtual corporations

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Strategic Alignment in Virtual Corporations

Luuk Kornelius

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Proefschrift

ter verkrijging van de graad van doctor aan de Technische Universiteit Eindhoven, op gezag van de Rector Magnificus, prof.dr. M. Rem, voor een commissie aangewezen door het College voor Promoties in het openbaar te verdedigen op woensdag 9 juni 1999 om 16.00 uur

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Luuk Kornelius

geboren te Valkenswaard

Dit Proefschrift is goedgekeurd door de promotoren:

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en
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Preface

During the last seven years, the research that resulted in this book has never left my mind. Always there was at least this little voice in the background, which reminded me of the work that still had to be done. Sometimes it was even shouting in my face. At times in which I did not make as much progress as would have liked to make, this voice could easily lead me to frustration and anger.

I gained most of my motivation to carry on from the awareness that this research was not important enough to be frustrated or angry about. My marriage to Liskje in 1995 and the birth of Willemijn in 1998 made me realise that I did not need my research to be a happy person.

This also helped me understand others who did not spent as much time listening to me as I might have wanted. Instead, I came to be very grateful for all the opportunities I was given to spent so much time on something that essentially was nothing but a strange hobby.

Piet van der Vlist has been the initiator for all this when he, in 1992, offered me to work for Bakkenist and TUE at the same time. Without him I would not have been writing this. Thanks.

I owe special thanks to my collegues at the "vakgroep I&T" from TUE for providing a stimulating and challenging environment in which I could spend hours and hours on seemingly useless and theoretic discussions on a wide variety of topics. However irrelevant they may have seemed to my research, each of these discussions helped me shaping my thoughts and refining my ideas.

I should of course express my great appreciation towards Bakkenist. Letting me be researcher and consultant at the same time allowed me to step back from my research every now and then, and do some real work. This prevented me from thinking that I was developing the cure for all problems businesses were facing.

A special word of acknowledgement should go to the organisations that allowed me to do my case studies; Philips Business Communications, Rank Xerox and Daf Trucks. Their people were always available to provide information or to give feedback on my ideas. Especially Menno Borger from Philips Business Communications has been an inspiring sparring partner.

Now that I am writing this last piece of text for my thesis, I realise that the little voice may soon be silent. I will miss him....

Luuk Kornelius
Hillegom, 12 April 1999

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Samenvatting (Summary in Dutch)

Toenemende klantspecificiteit van producten en technologische innovatie hebben geleid tot samenwerking tussen gespecialiseerde ondernemingen in de productie van complexe producten. Fabrikanten kunnen daarom niet zaken doen met leveranciers per transactie, maar zijn genoodzaakt te opereren in netwerken waarin langdurige relaties bestaan tussen bedrijven. In zulke netwerken (of "virtual corporations") heeft elke organisatie zich ontwikkeld tot specialist met betrekking tot specifieke componenten of functies van het gezamelijke eindproduct. Voor elk van deze specialisten geldt dat het niet kunnen samenwerken met de andere specialisten in het netwerk leidt tot een afname van de aantrekkelijkheid van zijn eigen product of dienst.

Bestaande concepten voor het optimaliseren van interorganisationele processen gaan uit van een sequentiele structuur van toeleverketens. Het gebruik van zulke concepten heeft geleid tot verbetering van de interactie tussen fabrikanten en hun leveranciers, waardoor beiden in staat waren om hun productieplanning verbeteren en zo de prestatie van de hele keten te verbeteren. Fabrikanten zijn daarnaarst genoodzaakt intensieve relaties aan te gaan met hun klanten, waarin zij de processen van hun klant kennen en informatie daarover distribueren door de keten.

De oorspronkelijke doelstelling van dit onderzoek was het opstellen van richtlijnen van dergelijke concepten voor interorganisationele samenwerking. Verkennende casestudies lieten echter zien dat binnen organisaties zulke concepten worden gezien als oplossingen voor operationele problemen die geen relatie hebben met de strategie van de onderneming. Concepten die aantoonbaar tot verbetering van de ketenprestatie zouden leiden konden niet worden geïmplementeerd door hun consequenties voor en afhankelijkheid van een

veelheid van processen en functies binnen het bedrijf en door gebrek aan mogelijkheid deze processen in de implementatie te betrekken. Dit leidde tot de conclusie dat, om deel te kunnen nemen aan virtual corporations, interorganisationele samenwerking gezien moet worden als onderdeel van de strategie en geen keuze op operationeel niveau kan zijn.

De casestudies lieten zien dat succesvolle implementatie van inter-organisationele samenwerking ook actieve betrokkenheid vereist van managers van uiteenlopende disciplines. Voor het stellen van prioriteiten tussen zulke multidisciplinaire projecten zijn richtlijnen nodig, waarmee management de afhankelijkheid van inter-organisationele samenwerking voor processen kan bepalen. Dit onderzoek is gericht geweest op de ontwikkeling van zulke richtlijnen.

Bestaande methodologieën voor strategie-ontwikkeling en prioriteitstelling met betrekking tot inter-organisationele samenwerking gaan uit van de producten die binnen de samenwerking worden uitgewisseld. Potentiële samenwerkingspartners kunnen echter uiteenlopende producten leveren en daarmee alle categorieën van de inkoopportfolio bestrijken. Zulke methodologieën kunnen daarom niet worden gebruikt voor de classificatie van inter-organisationele samenwerking. Verschillende vormen van inter-organisationele samenwerking kunnen wel goed worden onderscheidden aan de hand van proceskenmerken. Segmentatie van inter-organisationele samenwerking ten behoeve van strategieontwikkeling en prioriteitstelling moet worden gebaseerd op proceskenmerken en niet op productkenmerken

Zo'n procesorientatie is ook noodzakelijk met betrekking tot klanten. De kennis die nodig is voor de ontwikkeling en vervaardiging van producten kan zodanig zijn dat klanten eisen niet uit te gaan van de producten, maar verwachten dat de fabrikant de verantwoordelijk op zich neemt voor het faciliteren van het proces van de klant. Zulke fabrikanten worden daarmee dienstverleners. Door daarbij inter-organisationele samenwerking als onderdeel van hun strategie beschouwen treden ze op als "Gateway" naar de processen van hun partners. Dit betekent dat er een voortdurende interactie moet zijn tusen processen van klanten en processen van de faciliterende organisaties in het netwerk, gericht op voortdurende klanttevredenheid.

In de literatuur wordt beschreven dat de componenten van een 'strategische architectuur' de processen zijn, benodigd om een compleet geïntegreerd product te leveren. Dit geldt ook voor virtual corporations. Een architectuur bestaat naast componenten ook uit interfaces. 'Architectural knowledge' kan daarom net zo belangrijk zijn als 'component knowledge'. Het ontwerp van een virtual

corporation start bij het opstellen van een strategische architectuur die zowel de processen omvat als de systemen en structuren nodig om die processen met elkaar te integreren. Deze systemen en structuren vormen samen de infrastructuur voor de processen. De infrastructuur kan worden gekarakteriseerd op basis van middelen, beslissingsstructuren en de informatiesystemen.

Één van de karakteristieken van een virtual corporation is de verdeling van eigendom, macht en loyaliteit binnen het netwerk. Dit beperkt de vrijheden in het ontwerp van processen en infrastructuren en daarmee de flexibiliteit in het ontwerpen van de geïntegreerde producten of diensten. Strategische keuzes en het ontwerp van de infrastructuur van een virtual corporation moeten daarom iteratief op elkaar worden afgestemd. Het is niet mogelijk zonder meer specificaties voor de infrastructuur af te leiden uit de strategie.

Een Gateway kan zichzelf onderscheiden doordat het opzetten van onderscheidende vormen van samenwerking in een virtual corporation. Tijdens het proces van het afstemmen van strategie en infrastructuur moet een Gateway er vanuit gaan dat naarmate een meer "gesophisticeerde" infrastructuur noodzakelijk is voor inter-organisationele samenwerking, de kans groter is dat de samenwerking uniek en onderscheidend is.

Het opzetten van een competitieve virtual corporation is echter niet simpelweg het combineren van moeilijk te combineren processen. Een Gateway moet bovendien niet teveel energie steken in gevanceerde, maar overbodige infrastructuren. Het vaststellen van het strategisch belang van een proces vereist daarom meer dan alleen het vaststellen van de mate van gesophisticeerd zijn. Een Gateway moet een duidelijk beeld hebben van de reden waarom het een bepaald proces in de strategische architectuur opneemt.

Aan de hand van "Service Scope" en "Infrastructure Sophistication" kunnen de processen in de strategische architectuur worden geclassificeerd in vier groepen. Elk van deze groepen speelt een andere rol in attractiviteit van het geïntegreerde product of dienst. Gateways kunnen deze classificatie daarom gebruiken om het strategisch belang van processen vast te stellen.

Deze concepten en ideeën zijn gebruikt om een methodologie te ontwikkelen voor het afstemmen van strategie en inter-organisationele infrastructuren. Deze methodologie is toegepast bij Philips Business Communications. Het bleek daar een waardevolle benadering te zijn voor dergelijke afstemming.

Summary

In manufacturing, increased customisation on the one hand, and technological innovation on the other, have resulted in a need for co-operation between specialised organisations. Manufacturers can therefore no longer do business with suppliers on a transaction basis, but are required to build networks and set up longer lasting relationships. In such networks, or "virtual corporations", each of the organisations has evolved into a specialist for specific components or functions of the mutual final product. For each of these specialists, not being able to co-operate with other specialists in the network decreases the attractiveness of his product or service.

Prevailing concepts for optimisation of inter-organisational processes assume a sequential structure of supply chains. Indeed, the use of such concepts has resulted in improved interaction between manufacturers and their suppliers, which allowed both manufacturers and suppliers to improve their production planning and thus improve supply chain performance. Furthermore, manufacturers are required to build close relationships with their customers, intensively monitoring their customers' processes and subsequently use this information throughout the supply chain.

This research was started to develop guidelines for the implementation of such concepts for inter-organisational co-operation. Explorative case studies showed however that within organisations such concepts are viewed as operational issues, which have no relation to the organisation's strategy. Concepts that could demonstrably improve supply chain performance could not be implemented because of their impact and dependence on a multitude of processes and functions throughout the organisation and the inability to involve these processes in the implementation. This led to the conclusion that in order to participate in virtual corporations, inter-organisational co-operation should be seen as part of the organisation's strategy, not as a choice to be made at an operational level.

The case studies made clear that successful implementation of inter-organisational co-operation also requires the active involvement of managers of multiple disciplines. For management to give its commitment and involvement to such multi-disciplinary projects, guidelines are required for evaluating the dependence on inter-organisational co-operation of processes, in order to prioritise and to focus budgets and management commitment. This research aimed at the development of such guidelines.

Existing methodologies for strategy development and prioritisation in inter-organisational co-operation take the products exchanged in the co-operation as a starting point. Potential partners may however supply multiple products which may be spread over the entire purchasing portfolio. Such methodologies can therefore not be used for the classification of inter-organisational relationships. Instead process characteristics provide a basis for discerning inter-organisational relationships. Segmentation of inter-organisational co-operation for strategy development and prioritisation should be based on process characteristics, not on product characteristics.

This process orientation is also required towards customers. The knowledge required to develop and produce complex products may be of such specificity that customers do not want to buy such products, but instead demand their suppliers to take up responsibility for facilitation of the customer's processes. Such suppliers should therefore regard themselves as service providers, instead of manufacturers. If they consider inter-organisational co-operation part of their strategy, they act as the customer's Gateway to the processes of their partners. Consequently, there is a need for ongoing interaction between the process of the customer and those of the enabling organisations in the network, aimed at continuous customer satisfaction.

Literature research made clear that the components of a strategic architecture are the processes needed for a complete offering. This is also true for virtual corporations. An architecture also requires interfaces between its components. 'Architectural knowledge' may be equally important as 'component knowledge'. Designing a virtual corporation starts with drawing a strategic architecture that describes the processes needed for a complete offering as well as the means and structures required for interfacing them. These means and structures together form the infrastructure of the business processes. They can be be characterised on the basis of resources, decision structures and information systems.

One of the characteristics of a virtual corporation is the division of ownership, power and loyalty within its network. These constrain the design of processes and infrastructures. It consequently limits the flexibility in designing the offering to the market. Strategic choices and the design of virtual corporation's infrastructure

should therefore be aligned iteratively, instead of deducing requirements from a strategy.

A Gateway can distinguish itself through its ability to set up distinctive forms of co-operation in a virtual corporation. While going through the process of aligning strategy and infrastructure, it should consider that the more sophisticated the required infrastructure, the more complex the co-operation will be and the greater the chance that the co-operation will be unique.

However, setting up a competitive virtual corporation is not simply setting up a combination of processes that are hard to combine. Furthermore, a Gateway should be careful not to spend too much effort on sophisticated, yet superfluous infrastructures. Assessment of strategic importance of a process requires more criteria than the sophistication of its infrastructure alone. The Gateway requires a clear view on the need to include a process in its strategic architecture. Service scope and infrastructure sophistication can be used to classify the processes in the strategic architecture into four groups. Each of the groups plays a different role in the attractiveness of the offering. Gateways can therefore use the classification for assessment of the strategic importance of infrastructures.

These concepts and ideas have been used to develop a methodology for strategic alignment of strategy and inter-organisational infrastructures. This methodology has been applied to Philips Business Communications, where it appeared a valuable approach in such alignment.

1. Introduction

1.1. Background of the Research

Inter-organisational co-operation has become more important for many organisations. Those who operate in business-to-business markets, are confronted with a need to co-operate both on the suppliers side and on the customer side. Inter-organisational co-operation has become more important because of a need to customise products on the one hand and technological innovation on the other. Due to these pressures, many organisations need to combine their products with those of others before the customer perceives them as a complete offering. Furthermore, information technology now enables forms of co-operation that have never been possible before. This enables organisations to provide more complete combinations of products and services than ever. The ability to co-operate has thus become a prerequisite to compete in many markets. § 3.1 gives an overview of these trends and describes how they cause a need for inter-organisational co-operation.

Inter-organisational co-operation has been studied from various disciplines in management science. It is of course an important issue in purchasing (e.g. Lamming, 1993) and in industrial marketing (Wollaert, 1994). Also in logistics, inter-organisational co-operation has been studied and described abundantly (e.g. Godbersen, 1990; Hoogewegen, 1997; Verwijmeren, 1998; Van der Vlist, 1997). Finally, developments in information technology have led to the development of new concepts for inter-organisational co-operation, descriptions of which can easily be found in the literature (e.g. Southey, 1996; Cutkosky, 1996; Upton, 1996; Hardwick, 1996). The importance of inteorganisational co-operation has also been recognised in the strategy literature (e.g. Hamel, 1990; Morris, 1993).

However, in practice many organisations experience problems in using inter-organisational co-operation to their advantage. Neither within these organisations, nor in the literature, a clear view exists on what forms of co-operation should be developed in order to increase competitive strength. If inter-organisational co-operation really is as important as the literature suggest, this leads to missing opportunities and inhibits the creation of competitive advantage.

This might partly be attributed to the complexity of inter-organisational co-operation. As illustrated by the many fields in which the subject is studied, many issues interrelate in inter-organisational co-operation. Therefore, setting up inter-organisational co-operation is difficult and requires management commitment.

This research aims to interrelate the literature from the various disciplines on inter-organisational co-operation. The discussions, that follow from the confrontation between the various disciplines, are used to develop a coherent approach for alignment of strategic and choices and the development of inter-organisational co-operation. The approach aims to provide guidelines for determining the potential for competitive advantage through inter-organisational co-operation. It helps organisations that rely on inter-organisational co-operation, in order to provide a complete offering, in determining which elements to include in their offering and which infrastructures for inter-organisational co-operation to develop.

This approach comprises a conceptual framework (§ 1.2) and a methodology (§ 6.6, figure 6—13), which allows evaluating various forms of inter-organisational co-operation for their contribution to competitive advantage. The methodology uses a set of techniques that have also been developed in this research. First, a set of indicators for assessment of the means and systems needed for inter-organisational co-operation has been developed (§ 6.4, table 6—2 through table 6—4). Second, a portfolio analysis technique has been suggested for choosing a management approach towards various forms of inter-organisational co-operation (§ 6.5, figure 6—12).

1.2. Important Concepts in this Thesis

Important concepts in this thesis are *Offering, Virtual Corporation, Strategic Architecture, Infrastructure* and *Gateway*. In this section these concepts will be

introduced to provide some understanding of the conceptual model of this thesis. Throughout the book more formal definitions and discussions are given.

1.2.1. Offering

Offering refers to the combination of goods and services that the customer perceives and evaluates as a whole. The various goods and services are not necessarily acquired through a single transaction. Instead the customer may acquire multiple goods and services over time, and still consider them part of a single offering. In § 5.2.3, Shostack's molecular modelling technique services perfectly illustrates the compoundness of offerings and the interrelationships between the customer's purchasing criteria for each of the elements of an offering.

For instance, individual products, parking facilities and in-store-atmosphere all are elements of a supermarket's offering. After all, customers do not assess the supermarket on the basis of the purchase of one bottle of orange juice, but over time evaluate the completeness of the assortment, the convenience of getting there every weekend and the pleasure of being in the store.

The elements of an offering are not necessarily acquired from the same supplier. The parking facilities for example could be owned and operated by an independent organisation or by the local authorities. However, due to the fact that customers include the parking facilities in their decision to do their shopping at the supermarket, they may be considered part of the same offering.

One could argue that customers (implicitly) evaluate an infinite number of factors, many of which cannot be influenced. Any organisation therefore (implicitly) decides which elements it wants to include in its offering. Other relevant elements are then treated as outside factors. Consequently, identifying an offering is a subjective matter: the supermarket may decide to consider parking facilities an essential element of its offering, while the parking operator looks at its offering as nothing but accessible square metres. The parking operator will not consider orange juice part of his offering.

1.2.2. Virtual Corporation

A *Virtual Corporation* refers to the set of organisations, involved in providing the offering to the customer. The customers' choice to consider their products and services part of one offering requires these organisations to seek some sort of adjustment or co-operation. Because of the subjectivity of defining an offering, a virtual corporation is a subjective concept. The supermarket of § 1.2.1 may want to

consider the parking operator part of the virtual corporation. If the parking operator conceives the supermarket's assortment and atmosphere as irrelevant to his offering, he will not regard the supermarket part of his virtual corporation. A formal definition of 'virtual corporation' is given in § 3.2.5.

1.2.3. Infrastructure

Infrastructure refers to the systems and/or structures necessary for operation (cf. Longman, 1987). If operation is defined as the transformation of input and output, the infrastructure exists of the resources that perform the transformation, the required information systems and the organisational context of the various transformation processes (see § 6.1).

Each element of an offering needs its own set of transformation processes. Each element of an offering therefore has its own infrastructure. The infrastructure of a virtual corporation exists of the infrastructure for the elements of its offering. Due to the inter-organisational nature of a virtual corporation, the infrastructure of a virtual corporation exists of the infrastructures of its members. Part of this infrastructure facilitates inter-organisational adjustment and interaction of transformation processes. In order to be able to participate in a virtual corporation, an organisation should not only develop infrastructure for its in-house processes, but it should have an inter-organisational infrastructure as well.

1.2.4. Strategic Architecture

Strategic architecture refers to the set of competencies or processes required to provide the offering, and their interrelations (see § 5.3.2). Processes are firstly interrelated through input-output and secondly through the elements of their infrastructure: resources, organisational context and information systems (§ 6.1.2).

- Input-output relationships describe the transformation of objects in processes and thus determine the sequence of processes in time.
- Resource interrelations between processes describe the requirements processes impose on the resources of other processes.
- The organisational context describes the division of responsibilities for the various processes in the architecture.
- Information interrelations between processes describe communication on parameters such as timing, quantity, quality and status. In order to be able perform their transformation role, processes require information on their input as well as on their required output.

The view of the offering defines not only the boundaries of the virtual corporation, it also defines the strategic architecture.

1.2.5. Gateway

Gateway refers to an organisation that chooses to position itself as primary responsible for offering its customers a complex combination of products and services, many of which the customer does not produce or provide itself (see § 5.1.4). A Gateway's competitive advantage lies in its ability to ensure the interaction between the processes of the various organisations involved in providing the offering. This requires the Gateway to be able to set up and maintain inter-organisational relationships, and to build and implement the infrastructure required for inter-organisational co-operation with the organisations in its virtual corporation.

2. Problem Statement and Research Methodology

This chapter describes the problem statement, research objective and research questions for the research this book is based on. Subsequently, it describes the research design and research execution. The last section of this chapter describes the outline of this book. It explains where research questions are addressed and where important presumptions, assumptions or conclusions are given.

Investment goods by definition facilitate (a part of) the customer's process. In many cases, the customer cannot afford to accept a non-performing product, since this would directly impact his primary process. Furthermore, the customer may require the vendor to ensure the performance of the product over its lifetime, which requires a continuously varying combination of competencies. Providing investment goods can thus be complex. This complexity can be such, that even the providers of investment goods cannot develop all the required competencies on their own. In these cases, the providers need to focus and co-operate with others.

This results in networks of organisations, which co-operate to provide a joint product or product family. The co-operation requires interaction between the processes that are carried out when serving the customer. Therefore, the appropriate means and structures that enable such interaction must be in place.

2.1. Problem Statement

For organisations whose competence is only of interest to the customer if combined with the competencies of others, the ability to co-operate is of strategic importance. Co-operation offers them the opportunity to outperform competitors who cannot co-operate with the right partners. Co-operation can therefore be seen as an essential competence itself.

Inter-organisational co-operation has been an important subject in various fields of research. In logistics, many concepts for supply chain management have been developed. The benefits of Electronic Data Interchange, GroupWare and Internet have been demonstrated in the field of information technology. Possible structures for inter-organisational co-operation have been described abundantly in organisation theory. In Strategic Management, strategic alliances have been studied extensively. In the purchasing literature, portfolio techniques for supplier management are strongly advocated.

When deciding whether to develop an infrastructure for inter-organisational co-operation, arguments from all of these fields play a role. Experts like logisticians, purchasers and information technologists, design infrastructures that facilitate efficient and effective co-operation, using state of the art knowledge from their respective fields of expertise. Therefore, in many cases the bottleneck in developing inter-organisational infrastructures is not in the development of the technical solution.

However, as in science, these experts primarily deal with issues related to their own disciplines. The resulting problems are twofold: First, they are not able to describe the consequences and prerequisites in other fields, thus reducing the chances of successful implementation. Second, they are generally not able to explain the contribution of the infrastructure to the organisation's competitiveness. It is therefore difficult for managers to give their commitment to implementing the proposed infrastructure. Chapter 4 presents case studies that showed how demonstrable benefits of inter-organisational co-operation did not lead to management commitment for implementation of the infrastructure designs.

The organisations in the case studies had many characteristics of Gateway organisations. They needed co-operation with suppliers and partners for the provision of a complete offering to their customers. Nevertheless, there appeared to be no relationship between their strategy and the development of infrastructures for inter-organisational co-operation.

So, not only were experts not able to present the strategic impact of their infrastructure designs, neither was management able to formulate an integrated view on the infrastructure their organisations required, in order to use their ability to co-operate for creating competitive advantage. This led to the conclusion that Gateways require a framework, to evaluate elements of their infrastructure for inter-organisational co-operation for their strategic importance and potential contribution to competitive advantage (see thesis IV).

2.2. Research Objective and Research Questions

The subject of this research is:

> *Alignment of strategy and inter-organisational infrastructures for Gateway organisations*

The research objective is:

> *The development of a methodology for Gateway organisations, which allows these organisations to evaluate the strategic importance of designs for inter-organisational infrastructures.*

The results of this research should be valuable to managers and consultants, involved in discussions on the development of inter-organisational partnerships and inter-organisational infrastructures. Experts, like information managers, logisticians and purchasers, should be able to use the results to explain the value of the concepts they developed to the decision-makers. It is assumed that facilitating a dialog in such a broad target group requires the development of a common view on the relationship between products and the role of infrastructures and processes. This led to the first research question:

> *What is the relationship between products, processes and infrastructures for inter-organisational co-operation?*

Discussing and evaluating infrastructures requires defining them and finding characterisations that prevent ambiguity between the actors involved in the evaluation process. Frameworks used should be based on concepts and terminology that are recognised throughout the target group. Simplicity and straightforwardness are considered prerequisites for the representation of the concepts. The second research question therefore is:

> *How can inter-organisational infrastructures be characterised in such a way, that managers as well as experts from a range of disciplines can judge their value?*

Evaluating the strategic importance of inter-organisational infrastructures requires insight in the relationship between the strategy and infrastructures for Gateways. The third research question therefore is the following:

> *What is the relationship between inter-organisational infrastructures and strategy for Gateway organisations?*

Finally, the methodology should facilitate the evaluation itself. This calls for understanding the impact infrastructural design choices can have on the strategic position of the Gateway. Consequently, the fourth research question is:

> *What considerations should a Gateway take into account when assessing the strategic importance of infrastructure designs?*

The answers to these questions will be used to develop a methodology, which supports managers to evaluate existing inter-organisational infrastructures and to prioritise proposals for new ones. It stimulates experts within an organisation to use a common framework when discussing concepts they developed with management.

2.2.1. Research Products

The concepts, frameworks and techniques from this research are the result of a design process. The research objective was not to describe and analyse existing methodologies. The designs are based on literature, logic and experience from the case studies. One of the case studies served as a test case for applicability of the design. § 2.4 discusses the consequences of restricting the testing to a single case for the validity of the results.

The answer to the first research question regarding the relationships between products, processes and infrastructures has been laid down in a conceptual model which describes these relationships. This model is briefly introduced in § 1.2. Its concepts are discussed extensively throughout the book.

Insight in the relationship between inter-organisational infrastructures and strategy for Gateway organisations resulted in the extension of an existing approach for strategic alignment. The extended approach is presented in § 6.3 through § 6.6.

Characterisation of inter-organisational infrastructures provided a common language for managers and experts, which allowed them to compare and discuss

inter-organisational infrastructures. § 6.4 gives an overview of these characterisations. This characterisation could then serve as the basis for the development of a portfolio analysis technique for processes that make up a complex offering. The technique has been embedded in a methodology for evaluating the strategic importance of processes for Gateway organisations. The technique (figure 6—12, page 142) and the methodology are presented in § 6.5 and § 6.6. Chapter 7 describes the usage of the technique and the methodology in a real life situation.

2.2.2. Research Domain

The research has been restricted to business-to-business markets and the manufacturing of complex, customer specific investment goods, with a customer independent orientation on developing products (see also table 3—4). This particular area was selected, because the need to combine competencies from multiple organisations in a single offering was considered more apparent here than in other markets.

It can be argued that in other areas of business, organisations must experience a similar pressure. Further research will have to make clear if the results of this research are also applicable to these other areas (see § 8.4).

2.3. Contribution of the Research

This research is relevant from a scientific perspective as well as from a business perspective.

2.3.1. Contribution to the Scientific Community

In the literature on strategic management, authors stress the importance of developing alliances for combining competencies. Hamel and Prahalad explain how an organisation that forms and leads a coalition of companies that envision the same end product, can increase its strength significantly (Hamel, 1990). Post describes how Baan Company has leveraged its competencies through pulling in expertise from outside (Post, 1997). Van Aken, Hop and Post explain how world-wide 'hyper competition' requires organisations to focus on their core competencies and rely on purchased competencies of their suppliers and partners.

This type of purchasing and outsourcing requires organisations to set up stable and long-term relationship with a restricted set of suppliers, in order to ensure the availability of their suppliers' products and services (Van Aken, 1997). Morris and Ferguson state that building an architecture of products which is mirrored in a network of organisations is essential to "(...) win technology wars" (Morris, 1993).

In the literature on purchasing, partnership with suppliers is considered essential to ensure quality, availability and low costs for purchased components and/or services (e.g. Lamming, 1993). Watts, Kim and Hahn argue that purchasing should be "linked to corporate strategy", because of the organisation's dependence on its suppliers and their capabilities (e.g. Watts, 1992). Stuart's survey demonstrated how the increase in money spent on outsourcing leads to an increased strategic profile for purchasing (Stuart, 1996).

In the marketing literature authors advocate intensifying customer relationships. Stone, Woodcock and Wilson conclude from their research that customers require a customised relationship, which fits their individual needs and gives them access to their supplier's products and services (Stone, 1996). Vandermerwe even argues that organisations increase their strength by "owning" their customers (Vandermerwe, 1996). In analogy, Webster sees customer relationships as the "key strategic resource of the business" (Webster, 1992). This requires organisations to consider marketing and sales to be integrated in the service to the customer (Cespedes, 1995)

The literature on operations management comprises numerous publications on concepts for inter-organisational co-operation, based on advanced functionality of information systems. Examples can be found in logistics (e.g. Godbersen, 1990; Hoogewegen, 1997; Verwijmeren, 1998; Van der Vlist, 1997) and in product development (e.g. Southey, 1996; Cutkosky, 1996). Such technologies for inter-organisational communication are described in the literature on information systems (e.g. Upton, 1996; Hardwick, 1996).

In most cases, authors have not been able to explain the relationships between the various disciplines. The literature on strategic management does not help deciding which infrastructures to invest in. In the literature on logistics and the literature on information systems some publications address this issue (e.g. Evans, 1997; Clemons, 1992). However, generally these do not help identifying the opportunities for increasing competitive advantage, resulting from sophisticated forms of co-operation.

This research therefore aims to contribute to relating the literature on operations management (which comprise purchasing and logistics) to the strategy

literature (which comprises strategic management and marketing), in the field of ICT-enabled inter-organisational co-operation.

2.3.2. Contribution to Business

This research is based on the presumption that suppliers of investment goods must specialise in order to develop and deliver state-of-the-art products and services (see § 3.1.3). On the other hand, such suppliers are required to master multiple skills in order to provide total, turn key, solutions. This paradox can only be solved by combining the skills of numerous specialists in a single offering to the customer. Without inter-organisational co-operation they will not be able to sell their own products.

For these organisations, the offering they can make to their customer is restricted by their infrastructures for inter-organisational co-operation. Developing the wrong infrastructure, or not developing an essential infrastructure, may have serious consequences for the organisation's competitive position. This research aims to provide concepts and frameworks that facilitate the decision making on the development of inter-organisational infrastructures, in relation to the role they play in the offering to the customer. These concepts and frameworks should therefore be of value to experts and managers (and their consultants) involved in the decision-making concerning investments in inter-organisational infrastructures.

2.4. Research Methodology

2.4.1. The Role of Case Studies

A recurring issue in management science is the generalisation of findings and concepts. Generally, experiments in controlled circumstances cannot be set up. Instead, the research must be carried out through studying real life situations. Consequently, the results of such research may have been influenced by many hidden variables. Conclusions drawn in a specific situation may not be valid for another. The repeatability of research results can therefore not be guaranteed.

Studying real life situations (or case studies) can however serve a number of purposes. First, it helps understanding problems that so far have not been fully

recognised or understood. Case studies provide insight in the complexity of the problems, allow recognising the issues to be considered, and help developing directions for change. Van der Zwaan refers to this as *unfolding*.

Second, case studies can be used to identify mechanisms and processes that explain observations. Identification of such mechanisms and processes can be used for verification of hypotheses. Van der Zwaan refers to this function as *trying* (rather than using the term *testing*, which is more appropriate in case of experimental research). (Van der Zwaan, 1989; pp. 71-72). In this project, case studies have been used for both purposes.

2.4.2. Research Design and Research Execution

The research project existed of the following phases:

- Exploration of the field of research, refining research objective and research questions
- Development of the theoretical frameworks, concepts and techniques
- Verification of the theory
- Conclusion and reflection; recommendations for further research

Throughout the project preliminary findings have been published in technical journals, and papers have been presented at international conferences. This resulted in continuous feedback on conclusions drawn and choices made. Other additional, unstructured, input came from the researcher's experience as a management consultant with a major Dutch consulting firm, where he was involved in numerous projects, concerning logistics and information technology in networks of organisations.

Exploration of the field of research, refining research objective and research questions

In 1993 and 1994, three explorative case studies have been carried out with manufacturers of investment goods. These manufacturers had all set up projects for the implementation of promising logistic concepts, enabled by the availability of modern information technology. The purpose was to learn from successful implementation of concepts to identify criteria for choosing between concepts.
The explorative case studies were carried out with the following organisations:

- DAF trucks
- Rank Xerox Manufacturing
- Philips Business Communications

Previous research projects with these organisations had made clear that all three had a history of developing innovative internal logistic concepts. In 1993 and 1994 they had started projects to extend their experience with such concepts to their suppliers. Each of the case studies lasted between 6 and 8 months.

During these periods the researcher observed the activities and decisions of the responsible project teams. Information was collected through attending project team meetings, through participating in supplier visits and through interviews with selected members of the organisations involved. Important additional information was acquired, simply by being present in the organisation for 2 or 3 days a week. This ensured being involved in informal meetings and discussions, which probably provided the most valuable insights.

The observations from the case studies were used to analyse the course of events in the projects and their outcomes. These were laid down in reports, and validated with the project team members and their managers.

As chapter 4 describes, none of the projects resulted in successful implementation. This was largely attributed to a lack of management commitment to setting up inter-organisational co-operation. These conclusions led to the decision to focus on finding arguments, to be used in ensuring commitment of general management for the implementation of concepts for inter-organisational co-operation. This required a multidisciplinary approach.

As the lack of success in the case studies had not been expected, the research design had to be adjusted. The experience from the case studies led to new assumptions, which were then used to develop new research questions. In chapter 4, the literature on operations management (Van Donselaar, Clark & Scarf, Van der Vlist) is used to illustrate that the concepts, that were supposed to be implemented in the case studies, were not unique.

The adjustment of the research questions, required additional studying of the literature to gain some understanding of the strategic role of inter-organisational co-operation. For this purpose, the literature on Organisational Networks/Virtual Corporations (IMP-group, Davidow & Malone, Goldman, Brown c.s. and Konsynski) was studied. In addition, the supervision of graduate students, who worked on their assignments in the case study organisations, allowed to iteratively study the literature and to refine the problem statements. Not only did the students provide research material, but the supervision process also enabled ongoing

discussions with experts in the organisations. Chapter 3 is the result of this literature study[1].

Development of the theoretical concepts, frameworks, and techniques

The case studies and the literature study on virtual corporations led to the assumption that organisations who wish to use inter-organisational co-operation for creating competitive advantage require guidelines for the evaluation of various forms of co-operation. This required two things. First, the role of inter-organisational co-operation in the strategic positioning for a manufacturer of investment goods had to be analysed. Second, a methodology for strategic evaluation of inter-organisational infrastructures had to be developed.

The role inter-organisational co-operation in the strategic positioning was analysed on the basis of the literature on Strategic Management (Prahalad & Hamel) and the Marketing literature (General: Kotler; Industrial: Van der Hart, Webster; Services: Grönroos, Lovelock, Vandermerwe, Shostack). The outcomes of this analysis are given in chapter 5.

The methodology was developed using concepts from the field of Information Systems Development (Bemelmans) and Strategic Alignment (Venkatraman, Upton & McAfee, Konsynski). The development of the methodology is described in chapter 6.

Verification of the theory

The methodology was tried in one organisation, where it was expected to provide useful results. The fact that the outcome was indeed useful served as corroboration for the theory. Since only one organisation has been involved in the verification process, there is no guarantee that using the approach in other organisations will lead to similar findings. The value of the verification is therefore largely theoretical. It showed that the mechanisms, which were supposed to underlie the theory, exist. Although the findings cannot be generalised to other organisations, they can be generalised to the theory (cf. Yin, 1994).

Consequently, each organisation that wishes to use the approach will have to determine for itself if these mechanisms also exist in its own particular context. Further use of the approach in organisations with varying characteristics, will have

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[1] The reader may notice that this book does not follow the chronological order of the research here. The literature study on virtual corporations may be helpful in understanding the case studies, so that it is presented before the case studies are.

to provide more insight in the preconditions for its application. Heterogeneity between the organisations studied will strongly facilitate assessing the applicability of the approach in specific situations.

Philips Business Communications participated again in the verification of the theory. Ten processes were selected for analysing in the newly developed portfolio technique. These processes were considered essential for Philips' offering to the customer, but could only be included through inter-organisational co-operation. It was expected that the concepts, frameworks and techniques would lead to arguments for discussions that had not been used previously, or at least make existing discussions more explicit.

The results of this exercise turned out to identify the strategic opportunities or necessity of some relationships for Philips Business Communications, while it also showed that other relationships were far less important than assumed so far. The case studies showed how the methodology can be used to evaluate inter-organisational infrastructures and for setting priorities in the development of inter-organisational co-operation.

Conclusion and reflection; recommendations for further research

This research has been restricted to a confined domain. This domain was identified using the degree of customisation and the nature of customisation (see table 3—4). The concepts appeared to be valuable for Philips Business Communications, which was considered a typical representative for this domain. The value of this research increases with each time the approach is used in a different organisation, provided the exercise is well documented and made available to the research community. As is said in the above, heterogeneity between the subsequent cases will contribute to the evolution of the theory.

These starting points have been used to identify areas in which the use of the approach will lead to enrichment of the theory. For these areas, recommendations have been given for research questions (see § 8.4). In doing so, two directions have been chosen. First, the findings have been used to detail out the consequences within the domain. These consequences have been presented as starting points for further research within the domain. Such research would widen the scope of the theory.

Second, some thoughts have been given to the use of the concepts in the other domains, which have been discerned based on the same criteria (again see table 3—4). The reflection lead to hypotheses for these domains. These have also been suggested as subject of further research. Findings from such research will provide

additional insight in determining factors for applicability of the concepts, which would lead to enrichment of the theory.

2.5. Outline of the Book

Short descriptions of each chapter of this book are presented in this section. In the text, eleven theses will be given. The theses can also be found throughout the book. For each thesis, the page number is given in parenthesis. In short, the theses convey the assumptions as well as the findings from this research. The table on page 46 gives an overview of the chapters and the theses, as well as the subjects and research questions that are addressed in each chapter.

Chapter 1: Introduction

§ 1.1 describes the background of the research. In § § 1.2 some important concepts used in this thesis are introduced. More elaborate and formal discussions of these concepts are given throughout the book.

Chapter 2: Problem Statement and Research Methodology

§ 2.1 and § 2.2 describe the problem statement, research objective and research questions on which this research was based. § 2.4 describe the research design and research execution.

Chapter 3: The Virtual Corporation

§§ 3.1 though 3.3 give an overview of developments in manufacturing and concepts described in the literature. These developments are used to explain the increased importance of inter-organisational co-operation (thesis I).

thesis I: In manufacturing, increased customisation on the one hand, and technological innovation on the other, have resulted in a need for co-operation between specialists. Not being able to co-operate with other specialists decreases the attractiveness of the specialist's product or service (page 52).

This thesis provides insights that may be valid for a range of organisations. § 3.4 presents a typology to identify different types of such organisations. The typology is also used to position the research.

Chapter 4: Inter-Organisational Co-Operation: Three Case Studies

Chapter 4 addresses the question of how to use the ability to co-operate as a way to create competitive advantage. Prevailing ideas on supply chain management are briefly discussed in § 4.1 to indicate the opportunities that are presented in the literature. These ideas lead to an important assumption that underlies this research

thesis II:	Close relationships with customers, intensively monitoring their processes and subsequently using this information throughout the supply chain, where close relationships with suppliers have been built, can provide increased flexibility and reduced costs (page 75).

§ 4.2 and § 4.3 use explorative case studies to illustrate how opportunities can be missed, if there is no understanding of the role processes play in the offering to the customer. It is asserted here that inter-organisational co-operation not only concerns co-operating with suppliers, but co-operating with customers as well. The implications of this are outlined in thesis III:

thesis III:	In order to participate in virtual corporations, inter-organisational co-operation should be seen as part of the organisation's strategy, not as a choice to be made at an operational level (page 83)

The project studied in the case studies had a very limited scope. Yet the impact of the concepts that were to be implemented on other business functions and their dependence on these same business functions was considerably. This led to the conclusion that successful implementation of such concepts required commitment from managers from various disciplines. It was assumed that the availability of guidelines for evaluating the importance of inter-organisational co-operation would help managers to prioritise and to determine which forms of co-operation to set up (thesis IV):

thesis IV: Organisations that consider inter-organisational co-operation as a strategic issue, require guidelines for evaluating the dependence on inter-organisational co-operation of processes, in order to prioritise and to focus budgets and management commitment (page 84)

§§ 4.5 presents another case study. This study involved DAF Trucks, which attempted to use a commonly used framework for prioritising co-operation with suppliers. From this case study it was concluded that such prioritisation should be based on process characteristics, where existing frameworks used product characteristics for prioritisation (thesis V).

thesis V: Segmentation of inter-organisational co-operation should be based on process characteristics, not on product characteristics. (page 89).

§ 4.6 present an example, which illustrates the validity of this statement for co-operation with customers as well.

Chapter 5: Competitive Advantage through Inter-organisational Co-operation

§ 5.1 and § 5.2 concern the relationship between products, processes and infrastructures for inter-organisational co-operation. Insights from the literature on service marketing and strategic management are presented. From analysis of concepts and case studies in the literature, it is concluded that positioning virtual corporations as service providers provides a good starting point for the methodology. This leads to thesis VI:

thesis VI: The knowledge required to develop and produce complex products may be of such specificity that customers do not want to buy such products, but instead demand their suppliers to take up responsibility for facilitation of the customer's processes. Such suppliers should therefore regard themselves as service providers, instead of manufacturers. Consequently, there is a need for ongoing interaction between the process of the customer and those of the enabling organisations, aimed at continuous customer satisfaction (page 98).

§ 5.3 describes how facilitation of the customer's process may require processes from multiple organisations. The service provider can provide added value to his customer by integration of all these services into a single offering, the quality of which is measured by the performance of the customer's process. An important starting point for the design of a methodology is that a *Gateway* strategy requires outlining the required processes in a strategic architecture, on the basis of which a virtual corporation can be designed (thesis VII).

thesis VII: Designing a virtual corporation starts with drawing a strategic architecture that describes the competencies needed for a complete offering and the means and structures required for interfacing them (page 108).

Chapter 6: Alignment of Inter-Organisational Infrastructures

§ 6.1 gives a definition of infrastructures. Three elements are used to describe infrastructures: resources, decision structures and information systems (thesis VIII):

thesis VIII: Infrastructures for business processes can be characterised on the basis of resources, decision structures and information systems (page 115).

For each it is explained what the inter-organisational extension exists of. § 6.2 and § 6.3 describe various methodologies for designing infrastructures. § 6.3 describes why, especially in an inter-organisational context there is a need for alignment between strategy and infrastructure (thesis IX):

thesis IX: Division of ownership, power and loyalty within a network, constraints the organisations in such a network in the design of processes and infrastructures. It consequently limits the flexibility in designing the offering to the market. This requires a Gateway to align strategic choices and the design of the infrastructure of its virtual corporation, instead of deducing requirements from a strategy (page 123).

In § 6.3 it further assumed that sophistication of the infrastructure for including a process greatly determines the potential for a Gateway's competitive distinction (thesis X):

thesis X: A Gateway can distinguish itself through its ability to set up distinctive forms of co-operation in a virtual corporation. The more sophisticated the required infrastructure, the more complex the co-operation will be and the greater the chance that the co-operation will be unique (page 128).

§ 6.4 presents indicators for the sophistication of the inter-organisational extensions for all three elements of the infrastructure. § 6.5 describes how this characterisation of infrastructures serves as a basis for a portfolio analysis of inter-organisational processes (thesis XI).

thesis XI: *Service scope* and *Infrastructure sophistication* can be used to classify the processes in the strategic architecture into four groups. Each of the groups plays a different role in the attractiveness of the offering. Gateways can therefore use the classification for assessment of the strategic importance of infrastructures (page 145).

Chapter 7: Applying the Methodology: Philips Business Communications

Chapter 7 describes a case study. The concepts and techniques have been applied to one organisation, in order to test its applicability.

Chapter 8: Conclusions and Recommendations:

In chapter 8 the conclusions of the research are discussed in § 8.1. The four research questions are discussed and the theses from this book are put in perspective. The conclusions are reflected upon in § 8.2 and § 8.3. Recommendations for further research are given in § 8.4.

Overview

The following table gives an overview of the subjects and theses and the chapters in which they are discussed in this book.

Subject	Thesis	Text
Introduction		Chapter 1
Problem Statement and Research Methodology		Chapter 2
The Virtual Corporation	❑ thesis I: inter-organisational co-operation for competitive advantage	Chapter 3
Research Question 1: Relationship between products, processes and inter-organisational infrastructures	❑ thesis II: customer interaction required ❑ thesis III: inter-organisational co-operation is a strategic issue ❑ thesis IV: guidelines for evaluating forms of inter-organisational co-operation ❑ thesis V: process based segmentation of partnerships	Chapter 4
Research Question 2: Competitive Advantage through Inter-Organisational Co-Operation	❑ thesis VI: life time services instead of products ❑ thesis VII: blueprinting processes in a strategic architecture and develop matching infrastructure	Chapter 5
Research Question 3: Inter-organisational Infrastructures	❑ thesis VIII: characterise infrastructures on resources, relationships and information systems	§ 6.1
Research Question 4: Which Infrastructures to Develop	❑ thesis IX: strategic alignment required due to restricted freedom in infrastructure design	§ 6.2
	❑ thesis X: competitive distinction for Gateways though sophistication of inter-organisational infrastructures	§ 6.3
	❑ thesis XI: evaluate processes on service scope and co-operation complexity	§ 6.4, 6.5 and § 6.6
Application of the methodology in a case study		Chapter 7
Conclusions		§ 8.1
Reflection		§ 8.2 and § 8.3
Recommendations for Further Research		§ 8.4

table 2—1: The Structure of this Book

3. The Virtual Corporation

This chapter is the based on investigation of the literature and presents an overview of developments in industry that explain the importance of inter-organisational co-operation. Various ways of looking at networks and virtual corporations are discussed. The insights gained from this investigation are used to explain the focus of the research. The concepts described in this chapter may also help the reader to understand the case studies, described in chapter 4.

3.1. Evolution In Manufacturing

Manufacturing organisations increasingly evolve into manufacturing networks. Part of this evolution is described by Womack c.s. (Womack, 1991). They explain how, in the automotive industry, until the end of the 19th century one multi-skilled organisation, often even one craftsman, manufactured a whole car, entirely customised according to the customer specific requirements. Today, a car manufacturer needs his suppliers to deliver just-in-time and to co-develop components. Manufacturers can therefore no longer do business with suppliers on a transaction basis, but are required to set up longer lasting relationships. In this network of the car manufacturer, each of the organisations has evolved into a specialist for specific components or functions of the car.

3.1.1. Cost Reduction

Womack c.s. describe how under the influence of Taylor's scientific management, organisations started standardising their products and processes (cf. Taylor, 1911). The high days of standardisation were the early decades of this century. The classic example is that of Ford Motor Company, when it only manufactured one type of car in only one colour. Ford's goal was to mass-manufacture large numbers of products at the lowest costs per unit. Mass manufacturers such as Ford focused primarily on efficiency and therefore only rarely introduced product variants, nor did they allow customer specific adaptations.

3.1.2. Back to Customisation

Toyota took an important share of the car market through allowing customers to choose from a wide variety of options and variants (Monden, 1983). Toyota was capable of differentiating at mass production costs because of it's different approach towards manufacturing. Not only was the focus on efficiency, but also on fulfilling the requirements of individual customers. This final customer focus approach has been taken up by manufacturers of all kinds of products. In the late 1980s manufacturers like Toyota were moving back to the level of customisation of the former multi-skilled craftsman (Womack, 1991, pp. 126).

So far industry had been able to reduce costs by reducing the product variance, thus enabling standardisation of processes and increasing efficiency. Now industry was forced to increase product variety, while at the same time the pressure to reduce prices remained. Concepts like lean production, which were embraced in the early 1980ties have accelerated both trends, so that today industry is required to deliver highly customised products at the lowest costs possible. These two trends in industry, customisation and cost reduction, are depicted in figure 3—1.

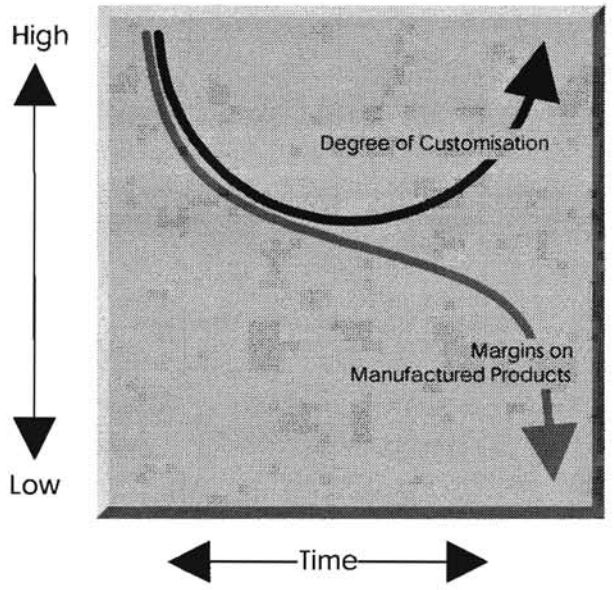

figure 3—1: Trends in Customisation of Products and Product Prices

3.1.3. Back to Core Competencies

In order to be able to standardise processes, required for reducing costs, manufacturers became to a large extend vertically integrated. By the late seventies they had burdened themselves with large organisations in which a large number of non-comparable activities had to be co-ordinated. This was one of the drivers for another development that has taken place since that time. Multi-skilled organisations (not only manufacturers) went 'back to core competencies' (Hamel, 1990). Focusing on core competencies resulted in the outsourcing of all activities that were not considered to be of strategic importance to the organisation's market position (Quinn, 1994). The value being added outside the organisation increased.

This has lead to the situation where now, in many industries, over 70% of the value of the final product is added by others than the manufacturer of the final product (Van Weele, 1994; Ansari, 1988; Bailey, 1990; Cavinato, 1991; Hay, 1988).

Components and/or sub-assemblies that were previously manufactured in-house, are now bought from suppliers.

Outsourcing has long been mainly cost driven. Suppliers, who were in many cases former divisions of the outsourcing firm, could be forced to reduce costs, or at least prices, under the threat of loosing their business. Furthermore, outsourcing allowed manufacturers to have their components produced in low cost countries. On the other hand, suppliers could develop economies of scale in their own specific niche.

These suppliers therefore soon became specialists. They developed their skills and improved their products. Many examples can be found of supplied components that are essential to the competitive strength of the compound product they are part of. For example, few personal computers do not have 'Intel Inside'. Today, advertisements for cars not only mention the technology developed by the car manufacturer. In many cases, the emphasis is on the accessories, manufactured by suppliers.

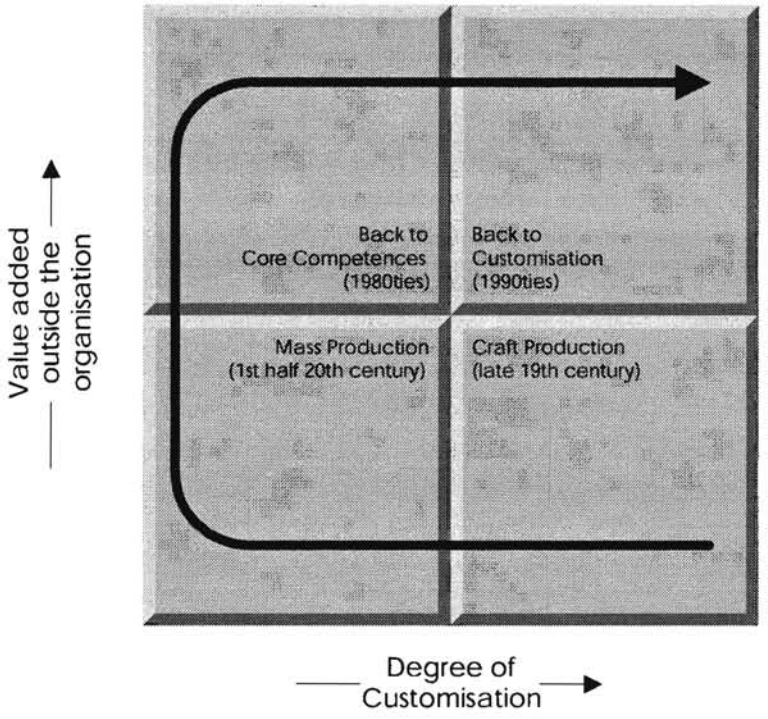

figure 3—2: 'Back to Core Competencies' and 'Back to Customisation'

Due to this evolution (see figure 3—2), in many cases, complex and compound products can only be created in co-operation. Suppliers have developed their own core competencies and skills. Their specialisation allows them to design and manufacture better components more efficiently than their customers can. Close co-operation with specialists is therefore required to be able to embed state-of-the art components in complex products. Manufacturers are less and less manufacturers and are increasingly required to know the right specialists and combine their skills (thesis I). For some, co-operation has even become a specialisation in itself (Martin, 1996).

thesis I: In manufacturing, increased customisation on the one hand, and technological innovation on the other, have resulted in a need for co-operation between specialists. Not being able to co-operate with other specialists decreases the attractiveness of the specialist's product or service

The need to combine outside skills has resulted in increasing attention being paid to purchasing and supply. While purchasing had long been the function which aimed at negotiating low prices and volume discounts, Kraljic asserted in the early 1980s that 'purchasing had to become supply management' (Kraljic, 1983). Today, supply management implies appreciating the importance of co-operating with suppliers of strategic items through mutual adjustment of products and processess and the exchange of knowledge and technology (e.g. Lamming, 1993). These benefit both buyer and supplier, so that the result is a much more attractive offering to the final customer than could ever be achieved through tough negotiation.

Hines argues, that the focus on profit margin of western industry (cf. Porter's Value Chain paradigm; Porter, 1985) has lead to a situation where suppliers are unjustly merely valued on their bargaining position. Hines promotes a different approach in which customer satisfaction is the primary goal. This implies that suppliers should be evaluated on their potential contribution to satisfying the customer. In this paradigm suppliers are seen as partners instead of adversaries (Hines, 1993).

Such approaches made manufacturers develop partnerships with their most important suppliers (Carlisle, 1989; Lamming, 1993; Håkansson, 1995). Partnerships resulted in close co-operation in various areas like product development, employee training and logistics (e.g. Frey, 1993). Within such partnerships, price reduction is often achieved by mutual efforts towards cost reduction instead of adversarial negotiation. Close co-operation is also aimed at quality and performance improvement. Increasingly, organisations realise that setting up a relationship is costly, but that within a good relationship synergy improves mutual performance (Kearny, 1994). Since partnerships, by definition, cannot be developed by a single organisation on its own, it is not surprising that the literature mentions partnerships not only as a sourcing strategy (e.g. MacBeth, 1994), but as a marketing strategy as well (e.g. Brierly, 1994; Evans, 1994).

Inter-organisational co-operation can thus be of strategic importance for those who wish to offer complex products to their customers. This is illustrated by

Eloranta c.s., who observed that the value added by the final assembly plant in the contemporary supply chain is marginal in the cost structure of the final product (Eloranta, 1995). Manufacturers who focus on managing and improving their internal processes, consequently have little influence over the biggest part of the production of their product. Although there may be considerable competitive advantage in having a sophisticated and efficient final assembly process, a manufacturer of complex products will not be able to operate successfully in his market, if he relies on his internal processes only. Then manufacturer should therefore treat inter-organisational co-operation as an essential part of strategy development. This is in line with Nagel's reasoning, which implies that only combining the best of everything allows the creation of an entirely customised product or service at very low costs (Nagel, 1993). This combination of specialists, co-operating closely in delivering customised products results in networks. For just as long as required these networks virtually operate as corporations.

3.2. Authors on The Virtual Corporation and the Extended Enterprise

Characteristic of networks such as Nagel describes, is that they are set up only for the duration of a program which aims at fulfilling a specific customer demand or market demand (see also Halman, 1995). In an interview, Davidow and Malone, call the focus on the individual customer's need 'thinking in reverse' (Browne, 1993). Due to the focus on a specific customer demand or on a specific market demand, and resulting temporary character of the demand, investing in incorporating specific skills may be dangerous. On the other hand, for complex products none of the specialist involved will be able to sell its specific component, unless it is combined into one offering with others. Combining outside skills upon demand gives individual organisations far greater flexibility and allows much more product variety.

Individual enterprises are therefore required to extend their resources, their control structures and their information systems in such a way, that they become an attractive partner for organisations which offer products that are complementary to their own products. They therefore need criteria which allow them to decide with who they need to co-operate, and which means and structures they need to invest in. In doing so, they are configuring their own network. The following sections present some concepts used to describe inter-organisational

relationships and networks. This overview helps defining an important concept in this book: the virtual corporation.

3.2.1. Evans and Wurster and the Hyperarchy

Evans and Wurster illustrate the complexity of inter-organisational interactions and interdependencies in their 'hyperarchy' model (Evans, 1997). In a hyperarchy, everyone communicates with everyone else. In a hierarchy each organisational unit depends on one superior organisational unit, which has access to information that is, by definition, not available for its subordinates. Since the bargaining power in buyer-supplier relationships highly depends on this asymmetry of information, such relationships will drastically change if information technology eliminates this asymmetry. Evans and Wurster claim that under the influence of information technology and standardisation of communication, hyperarchies will challenge, and eventually replace, hierarchies. In figure 3—3 the communication links between organisations are drawn for the hyperarchy, as opposed to the hierarchy.

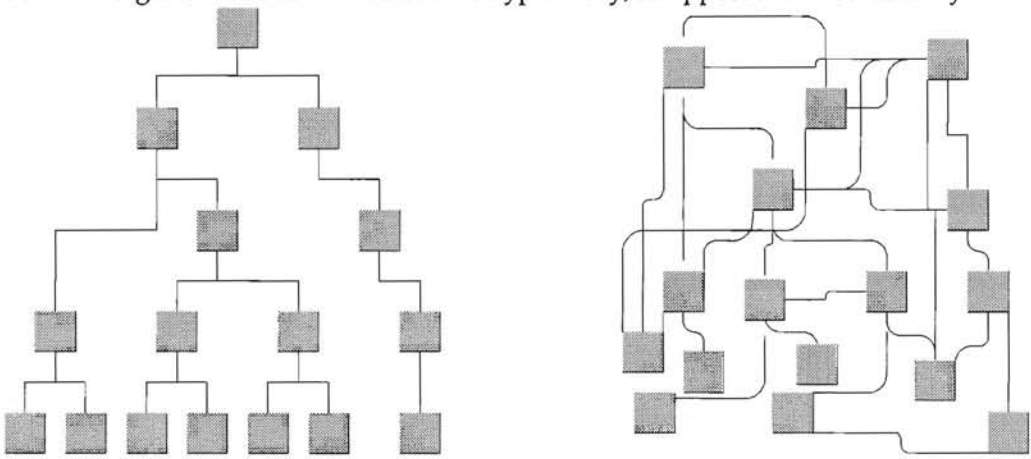

figure 3—3: Hierarchy (left) versus Hyperarchy (right)

Inter-organisational relationships in hierarchies are, by definition, bilateral. When considering networks, thinking in hierarchies therefore typically leads to a strict distinction between customers and suppliers. Customer oriented effort (i.e.

marketing and sales) is directed at making sure to be selected, supplier oriented effort (i.e. purchasing and procurement) is directed at selecting the right suppliers.

However, selecting the right customers, can be equally important as being selected by the right suppliers. The hyperarchy model consequently seems a much more accurate representation of inter-organisational interdependencies. Since hierarchical thinking has been the basis for most models and methodologies for inter-organisational co-operation, they are not necessarily valid in a hyperarchical context.

3.2.2. The IMP-group on Business Relationships

The hyperarchy model can be compared to the network models of the International Marketing and Purchasing (IMP) group. This group has published abundantly on networks of organisations co-operating in partnerships (e.g. Håkansson, 1982; Håkansson, 1989; Anderson, 1994; Håkansson, 1995). The IMP group looks at inter-organisational networks as constellations of relationships. Its viewpoint is that each relationship between companies is heavily influenced by the relationships the companies have with other companies. In this view networks are infinitively large[2], never balanced, never optimal and different for all its members (see figure 3—4, after Axelsson, 1992, p. 117). The IMP-group is not so much studying individual networks, but rather sees networks as a way of looking at the world.

[2] Note that some argue that the maximal number of nodes between two randomly selected persons in the world wide network of relationships between individuals is six (e.g.: www.sixdegrees.com)http://www.sixdegrees.com)/. If similar analysis would be performed on organisations an equally low number would undoubtedly be found.

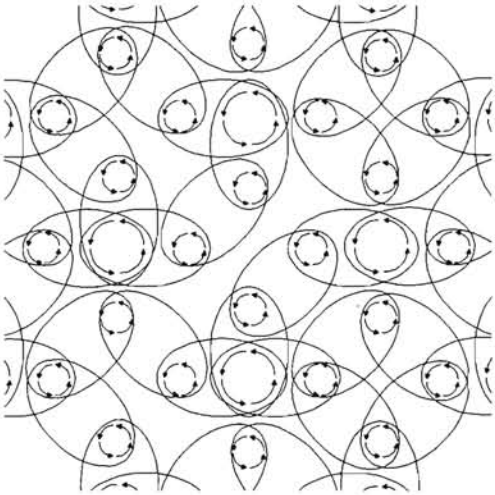

figure 3—4: Business Relationships as Elements of a Network Structure

Networks in the IMP-view consist of actors and of relationships. Relationships are the result of enactments carried out by the actors and can be characterised by factors, like technology, knowledge, social relations, administrative routines and legal ties (see Axelsson, 1992, p. 115 or Håkansson, 1995, p. 13). Actors are indirectly connected to other actors through relationships. This is called *connectivity*.

Due to connectivity, an actor can only partly identify the networks in which he operates. There are always indirect relationships to other actors, of which the actor is not aware. These unknown relationships can however be essential to the functioning of the actor in question. The IMP-group criticises traditional marketing and purchasing research that primarily focuses on bilateral and direct relationships, whereas they make clear that multi-lateral and indirect relationships should also be considered.

However, despite this connectivity, no organisation should try to control all relevant relationships, or be even aware of them. It should make a selection of the ones it considers most important and should direct its investments in resources, control structures and information systems towards them.

3.2.3. Davidow and Malone on the Virtual Corporation

Despite the extensive amount of work done by the IMP-group, Davidow and Malone call networks of co-operating manufacturers a new kind of business (Davidow, 1992). They name these networks virtual corporations. In their book 'Virtual Corporation', Davidow and Malone present their vision on 21st century industries, which will be built around "a new kind of product, delivering instant customer gratification in a cost effective way". These products have a very rich service component, that is often more important that the tangible characteristics of the product. They must and can therefore be produced in several locations and offered in a great number of models and formats. Davidow and Malone call these products 'virtual products'. They believe that a manufacturing company will not be an isolated facility of production, but rather a node in the complex network of suppliers, customers, engineering, and other service functions.

This network is referred to by Davidow and Malone as 'The Virtual Corporation'. The real time adaptation of the virtual product to the customer need requires the virtual corporation to maintain integrated and ever-changing data files on customers, products, and production and design methodologies. They therefore speak of it in terms of patterns of information and relationships that will appear less a discrete enterprise and more an ever-varying cluster of common activities of suppliers and their downstream customers in the midst of a vast fabric of relationships. These relationships will be built on principles such as 'joint destiny, trust and sharing information'.

The virtual corporation of Davidow and Malone is described as almost edgeless, with permeable and continuously changing interfaces between company, supplier and customers. Nevertheless, Davidow and Malone stress the importance of brand names and product identity. A virtual corporation is identified by the activities carried out and the products delivered. In fact a virtual corporation is defined through the product or product line it produces. In this definition a virtual corporation is not constructed deliberately, but is the result of the choices made by the individual organisations. When compared to the network paradigm of the IMP-group, the virtual corporation can be seen as an instance of existing networks, i.e. a specific subset of the infinitive network (figure 3—5).

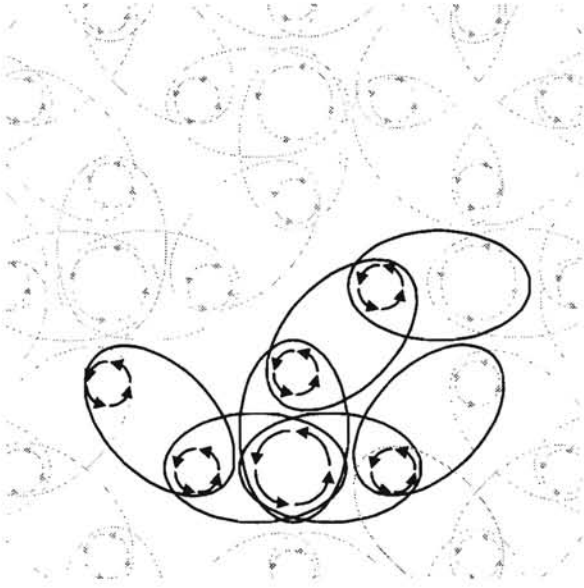

figure 3—5: A Virtual Corporation as Instance of Networks

3.2.4. Browne c.s. and Konsynski on the Extended Enterprise

Konsynski, as well as Browne, Sackett and Wortmann, suggest, like Davidow and Malone do, that the traditional view of business organisations is no longer valid (Browne, 1995, p. 10.; Konsynski, 1985; Konsynski, 1993, p. 111). Instead of speaking of virtual corporations however, they use the term 'Extended Enterprise' when referring to a new paradigm for manufacturing.

Browne, Sackett and Wortmann argue that computer integrated manufacturing (CIM) will enable inter-enterprise networking across the value chain. Manufacturing systems are no longer confined to a single factory, but cross enterprise boundaries. Integration of core operations of independent organisations with the operations of suppliers and customer results in *extended enterprises* (figure 3—6).

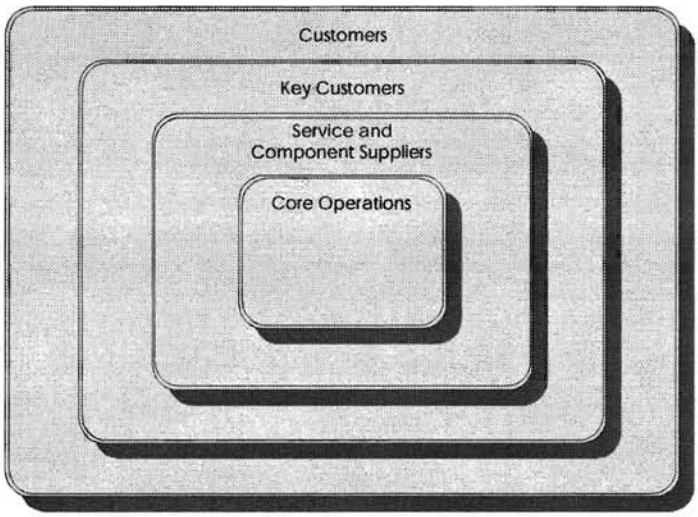

figure 3—6: Extended Enterprise According to Browne, Sackett and Wortmann

Konsynski also argues that information technology transforms the boundaries of enterprises. Information technology allows regarding outside processes to be seen as extensions of internal processes, thus extending the boundary of the enterprise (figure 3—7). In Kinsynski's view an extended enterprise is an individual enterprise that has been able to increase his control over outside processes, through having developed control and co-ordination systems and through the appropriate deployment of computer and communication technologies.

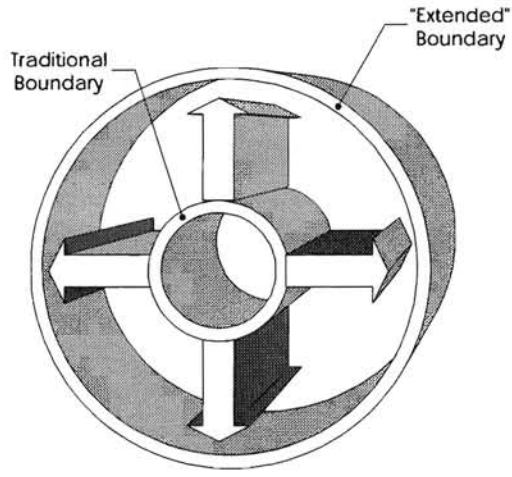

figure 3—7: Extended Enterprise Boundaries According to Konsynski

3.2.5. A Definition of the Virtual Corporation

From analysing the various views on networks, virtual corporations and extended enterprises it has become clear that developing a strategy for inter-organisational co-operation requires a different view on inter-organisational relationships than traditionally taken. Furthermore, the number of inter-organisational relationships that influence a single organisation, in theory is innumerable. An organisation should make a selection of the relationships it wants to control, thus selecting the actors it considers part of its network. By taking a product or product line as a starting point the organisation is in a way identifying the virtual corporation involved in the delivery of this product or product line. This leads to the following definition of virtual corporations:

> *A virtual corporation is a network of independent organisations that provide a joint offering.*

Konsynski's description of an extended enterprise as "any organisation having extended its boundaries through the deployment of information technology" would lead to the conclusion that a virtual corporation is made up of extended enterprises. This would allow drawing figure 3—8. It shows that, in Konsynski's definition, each of the ellipses in figure 3—4 represents a single extended enterprise. Martin refers to such organisation's as 'Cybercorps' (Martin, 1996)

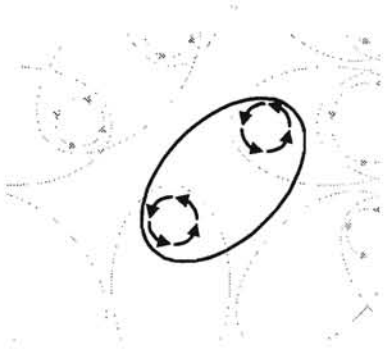

figure 3—8: Extended Enterprise, Extended into other Extended Enterprises

Although it is important to make a distinction between networks ("virtual corporation") and individual companies that are able to participate in virtual corporations ("extended enterprise"), the literature often uses the virtual corporation and extended enterprise interchangeably (compare Konsynski to Browne c.s.). In order to avoid confusion, the term extended enterprise will not be used in the rest of this book.

3.3. The Enabling Information Technology

In § 3.1 the importance of managing virtual corporations has been explained by looking at market developments. Increasing demands for customisation and cost reduction at the same time requires manufacturers to be able to perform in or even co-ordinate networks. A market-pull so to say.

However, many authors argue that today's information and communication technology enable new organisational concepts and allow independent organisations to co-operate in a manner that has not been possible until recently. The authors that are mentioned in § 3.2 stress the importance of information technology. Davidow and Malone speak of the virtual corporation as an IT-enabled network of organisations. Konsynski states that organisational boundaries are transformed by the use of information technology (Konsynski, 1993, pp. 111). Browne, Sackett and Wortmann assert the emergence of the virtual corporation to be facilitated by today's emerging computing and telecommunications technologies (Browne, 1995, pp. 237). Thus, not only a market pull led to co-operation in networks, a technology push most certainly exists as well.

Various studies in the field of economics show that information technology may reduce the co-ordination costs that result of outsourcing activities and therefore stimulate co-operation between firms (Clemons, 1992). Important IT-developments that enable inter-organisational co-operation in virtual corporations are: the development of standards for exchanging information, e.g. EDIFACT and STEP (Hardwick, 1996), the reduction of prices for computational power of processors and the interconnectivity of communication networks, resulting in the Internet and the like. Williamson's transaction cost theory then predicts that to some extent weighing economies of scale against transaction costs, leads to the outsourcing of activities that have so far been carried out inside the organisation (Williamson, 1975).

3.4. A typology of Virtual Corporations

The need for customisation as well as the need to specialise and co-operate can probably be found in many areas of business. Consequently, so will virtual corporations. This research focussed on manufacturers of investment goods. In this section a typology is developed in order to show how virtual corporations for investment goods differ from other virtual corporations. Two existing typologies are used to develop a new typology of virtual corporations.

Later, in chapter 8, this typology is also used to evaluate the applicability of the research results to other types of virtual corporations.

3.4.1. Botter's Typology of Industrial Organisations

Botter developed a typology for industrial organisations, based on the the lot size, or customisation, and the compoundness of the product. It has been argued in § 3.1 that the need to customise has been an important driver for setting up virtual corporations. Customisation implies one-of-a-kind production and consequently, virtual corporations will have small lot sizes. Furthermore, inter-organisational co-operation is only required if products are composed of multiple components. Virtual corporations will therefore be positioned in upper right cells of Botter's typology (Botter, 1988; see table 3—1).

↓ compoundness of product ← lot size →	Mass production	Long running series	Medium series	Small series/ one of a kind
high ↑ Installations			Virtual Corporations	
Compound products				
Simple products				
low ↓ Materials				

table 3—1: Botter's typology

Virtual corporations are identified by their offerings (see page 60). A typology of virtual corporations may therefore be based on a typology of the products and services. The demand for customised offerings is considered one of the drivers for inter-organisational co-operation in virtual corporations. The offering of a virtual corporation will therefore be customer specific. Thus, the *degree of customisation* and the *nature of customisation* provide starting points for identifying various types of offerings from virtual corporations.

3.4.2. Degree of Customisation: Customer Independent Orientation

The more customised the virtual corporation's offering, the more important continuous reconfiguration of the network will be. Various measures have been developed to typify the degree of customisation of products.

Wortmann identifies various types of one-of-a-kind production situations, using the customer order decoupling point (Wortmann, 1992). He refines the typology by using a continuum on which one-of-a-kind manufacturing can be positioned. This continuum is characterised by customer independent investments in the process of realisation of the product. Customer independent investments have been made in product development, process development or in capability development (see table 3—2).

Manufacturing Situation → ↓Customer Independent Orientation	Engineer-to-Order	Make-to-Order	Assemble-to-Order
Product Oriented	Aircraft	Machine tools	Trucks
Process Oriented	Printing	Paper	Steel
Capability Oriented	Aerospace	Foundry	Construction

table 3—2: Wortmann's continuum as one dimension of a typology for one-of-a-kind production.

From product to capability, the degree of customisation increases. In product oriented situations the customer is given a choice from predefined components or modules. In process oriented situations, the customer specifications are restricted to the limits of the production process. In capability oriented situations, customer specific solutions are limited to a range of problems. Wortmann's continuum, between product orientation and capability orientation, can thus be seen as an indicator for the degree of customisation.

3.4.3. Nature of Customisation: Tangible Products and Services

For tangible products, customisation is adding or manufacturing components according to customer specific requirements. This would result in a product that meets the customer's requirements, provided these do not change. In a dynamic environment, such customisation would not last very long.

Delivering customised products could therefore imply the continuous adjustment of the product to continuously changing customer requirements, which in turn implies continuously knowing the customer. The manufacturer could then constitute himself as a partner with the expertise regarding the required functionality. From there, it is only a small step to taking up the role of a service provider. The service being delivered is the guaranteed functionality during an agreed upon period.

The customisation can then be achieved through customised services around the tangible product. A distinction between customisation through tangible components and customisation through service can therefore be made. This is depicted in table 3—3.

Customisation through Services→ ↓Customisation through Tangibles	Standard	Customised
Standard	(no customisation)	Photo-copiers, Car availability programs
Customised	Trucks	PABX-systems

table 3—3: Different Kinds of Customisation

The lower left quadrant of the table shows customised tangible products that are sold without any customised adaptation of the related services. Trucks, for example, are often assembled to customer order, while great freedom with respect to choosing components is given to the customer. Each truck is therefore entirely customised. The related services like the service network and maintenance programs can be the same for all customers.

The upper right quadrant gives non-customised tangible products that can be delivered through networks that provide entirely customised service concepts. Photocopiers are more and more provided as elements of customer specific service programs. The provider guarantees a price per copy and develops a service program that suits the customer's business process. The customer does not even own the copiers any longer. In the consumer market, car availability program work along similar lines, consumers pay for functionality, like the right to use a car for a certain number of days and kilometres.

A mixture of the two can be found in the lower right corner of the diagram. In these cases, tangible products are customised to deliver the required functionality. The functionality can however only be guaranteed over time, through also providing customised services. For example, Philips Business Communications' high end PABX systems are specified to customer order. Once they are installed however, the customer requires a customised maintenance package, dedicated training programs and continuous upgrading of the system.

3.4.4. A New Typology of Virtual Corporations

The *degree of customisation* and the *nature of customisation* characterise customised products and allow drawing a typology of such products. The relationship between products and virtual corporations implies that such a typology will also

be a typology of virtual corporations[3]. As with any typology, it presents ideal types. The positions of the examples given in table 3—4 are therefore disputable. The purpose of the typology is to demonstrate that virtual corporations of different nature exist. In § 2.2.2, it will also be used to show the focus of this research project.

Customer independent orientation → ↓Nature of customisation	Product	Process	Capability
Service	Car availability program	Catering	Repair
Service *and* tangible products	High end PABX	Development and Printing of Personal Photos	Installations
Tangible products	Trucks	Printing	Construction

table 3—4: a new typology of virtual corporations

3.5. Conclusions

Reduced margins on manufactured products and increased for customisation, have caused manufacturers to focus on their core competencies and to combine these with competencies of others. Manufacturers are required to co-operate with their suppliers and partners in providing a joint offering to their customers. Not being able to co-operate decreases the attractiveness of their products or services.

This development has lead to the origination of networks of organisations that co-operate in the development, production and provision of a joint product to the network's customer. In the literature such networks are referred to as "virtual corporations" or "extended enterprises". In this book the term "virtual corporation" will be used.

Information and communication technology (ICT) plays an important role in enabling inter-organisational co-operation in virtual corporations. ICT allows the

[3] Note that Botter only positioned tangible products in his typology, whereas virtual corporations deliver hybrids, existing of combinations of services and tangible products.

creation of networks that would otherwise not have been possible. In order to be able to deal with the ever-increasing pressure to reduce costs and to focus at the same, organisations should ensure their ability to use ICT in inter-organisational co-operation in virtual corporations.

The following chapter presents three case studies of organisations, which, at the time, had set up projects for ICT-enabled inter-organisational co-operation. The case studies will be used to demonstrate the importance of having a clear view on the role of inter-organisational co-operation.

4. Inter-Organisational Co-Operation: Three Case Studies

This chapter will first present some basic ideas that underlie many concepts for inter-organisational co-operation between buyer and supplier, including those of the two case studies that will subsequently be described: Philips Business Communications and Rank Xerox. These case studies demonstrate the need to identify the impact of other business functions on inter-organisational co-operation and vice versa. DAF trucks is used in the third case study to illustrate the importance of a clear view on the role partners play in the virtual corporation's processes.

At the start of this project, the focus was on inter-organisational co-operation with suppliers. Promising examples in which supplier oriented co-operation resulted in improved inter-organisational efficiency could be found in the literature (e.g. Bowersox, 1990; Godbersen, 1990; Kreuwels, 1994). This raised interest in developing control concepts, based on further integration and increasing exchange of information with suppliers. Close co-operation between buyer and supplier is not a new issue for industry and for research. Therefore, purchasing, production management and supply chain management were considered to provide a theoretical background and guiding principles for the design method for inter-organisational co-operation.

The literature on purchasing and supply, as well as the literature on industrial marketing, present theoretic concepts and case studies on developing partnerships

and improving inter-organisational co-operation. Prevailing concepts are discussed to provide a background to the case studies.

4.1. Supplier and Buyer in the Supply Chain

This section will use widely accepted definitions of purchasing and sales as well as typical examples of models for inter-organisational co-operation to illustrate the separation between buying and selling.

4.1.1. Interaction through Transaction

Van Weele defines purchasing as obtaining from external sources all goods and services that are necessary for running, maintaining and managing the company's primary and support activities at the most favourable conditions. (Van Weele, 1994; p. 9). Kotler defines marketing as the social and managerial process by which individuals and groups obtain what they need and want through creating, offering and exchanging products of value with others (Kotler, 1997).

From these definitions, it follows that buying and selling are opposite, yet complementary activities. They are complementary in the sense that only when combined they result in transactions. Economists see a transaction as the satisfaction of needs in exchange for money. The actor with a need to be satisfied acts as a customer through buying a good or a service. The actor who satisfies the need acts as a supplier, through at the same time selling the good or service (see figure 4—1).

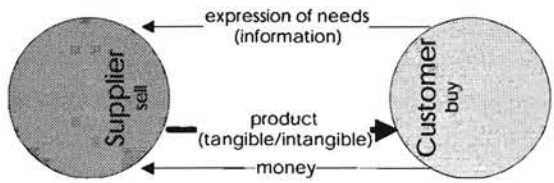

figure 4—1: A Transaction as the Satisfaction of Needs in Exchange for Money

Customers and suppliers meet on the market, formed by the confrontation between supply and demand. On the demand side of the market customers can be

found, while suppliers are positioned on the supply side. Depending on the situation, each organisation may operate both as a customer and as a supplier, taking up the appropriate role for each transaction (e.g. Devine, 1979; Nicholson, 1978).

4.1.2. Inter-Organisational Flow of Goods and Services

In figure 4—1 products (tangible and/or intangible) are passed from a supplier to a customer, who in turn acts as a supplier when he passes the same products on to his customers, after having added value to them. Products flow through chains of actors, who set up and maintain bilateral relationships in which transactions take place. The customer can be found downstream, whereas the supplier is positioned upstream. Information and money flow in the opposite direction to the products being transferred (see figure 4—2).

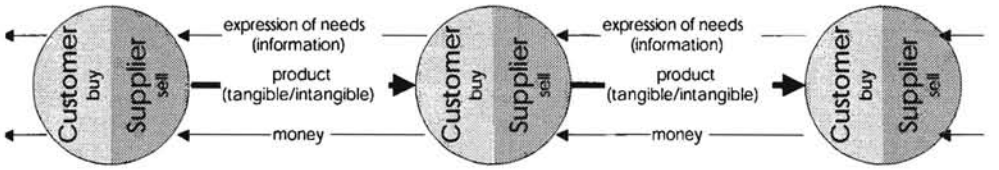

figure 4—2: Flows of Products, Information and Money

The simulation studies of Forrester have shown how, in a sequence of individually optimising systems, minor changes in requirements for the last system may result in great variations in upstream demand (Forrester, 1961; Van Aken, 1978). Clark and Scarf proved that in sequenced processes, decoupled by stocks, local reordering results in sub optimal levels throughout the chain. This led to the development of Base Stock Control, where calculated echelon stock is used instead. BSC includes all items in downstream processes, and take this as the basis for the control of local stocks. This results in optimal levels for all stock points (Magee, 1958; Clark, 1960).

On the basis of this, Van Donselaar has developed the concept of Line Requirements Planning (LRP; Van Donselaar, 1993). LRP uses requirements for the final production step as the direct input for the planning of all upstream processes and considering at the same time the availability of materials in all downstream

processes. LRP greatly reduces the effects of these variations when compared to local reordering policies.

4.1.3. A typical Supply Chain Model: CMSO

For inter-organisational processes it seems only logical to apply similar reasoning (Verwijmeren, 1998). This explains the growing interest in concepts that use downstream information for upstream planning. The supplier is then also seen as the customer's supplier (Hoppenbrouwers, 1994). Additional (direct or indirect) insight into the needs of the final customers allows suppliers to tune their processes to these needs (figure 4—3).

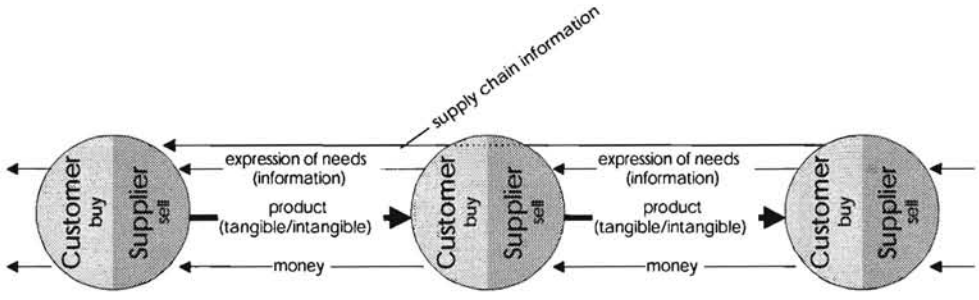

figure 4—3: Insight in the Needs of Downstream Customers

This type of thinking has been the starting point for the development of supply chain management concepts. A typical example is the reference model for the automotive industry of the ESPRIT II CMSO program (Computer Integrated Manufacturing for Multi-Supplier Operations, Godbersen, 1990; Schneider, 1994). The elements of logistic chains in the CMSO reference model are individual organisations (each pyramid presents an organisation). The model distinguishes three business processes (buy, produce/store and sell) within each organisation. These business processes can be found in all functions that are carried out inter-organisationally. Inter-organisational processes form process chains, linked through buying and selling.

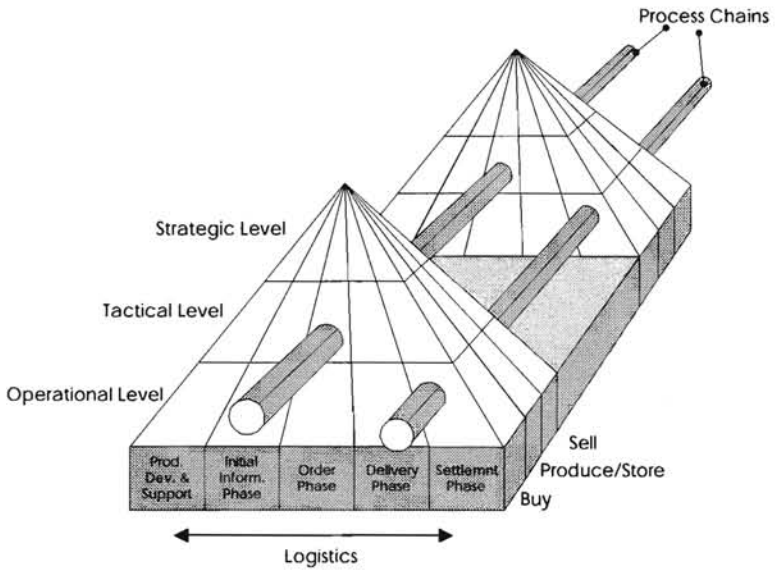

figure 4—4: CMSO Process Chains

Through identification of all actors subsequently adding value to the materials (see figure 4—5), CMSO develops reference models. These models are then used for the identification of the information to be exchanged throughout the supply chain.

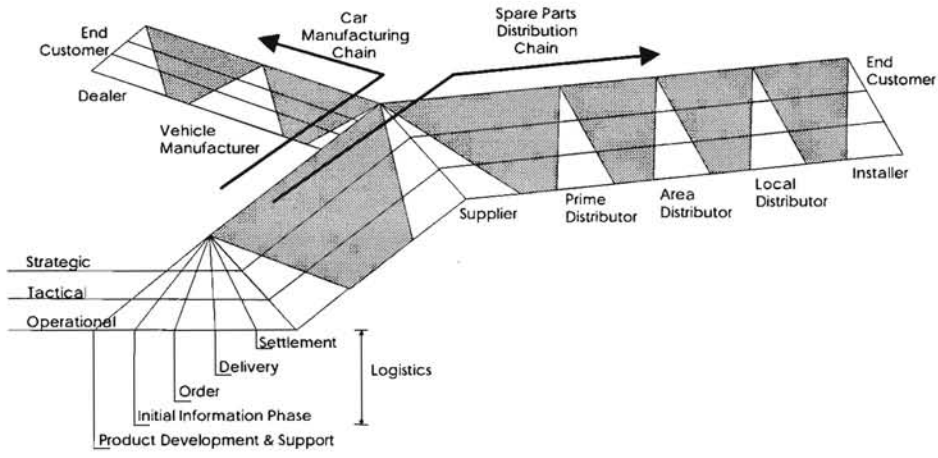

figure 4—5: The CMSO Model for Automotive Supply Chains

4.1.4. Exchanging Information in a Supply Chain: MLSC

Multi Level Supply Control (MLSC) is an inter-organisational derivation of Base Stock Control. As suggested by the CMSO model, MLSC gives the supplier detailed insight in needs of the downstream customer. Information which is available downstream the supply chain is immediately communicated to upstream suppliers. Aggregated information is detailed out step by step through the use of increasing insight in market and/or customer requirements. The supplier does not proceed with a next step before the customer has given additional specifications (Kreuwels, 1994, p. 124; Van der Vlist, 1997).

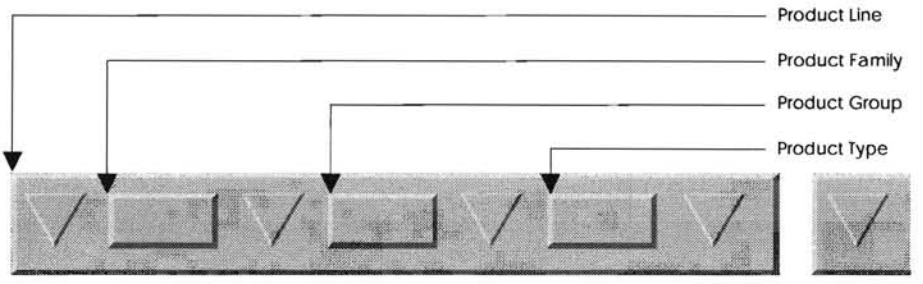

figure 4—6: Multi Level Supply Control

Analytical research (e.g. Clark, 1960; Van Donselaar, 1993), surveys (e.g. Banerjee, 1993; Fawcett, 1993) and case studies (e.g. Hoppenbrouwers, 1993) have shown that, under a number of conditions inter-organisational exchange of information on downstream requirements, results in reduced nervousness of information communicated to suppliers. Consequently, both manufacturer and supplier will be able to improve their planning, thus improving supply chain performance. Kreuwels outlines the conditions under which MLSC will result in improved supply chain performance (Kreuwels, 1994, p. 105-106):

- critical resources must be shared by product types within a group, product groups within a family, etc. before they are distinguished from each other;
- market- and/or production prognoses must be based on the same hierarchical product structure;
- both partners must be willing to co-operate in achieving mutual performance;

The concepts as described in this section lead to the following presumption:

thesis II: Close relationships with customers, intensively monitoring their processes and subsequently using this information throughout the supply chain, where close relationships with suppliers have been built, can provide increased flexibility and reduced costs

The potential of supply chain concepts raised interest in the question how to implement them. A series of explorative case studies was therefore set up with manufacturers of investment goods. These had all set up projects for the implementation of promising logistic concepts. The purpose was to learn from

successful implementation of concepts to identify criteria for choosing between concepts. The case studies of Philips Business Communications and Rank Xerox illustrate that recognising the potential of supply chain approaches does not necessarily lead to successful implementation.

4.2. Supply Chain Management: Philips Business Communications

Philips Business Communications in the Netherlands, a manufacturer of PABX systems, has experienced that customers no longer buy telephone switches, but instead expect Philips Business Communications to be a provider of communication solutions that facilitate their business processes. For example, airlines ask Philips Business Communications how it can help them selling more seats and major banks require Philips to participate in developing solutions for better serving the bank's customers.

This requires Philips Business Communications to devote itself to the business processes of customers and the role it can play there as a specialist in communication technology. For each customer a dedicated solution has to be designed. If new opportunities or new requirements arise over time, Philips Business Communications should be able to provide adequate support and equipment immediately. Preferably, Philips Business Communications should even suggest pro-actively before the customer has identified the opportunities or requirement.

This case study existed of participating in a project group from Philips Business Communications's factory in Hoorn: the International Purchasing and Supply Centre (IPSC). The project goal was to develop and implement customer orientation in the supply of the most expensive purchased component: the cabinet for the PABX. Two suppliers were involved in the study.

4.2.1. The Existing Materials Management Concept

The existing materials management concept for the cabinets was based on replenishment of the final assembly buffer stock (FAS buffer) at the IPSC. Final assembly started two weeks before the PABX systems was to be delivered to the customer. The supplier was sent a kanban order, as soon as a set amount of cabinets had been taken from the buffer. Within two weeks the supplier replenished the buffer stock (see figure 4—7).

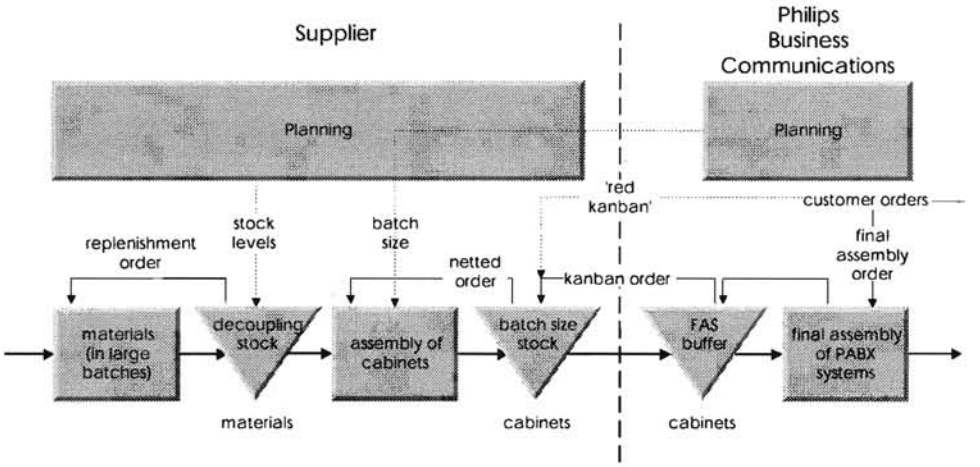

figure 4—7: The Supply of Cabinets to Philips Business Communications

The consequence of using kanbans for ordering new cabinets is that information on customer orders was only indirectly communicated to suppliers (cf. "local re-ordering" § 4.1.2).. This would have been expected, had Philips Business Communications chosen to be a mere transaction oriented manufacturer, focused on delivering switch systems in short delivery times. However, Philips Business Communications positioned itself as a provider of telecommunications solutions and therefore intensively co-operated with customers, Philips Business Communications knew customer requirements long before it started the final assembly.

Nevertheless, not before the start date for final assembly any information on requirements was communicated (in the form of a kanban) to the supplier. At the same time, Philips had started a delivery time reduction program for purchased components, aimed at stimulating suppliers to accelerate their processes and decrease their delivery time from two weeks to one week.

4.2.2. Availability of Customer Information

In the case study, a survey was carried out to find out to what extend extra information on customer requirements could be communicated to suppliers. Therefore, over a period of 8 weeks all 126 customer orders which included one of four types of cabinets were analysed. For each order the manufacturing release

date was compared to the order date (at which the sales or service department had entered the customer requirements in the information system). The time between these two date was called 'release delay'. The release delay thus represents the time between the moment Philips Business Communications received the information and the moment Philips Business Communications started acting upon it.

The chart of figure 4—8 presents the outcome of the analysis of the orders. The columns represent the number of occurrences per release delay. The gray area gives for each release delay, the cumulative number of orders with a release delay that is equal or longer.

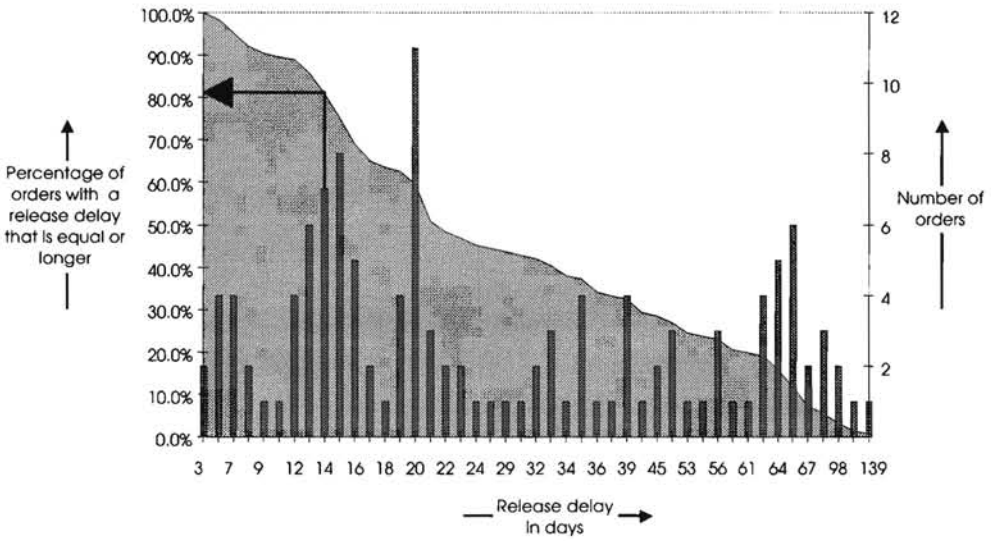

figure 4—8: Count of Release Delay per Order for 126 Customer Orders

It became clear that the minimal release delay was 3 days. The average release delay per order was almost 33 days and over 80% of the orders had a release delay of more than two weeks, the current delivery time of the suppliers.

Further analysis was performed on individual cabinets. After all, the suppliers were only interested in the number of cabinets per type they had to produce. Almost 92% of the cabinets had a release delay of more than two weeks. A similar graph was drawn (see figure 4—9). The columns give the number of cabinets with

a certain release date. The various shadings in the columns refer to the various type of cabinets. The average release delay per cabinet turned out to be over 45 days. Some 90% of the cabinets had a release delay of two weeks or longer.

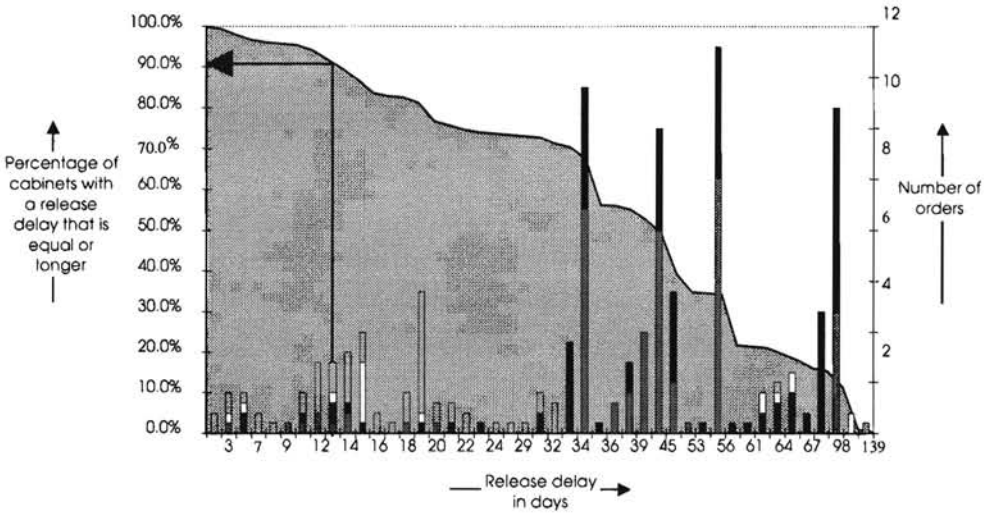

figure 4—9: Count of Release Delay per Cabinet for 126 Customer Orders

The results implied that, had Philips informed the suppliers on the requirements for cabinets at the moment that customer orders were confirmed, 92% of the cabinets could have been made to customer order without reduction of delivery times. On the contrary, the suppliers could have extended their delivery to four weeks and still produce almost 75% of the cabinets to order.

When comparing figure 4—8 and figure 4—9 it can be noticed that peaks in terms of cabinets concern longer release delays that peaks in terms of orders. This could be explained by the fact that, generally spoken, the release delay increased with the order size (i.e. the number of cabinets in an order). Large orders require a more intensive, and consequently longer, solution development process.

4.2.3. The Need for an Integrated Approach

On the basis of the analysis in § 4.2.2 it was argued that Philips Business Communications was able to considerably reduce the costs of the cabinet manufacturing and supply processes. This required the information from the sales process to be made available to the purchasing process. Furthermore, the sales process had to be adjusted in such a way that the information was acquired in a structured manner, in order to deduce requirements for the cabinet manufacturers. Had Philips Business Communications integrally perceived the cabinet supplier as a partner in its virtual corporation, it would have informed the supplier immediately on customer requirements.

However, the project group involved did not have any authority or influence on the sales processes[4], and nor did its superiors. The project led to a general agreement on the potential of the improvements and savings for the IPSC and the suppliers, but this agreement did not result in implementation of a supply chain management approach. It was not considered realistic to have the IPSC suggest adjustments to the sales process.

4.3. Supply Chain Management: Rank Xerox Manufacturing

Another case study was carried out with the Rank Xerox manufacturing plant in Venray (The Netherlands). Rank Xerox aimed at reducing stock levels and improving manufacturing efficiency throughout the supply chain, through providing suppliers with insight in its materials requirements planning. A project team was set up, which reported the manager of the materials management department, and closely co-operated with the purchasing department. Three suppliers were selected for pilot introduction of the concept. The activities and decisions of the project group have been observed throughout the project.

4.3.1. The Information to be Exchanged

Rank Xerox planned its production using a Rolling Production Plan (RPP). In the RPP the number of final products per type per period was planned. At the

[4] The difficulties experienced in acquiring the data for the analysis of § 4.2.2 were illustrative for that matter.

beginning of each period the RPP was discussed, modified if necessary and finally approved. Once approved the first period of the RPP could not be changed. Within the second period configuration switches were allowed (same quantities, other types) and after two periods volume switches could be made (other quantities, other types). The RPP was detailed out in a production plan were the number per type per week was planned.

In the project, suppliers weekly received a delivery schedule in which gross requirements and net requirements for all their components were given, calculated over a period of eight months. The structure of their production processes allowed them to aggregate requirements for groups of components, which went through similar production steps. With the next delivery schedule they could plan the following, more specific steps. Thus flexibility was increased, now that they no longer had to allocate raw materials to their end products, from the first production step on.

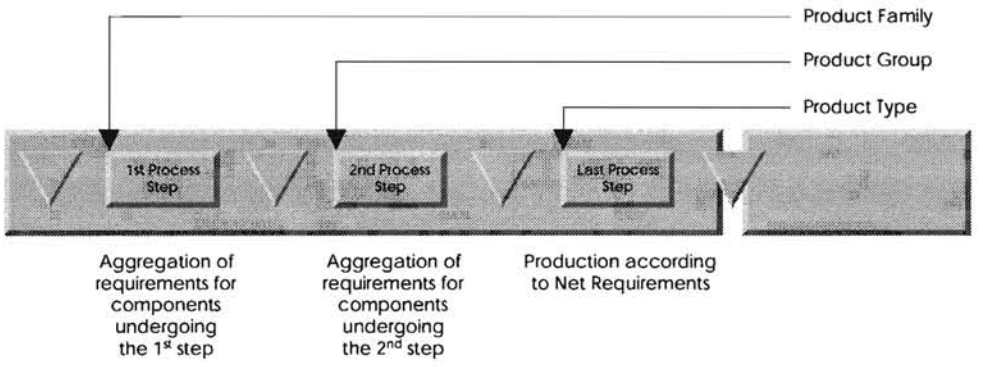

figure 4—10: Supplier Plans per Product Step by Aggregating Requirements

This concept is comparable to MLSC (see also figure 4—6). Kreuwels describes how communicating the net requirements to the supplier is a simple way of achieving stock reduction and increased flexibility in the supply chain (Kreuwels, 1994, pp. 115-118). Rank Xerox therefore considered it a good way to gain experience with inter-organisational production control, before more advanced variants would be implemented.

With the introduction of MLSC, Rank Xerox also implemented Pay-on-Production. Pay-on-Production implied that payment to suppliers was no longer related to receipt of components, but to the actual moments that the materials were used in production. It was introduced as a way of stimulating suppliers to optimally adjust their planning to that of Rank Xerox.

4.3.2. Role of the Departments

Rank Xerox and the suppliers had agreed that the prerequisites for MLSC were met (see also § 4.1.4, page 75, for Kreuwels' outline of the conditions for MLSC). First, product types within a group shared critical resources, before being distinguished from each other. Second, there was a strong correlation between increasing certainty on product specification and increasing specificity in the supplier's production process. Third, Rank Xerox had since long developed intensive partnerships with many suppliers, so that a basis was available for intertwined relationships. It was therefore expected that the introduction of MLSC would improve supply chain performance.

Nevertheless, already before the pilot projects had started, the suppliers objected to implementation of the concept. The reason for this was that they considered Rank Xerox' materials requirements planning to be insufficiently reliable for MLSC. The unreliability was caused by a diversity of factors, which involved various other departments within the Rank Xerox organisation.

- The sales department could add additional sales orders to the Rolling Production Plan on short notice, especially when it concerned large orders. These orders led to additional requirements that had not been included in the planning.
- The production department could decide to combine, postpone or anticipate production orders in order to optimise production efficiency. Usage of materials in production therefore did not correspond to the original planning. Furthermore, materials usage was not recorded in the information system, so that MRP calculation could not consider availability of components.
- The service department and other Xerox factories were allowed to enter their requirements directly into the MRP-system. All requirements were consolidated before rescheduling messages were presented to the materials planners. The planners could only compare the total requirements to the Rolling Production Plan and had no insight in the importance of the extra demand.
- The Asset Recovery plant recycled components from machines that were taken back from customers. If available, these components were used instead of new ones. Net requirements were calculated from the gross requirements and the

number of available recycled components. Little insight existed in available machines, let alone in the usability of their components. Suppliers were therefore confronted with both cancellations and rush orders.

The project team had no means to influence priorities, procedures and authorisations of the other departments. The other departments were in no way stimulated to look at inter-organisational co-operation with suppliers. Pay-on-Production confronted the suppliers directly with the financial consequences of the unreliable information. They therefore refused to further co-operate in the implementation of MLSC and Pay-on-Production.

4.4. The Need for an Integrated Approach

The Rank Xerox case led to the same conclusion as the Philips Business Communications study: inter-organisational co-operation should be managed throughout the organisation, and should not be seen as relevant only for the manufacturing and the purchasing departments. Only under these conditions concepts for controlling the supply chain, like BCS, LRP or MLSC, can be implemented. Strong interaction between the departments involved in process co-ordination should therefore be established. A strict separation between purchasing and sales should be avoided.

Managing inter-organisational co-operation throughout the organisation requires embedding inter-organisational co-operation in the strategy. First, guidelines and criteria are required for the selection of processes and partners to be incorporated in its virtual corporations. Once these have been identified, requirements for individuals, departments and companies can be defined. The resulting division of responsibilities among these actors will then be the basis for implementing control concepts at the operational level (thesis III).

thesis III: In order to participate in virtual corporations, inter-organisational co-operation should be seen as part of the organisation's strategy, not as a choice to be made at an operational level

4.4.1. The Involvement of General Management

In the case studies, operational experts had selected and/or developed concepts for inter-organisational co-operation. In theory, these concepts provided benefits such as reduced stock levels, increased flexibility and reduced delivery times. However, both at Philips Business Communications and at Rank Xerox, general management had not been involved in the projects. Therefore, management had no understanding of the impact of the concepts to be implemented on other business functions.

This could be addressed to the focus of the projects and the resulting composition of the project teams. General management did not consider the projects potentially of strategic importance. Both projects therefore had no objective to investigate their relation to other business functions. The experts involved were qualified and authorised to detail out the information to be exchanged, to specify requirements for information systems and to develop procedures and decision rules for ordering and supply. The experts reported to the logistic manager only, who was not expected to inform general management on the specific projects. At the same time, he had no overview or leverage over other business functions.

Without extending the scope (and the budget) of the projects to include other business functions, the implementation of the proposed concepts for inter-organisational co-operation could not succeed. However, this would require the active involvement of managers of multiple disciplines. By accepting inter-organisational co-operation as a strategic issue, more forms of co-operation than just the pilot-projects in the case studies would require this kind of commitment and involvement. For management to give its commitment and involvement to such multi-disciplinary projects, guidelines for priority setting were required. This led to the assumption of thesis IV. This assumption underlies the rest of the theory developed and tested in this research.

thesis IV: Organisations that consider inter-organisational co-operation as a strategic issue, require guidelines for evaluating the dependence on inter-organisational co-operation of processes, in order to prioritise and to focus budgets and management commitment

4.4.2. An Existing Framework for Inter-Organisational Prioritisation

In line with the supply chain concepts as described in § 4.1, inter-organisational co-operation is often considered closely related to purchasing. The plea for avoiding a strict separation between purchasing and sales does not imply ignoring existing approaches to defining strategies for inter-organisational co-operation. Kraljic's purchasing portfolio technique (Kraljic, 1983), is still widely and successfully used as basis for segmentation in purchasing. It is illustrative for that matter that all three organisations in the case studies had classified their purchasing portfolio on the basis of Kraljic's technique.

The technique starts by classifying purchased items into four groups, each requiring a different purchasing focus. Kraljic uses two criteria for evaluating the purchased components: the *profit impact* of purchasing and the *supply risk*.

The profit impact of a given component is determined on the basis of the value purchased, the percentage of the total purchasing costs and the impact on product quality and business growth. Supply risk is assessed in terms of availability, number of suppliers in the market, competitive demand, make or buy opportunities, storage risks and substitution possibilities. The two criteria form a matrix in which purchased items can be positioned.

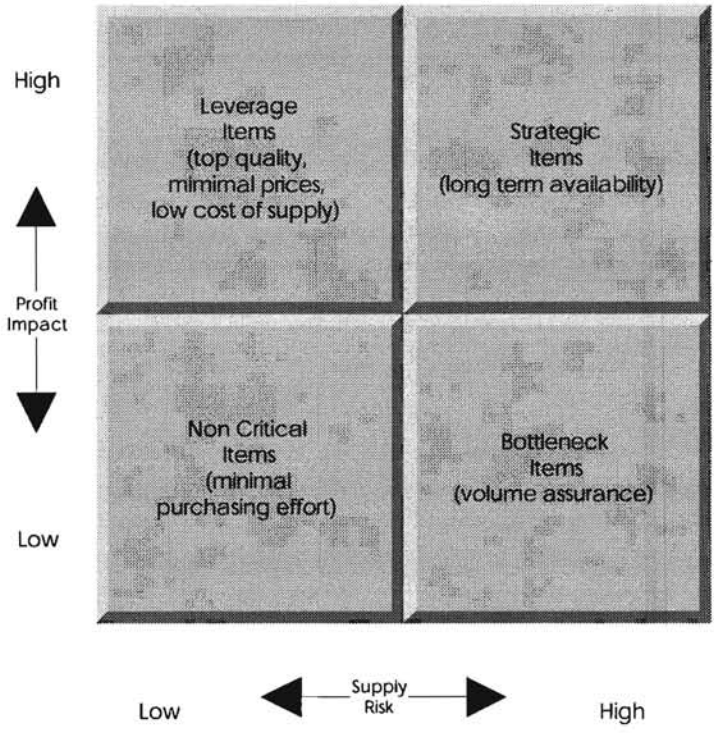

figure 4—11: Kraljic's Classification of Purchased Products

For each group of products a different purchasing focus is suggested. For *Bottleneck* items (high risk/low impact), assuring the right quantities is the primary issue, if necessary at the cost of higher prices or stock levels. *Non Critical* items (low risk/low impact) should be acquired with minimal effort, while focus for *leverage* items (low risk/high impact) should be on top quality, reduction of prices and costs of supply. These are also important for *strategic* items (high risk/high impact), but their problematic availability primarily calls for continuous dedication to maintaining supplier relationships on the one hand, and a ceaseless search for alternatives on the other.

The purchasing portfolio technique has proven to provide a differentiated approach to analysis of supply markets, thus facilitating the formulation of purchasing strategies for groups of items. The technique therefore seemed useful

for defining strategies for inter-organisational co-operation as well. When DAF N.V., in 1992, attempted to use the technique for exactly this purpose, it was considered valuable to participate in the project group.

4.5. DAF Trucks: Diversified Co-Operation with Suppliers

DAF N.V., a Dutch Manufacturer of Trucks, had decided that closer co-operation with suppliers would provide opportunities for maximum use of their knowledge and competencies. This had led to the decision that the amount of suppliers was to be reduced. With the remaining suppliers, partnerships could be developed, in order to profit maximally from their competencies. The following case study describes how DAF Trucks used Kraljic purchasing portfolio, as a starting point for developing strategies for co-operation with its suppliers.

4.5.1. Positioning product groups

At the time, DAF N.V. produced approximately 10,000 trucks per year in its manufacturing facility in Eindhoven, The Netherlands. Purchasing turnover for production related goods amounted up to approximately NLG 2.9 billion; 60% of its sales. DAF purchased some 20.000 different components from close to 800 suppliers. A supplier reduction program was started in order to be able to treat the remaining suppliers as partners, responsible for a specific specialism.

So far, DAF had been selecting and evaluating suppliers on their ability to produce components according to specifications at minimal costs. One of the first projects to be set up with the remaining suppliers would be a reduction of the number of different components through fierce standardisation.

DAF did not want to position each of the 20.000 components individually in the purchasing portfolio, but instead define purchasing strategies for groups of products. Each of the groups was to be put under the responsibility of one or a few suppliers. Each of the groups would furthermore be evaluated against Kraljic's portfolio positioning criteria; *profit impact* and *supply risk*.

4.5.2. DAF's commodity codes

Kraljic's portfolio technique is based on product characteristics. It was therefore assumed that product characteristics would provide a useful basis for developing supply strategies. DAF's engineering department had developed a classification of components based on product characteristics. The purpose of the classification was to offer insight into the existing component base while designing new ones. It allowed weighing alternatives and avoiding redundancy during product design.

Each time a new component was designed, it was classified using so-called *commodity codes*[5]. The classification had led to 63 *commodity groups*, which in turn were divided into 432 *sub commodity groups*. A commodity group was supposed to cover all components playing a role in a particular function of the truck. However, some commodity groups typically referred to the technology or the material required for their manufacturing. Examples of the first set of 'function-driven' commodity groups are *internal engine components, brake actuation equipment* and *gearboxes*. Examples of the second set, the "process driven" groups, are *machined parts, rubber parts* and *ferrous castings*.

Within the function-driven groups, no process homogeneity could be found between the subgroups. A good illustration of this is the commodity group *internal engine components*. This group comprised all of the purchased components required for the engines. The required competencies and processes for each of the groups of engine components varied considerably. The subgroups varied from *cylinder head gaskets* to *crankshafts* and *thermostats*. Consequently, suppliers only supplied to a single subgroup. There were no "internal engine components suppliers".

4.5.3. The Need for a Process Orientation in Partnership Segmentation

Within the process driven groups, there appeared to be more consistency in terms of required technologies and processes. These groups generally either comprised standard products, or existed of customised products from standard processes. They were respectively purchased from wholesalers and from jobbers.

The study learned that only the process driven groups could be used for positioning in the purchasing portfolio. The function driven groups were not homogenous enough to evaluate profit impact and supply risk per group. All

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[1] Although in English "commodity" 'means "trade goods", DAF Trucks assigned a "commodity code" to all purchased components, even when speaking of custom made, high value sub assemblies, such as engines and gear boxes. Here DAF's interpretation of the term will be used.

products within a process driven group however, in principle imposed similar requirements upon suppliers. This could be explained by the fact that implicitly a process or a manufacturing technology was specified before creating the group. Whereas in the function driven group there was no relation between the classification criteria and the processes of the suppliers in question.

It was concluded from the case study that, Kraljic's classification of supply situation on the basis of "items" does not provide guidelines for prioritising inter-organisational co-operation. Prioritisation for the implementation and maintenance of inter-organisational co-operation with suppliers should be based on evaluating processes (see thesis V).

thesis V: Segmentation of inter-organisational co-operation should be based on process characteristics, not on product characteristics.

4.6. Process Orientation in Marketing

The marketing literature also describes portfolio techniques where markets for individual products are evaluated for their attractiveness against the company's position on the particular markets (Kotler, 1997, pp. 39-44). However, Webster strongly advocates a customer-oriented segmentation of a company's offering in business-to-business markets. He stresses that the product in industrial marketing is a variable factor and consists of a complex array of technical, economic and personal relationships between buyer and seller (Webster, 1979, p.73).

The complexity of most investment goods makes it difficult for their users to specify needs in terms of required processes. Requirements are easier specified in terms of kilometres (trucks), copies (photocopiers) or takeoffs (aircraft). However, without insight in the customer's processes it will be impossible for the supplier to guarantee kilometres, copies or takeoffs.

The importance of identifying customer processes is illustrated through a survey that was carried out for Festo Nederland BV. Festo Nederland is the Dutch sales organisation for Festo International, a manufacturer of pneumatic components. These components are used in various types of machinery and sold through national sales organisations or agents in some 50 countries. Festo's

worldwide turnover amounted up to DEM 2 billion in 1996, while the Dutch sales organisation, generated an annual turnover of approximately NLG 60 million.

Festo Nederland had divided its products into two groups, based on differences in product characteristics: pneumatic and cybernetic. The survey of the Dutch market showed important differences in requirements from two groups of customers, despite the fact that both groups used all types of Festo's products.

- Equipment Manufacturers demand Festo to closely co-operate in developing complete, preferably standardised, solutions in which Festo products play an important role. Once in production they require guaranteed supply of larger quantities at minimal costs. Demand is to a certain extend predictable.
- End users buy directly from Festo Nederland or indirectly from local agents. In most cases, they need components for repair or maintenance of their equipment (originally manufactured by the equipment manufacturers!). Speed, availability and assistance are considered far more important than costs, since costs of down time can be enormous when compared to costs of individual components.

Festo concluded that for each of the groups, different processes had to be established, in order to be able act as a process enabler to the customers. For equipment manufacturers it had to adapt its design processes as well as its distribution process. The design process required more interactions with customers and access to information on previously developed solutions. The distribution process had to be redesigned in such a way that the equipment manufacturer's production planning could be used as a basis for Festo's own planning. For end users, Festo had to develop different processes that guaranteed instant availability for the first group (frequently used products), and fast delivery for the second (exotic products).

SKF Bearings made an almost similar division when it segmented its organisation into three business areas: Bearing industries, bearing services and speciality bearings. This segmentation allowed the development of different customer oriented processes through which similar products were sold (Taishoff, 1994). For both SKF and Festo differences in individual products appeared to be less significant than the differences in the processes the customers use the products in.

4.7. Conclusions

The case studies in this chapter made up the first phase of the research: "Exploration of the field of research, refining research objectives and research

questions" (see 2.4.2, page 36). The case studies of Philips Business Communications and Rank Xerox confirmed the theory on supply chain management: ignoring information that becomes available through co-operation with customers unnecessarily complicates the co-operation with suppliers. However, the cases also made clear that as long as purchasing and sales are seen as separate disciplines, it is very difficult to have suppliers respond directly to customer demand.

Both studies led to the same conclusion: inter-organisational co-operation should be managed throughout the organisation, and should not be seen as relevant only for the manufacturing and the purchasing departments. Only under these conditions concepts for controlling the supply chain, like BCS, LRP or MLSC, can be implemented. Strong interaction between the departments involved in process co-ordination should therefore be established. Inter-organisational co-operation should as a strategic issue, not as a choice to be made at an operational level. By accepting inter-organisational co-operation as a strategic issue, management should constantly prioritise budgets, commitment and involvement. Therefore guidelines for evaluating various forms of inter-organisational co-operation need to be developed.

Existing methodologies for evaluation of inter-organisational co-operation merely focus on the products exchanged in transactions between buyer and supplier. However, product characteristics cannot be used to develop guidelines for setting up relationships, as DAF Trucks experienced. This case study made clear that if suppliers are seen as partners, who can be made responsible for segments of the purchasing portfolio, the formulation of strategies for inter-organisational co-operation should be based on the processes, instead of products. The cases of Festo and SKF Bearings led to similar conclusions regarding customer-oriented co-operation.

The next chapter will discuss concepts from marketing and strategic management in order to find out what exactly can be the role of inter-organisational co-operation in the strategic position of a manufacturer of investment goods. The outcomes of analysis will be used in chapter 6 to develop a methodology that can be used for evaluating various forms of inter-organisational co-operation

5. Competitive Advantage through Inter-organisational Co-operation

Chapter 3 explained the importance of inter-organisational co-operation. Subsequently, chapter 4 made clear that inter-organisational co-operation is not easily implemented, even if operational concepts are readily available. Management commitment and prioritisation are required, yet existing guidelines are not applicable for this. Before such guidelines can be developed, insight is needed in the role of inter-organisational co-operation in the creation of competitive advantage. This chapter therefore reviews concepts from service marketing and from strategic management in order to provide a background for the development of guidelines in chapter 6. Examples from the literature are used to illustrate the importance of a process orientation.

5.1. Service Orientation and the Gateway Organisation

One of the explanations for the need to set up inter-organisational co-operation with suppliers and partners is that manufacturers are required to increase the customisation of their offering (see chapter 3). This customisation is often not

restricted to adding customer specific features to physical products (see § 3.4). Especially manufacturers of investment goods may find that their customers require them to add customised services to their products. Ultimately, the customer may no longer want to buy the product, but instead demand the supplier to be responsible for the product's performance in the customer's business processes.

After all, customers using investment goods are by definition companies themselves. Focusing on core competencies is equally important to them, as it is to any other organisation. Specification, operation and maintenance of equipment are no self evident core competencies to these customers. So, not only are manufacturers required to co-operate with their suppliers for delivering a complete product, their customers also require them to act as partners who provide guaranteed solutions for business processes. Inter-organisational co-operation therefore comprises suppliers as well as customers.

Goldman and Nagel state that "An *agile manufacturing firm* should deliver products that are designed to evolve". This implies that as the needs of users change, as improvements are introduced, users should be able to readily reconfigure or upgrade what they have bought instead of replacing it. In these cases quality is not measured in the number of defects, but in customer gratification over the full life of the product (Goldman, 1992, pp. 26-27).

The focus on customer gratification over the full life of the product requires a focus on the customer's primary business process. The supplier should not only be able to offer the appropriate products, but should also ensure the availability of the processes required to pro-actively play its role in the customer's process. This comprises more than assembling a compound product according to a Bill-of-Material and delivering it at the right place at the right time. If so, these organisations can no longer focus on selling products. Instead they should aim at constantly increasing the customer's benefits and at reducing his costs, through ensuring the performance of a superior product throughout the entire period in which it is used, in concordance with changing needs and technologies.

Scania therefore measures the usage of trucks and has decision rules for deciding when to maintain or replace the customer's trucks (Brooks, 1996). Similarly, Philips Medical Systems needs to have detailed insight in the utilisation of OR-equipment, so that it can decide when to replace or upgrade components (Wollaert, 1994). Xerox and Océ are able to remotely dial-in to the equipment they delivered to the customers and use this information to plan maintenance and repair (Wollaert, 1994). These companies can therefore be seen as typical examples of the 'agile' firms of Goldman and Nagel.

5.1.1. The Process Oriented Value Chain

The responsibility for facilitating the customer's process is inconsistent with the traditional view on value chains. Value chains are traditionally presented as if their steps take place sequentially (e.g. Porter, 1985). All steps are designed and evaluated for their contribution to customer satisfaction at the end of the value chain. In turn, the customer starts up his own value chain, traditionally with no relation or feedback to the supplier's value chain (figure 5—1).

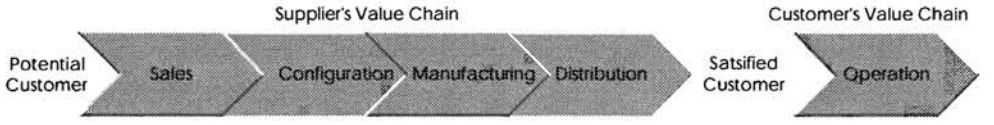

figure 5—1: Transaction Oriented Value Chain

Such a transaction orientation conflicts with aiming at constantly increasing the customer's benefits and reducing his costs. Enabling a customer's process requires achieving customer satisfaction, for as long as the enabled process takes place. In that case the value chain does not deliver value, until the customer carries out his process. This process should therefore be seen as an essential part of the value chain. Since the customer's process is enabled through the other processes in the value chain, these processes may be carried out concurrently and continuously.

Theoretically, none of the activities is concluded before the relationship with the customer ends. In practice, there is of course a continuous shift in focus, which shifts along with the stage of the relationship with the customer. This leads to a process oriented value chain, which is drawn in figure 5—2.

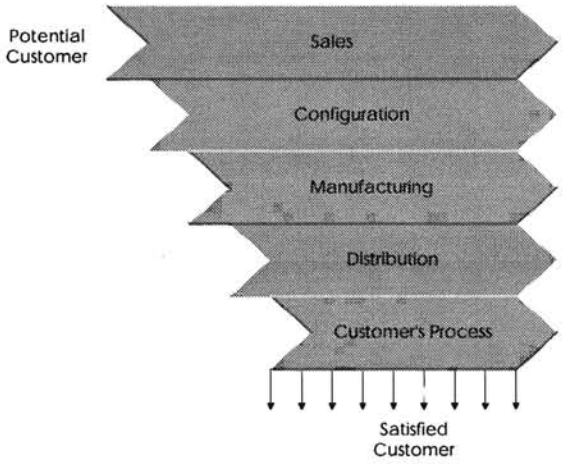

figure 5—2: Process Oriented Value Chain

5.1.2. Monitoring the Customer's Operation

The process orientation implies building long term relationships with customers and learning about their behaviour, problems and preferences, in order to tailor the processes to individual needs. This requires observing and understanding the customer's operation. Not simply to gather information for specifying a product, but to identify the customer's problems and mobilise competencies to solve them.

Defining and developing the service's features and characteristics is a continuous process, based on insight in the customer's process. Tight links to the customer are therefore essential. This explains why customer loyalty and customer retention are such important issues in marketing (e.g. Reichheld, 1990; Cespedes, 1995; Page, 1996; Hagel III, 1997). While these authors mainly focus on communicating with the customer, Goldman c.s. go even further by stating that customers require their service provider to be able to monitor his products while they are being used by the customer (Goldman, 1992, p. 28).

Caterpillar, for instance, is currently developing systems and concepts based on remotely reading sensors on all Caterpillar machines in a particular area. A field technician can diagnose the readings, with the aid of his computer, in which the history of the machine is stored. The computer validates the diagnosis, the costs of labour and parts and the risk of not performing the work. The outcome of the

evaluation may be the starting signal for a range of interacting processes, carried out by various actors in and outside the Caterpillar organisation, co-operating in solving, or even preventing, the customer's problem. This type of co-operation heavily relies on the use of ICT by all actors, within their own processes as well as in order to ensure communication and interaction between the actors (Fites, 1996).

5.1.3. Process Orientation implies Service Orientation

It can now be concluded that the process-oriented approach has two characteristics: first, it implies integration between the processes of customer and supplier; second it requires a focus on continuously providing benefits instead of a focus on selling products. These two characteristics are closely related to two important elements of commonly used definitions of services: *inseparability* and *intangibility* (e.g., Cowell, 1987; Lovelock, 1991; Kotler, 1997).

A closer look at the examples in the beginning of this section indeed shows that such manufacturers of investment goods have actually become service providers. Scania is developing a broad variety of services around its trucks, positioning itself as a provider of customised transportation solutions[6]. These services include leasing schemes, fleet management, and inspection and repair. Scania is consciously cutting down the difference between the tangible product and the intangible service. Philips Medical Systems has experienced that hospitals highly value services as an essential element of the product. Corrective and preventive services enable hospitals to rely on the equipment. Life cycle services guarantee maximum adjustment of the product to changing requirements and advancing technologies.

Philips Medical Systems offers service contracts to hospitals for an agreed upon price per period, thus allowing a closer interaction between the tangible product and the intangible service. Manufacturers of photocopiers like Xerox ('The Document Company') and Océ-Van der Grinten even have their customers pay per copy.

The trucks, medical systems and photocopiers enable the customers to carry out their business processes. Their products generate costs and benefits for the

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[6] In table 3—3 the manufacturing of trucks is presented as an example of customised physical products with standard services. The introduction of customised services by Scania, implies that its offering is positioned in the lower-right quadrant of the table.

customers over a long period and thus have become equipment for providing a service. This leads to thesis VI:

thesis VI: The knowledge required to develop and produce complex products may be of such specificity that customers do not want to buy such products, but instead demand their suppliers to take up responsibility for facilitation of the customer's processes. Such suppliers should therefore regard themselves as service providers, instead of manufacturers. Consequently, there is a need for ongoing interaction between the process of the customer and those of the enabling organisations, aimed at continuous customer satisfaction

5.1.4. Gateway to Solutions

Vandermerwe refers to organisations which choose to take up such strategies as 'Gateways to Customer Solutions' (Vandermerwe, 1996, p. 773). She describes four stages in the progression of thinking from products, through benefits, via solutions to Gateways, using Rank Xerox as an example. In stage four, the Gateway-stage, the offering no longer exists of the equipment required for making documents, but of the documents themselves (table 5—1).

	Stage 1: 1960s	stage 2: 1970s	Stage 3: mid-1980s	stage 4: mid-1990s+
Value	Features	Benefits	Solutions	"Gateways"
Offering	Product or Services	Products Augmented by Services	Product and Services	"Products" of the Products and Services
Object	Market Share (Boxes)	Market Share "Products"	Market Share Products, Software and Services	Share of Potential Activity in "Market Spaces"
Market Power	Sell (Boxes)	Help Customer Make Better Documents and Make Documents Better	Help Specific User Groups to Use Documents Better and Differently	Become the Integrator of Improved Life and Business Performance through Documents

table 5—1: Moving Through the Stages to "Gateways": Rank Xerox (Vandermerwe, 1996, p. 774).

Being a Gateway means working with partners to achieve one integrated ongoing customer result, consisting of all of the four stages. Typically, Rank Xerox is developing a 'distribution and print on demand system' in close co-operation with AT&T USA. They work together on offering total, customised, solutions for individuals who send and receive documents. AT&T foresees a future where books are no longer printed centrally and shipped around the country, but distributed and published in many places. In this view of the future, Rank Xerox aims for being the Gateway to software, distribution, shipping, storage, printing, binding, etc. (Kupfer, 1996, p. 66).

The essence of the Gateway concept is the ongoing interaction with the customer's operation, its focus on solutions instead of clearly defined products and being a node in the virtual corporation of suppliers and partners.

The Gateway gives the customer's access to the members of the virtual corporation, and at the same time brings the customer within reach of the suppliers. Caterpillar therefore serves as typical example of a Gateway. Without Caterpillar diagnosing, its customers would never have been able to select the

appropriate supplier. On the other hand suppliers would not have had access to the customers (see § 5.1.2).

5.2. Services

In chapter 3 it has been argued that manufacturers of investment goods have to operate in virtual corporations, in order to be able to meet their customer's requirements. Section § 5.1 explained how such manufacturers move towards Gateway organisations with a strong service orientation. This service orientation is therefore used as the starting point for discussing inter-organisational co-operation in virtual corporations.

5.2.1. Inseparability and Intangibility of Services

Two common elements of most service definitions are inseparability and intangibility:

- Inseparability of services implies that they are produced and consumed simultaneously. This requires involvement of the customer in the production process. There is a strong interaction between supplier and customer. Consequently the quality of the service is limited by the degree of co-operation of supplier and customer.
- Intangibility of services implies that they cannot be seen, smelled, touched or heard before they are purchased. The service cannot be evaluated before it is delivered and consumed. Historic results or experiences and the means available for production of the service only give an indication of what can be expected.

In the literature pure services are defined as follows:

> *Services are bundled activities resulting in customer benefits, the production of which cannot be separated from their consumption* (after, e.g., Stanton, 1981, p. 441, pp. 23-27; Crane, 1993, pp. 13-15; Lovelock, 1991, p. 18).

Many authors acknowledge the importance of combining tangible products and services into one offering. In the marketing literature, products are described as a combination of intangible and tangible elements, which can be positioned on a continuum, ranging from pure products to pure services (e.g. Rathmell, 1966; Shostack, 1977; Van der Hart, 1988; Berry, 1990; Armistead, 1992; Leppard, 1994; Kotler, 1997).

Christopher explains that tangible products cannot exist without services, by stating that 'there is no value in the (*tangible, LK.*) product until it is in the hands of the customer (Christopher, 1992, pp. 26). Marshall (Marshall, 1947) and Kasper (Kasper, 1995) go even further by arguing that there is no foundation for making a distinction between products and services. Essentially they state that products do not exist, only services do [7]. Grönroos avoids this discussion by allowing the organisation itself to define whether its offerings are products or services:

> *Services are objects of transaction offered by firms which consider themselves service organisations (Grönroos, 1982).*

This seems a circular definition. However, it makes clear that any organisation can look at its product as a composition of activities resulting in customer benefits, the production of which cannot be separated from their consumption. Defining the product as a process implies that the organisation sees itself as a service provider. All customer driven processes then make up the service, including manufacturing. In this view, trucks, copiers and medical equipment are the result of the service, but are not a product in itself.

5.2.2. The Service Mix

The service literature presents various frameworks and models that explain that services are composed of multiple components. For example, Van der Hart c.s. describe the service mix; a generic model comprising important service types, to be combined into one offering (see figure 5—3; Van der Hart, 1994).

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[7] Kasper states: *"A Product is Only A Service!"*, Marshall illustrates this as follows:

> *"Men cannot create material things. In the mental and moral world indeed he may produce new ideas, but when he is said to produce material things, he really only produces utilities or, in other words, his efforts and sacrifices result in changing the form or arrangement of matter to adapt it better for satisfaction of wants. All that he can do in the physical world is either to readjust matter so as to make it more useful, as when he makes a log of wood into a table; or to put it on the way of being made more useful by nature, as when he puts seed where the forces of nature will make it burst into life".*

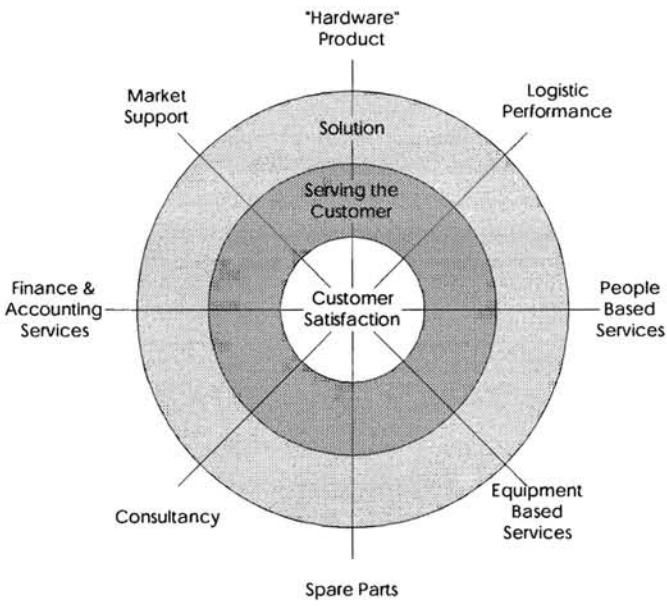

figure 5—3: The Service Mix

This mix of services allows the delivery of customised solutions to specific problems. The model of Van der Hart c.s. is comparable to that of Kinnear and Bernhardt, who speak of the 'Total Product', which is a combination of tangible elements and intangible services (Kinnear, 1986, p.268). Thus, designing a service is identifying the processes that need and can be included in the service. Van der Hart c.s. use the service mix to draw up different service profiles for different markets (figure 5—4). The validity of the profiles will not be discussed here, but the charts are presented to illustrate that the significance of the respective elements of the service mix may vary to the customer.

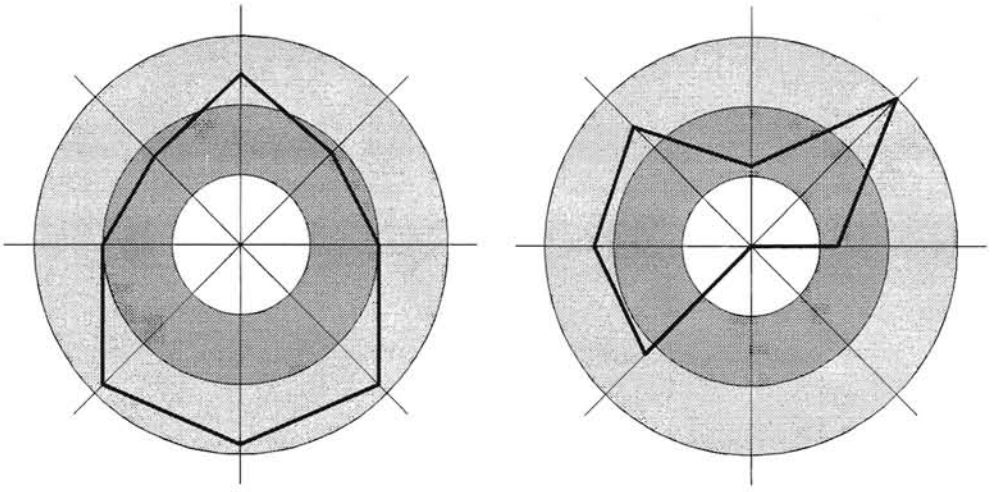

figure 5—4: Service Profiles for Two Different Products
(Left: Medical Equipment; Right: Cement)

For a Gateway, the development of customer solutions implies composing the appropriate mix of services and ensuring their integration a single offering. The first step is to analyse which services are required.

5.2.3. Modelling Composed Services

Shostack has developed an approach for modelling and blueprinting services for marketing purposes (Shostack, 1977; Shostack, 1982). It clearly explains what composing services means. Shostack models product/service combinations as if they are 'atoms' connected in unique 'molecular' combinations. Each of the atoms represents a product or a process. Bonds represent the relationships between purchasing criteria of two bonded elements. A bond implies that the customer is not interested in a particular element (or at least less interested), if a bonded element does not meet his requirements.

In figure 5—5 key elements of an amusement park are depicted, using Shostack's modelling approach. *Rides*, *Games* and *Shows* are the main attractions of the park. The appreciation for rides will greatly increase if *First Aid* is also offered. Parents of young children will not let their childeren take the rides, unless first aid

facilities are present. Consequently, rides and first aid are bonded. For teenagers this particular bond might however be less important. For them, *Games* will not be attractive if there are no *Prizes* available. In this particular park, the *Merry-go-Round* served as the park's land mark, so that it appeared on each of the prizes as well. If the merry-go-round would not have been there, the prizes would probably not be recognised as specific to the park, and would therefore be considered less attractive. Thus, the merry-go-round is not only bonded to the rides, but also to the prizes.

The concept of binding elements shows how the customer evaluates the entire combination of service elements. Each of the elements can be replaced by another, as soon as this results in a better fulfilment of the customer's requirements. The bonds make clear, which other elements are influenced by the replacement. In the example, food & beverages are considered bonded to shows. If popcorn would be taken of the menu, the model predicts less appreciation for the shows. However, it also suggests that no impact is expected on the attractiveness of games and rides.

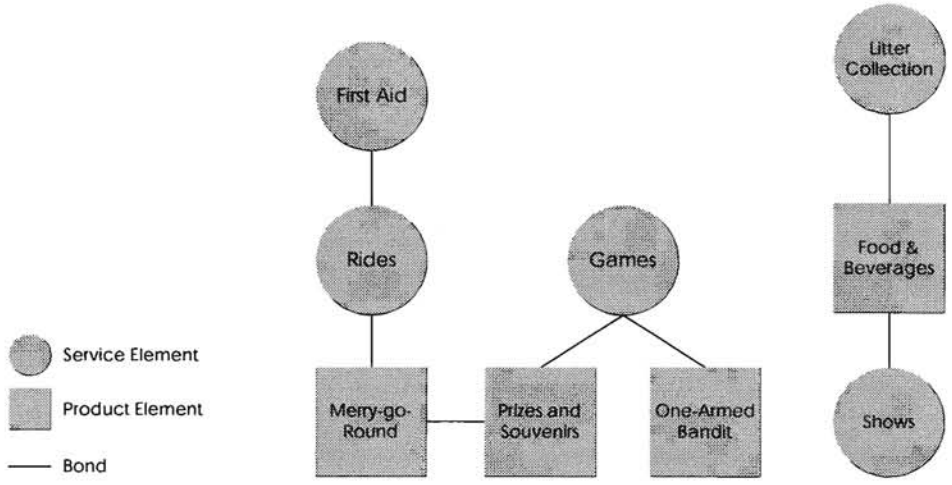

figure 5—5: Modelling an Amusement Park

5.2.4. Primary and Secondary Services

Looking at combinations of service elements, it becomes clear that some elements are critical for the primary role of the service, others provide additional convenience or can easily be replaced by alternatives. Kotler distinguishes the primary service package and secondary service features (Kotler, 1997, p. 474). This distinction is referred to as *service scope.*

The primary service package is provided to meet the customer's basic expectations and is the heart of the business, the *raison d'être* for the service provider. In addition, but not less important, secondary service features can be included to distinguish the offering from those of competitors.

The primary package of airlines, for example, exists of transportation of people and luggage. The secondary package may comprise a variety of services like movies, air-to-ground telephoning, and advanced seating. Similarly, the Marriot hotel chain offers computer and communication infrastructures for the high tech traveller, in addition to its primary package which exists of food and sleeping accommodation (Kotler, 1997, p. 475).

Kotler adds that secondary service features are easily copied. Once widely copied, customers will demand these features as a matter of course. If so, these features have become part of the primary service package. On the other hand, primary service elements will become obsolete if they are outperformed by newly developed products or services which satisfy the same needs. For example, traditional banking services (at the office window) are being replaced by electronic banking and automatic teller machines. Service elements should therefore continuously be re-evaluated for their customer significance.

5.3. Composing Virtual Corporations

Virtual corporations are not absolute entities, which can be discerned based on unambiguous criteria. On page 60, the definition of the 'virtual corporation' states that the organisations providing a joint product or product family make up a virtual corporation. Identifying a virtual corporation therefore requires defining its product or offering. Each organisation in the virtual corporation will have its own perception of its offering, and consequently have a different perception of the virtual corporation that produces it. This calls for alignment of the strategies of the

individual organisations. This in turn requires insight in the process of composing the offering of individual organisations.

5.3.1. The Importance of Architectural Knowledge

Venkatesan describes how the Cummins Engine Company is capable of making a medium duty engine that is more fuel-efficient, reliable and cost-effective than any other engine, thanks to the 'combustion recipe' developed by Cummins' engineers. The recipe allows them to specify a better combination of the same components than their competitors could (Venkatesan, 1992;.p. 102). This example illustrates the importance of architectural knowledge, which Venkatesan defines as "the intimately detailed and specialised power of translation required to capture customer requirements and reproduce them in the language of subsystem performance specifications".

It is, however, not only the architectural knowledge of Cummins' engineers, that allowed them to specify the combination. The engineers at the respective suppliers must also have used their architectural knowledge to design components, and ensure that they work in combination with other components. Each organisation in a network should have some vision on the architecture its products function in.

Venkatesan refers to architectural knowledge as *"The Crown Jewels"*. He states that a company can even outsource the manufacturing of critical parts and components, as long as it is capable of making a competitive combination of subsystems. Without the architecture none of the parts and components is able to generate customer benefits. It is not unthinkable that than compatibility with the architecture is more important than being Best-in-Class.

Similar examples are given by Henderson and Clark. They describe how competitors of Xerox and RCA introduced new products with new functionality, based on existing technologies developed by Xerox and RCA (Henderson, 1990). The strength of these competitors, respectively Canon and Sony, was in combining these (licensed) technologies with others in new compositions (or: architectures), thus supplying the market with desktop copiers and transistor radios.

The examples make clear that next to core technologies or manufacturing techniques, the ability to combine existing technologies into new products is a competence in itself. This not only requires knowledge on the technologies ('component knowledge'), but also on their interactions and interfaces ('architectural knowledge').

The essence of architectures is designing well defined component interfaces. This results in a stable environment for product development, allows reuse and upgrading of components, enables communication on components specifications, facilitates a learning organisation, and it gives the organisation with the architectural knowledge the position to either develop components which maximise the opportunities of the architecture, or co-operate with vendors who offer components compatible with the architecture. (Erens, 1996, p. 238-239).

Erens describes how product families are designed for a market and cater for the individual wishes of customers by introducing variety within the strategic service architecture (cf. Erens, 1996, p. 8).. The examples of Cummins, Canon and Sony illustrate how an architecture allows the development of generic physical products, which can be used to derive market specific or even customer specific variants. Similarly, a virtual corporation can develop a service architecture for generic services.

5.3.2. The Strategic Architecture

Hamel & Prahalad's introduce the concept of the 'strategic architecture'. A strategic architecture, as they define it, describes which competencies need to be developed, in order to be a player in a (future) market (Hamel, 1994). They argue that an organisation should start by developing a 'dream'. This dream describes how the (extended) functionality of their products will be delivered in the future. Based on this picture, the organisation starts to outline the competencies required for making this dream come true in a blueprint, the strategic architecture.

The choice of the appropriate competencies could be compared to the choice of the right components in product design. Shostack's modelling technique may be very helpful in this respect (§ 5.2.3). However, an architecture also requires interfaces between its components. In the previous section it has been argued that 'architectural knowledge' could be equally important as 'component knowledge'. Drawing a strategic architecture of competencies therefore also requires ensuring that the competencies result in a single offering.

Drawing on the analogy to product architectures, the interfaces in the strategic architecture exists of the means and structures that ensure the interaction between the processes. In a virtual corporation, where processes are distributed over numerous organisations, the means and structures for inter-organisational co-operation are part of these interfaces. Only if the processes properly interact, the organisations in a virtual corporation will be able to make the customer perceive their joint offering as a single offering from a single organisation.

The development of these interfaces requires careful consideration. One easily develops the wrong ones, or fails to develop the required one. Decisions regarding the development of interfaces should therefore be closely linked to the choice of competencies in the strategic architecture (thesis VII).

thesis VII: Designing a virtual corporation starts with drawing a strategic architecture that describes the competencies needed for a complete offering and the means and structures required for interfacing them

5.3.3. Competitive Advantage for Virtual Corporations

Choosing to become a Gateway implies relying on the ability to co-operate more than on particular competencies. One may therefore argue that a Gateway would not need a strategic architecture. This is not the case. Just like any organisation, a Gateway should have a clear view on the processes that it requires for a complete offering. It requires this view in order to decide with which organisations to co-operate.

A Gateway should in other words draw a strategic architecture for the virtual corporation it requires. This strategic architecture not only comprises all the processes needed, but also describes the means and structures needed to make them interact. Once the 'dream' has been built, the Gateway will have to decide which processes to include in its offering and which to leave out. Hamel and Prahalad present three criteria for determining the importance of competencies (Hamel, 1994):

- Value for the customer
- Distinction from the competitor
- Extendibility to other products and/or markets

Customer value and *distinction from the competitor* determine the relevance of the competency for a single offering. If a particular competency results in the fulfilment of a need that the customer perceives, while others are unable to fulfil the same need, one has created a very strong position. The third, *extendibility to other products and/or markets*, is important for the longer term; if a competency also helps creating competitive advantage in other markets, it is even more attractive to develop it. For virtual corporations, the same three criteria will have to be used for

evaluating the potential competitive advantage of including a component in the offering.

It is important to note that the inter-organisational context of a virtual corporation adds an extra dimension to the second criterion ('distinction from the competitor'). In chapter 3, it has been argued that being able to co-operate with others has become a specialisation in itself (see thesis I, page 52). A virtual corporation should therefore, among other things, distinguish itself from its competition through its ability to co-operate.

For each component a potential distinction from competitors exists in being able to include it in the offering, where others are not. This advantage may come from the difficulty to put the required means and structures in place. Again, this confirms the importance of not only considering individual competencies, but also evaluate the complexity of interfacing them through inter-organisational co-operation

In the next chapter the 'means and structures' for interfacing inter-organisational processes will be referred to as 'inter-organisational extensions to the infrastructure'. For Gateways and virtual corporations, inter-organisational extensions to the infrastructures are essential for being able to include components in an offering. These extensions therefore largely determine the Gateway's distinction from its competition.

5.4. Conclusions

This chapter aimed to provide insight in the role inter-organisational co-operation plays in the creation of competitive advantage for virtual corporations. Therefore some concepts from the service marketing literature and from the literature on strategic management have been reviewed. The review has been done on the basis of the assumption that manufacturers of investment goods may be required by their customers to take up responsibility for facilitating the customers' processes. The knowledge required to develop and produce complex products may be of such specificity that customers do not want to buy such products, but instead demand their suppliers to take up responsibility for facilitation of the customer's processes (see thesis VI). Such manufacturers increasingly have to position themselves as service providers.

This does not imply that the manufacturer should provide all the required services to his customer on his own. The complexity of the service may be such

that such a manufacturer needs to co-operate with partners, each of which is made responsible for a sub-process. The literature calls such organisations "Gateway to solutions"; a Gateway gives the customer access to the processes of his partners in the virtual corporation. The Gateway ensures that the customer can perceive theses services as one offering.

The products and services that make up the virtual corporation's offering may be strongly interrelated. A particular element of the offering will be less attractive to the customer if other elements are not available or do not meet his requirements. In the literature on service marketing, a distinction is made between primary services and secondary service features. The first are critical for the facilitated process, the latter provide additional convenience or can easily be replaced by alternatives.

Designing a virtual corporation starts by drawing a strategic architecture. As any architecture, a strategic architecture should describe components and interfaces. The components of a strategic architecture are the competencies required for creating the offering, the interfaces describe the infrastructure required to integrate these into a single offering. A virtual corporation can distinct itself from its competitors by being able to include elements in its offering that others cannot. Inter-organisational infrastructures are essential for this. For participants in a virtual corporation, distinction from the competitor is, to a large extent, determined by their inter-organisational infrastructures.

6. Alignment of Inter-Organisational Infrastructures and Strategy

Chapter 5 led to the conclusion that distinction from the competitor for participants in a virtual corporation is largely determined by their inter-organisational infrastructures. However, a clear view on infrastructures has not been given in this thesis so far. This chapter will therefore explain what exactly is meant by inter-organisational infrastructures, and elucidate why alignment between strategy and infrastructure is important for virtual corporations. Subsequently, a methodology for alignment of strategy and inter-organisational infrastructures is proposed.

6.1. The Infrastructure of the Virtual Corporation

6.1.1. Defining infrastructure

Longman's Dictionary of Contemporary English describes infrastructure as follows: "the systems and structures which are necessary for the operation of a

country or an organisation" (Longman, 1987). Operation (or process) can be seen as the transformation of input to output. Thus, the infrastructure of a virtual corporation can be seen as the systems and structures that a virtual corporation needs to transform input to output. However, Renkema uses the following definition of information infrastructure as follows (Renkema, 1996):

> *"The information infrastructure of an organisation is the whole of people, means and procedures in the field of information technology, appointed by the organisation for shared usage ."*

Renkema's definition has one important restriction. He explicitly states that infrastructures are appointed for shared usage[8]. Anything that is specifically assigned to an organisational unit is, in his view, not considered part of this unit's infrastructure. However, Renkema adds that the identification of an organisational unit is context sensitive. Infrastructure should therefore be considered nested and layered: people, means and procedures can be seen as infrastructure from one level, they can be local from a higher level. This would imply that from the perspective of a participant in a virtual corporation, the infrastructure exists of all systems and structures that it shares with other participants.

In practice one often speaks of the infrastructure of an organisation or the infrastructure of a country. Even Renkema does so when he describes the infrastructure of the "(...) the infrastructure of the department (...)", which among other things exists of "(...) 'own' applications and databases for strategic management, financial policies and legislative obligations (...)". He also concludes that "(...) a large part of the department's infrastructure is provided from outside the department (...)", which implies that at least a small part of its infrastructure is not shared with other departments (Renkema 1996; p. 57).

Including organisational borders in a definition of infrastructures seems unnecessarily complicating. Therefore, in this thesis, the definition that is used will be in line with Longman's description:

> *The infrastructure for an operation comprises anything a process needs to transform the input of a process into the desired output, provided it can be used repeatedly, by a different process or by another instances of the same process.*

The definition implies that each process has its own infrastructure. Since processes typically have their hierarchy, the view on the infrastructure depends on the

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[8] The fact that Renkema's only discusses the *information* infrastructure is not considered relevant here

viewpoint taken, as in Renkema's definition. However, in this thesis the viewpoint does not depend on the organisation that is considered, but depends on the selected process. For example, in car maintenance, the required tools and machinery are part of the infrastructure, while the car itself is not. For taxi services, cars belong to the infrastructure. The hierarchical nature of processes is reflected in the hierarchical nature of infrastructures. Examples of sub-processes within car maintenance are valve adjustment and changing the oil. Each sub-process requires its own infrastructure, which exists of a subset of the infrastructure for car maintenance.

Note that Renkema's definition of infrastructure falls entirely within the definition of this thesis, due to the relationship between 'shared usage' and 'repeated usage'. Shared usage of means and structures by different organisational units always implies repeated usage. If repeated usage is not possible, then two organisational units would not be able to share. If systems and structures were specifically used for a process that is carried out by one organisation, Renkema would not consider them infrastructural. For example, he would only call a hammer infrastructure if a carpenter shares it with one or more of his colleagues. This thesis would consider the hammer part of the infrastructure for nailing, whether the carpenter uses it alone or not.

6.1.2. The elements of the infrastructure for a process

A process is the transformation from input into output. The system that performs this transformation can thus be seen as the infrastructure for the process. A commonly used representation for such a system is given in figure 6—1 (cf. De Leeuw, 1979 and Falster, 1997; p.47).

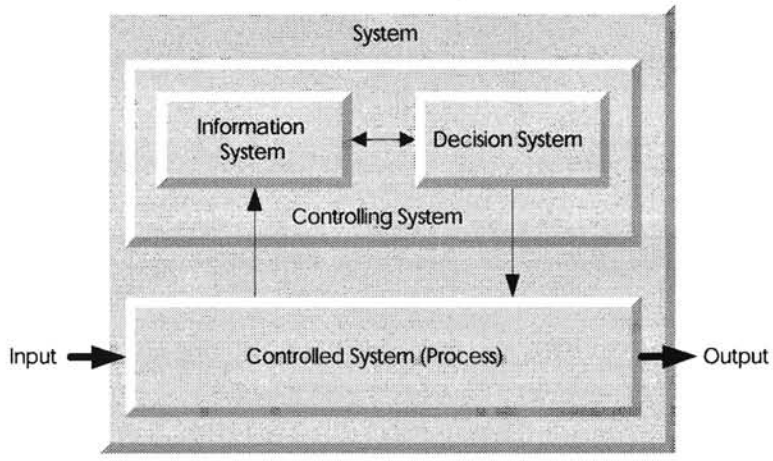


figure 6—1: A Generic Representation of a Process

The figure shows that the infrastructure of a process exists of three sub systems:

- the **Controlled** System
- the **Decision** System
- the **Information** System

Falster explains how manufacturing systems, which typically transform physical input into physical output, can be described using three views: the workflow view, the resource view and the decisional view. The work flow view and the resource view are used to describe the controlled system, while he uses the decisional view to describe the decision and the information system (Falster, 1997; p. 49-57):

- The **Controlled System**: Resources and Workflow descriptions

  The resources view and the workflow view together give a description of the controlled system (the primary process). Falster divides resources into durable and non-durable resources. Durability determines if resources are part of the infrastructure. Durable resources are part of the system, where non-durable resources leave the system after transformation. Non-durable resources can by definition not be re-used, so that only durable resources should be seen as part of the infrastructure.

  The work flow view describes the sequence in which the durable resources are used and the activities they should perform, in order to achieve the desired output. Without workflow descriptions, the system can do nothing. The resource

infrastructure of an operation does therefore not only exists of the required resources, but includes the workflow descriptions as well (cf. Hayes, 1996; p. 10).

- The **Decision System**: Decision makers, Organisation and Decision rules

  Falster describes the decision system (or controlling unit) as the complex of human of non-human decision-makers, the decision-maker's organisation and the decision rules (Falster, 1997; p. 46). The entire decision system can be seen as the operation's control infrastructure.

- The **Information System**: Facilities for communication, information processing and data storage

  According to Falster, the information system is the system that collects/disseminates information (i.e. communicates), processes information and stores data to support the decision system in making decisions (Falster, 1997; p. 47). All facilities for communication, information processing and data storage are part of the operation's information infrastructure.

It can now be concluded that characterising the infrastructure for a process requires describing the three sub systems, whereby the controlled system should be described in terms of both resources and workflow descriptions (see thesis VIII).

thesis VIII: Infrastructures for business processes can be characterised on the basis of resources, decision structures and information systems

6.1.3. Inter-organisational infrastructures

The infrastructure of a virtual corporation exists of the infrastructures for all the processes required to produce and provide the virtual corporation's offering (cf. Hardwick, 1996). The diagram figure 6—1 is as valid for inter-organisational processes as it is for processes within one organisation. Hence, the infrastructures in a virtual corporation can also be characterised on the basis of resources & workflow descriptions, decision structures and information systems.

The fundamental difference between a real corporation and a virtual corporation is reflected in the distribution of ownership, power and loyalty, which is a possible source of conflict between the participant of a virtual corporation (Van Aken, 1998; see § 6.2.3). This has its impact on infrastructures as well. Consequently, infrastructures for inter-organisational processes should be considered distributed over multiple organisations (see figure 6—2).

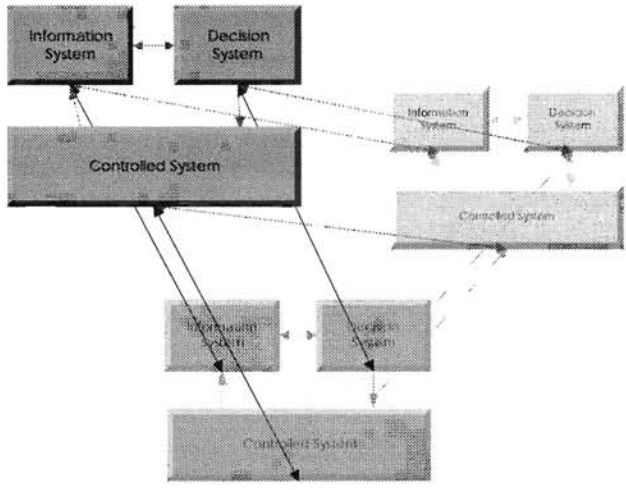


figure 6—2: Inter-Organisational Distribution of Infrastructures

Each participant in a virtual corporation will have to extend its infrastructure in such a way that it can co-operate with other participants. This leads to inter-organisational extensions of the infrastructure on all three dimensions:

- Inter-organisational extensions for **resource** infrastructures

  The resource infrastructure of an operation exists of the required resources and the workflow descriptions. Each of the participants is involved in producing and providing the offering because of his specific resources. Consequently, resources will generally not be shared between organisations. Inter-organisational resources therefore are the resources that are involved in inter-organisational co-operation, like the material planner for purchased parts.

  The inter-organisational character of the resource infrastructure will also be reflected in the workflow descriptions that describe the sequence of activities carried out by the participants involved. The inter-organisational extension to the resource infrastructure therefore consists of the resources that can be assigned to inter-organisational co-operation and the extended workflow descriptions.

- Inter-organisational extensions for **control** infrastructures

  Control is taking measures on the basis of comparing measurement results to norms and goals (e.g. Van Aken, 1978, p. 45; De Leeuw, 1986, pp. 112-116). In a virtual corporation the results that can be measured and the measures that can be taken highly depend on the inter-organisational decision system. Falster defined

the decision system as the complex of human of non-human decision-makers, the decision-maker's organisation and the decision rules (Falster, 1997; p. 46).

In a virtual corporation the decision-makers are distributed over the participating organisations in the virtual corporation. Their organisation, their decision rules *and* their decision power is largely determined by the relationship between the organisations. Inter-organisational relationships therefore form the inter-organisational extension to the control infrastructure.

- Inter-organisational extensions for **information** infrastructures

  The information infrastructure of an operation exists of the facilities for communication, information processing and data storage. The facilities for exchanging information between participants and the systems to process and store this information form the inter-organisational extension to information infrastructures (cf. Konsynski, 1993).

6.2. The Design of Infrastructures

In § 5.3.2 it has been argued that a strategic architecture should not only consist of components, i.e. processes and competencies, but should comprise interfaces as well. These interfaces are formed by their infrastructures. Identifying and developing infrastructure therefore is as essential as identifying and developing the components of the architecture. Various methods for developing infrastructures exist. These methods primarily focus on single organisations. In this section, two typical, yet opposite, approaches, the P-C-I-paradigm and Business Process Re-Engineering, are discussed and used to suggest a paradigm for designing inter-organisational infrastructures.

6.2.1. Deducive Thinking: the P-C-I-paradigm

The P-C-I-paradigm starts from the assumptions that processes are designed as solutions to problems. On the basis of process characteristics a control structure should be deduced, in which goals, norms and measures are laid out. The information system mirrors the control structure and can therefore not be determined before the control structure (i.e. decision structure) is in place (Bemelmans, 1994). In other words, the information system is seen as a function of the process and the control structure (figure 6—3).

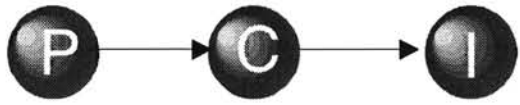


figure 6—3: P-C-I-paradigm for deducive design of information systems

The P-C-I-paradigm addresses all elements of an infrastructure. It prescribes the sequences it which they should be developed. All though it is presented as a paradigm for the design of information systems, it should therefore actually be seen as a model for designing infrastructures. Process design should then be seen as the design of the controlled system. In § 6.1 it is argued that the controlled system can be described in terms of resources and the workflows between the resources. Therefore, the P-C-I-paradigm should be slightly be revised in order to become a paradigm for designing infrastructures. According to the paradigm, resources and workflows should be designed first (R). On the basis of the resource design a control structure (or decision structure) can be designed (C). The control structure can then be mirrored in the design of the information system (I). This leads to the R-C-I-paradigm for deducive design of process infrastructures, as given in figure 6—4.

figure 6—4: R-C-I-paradigm for deducive design of process infrastructures

6.2.2. Inducive Thinking: Business Process Re-Engineering

Hammer and Champy object to deducive thinking, such as propagated in the P-C-I/R-C-I-paradigm. Especially since in most cases processes are *re*-designed instead of designed. They argue that taking existing processes as a starting point only leads to improvement of old processes, while information technology presents many opportunities to replace those processes to ones that are fundamentally different.

Therefore they promote "Inducive Thinking" while designing business processes (Hammer, 1993, chapter 5). This implies that information technology should be taken as the starting point. Managers, or business engineers, should recognise a powerful potential solution, problems it might solve and develop processes that use the power of information technology to their maximum.

These statements of Hammer and Champy are of course somewhat provocative. When looking at their "new rules" it becomes clear that they do not want to begin with selecting information systems. What they want is starting points to be questioned (Hammer, 1993; chapter 5). Inducive thinking implies looking at information systems in terms of the opportunities they present and the problems they might solve. In the paradigm of Hammer and Champy, the design process takes information technology as a starting point, and processes are designed to maximise the use of offered opportunities.

It should be noted that Bemelmans also argues that there are many interactions between the design of processes, control structures and information systems. In practice, during each of the design phases in the P-C-I-paradigm new insights may arise, which requires going back to the previous step. Constantly balancing workflows, resources, control structures and information systems leads to an iterative design process, rather than a sequential one. Infrastructure design will therefore be a combination of deducing and inducing. Only if the combination of resources, control structures and information systems is in balance, the infrastructure can be used to meet the customer's demand (figure 6—5).

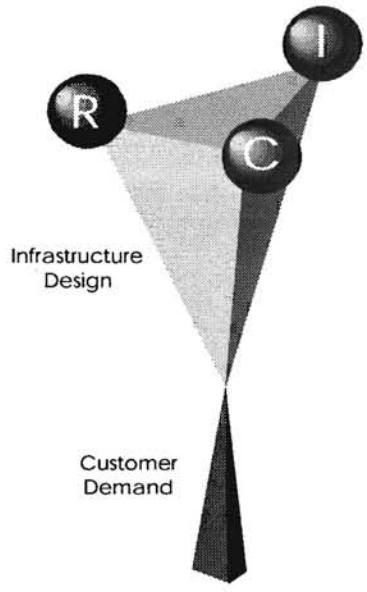


figure 6—5: Balance between resources, control and information

6.2.3. The Infrastructure Design Space

Three design dimensions of a process infrastructure have been identified: resources, control structures (or decision structures) and information systems. Thus, the design space for an infrastructure is set by resources, control structures and information systems (figure 6—6).

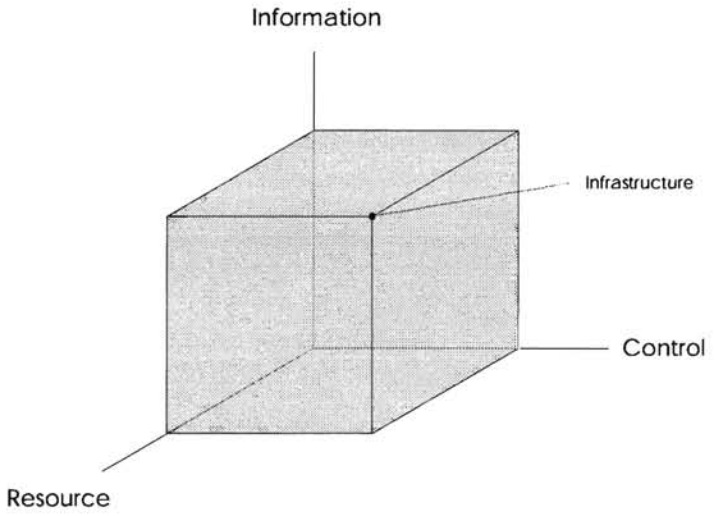


figure 6—6: Infrastructure Design Space

The infrastructure of a virtual corporation consists of the infrastructures of its participants. In § 5.3.2 it has been argued that these infrastructures can be seen as the interfaces between the processes of the virtual corporation. It may seem the Gateway's task to design the strategic architecture, design the virtual corporation's infrastructure, and subsequently select partners who are to be made responsible for a specific subsystem. Yet, in a network, each of the organisations will have developed its specific infrastructure.

If unity of ownership, power and loyalty exist, balancing the dimensions is already difficult. However, within a virtual corporation such unity by definitions does not exist (Van Aken, 1998). This will lead to conflicts of interest and opinion between the participants, so that each autonomous participant will only to a certain extend be willing and capable to adapt his infrastructure to the specifications of the Gateway. If the Gateway cannot find or convince partners to develop the required infrastructure, it cannot establish the required processes. The design space is therefore limited by the willingness and ability of others to implement inter-organisational infrastructures for co-operation in the virtual corporation. A Gateway may therefore experience a mismatch between the available or feasible

infrastructure and the required infrastructure. This mismatch may obstruct the implementation of the Gateways strategy and is to as *infrastructural mismatch* (figure 6—7).

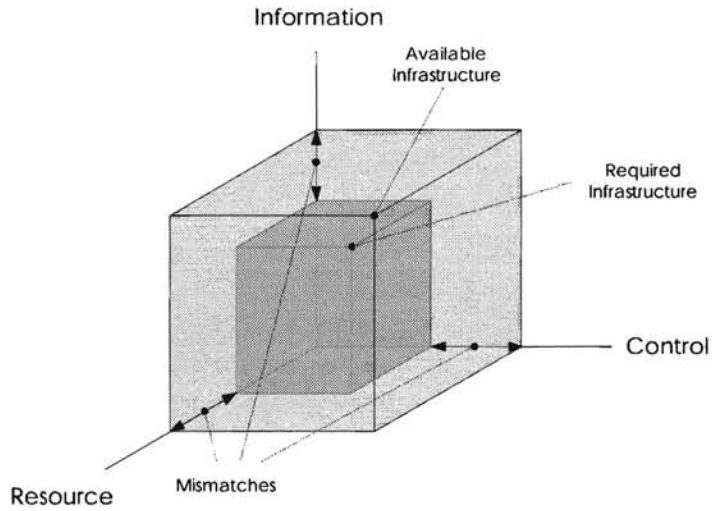


figure 6—7: Infrastructural mismatch between Required and Available infrastructure

It has been argued that the purpose of designing infrastructures is to find a balance between the elements of the infrastructure (figure 6—5), so that the infrastructure enables processes that exactly meet the customer's demand. However, the problem in balancing the elements of the infrastructure is that there are limits to the feasible. The required resources could be scarce or unavailable, control structures undesirable and information systems unrealistic. If the balance between the elements of the infrastructure cannot be achieved, the customer demand cannot be met.

Thus, infrastructural mismatches may require Gateways to re-evaluate their offering. Therefore, a Gateway cannot formulate a strategy first and subsequently specify an infrastructure. A Gateway will constantly have to align its strategic choices and the design of the infrastructure of its virtual corporation (thesis IX).

thesis IX: Division of ownership, power and loyalty within a network, constraints the organisations in such a network in the design of processes and infrastructures. It consequently limits the flexibility in designing the offering to the market. This requires a Gateway to align strategic choices and the design of the infrastructure of its virtual corporation, instead of deducing requirements from a strategy

6.3. Strategic Alignment

The P-C-I/R-C-I-paradigm and Business Process Re-Engineering do not address the relationship between infrastructure design and strategic business choices. Deducive thinking suggests that the design of the infrastructure be deduced from strategic choices. I.e., strategic choices are translated into objectives to be met by the workflow, which subsequently leads to the design of an infrastructure of resources, control structures and information systems. On the other hand, inducive thinking comes down to formulating strategies on the basis of opportunities offered by infrastructures. For a Gateway organisation the alignment of strategic choices and infrastructural design is essential.

Venkatraman developed a two dimensional model for aligning strategy and infrastructure on the one hand, and business objectives and information technology on the other (Venkatraman, 1991; Henderson, 1993). These two dimensions allowed the definition of four domains (see figure 6—8).

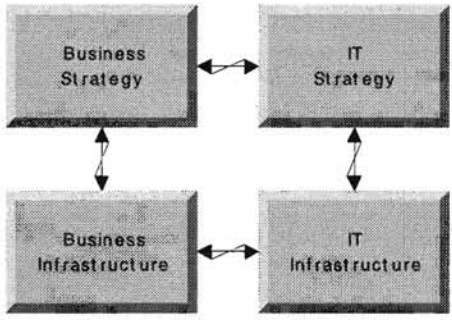


figure 6—8: Strategic Alignment

- Business Strategy concerns products and markets, competencies and co-operative relationships with customers and suppliers
- Business Infrastructure concerns internal administration, implementation processes and organisational skills
- IT-Strategy comprises the range of IT-functions, distinguishing IT-technologies and IT-governance
- IT-Infrastructure pertains to applications (hardware and software), development processes and IT-skills

If Venkatraman's IT-infrastructure is the information infrastructure of § 6.1, the business infrastructures comprises the resource infrastructure and the control infrastructure.

Venkatraman has developed a paradigm for alignment of strategy and infrastructure within one organisation (Venkatraman, 1991). As Bemelmans does, Venkatraman primarily focuses on the development of information infrastructure. However, he explicitly recognises the relationship between IT-infrastructure and business infrastructure. This section will therefore discuss Venkatraman's paradigm for its validity for Gateway organisations.

6.3.1. Interaction between Strategy and Infrastructure

Intuitively, one would argue that in practice, the interaction between strategic choices and infrastructure design, would be the mixture of deducing and inducing, as suggested in § 6.2.2. However, Venkatraman's studies indicate that few organisations treat their IT-infrastructure as a starting point for strategic discussions. Venkatraman identified three types of interaction between strategic decision-making and design of the IT-infrastructure: *independent*, *reactive* and *interdependent*

- In the **independent** type, the development of the IT-infrastructure takes place outside the organisation's strategic context. Design and modifications are done independent of strategic choices. On the other hand IT is no issue when formulating strategies. General management will therefore not need (and generally not possess) any knowledge on what IT can do for its company. Money spent on IT is treated as an administrative expense, for which a specific IT budget is generated, independent of the business process it supports. The IT function is positioned at lower levels in the organisational structure and in many cases reports to a financial manager or financial controller.
- In the **reactive** type, the IT-infrastructure has been recognised as a tool for business processes. This implies that if it can be made clear that IT enables the

implementation of strategic choices, general management will allow money to be spent on IT at the cost of other business expenses. The IT-function is appreciated for its expertise and has often been given a supportive position to the management team.

- In the **interdependent** type, design choices for the IT-infrastructure may be signals for changes and improvements of strategies, while strategic choices are immediately evaluated for their impact on the IT-infrastructure. Money spent on IT is regarded an investment and the IT-function is regarded a critical function in the organisation.

Most organisations in his studies belong to the first or second type and deduce their IT-infrastructure, respectively indirect or direct, from their strategy. Successful organisations, however, have acknowledged the interdependency between strategy and IT. They have in other words adopted inducive thinking as well.

6.3.2. Patterns of Alignment

There are no hierarchical levels of importance between the domains, so that all four domains can be the starting point for the (re-)design process. If a domain is the starting point for redesign, the model suggests that the two adjoining domains are evaluated and aligned to it. This leads to four patterns of alignment, presented in table 6—1.

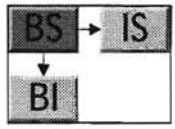
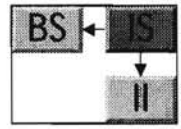
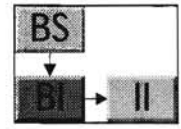
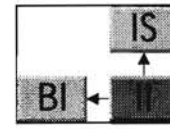
	Competitive Potential	Technology Potential	Business Value	Service Level
Diagram				
Starting Point	Business Strategy	IT-Strategy	Business Infrastructure	IT-Infrastructure
Domain Anchor	Product-Market Arena	IT Arena	Organisation	Information Systems Products and Services
Management Focus	Re-engineer Business Processes	Adapting the IT-Platform	Transforming Work and Organisation	Redesigning Information Systems Portfolio
Analytical Frameworks	Competitive Strategy Frameworks	Technology Scan and Forecasting Scenarios	Business Process Analysis	Portfolio Analysis of Applications
Measures	Business Measures Relative to Competitors	Measure of IT Capability and Flexibility	Organisational Efficiency	Service Levels

table 6—1: Alternative Patterns of Alignment according to Venkatraman

Venkatraman argues that achieving all four kinds of alignment is required for "leveraging IT for sustained success in the market place". However, in a virtual corporation the interaction between the processes of the various actors demands the actors to exchange knowledge, information, materials, etc.. In other words, the organisations highly depend on each other's strategies and infrastructures. Strategic Alignment for organisations who wish to participate in virtual corporations therefore also requires inter-organisational alignment with strategies and infrastructures of other participants (figure 6—9).

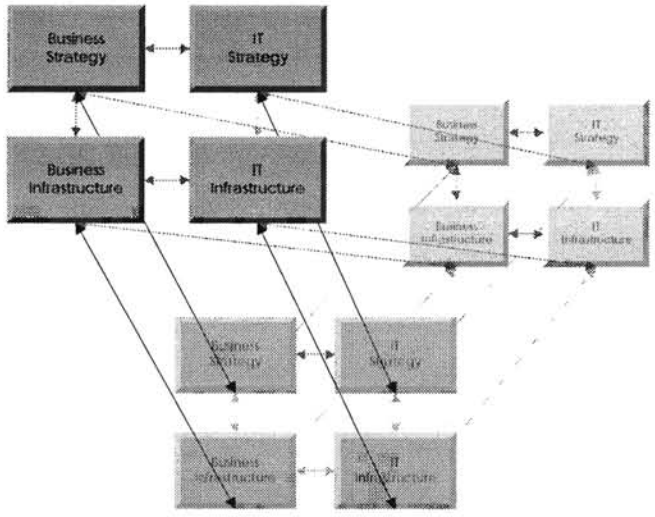


figure 6—9: Inter-organisational Alignment

6.3.3. Inter-organisational Alignment

The Gateway's network is essentially infinite (see figure 3—4, page 56). A Gateway should therefore decide which organisations to include in its alignment process. This requires insight in the competitive advantage that results from being able to co-operate with these organisations. It is clear that, if everyone would be able to set up a particular inter-organisational relationship, there is little chance that such co-operation will lead to competitive advantage. On the other hand, if no competitor manages to develop an inter-organisational process, due to the very sophisticated infrastructure that is required, the first who succeeds may have developed a niche without competition.

It has therefore been argued in § 5.3 that a Gateway can distinguish its virtual corporation through the ability to set up forms of co-operation that others cannot set up. Complex forms of co-operation, based on sophisticated infrastructures, therefore offer more opportunities for competitive distinction of a virtual corporation. It is therefore assumed that the more sophisticated the infrastructure that is required, the greater the opportunities for building a distinctive position (thesis X).

thesis X: A Gateway can distinguish itself through its ability to set up distinctive forms of co-operation in a virtual corporation. The more sophisticated the required infrastructure, the more complex the co-operation will be and the greater the chance that the co-operation will be unique

Strategic alignment of strategy and infrastructure for virtual corporations therefore requires assessment of the sophistication of the required infrastructure, so that the potential competitive distinction can be determined.

6.4. Sophistication of Inter-Organisational Infrastructures

The word 'sophistication' is used in various meanings. It is derived from the Latin verb 'sophisticare', which means "to adulterate, to educate" (Muller, 1978). Longman describes 'sophistication' as "unnecessarily complicated", "worldly" or "advanced" (Longman, 1987). Similarly, Ten Bruggencate translates it into "artificial", "distinguished" or "delicate, refined" (Ten Bruggencate, 1981). Infrastructures that provide competitive advantage are off course not unnecessarily complicated or artificial. In this thesis sophisticated infrastructures are 'advanced' and 'delicate' infrastructures. Advanced, in the sense that the infrastructure is based on the latest insights, modern concepts and state-of-the-art technologies, Delicate, in the sense that the infrastructure is unique and difficult to implement and to maintain.

The difference between the two interpretations seems obvious. However, in practice it can be very subtle. First, an infrastructure can be advanced and delicate, while the required transformation could also be achieved through a much simpler infrastructure. In that case the infrastructure may justly be characterised as unnecessarily complicated. The experts responsible for the design of the infrastructure should therefore constantly question the need for sophistication.

Second, 'unnecessary' could also refer to the transformation, instead of the complicatedness of the infrastructure. If in that case a sophisticated infrastructure has been built, it could be characterised as complicated, yet unnecessary. This requires careful assessment of the role of the infrastructure in creating and providing the offering by those responsible for strategic and commercial decisions.

Despite this potential ambiguity, which results from the various meanings of the word, this thesis will use the term sophistication to refer to 'advanced' (delicate, refined) infrastructures, in lack of a satisfactory synonym. So, where in this thesis

infrastructures are characterised as sophisticated, they are considered to potentially provide distinction from the competition.

Concepts for inter-organisational co-operation can therefore be evaluated for their potential competitive advantage, by looking at the sophistication of the required inter-organisational infrastructure. Therefore, a clear view on the sophistication of such inter-organisational infrastructures is needed, The view should be shared between the managers responsible for strategy and the experts responsible for the inter-organisational infrastructure.

For this purpose, for each of the dimensions a number of aspects have been discerned on the basis of literature. These aspects have been used in § 6.4.1, § 6.4.2 and § 6.4.3 to identify factors that determine complexity indicators and advancedness. These factors are used as the indicators for infrastructure sophistication. No attempt has been made to achieve completeness. Other indicators for sophistication may also exist. However, the correlation between indicators within a dimension is considered strong enough to justify the usage of a limited set of indicators. The indicators are used to indicate three levels of sophistication:

- Sophistication is low if the infrastructure is basic and traditional. Such an infrastructure can easily be implemented and can also easily be done away with. This level will be referred to as **elementary**.
- Sophistication is medium if the infrastructure requires investments and if implementation and usage are not self-evident. However, the required expertise and technology for such infrastructure is abundantly available. If not in house, then it can easily be found on the market. Generally, such infrastructures determine the minimal performance for professional operations. This level will therefore be called **professional**.
- Sophistication is high if the infrastructure is truly distinctive. Such an infrastructure is based on new technologies and state-of-the-art expertise. This level of sophistication will therefore be labelled **sophisticated**.

§ 6.5 will explain how the indicators can be used in a methodology to evaluate inter-organisational[9] infrastructures and direct management attention to them. Chapter 7 will describe an application of this methodology to the inter-organisational infrastructures of Philips Business Communications.

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[9] Because of the focus of this research, the subsequent indicators mainly refer to the inter-organisational extension of the infrastructures. This does not imply that the elements and indicators that are discussed should all be specific to inter-organisational infrastructures. Some may very well also be applicable to *intra*-organisational infrastructures.

6.4.1. Sophistication of Inter-Organisational Resource Infrastructures

The resource infrastructure exists of the controlled system, which transforms input into output. It includes the durable resources and the workflow descriptions (see § 6.1.2). Apart from durability, Falster uses two more criteria to classify resources: tangible/non-tangible and human/non-human. This leads to a subdivision of the resource infrastructure into human resources (people) and non-human resources. The non-human resources can in turn be divided into tangible resources (equipment) and non-tangible resources (knowledge). So, the resource infrastructure can be described in terms of *people, equipment, knowledge* and *workflow* (Falster, 1997; p. 57).

Degree of Training and Experience of People

An indicator for the sophistication of people (human resources) could be *the degree of training and experience* and the limits of their personal 'knowledge space'. At the elementary level, people have not been trained and they should be given clear, yet simple instructions (e.g. a driver of a parcel service van). People are considered professional if they have received considerable, directed, training in a specific area (e.g. a materials planner for purchased goods in a factory of photocopiers). People is characterised as sophisticated, if they are highly educated and intelligent, and are able to deal with issues in areas that are not formalised and/or new to them ('t Hart, 1997; p. 4-7) (e.g. an engineer working on the design of a new car).

Application Specificity of Equipment

For equipment *application specificity* is chosen as the indicator for sophistication (cf. Mertins, 1994). Equipment sophistication is considered elementary if it exists of tools that are designed for simple tasks that exist in many applications (e.g. a hammer or a screwdriver). For such tools, tolerance is not even a measure. Equipment is regarded professional if it is designed for a combination of tasks, specific to the business. Flexibility exists within a range of applications (e.g. an insulated trailer with a cooling installation). Sophisticated equipment can only be used for a unique and distinctive combination and sequence of tasks with low tolerances (e.g. a set up for a complex chemical process).

Newness and Structure of Knowledge

The sophistication indicator that is used for knowledge is the *newness of the knowledge and the degree of structure*, which determines whether or not it can be documented (cf. "indetermination of tasks"; Boreham, 1983). Elementary

knowledge has existed for long and can be thoroughly detailed out in documentation (e.g. knowledge on recipes). The validity of professional knowledge depends on the context in which it is applied. Much of the knowledge concerns rules for interpretation within the context. As the context changes, the knowledge should be updated. Professional knowledge can be documented through describing previous interpretations and their contexts (e.g. knowledge on jurisprudence). Sophisticated knowledge concerns new and therefore unknown contexts. Since the context is not clear, the knowledge cannot be limited and structured (e.g. knowledge required for offshore oil drilling in a new area).

Direction of the Workflow and Sequence of Activities

The sophistication indicator for the workflow is the *direction of the workflow and the sequence of activities*. The workflow sophistication is labelled elementary if resources are used sequentially and the first group of resources is done, as soon as the work is handed over to the second group ("sequential routing"; Van der Aalst, 1997; p. 44 or "decoupled transactions"; Hofman, 1989; p. 110). In this case there is only one moment of synchronisation (e.g. in the supply of tyres to a car manufacturer).

At the professional level, the resources also perform their tasks sequentially, but they hand over the work to each other multiple times ("inserted transactions"; Hofman, 1989; p. 111). Each time the work is handed over, the resources have to synchronise (e.g. a foundry that sends its castings to a supplier for deburring and polishing, who subsequently returns them to the foundry for checking and packaging).

The workflow is considered sophisticated if both groups of resources not only exchange the work multiple times, but also work in parallel ("parallel routing"; Van der Aalst, 1997). The resources should consequently constantly synchronise the results of their activities (e.g. two groups of specialised engineers that work together on the development of a new product).

Indicators	Elementary	Professional	Sophisticated
Degree of training and experience of people	Instructed, untrained workers	Uniformly trained specialised workers	Highly educated individuals, dealing with unformalised and new issues
Application specificity of equipment	Inexpensive, generally applicable tools	High tolerance, single purpose	Low tolerance, specifically designed
Newness and structure of knowledge	Permanent, thoroughly detailed out	Contemporary, well documented	Innovative, not documented
Direction and sequence of activities	One directional and sequential	Bi-directional and sequential	Bi-directional and Parallel

table 6—2: Sophistication Indicators for the Inter-Organisational Extension to the Resources Infrastructure

6.4.2. Sophistication of Inter-Organisational Control Infrastructures

In § 6.1.3 it has been argued that inter-organisational relationships form the inter-organisational extension to the control infrastructure. A classification of inter-organisational relationships can be found with Van Aken, Hop and Post (Van Aken, 1998). This classification uses Williamson's continuum between "markets and hierarchies" (Williamson, 1975) and positions Jones' "Network Governance" (Jones, 1997) between the two extremes (figure 6—10).

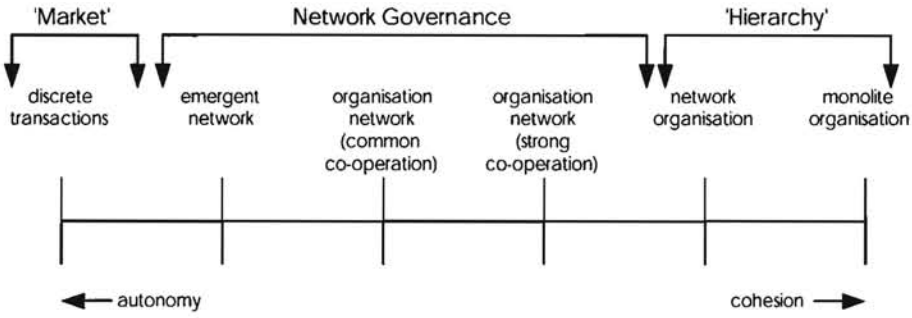

figure 6—10: Autonomy and Cohesion between Organisations or Organisational Units

From market to hierarchy, the strength of inter-organisational relationships increases. Consequently, organisations will have to put more effort in setting and maintaining the relationship. Characterisations of the positions on the continuum may therefore be used as indicators for sophistication of the inter-organisational extension to the control infrastructure.

Characterisations of the positions on the continuum are abundant in the literature (e.g. Carlisle, 1989; Broersma, 1991; Hiemstra, 1991; Smith Ring, 1992; Kamath, 1994; Lamming, 1993, Håkansson, 1995). Four aspects often reoccur, which have been selected as possible indicators for sophistication of the inter-organisational extension to the control infrastructure: *duration of the relationship, basis for co-operation, level of adjustment* and *use of contracts.*

Basis for Co-Operation

Control is taking measures on the basis of comparing measurement results to norms and goals (e.g. Van Aken, 1978, p. 45; De Leeuw, 1986, pp. 112-116). In a virtual corporation the basis for co-operation determines the norms and goals for controlling inter-organisational operations. In case of transaction based operations, the parties involved have one goal: maximising their own profit from the transaction in question. Basically, the only measure they can take is not finishing the transaction, if they do not consider the transaction profitable enough. On the other end of the continuum, co-operation may directly influence the continuity of the organisations involved. Their goal is to remain in business, their dependence on the relationship gives them very little room for control.

However, continuity will not always be at stake. Often, organisations periodically evaluate the synergy of co-operation against alternative options, such

as co-operating with other partners or not co-operating at all (e.g. a manufacturer who has set up JIT supply with a supplier of tyres, which requires close co-operation, in order to reduce mutual costs. The manufacturer could decide to work with another supplier, or to produce the tyres himself, if one of these options becomes more profitable). If their continuity is not at stake, co-operating organisations have greater freedom in managing their operations (cf. Carlisle, 1989).

Thus, transaction based co-operation is seen as an indicator for an elementary control infrastructure. Co-operation that is not directed at continuity, but on synergy only, is considered to indicate a professional control infrastructure. The control infrastructure is regarded sophisticated, if the co-operation affects the continuity of the organisations involved.

Level of Adjustment

Van Aken, Hop and Post explain how in a single organisation, there is by definition, unity of ownership, power and loyalty. In a network however, this "classical trinity", again by definition, does not exist. The greater the differences in ownership, power and loyalty between the individuals and organisations involved, the less compromises the individuals and organisations are willing to make to the network they create through co-operation (Van Aken, 1998).

The type of adjustments made may therefore indicate the intensity of the relationship. If no adjustments are made ("take it or leave it!", "like it or not!"), organisations can do business on a transaction base only. This may indicate an elementary control infrastructure. By adjusting processes to each other, they increase their mutual commitments. Adjustment of processes may therefore indicate a professional control infrastructure (e.g. the JIT delivery of tyres to the car manufacturer). The ultimate commitment organisations can make, without sharing ownership, is mutual adjustment of investments.

Duration of the Relationship

On the transaction side of the continuum, the relationship is over as soon as the transaction is finished. On the other extreme, the duration of the relationship is indefinite; i.e. there is no intention to eventually end the relationship (Smith Ring, 1992; p. 486). In many relationships, however, the co-operation periodically evaluated and either terminated or continued. As the relationship lasts longer, uncertainty about the future of the relationship increases, so that managing the relationship becomes more complex.

The duration of relationship may therefore serve as another indicator for sophistication of the control infrastructure. Relationships that last as long as the transaction are characterised as elementary, relationships that have been set up for a fixed period are regarded professional, relationships that have an indefinite duration are labelled sophisticated.

Use of Contracts

Smith Ring and Van de Ven studied co-operation between organisations. They concluded that risk and trust determine the type of relationship chosen (Smith Ring, 1992).

Transactions are used in case of low risk/low trust. *Discrete contracts* are set up again for each transaction. If trust increases, (low risk/high trust) organisations increase their co-operation and repeat their transactions. This results in *recurrent contracts*, without any obligations regarding continuity of the co-operation (e.g. a manufacturer assigns a supplier as a preferred supplier, while the supplier gives the manufacturer a 10% discount on all purchases). In case of high risk/high trust, organisations use *relational contracts*, which specify performance outcomes and has built in safeguards to ensure dedication to the respective goals of the parties involved. Issues such as quality, prices and volume can be left relatively open-ended (e.g. a super market and a transportation company set up co-operation for daily distribution to all super markets of the chain. They agree to minimise cost and to develop constantly improve their mutual performance. Each will however be held liable for costs incurred at the partner due to lack of dedication to mutual operation).

Discrete contracts are seen as an indicator for an elementary control infrastructure. Recurrent contracts indicate the existence of a professional control infrastructure, while relational contracts are assumed part of a sophisticated control infrastructure.

Indicators	Elementary	Professional	Sophisticated
Basis for Cooperation	Profit Margins	Synergy only	Continuity
Level of Adjustment	None	Operations	Investments
Duration	Transaction only	Fixed period	Indefinite
Use of Contracts	Discrete contracts	Recurrent Contracts	Relational Contracts

table 6—3: Sophistication Indicators for the Inter-Organisational Extension to the Control Infrastructure

6.4.3. Sophistication of Inter-Organisational Information Infrastructures

Inter-organisational information infrastructures play an important role in the creation of competitive advantage. In many cases information technology has long been the bottleneck for creating inter-organisational co-operation. Without inter-organisational information technology, banks would not have been able to give each other's customers access to each other's Automatic Teller Machines. Similarly, a publisher of brochures requires inter-organisational information technology to have customer comments processed by a designer immediately, so that numerous versions per day can be created and evaluated.

In these examples, inter-organisational information technology has become prerequisites for doing business very rapidly. Even if many organisations still find it difficult to understand, let alone to use and manage it. Malhotra speaks of "the ever increasing sophistication of information systems" (Malhotra, 1998). Indicators for sophistication of inter-organisational information systems should therefore be used with care. Not only increases the sophistication of information systems, users also become more used to information technology. Acceptance and adoption of technologies reduce the potential for competitive advantage. Technologies that are sophisticated today may therefore be elementary tomorrow.

Nevertheless, in this section an attempt is made to identify some indicators for sophistication of the inter-organisational extension to the information infrastructure. In § 6.1.3 the inter-organisational extension to the information infrastructure is said to comprise all facilities for exchanging information between participants and the systems to process and store this information. Kumar and Van Dissel characterise inter-organisational information systems on the basis of the *interaction between applications* (Kumar, 1995), which may a useful indicator for

sophistication. Martin sees the *means that are used for communication* between computers as an important indicator for the maturity (Martin, 1996), while Konsynski refers to the *use of standards* in general as an indicator for sophistication (Konsynski, 1990). Hammer and Champy describe various roles IT can have in processes (Hammer, 1993). If the *role of information technology in for the process* becomes more important, this could be seen as an indication of increased sophistication of the information infrastructure.

Application Interaction

Kumar and Van Dissel distinguish three types of inter-organisational information systems (IOS): pooled, sequential, reciproke. This division seems to indicate sophistication when applied to application interaction. The most structured application interaction is achieved by sharing the same ('pooled') application, which might even be the application of one of the actors (e.g. a dedicated on-line ordering application for retailers, provided by a wholesaler). Because of the required structuring, such applications can only be used for well-defined and limited functionality. Pooled application sharing is considered elementary.

A form of application interaction that leaves somewhat more flexibility to the actors is sequential interaction, where the output of one application serves as the input for the other (cf. decoupled transactions in § 6.4.1). Sequential interaction only requires specification of the outputs and inputs (e.g. a retail application that sends EDI-orders to the ERP-application of the wholesaler). It is more sophisticated that pooled application sharing, so that it is labelled professional.

Finally, reciproke application interaction allows the organisations involved to minimise the structure of their interaction. Input and output have not been predefined and the exact role and structure of the inter-organisational information cannot be determined before the actual usage takes place (e.g. systems which allow engineers of multiple organisations to review and comment each other's CAD-models continuously). This type of application interaction may be a good indicator for sophisticated infrastructures.

Means for Communication

Martin describes the evolution in the means for communication from direct connections between computers to wide area networks (WAN) and, ultimately, to the Internet (Martin, 1996). Direct connections are the easiest to put in place, but are by definition very specific, so that flexibility is low. Such connections are considered elementary.

WANs offer much more functionality and therefore increase flexibility of usage. However, these networks are expensive to install and maintain, so that communication is limited to others that use the same network. Such networks are considered to indicate professional infrastructures. The Internet has almost unlimited flexibility regarding functionality, as well as with respect to the choice of partners (Upton, 1996). The use of the Internet may therefore indicate a sophisticated infrastructure.

Use of Standards

Standards for the exchange of information and the interaction of applications have been defined in many areas. However, in the past organisations have developed their own proprietary information systems and formats and still use them today. The use of proprietary formats could indicate an elementary information infrastructure.

More sophisticated organisations replace their proprietary systems by standard software and standard hardware. Furthermore, they use standards developed by third parties for the exchange of information and the interaction between applications (e.g. Business Application Program Interfaces (BAPI) for SAP R/3 or EDIDACT-messages). If existing standards have been adopted, the information infrastructure may be referred to as professional.

Highly sophisticated organisations involve themselves in setting the standards, thus being able to integrally implement these in their information systems at a moment others may not even be aware of the standard. (e.g. American Airlines developed opened its airline reservation system for competitors, after it had ensured the adoption of the system throughout the travel industry. Today, its application SABRE virtually is the standard for airline reservation systems and thus became a real asset to American Airlines (Martin, 1996; p. 26)).

Role of IT in the Processes

The role of information technology for the process might also serve as an indicator for sophistication of the information infrastructure. An indicator for an elementary infrastructure could be the use of information technology for registrative purposes only (e.g. tracking of stock mutations for the financial administration).

If information technology is used to make processes more efficient, the information infrastructure can be characterised as professional (e.g. a purchasing department reduced its paperwork as a result of sending EDI-orders directly from the computer).

The information infrastructure plays a sophisticated role if it has been used to define and implement processes, which would not have been possible without information technology (e.g. a manufacturer of telecom equipment lets his customers configure their own switches through the use of a product configurator tool on the world wide web).

In table 6—4 indicators for the possible sophistication indicators from this section are summarised. Technological innovation will require periodic evaluation of the indicators for their validity.

Indicators	Elementary	Professional	Sophisticated
Interaction between applications	Pooled	Sequential	Reciprocal
Means for Communication	Direct Connection	Wide Area Network	Internet
Use of Standards	Proprietary Systems and Formats	Adoption of Standards	Setting Standards
Role of IT in the Processes	Registration	Improving Process Efficiency	Prerequisite for the Process

table 6—4: Sophistication Indicators for the Inter-Organisational Extension to the Information infrastructure

6.5. The Process Portfolio of the Gateway's Virtual Corporation

The indicators that have been developed in § 6.4 allow assessment of the sophistication for a given or proposed infrastructure on all three dimensions (see figure 6—11).

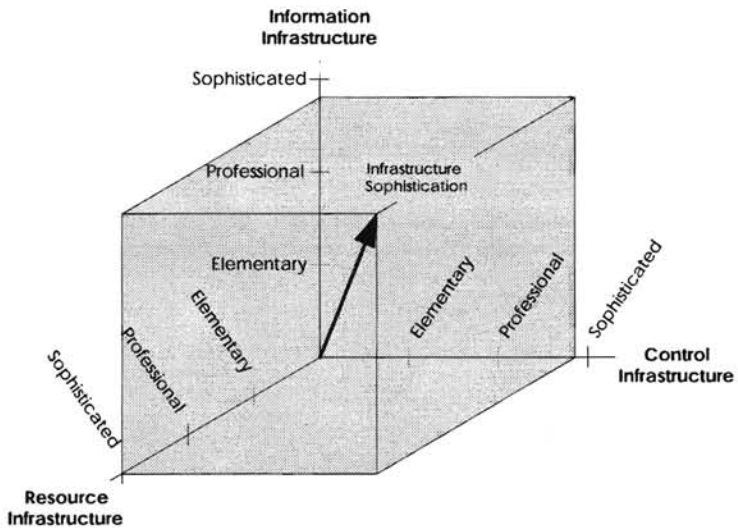

figure 6—11: Assessment of infrastructure Sophistication

Each process requires its own infrastructure (see page 112). The sophistication of the required infrastructure for a process determines the chances that competitors are capable of the same process. It is thus assumed that the infrastructure sophistication determines the potential contribution of a process to competitive advantage. A Gateway has chosen to distinguish itself from its competitors through being able to set up forms of co-operation that others cannot set up (thesis X). The competitive strength of a Gateway therefore depends on the sophistication of the inter-organisational extension to the infrastructures of the processes it requires in its virtual corporation.

However, setting up a competitive virtual corporation is not simply setting up a combination of processes that are hard to combine. Furthermore, a Gateway should be careful not to spend too much effort on sophisticated, yet superfluous infrastructures. Assessment of strategic importance of a process requires more criteria than the sophistication of its infrastructure alone. The Gateway requires a clear view on the need to include a process in its strategic architecture.

In § 5.2.4, *service scope*, Kotler's division between the primary service package and secondary service features, has been introduced. The primary service package is provided to meet the customer's basic expectations and is the heart of the

business, the raison d'être for the service provider. Regarding all processes required for offering the primary service package, Gateways have no choice but to implement the require infrastructures, be they sophisticated or not.

In addition, but not less important, secondary service features can be included to distinguish the offering from those of competitors. Here Gateways have a choice. A Gateway may decide that the infrastructure is too difficult to implement and focus on other additional features. Seemingly, *infrastructure sophistication* and *service scope* allow a Gateway to evaluate whether it wants to include a process in its strategic architecture, and subsequently develop the required infrastructure. The two criteria lead to a classification of processes into four groups.

A closer look at these four groups shows that such a classification resembles Kraljic's classification of purchased items (see figure 4—11). Where Kraljic speaks of *profit impact* of purchased items, a Gateway would evaluate the *service scope* of the processes in its portfolio. On the other hand, instead of Kraljic's *supply risk*, a Gateway considers *infrastructure sophistication*[10]. This can be explained by the fact that through combining processes of other organisations, Gateways, in a way, perform purchasing tasks on behalf of their customers.

In analogy to Kraljic's classification, the processes in the four groups will respectively be referred to as *routine* (primary service/low infrastructure sophistication), *leverage* (secondary service/low infrastructure sophistication), *strategic* (secondary service/high infrastructure sophistication) and *bottleneck* processes (primary service/high infrastructure sophistication). The resulting portfolio matrix is given in figure 6—12.

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[10] Note that Kraljic evaluates purchased items, while a Gateway evaluates processes (thesis V)

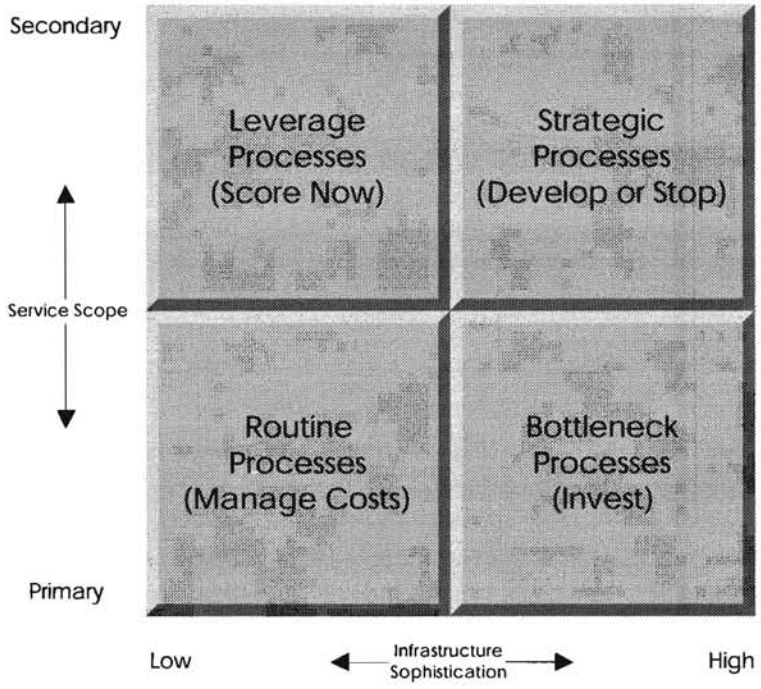

figure 6—12: The Gateway's Process Portfolio

6.5.1. Routine Processes

Routine Processes require a low sophistication of the inter-organisational infrastructure and can thus easily be included in any offering. Consequently, competitors can easily offer them too. Routine processes are also part of the primary service package, so that they will only meet the customer's basic expectations. The customer will demand quality, but could very well take it for granted, if not now, then within the near future. Consequently, customer satisfaction is more difficult to achieve than customer disappointment.

Creating efficient and effective inter-organisational co-operation should be essential for routine processes. The virtual corporation's performance should meet market standards and costs should be minimal. If not well managed, routine processes may cause the virtual corporation to quickly lag behind its competitors.

If an infrastructural mismatch is identified, the infrastructure should be adjusted as soon as possible. However, because of the simplicity of the infrastructure, this should not be difficult.

Knowledge and infrastructures required for routine processes are by definition straightforward and in conformance with international standards. Moreover, because of their primary role, the risk of obsolescence for the infrastructure is minimal. Since the infrastructure can be reused or written off without much harm being done, switching partners can be easy. Focus on low prices trough tough negotiation may therefore be a fruitful strategy for these processes.

6.5.2. Bottleneck processes

Bottleneck processes are difficult to implement because of their sophisticated infrastructures. However, as part of the primary package, each competitor will have to incorporate similar processes in its offering. The infrastructure sophistication for bottleneck processes presents opportunities to outperform competitors, but also bears the risk of being outperformed while not being able to respond effectively.

An infrastructural mismatch should therefore preferably be eliminated through adjustment of the infrastructure. However, chances are that none of the competitors is able to develop a similar infrastructure. This gives the Gateway some leeway. The urgency to adjust the infrastructure depends on the level of sophistication competitors are able to achieve. If management chooses to be defensive, it may decide to postpone adjustment of the infrastructure, provided it carefully monitors innovations and infrastructural initiatives of competitors.

It would however be naïve to postpone the adjustment of the infrastructure for too long. Failing to establish these processes may turn them into bottlenecks for offering the primary service package. In the end management should be committed to ensuring inter-organisational co-operation for these processes throughout the organisation. Strong dependence on other organisations should not be considered a problem, since bottleneck processes are part of the primary package. Their customer significance is therefore guaranteed as long as the offer does not change fundamentally.

6.5.3. Leverage processes

Leverage processes enable the Gateway to flexibly diversify the virtual corporation's offering and adjust it to customer requirements. They are however

easily copied by competitors or by the customer himself, so the virtual corporation should not rely too much on the leverage processes.

Leverage processes bear the risk of incorporating unnecessary services in the offering, which, despite their ease of inclusion, require resources and management attention. Thus, leverage processes may result in a loss of focus. For customers there must be added value in the integration of services into a single offering. The added value of integrating leverage processes could be very low, since the resulting service may be easily available elsewhere.

If an infrastructural mismatch exists, management should be careful to adjust the infrastructure, even if this seems easy to do. Adjustment will always take time. Competitors that do not have an infrastructural mismatch may have introduced the feature before the Gateway's has adjusted the infrastructure.

6.5.4. Strategic processes

Strategic processes can make or break the virtual corporation's competitiveness. Once in place, strategic processes distinguish the offering, while competitors are not able to establish a matching service on short notice. Thus, strategic processes potentially provide a lasting advantage.

However, strategic processes create inter-organisational dependencies and require specific investments. If the wrong partner has been chosen, if setting up co-operation fails, if a competitor has a substantial head start, or if the customer has not enough appreciation for these secondary services, the Gateway may find itself in a troublesome position. It will have installed an expensive, yet unsuitable, infrastructure, developed inaccurate knowledge and put itself under costly obligations towards the wrong partner(s).

Before a Gateway decides to adjust the infrastructure to eliminate an infrastructural mismatch, market research and supplier selection may therefore be essential activities. Since strategic processes are not part of the primary package, the Gateway would be able to afford to weigh them against alternatives that are easier to establish or decide to improve primary services first. However, once the decision has been taken to adjust the infrastructure, management should be involved in the implementation and operation of the inter-organisational infrastructures for such processes.

6.6. A Methodology for Evaluating Inter-Organisational Infrastructures

This discussion shows that using the two criteria, service scope and infrastructure sophistication, suggests different approaches for each of the four groups. The classification may therefore be a useful aid in the assessment of the strategic importance of processes, which subsequently allows management to prioritise between infrastructures. This leads to the following assumption (thesis XI):

thesis XI: *Service scope* and *infrastructure sophistication* can be used to classify the processes in the strategic architecture into four groups. Each of the groups plays a different role in the attractiveness of the offering. Gateways can therefore use the classification for assessment of the strategic importance of infrastructures

In this section a methodology will be suggested for evaluating the strategic importance of processes on the basis of (proposed) inter-organisational infrastructures. The methodology should allow Gateways to focus management attention in the development and operation of inter-organisational infrastructures.

The methodology starts a clear statement on service scope of the process that is being evaluated. The sophistication indicators from §§ 6.4.1, 6.4.2 and 6.4.3 can be used to assess the required sophistication of the (proposed) inter-organisational extensions to infrastructure that enable including the process in the Gateway's offering. Subsequently, required and available sophistication can be compared to identify infrastructural mismatch. The process can then be classified on service scope and infrastructure sophistication, so that a management approach can be chosen. If an infrastructural mismatch exists, this may result in re-definition of the offering. Re-definition of the offering implies redefining processes and service scope and restarting the methodology. Thus five steps have been identified for alignment of strategy and infrastructure (figure 6—13).

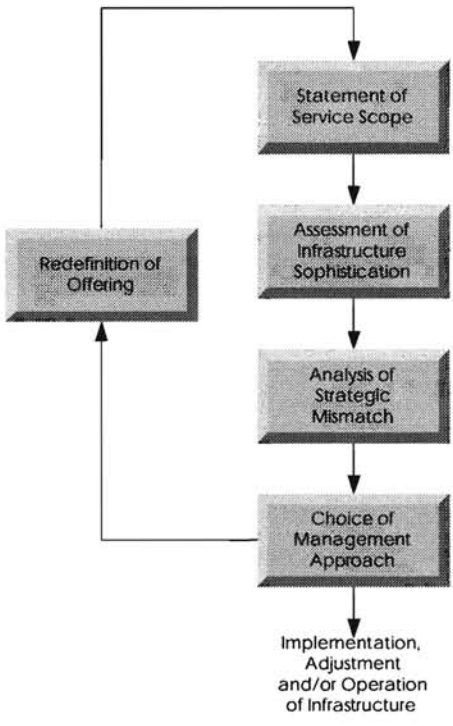

figure 6—13: A Methodology for Alignment of Strategy and Infrastructure

In §§ 6.6.1 through 6.6.5 these five steps will be briefly discussed. In chapter 7, describes a case study in which the methodology has been applied to part of the process portfolio of Philips Business Communications. The case study will serve as an example of an application of the methodology.

6.6.1. Statement of Service Scope

The methodology can be used to determine a management approach for processes that make up a Gateway's offering. All though the customer should perceive the offering as an integrated whole, the Gateway may be able to identify the processes that make up the offering and determine the role these processes play in the creation of customer benefits (cf. Shostack's molecular modelling technique, § 5.2.3). The Gateway's market positioning strategy determines whether a particular

process is considered necessary for primary services, or if its outcomes are seen as secondary service features.

6.6.2. Assessment of Infrastructure Sophistication

If the process has been clearly identified, the inter-organisational extensions ot infrastructure that are needed to include the process in the Gateway's offering can be determined. In case of a proposed infrastructure, the indicators from §§ 6.4.1, 6.4.2 and 6.4.3 can be used to determine the sophistication level of the infrastructure design. The design should be complete and accurate. In other words, the design should address resources, relationships and information systems, and it should enable the provision of the required benefits and meet all quality standards. The methodology also assumes that the designers of the infrastructure have not unnecessarily complicated the design.

The methodology can also be used to evaluate existing processes. The indicators will be then be used to determine the sophistication of the existing infrastructure. Completeness is not an issue, since the infrastructure exists in real life. However, inaccuracy and unnecessary complications should be compensated for by re-design of the infrastructure. So, if today an infrastructure does not satisfy the requirements, or if it can be simplified on one or more of the design dimensions it should be redesigned, before its competitive advantage can be evaluated.

6.6.3. Identification of Infrastructural mismatch

If the indicators have been used to determine the required infrastructure sophistication can be assessed as in figure 6—11. The same can be done for the infrastructure that is available in the Gateway's organisation and with the available partners. This leads to the identification of the infrastructural mismatch. Now the infrastructural mismatch, as illustrated in figure 6—7 can be made explicit. For each process a sophistication profile can be drawn, which explicates the sophistication of required and available infrastructures (figure 6—14).

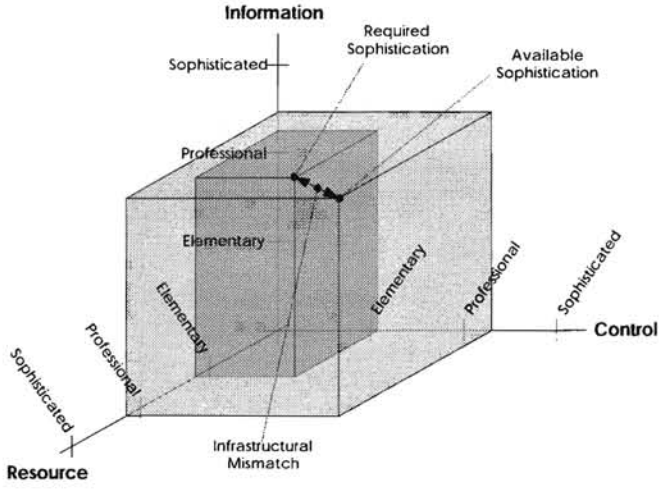

figure 6—14: Infrastructural mismatch between Required and Available Sophistication

An infrastructural mismatch implies that the available infrastructure is not sufficiently sophisticated. It will therefore, by definition, not occur for routine processes or leverage processes. For strategic and for bottleneck processes strategic mismatches could be commonplace, because of the difficulty of implementation and operation of sophisticated infrastructures.

6.6.4. Choice of Management Approach

After service scope and infrastructure sophistication have been determined, the process can be classified on service scope and infrastructure sophistication. This leads to classification of the process in one of the four groups. This classification may be used to determine a management approach towards implementing an operating the infrastructure and a possible infrastructural mismatch.

For primary processes, management can then determine whether it should focuses on cost reduction, in case of routine processes, or if it should invest in the infrastructure, in case of bottleneck processes. For secondary processes,

management can determine whether, in case of leverage processes, it should score now or, in case of strategic processes, if it should choose between developing the infrastructure or leave the process out of consideration and redefine the offering.

6.6.5. Redefining the offering

The goal of alignment of strategy and infrastructure is to eliminate the infrastructural mismatch, either through adjustment of the infrastructure, or through adjustment of the offering. Adjustment of the offering will only be possible with respect to secondary processes. Only for these processes a Gateway may decide to reconsider the offering, if it identifies a strategic mismatch or if the infrastructure does not appear to be competitive enough.

Gateways are expected to have less influence over the required infrastructure because of the division of ownership, power and loyalty that they will experience in setting up a virtual corporation. A Gateway may therefore have to go through the alignment cycle multiple times before it has a fit between strategy and infrastructure.

6.7. Conclusions

Chapter 5 led to the conclusion that for participants in a virtual corporation, distinction from the competitor is, to a large extent, determined by their inter-organisational infrastructures. However, division of ownership, power and loyalty within a network, constraints the Gateway in the design of processes and infrastructures. A Gateway therefore has a considerable chance to be confronted with a mismatch between the required and the available infrastructure (figure 6—7). This limits the Gateway's flexibility in designing its offering. A Gateway therefore cannot simply deduce the requirements for its infrastructure from its strategy. Instead it will have to iteratively align strategic choices and the design of the infrastructure of its virtual corporation.

In this chapter an attempt has been made to develop a methodology that allows Gateway organisations to determine the role their inter-organisational infrastructures play in creating competitive advantage, and subsequently choose a management approach towards implementation and operation of the infrastructure. The methodology has been applied in the case study of Philips Business Communications. This case study is described in chapter 7.

The methodology assumes that for each process an infrastructure can be discerned. The infrastructures of a process comprise anything a process needs to transform input into desired output, provided it can be used repeatedly, by a different process or by another instances of the same process. A commonly used division of the system that enables a process has been used to discern three sub-systems, which make up the infrastructure for a business process:

- the **Controlled** System
- the **Decision** System
- the **Information** System

For a Gateway and its Virtual Corporation inter-organisational extensions are especially important for competitive distinction. The inter-organisational extension to the controlled system can be characterised on the basis of extended workflow descriptions and the resources that can be assigned to inter-organisational co-operation. The inter-organisational extension to the control infrastructure exists of inter-organisational relationships. The inter-organisational extension to information infrastructures is formed by all facilities for exchanging information between participants and the systems to process and store this information. The more sophisticated extensions are needed to include a process in a Gateway's offering, the greater the opportunities for creating competitive advantage.

Regarding all processes required for offering the primary service package, Gateways essentially have no choice but to implement the required infrastructures, be they sophisticated or not. For secondary services a Gateway may decide that the infrastructure is too difficult to implement and focus on other additional features. Seemingly, *infrastructure sophistication* and *service scope* allow a Gateway to evaluate whether it wants to include a process in its strategic architecture, and subsequently develop the required infrastructure. This leads to a classification of processes into four groups, each of which requires a different management approach (figure 6—12).

For *Routine* processes (primary/non-sophisticated) focus should be on efficiency and accuracy. Infrastructural mismatches are unacceptable. Straightforward tough negotiation can be a fruitful strategy to reduce costs. *Bottleneck* processes (primary/sophisticated) require investments in the inter-organisational infrastructure and strong inter-organisational dependence should not be considered a problem. The existence of infrastructural mismatches is probable. The urgency to eliminate them could be made dependent on the degree to which competition also experiences the mismatch. *Leverage* processes (secondary/infrastructure) are easily copied by competitors, and should therefore

not be relied upon too much. An infrastructural mismatch could be reason enough not to include the process in the offering. *Strategic* processes (primary/infrastructure) require extensive market research before an infrastructure is developed to eliminate a mismatch.

The division of processes has been used to develop a methodology for alignment of strategy and infrastructures. The methodology is assumed to serve as a useful aid in the dialogue between infrastructure experts and management. It may facilitate alignment between the development of inter-organisational infrastructures and definition of the Gateway's offering.

7. Applying the Methodology: Philips Business Communications

This chapter describes a case study in which the methodology developed in chapter 6 is tested for its applicability in practice. Philips Business Communications serves as a perfect example of an organisation that is confronted with customers looking for Gateway organisations, instead of product manufacturers. Philips Business Communications has long been a manufacturer of PABX-systems, but now experiences that customers have moved to thinking in functions, instead of product specifications.

Philips Business Communications participated in one of the explorative case studies (see § 4.2). In that case study it became apparent that the non-existence of a clear view on the role of inter-organisational co-operation inhibited the implementation of sophisticated inter-organisational infrastructures. Together with the outcome of the other explorative case studies, this led to the conclusion that Gateways require a methodology for determining the contribution to competitive advantage of processes that depend on inter-organisational co-operation (thesis IV). It was assumed that the use of such a methodology would result in a more explicit view on the importance of inter-organisational infrastructures.

The methodology has been described in § 6.6. The five steps of the methodology have been applied to a number of processes in the process portfolio of Philips Business Communications. The purpose of this exercise was twofold. Firstly, the case study should make clear whether the classification of processes leads to a better understanding of the contribution of inter-organisational infrastructures to competitive advantage. Secondly, application of the methodology might provide additional insight in how to use it and which pitfalls to avoid.

Philips Business Communications was considered to provide a useful case study for trying the methodology for a number of reasons. First, it serves as a typical example of a Gateway organisation (see § 7.2), for which the methodology has been developed. Second, the explorative case study had shown that management did not have a clear view on the importance of inter-organisational infrastructures. If the methodology provided such a view, this would serve as a demonstration of its applicability.

7.1. Outline of the Case Study

The case study addressed a number of processes from the process portfolio of Philips Business Communications. The service scope of the processes in the study has been determined together with a member of the strategy staff (§ 7.3). Subsequently, experts from within the organisation have been interviewed to discuss the required and available infrastructures. The outcomes of these interviews (table 7—2 and table 7—3) have been compared to the indicators from § 6.4 to determine the required sophistication levels (§ 7.4) and infrastructural mismatches (§ 7.5). Subsequently, service scope and infrastructure sophistication were used to position the processes in the process portfolio matrix and suggest management approaches (§ 7.6) and, if necessary, directions for redefinition of the offering (§ 7.7).

7.2. Philips Business Communications

Philips Business Communications is a mid size player in the market for Private Automatic Branch eXchanges (PABX). Competitors are (among others) Nortel, Siemens, Ericsson and Alcatel. For long, PABX switches were sold through national PTTs, who held monopolies in these markets. For Philips Business

Communications, The Netherlands and Germany traditionally were the most important countries. Over the last years, the market for PABXs has changed. Changes have taken place in the market structure as well as in the technologies used. First, PTTs have had to give up their monopolies in the PABX market, so that Philips Business Communications can now do business with the users of their systems, without the PTTs interfering. Secondly, the integration of voice and data communication and the rapid growth of mobile telephony have caused customers to demand new functionality from their PABX-suppliers.

Where Philips Business Communications has therefore always been a supplier of physical products, customers now require it to develop, implement and continuously adjust telecommunication solutions to support customer specific business processes. In other words, Philips Business Communications is required to become a Gateway organisation.

The heart of the solutions still is the PABX switch, which is customisable through combining components and adapting embedded software according to customer requirements. Yet, only in combination with a tailor-made network infrastructure, a customer specific variety of peripherals and personal devices, and an extensive, individualised, service package the solution is considered complete. Philips Business Communications can therefore no longer provide the entire solution alone. It highly depends on partners who provide knowledge and process capabilities required for solving the customer's problem, in addition to its own competencies. Furthermore, since customer requirements change over time, so should the solutions and, consequently, so should the partners.

As a Gateway, co-operation has become a key word for Philips Business Communications, in both marketing and purchasing. On the one hand it must co-operate with its customers to identify and anticipate customer requirements, on the other it must co-operate with its suppliers and service partners so that processes and infrastructures can be aligned.

7.3. Statement of Service Scope

7.3.1. Primary Processes

So far, the PABX is still the heart of the solutions offered. All processes related to manufacturing, assembly and installation of the PABX therefore form the primary

service package. The most important processes in the primary service package are directly related to facilitating voice communication. It includes all processes required for putting in place the (tangible) PABX such as manufacturing of half-products and subassemblies, final assembly, distribution and on site installation. Philips Business Communications has well managed relationships in place for processes required for traditional line switches.

Recent developments in the PABX market, and *Must Do's* for any player, are facilitating mobile communication and connecting 'remote' or 'virtual' workplaces over the Internet. Users must be able to use a single mobile handset, within the PABX's network as well as in public cellular networks. Virtual workplaces must be (temporarily) integrated in the PABX network, as if directly connected to it, taking advantage of the cost structure and the accessibility of the Internet. Philips Business Communications has appointed Mobile communication and Internet Integration key elements of its product strategy.

7.3.2. Secondary Processes

In addition to its PABX, Philips Business Communications has developed various additional services. Two examples are customer base marketing and recovery operations. Customer base marketing exists of proactively informing the customer on new or improved functionality, combined with free pilot testing programmes and low threshold financial conditions. Recovery operations ensure the availability of telecommunication facilities in case of serious damages to the system, for instance caused by fire or leakage.

New opportunities for diversification are in the convergence of information technology, data communication and telecommunication (voice) for professional products and services. This convergence can, for example, be found with customers who use their PABX to facilitate call centres. For these customers, the PABX switch is the enabler for strategic business processes. The PABX must communicate with the information system which can be linked to other systems in a data network. If, for instance, a client calls the call centre, the switch must identify the caller and signal the information systems, so that the appropriate customer file can be presented on the workstation of the employee. The interaction between PABX and information system must allow analysis of calling behaviour, caller identity and process performance. Ultimately, the PABX must be an integrated part of the customer's workflow management system.

Furthermore, customers require great flexibility in setting up call centres and adjusting them to varying needs. In case of specific events, such as promotions,

emergencies or product introductions, they want to extend their call centres or even (temporarily) set up new ones. Customer's therefore call for 'plug and play' workplaces at request.

A variety of competencies is required to complete Philips Business Communications's offering. In the case study ten processes have been selected for evaluation. Each of the ten processes requires some sort of co-operation with others and each is considered valuable for end users. Six of these processes are essential for being recognised as a player in the market and are therefore considered primary processes. Four processes allow distinguishing the offering from those of competitors and are labelled secondary (table 7—1).

Processes for Primary Services	Processes for Secondary Services
❑ Manufacturing & Assembly	❑ Customer Base Marketing
❑ Software Configuration	❑ Recovery Operations
❑ Distribution	❑ Call Centre Extension
❑ On Site Installation	❑ Workflow Interaction
❑ Mobile Communication	
❑ Remote Working	

table 7—1: Primary and Secondary Processes for Philips Business Communications

7.4. Assessment of Infrastructure Sophistication

In § 6.3 indicators for assessment of the infrastructure's sophistication have been developed. These indicators have been used for evaluating co-operation complexity of the selected processes of Philips Business Communications. In the following subsections the requirements for resources, relationships and information systems are discussed. They are subsequently summarised and categorised in table 7—3 (page 166). In § 7.5 the processes are positioned in the Process Portfolio, by comparing the requirements to the indicators.

7.4.1. Primary Processes

Manufacturing & Assembly

The structure of the PABX's Bill-of-Materials has not changed significantly over the last decade. However, Philips Business Communications has put considerable effort in supply rationalisation, e.g. through ordering subassemblies or complete products from selected suppliers, instead of large amounts of components from a broad range of suppliers. Other components have been largely standardised and/or simplified. Important developments have been the transition from leaded printed circuit boards to surface mounted technologies and the use of standard personal computers instead of dedicated control units. Like the manufacturing processes, the final assembly process of Philips Business Communications has been continuously refined so that a very efficient process is in place.

Today, product design and work instructions have been well documented so that trained people and organisations that have multipurpose equipment in place can carry out manufacturing and assembly.

The most important performance indicators for manufacturing and assembly are efficiency, timeliness and reliability. Co-operation with suppliers, based on recurrent contracts, allows Philips Business Communications and its suppliers to mutually adjust operations. The need for specific investments at either side is limited. Periodically Philips Business Communications or a supplier decides not to continue the co-operation any longer. In most cases alternatives can be found before customers notice the ending of the relationship. It is therefore not desirable to further intensify co-operation.

Interaction between information systems of Philips Business Communications and its suppliers is sequential. Fine tuning processes might require the exchange of EDI -messages, but in most cases facsimile is sufficient. Philips Business Communications and the suppliers use their production planning information systems independently. Standards for the exchange of information are not required to achieve adjustment of operations so that human interfaces for transferring information suffice.

For some subassemblies (e.g. cabinets, see § 4.2.2, page 80) it is important to inform suppliers well in advance on future requirements. This requires MLSC-like concepts, where extensive delivery schedules are exchanged. Manual transfer and evaluation of these delivery schedules is generally not desirable. Suppliers must be able to receive and process them electronically. In those cases, information systems

must be equipped to exchange and process EDI-messages. If information is exchanged electronically, wide area networks are used.

The shift to buying standardised subassemblies has increased the importance of OEM suppliers. For them Philips Business Communications is only a minor customer. In some cases this forces Philips Business Communications to perform product evaluation, supplier selection and price negotiation for each purchase order, where adjustment of operations is required to perform adequately in terms of cost, timeliness and reliability. Further hardware standardisation will however reduce the dependence upon such suppliers.

Software Configuration

As explained before, software has become the basis for the PABX's customisation. The components of the PABX comprise interacting software components, each of which is configured by a different partner. Software configuration, installation and testing form an interactive process, in which numerous departments and organisations are involved. The specificity of customer requirements leads to a need for creativity and flexibility while configuring the software. Therefore professionals are required, whose responsibilities cannot be defined in contracts. Instead, actors must take up work on the basis of the required competencies in specific situations.

Actors should not only know the software and its pre defined functions, but should also be able to flexibly customise it to customer specific situations, using specifically developed complex configuration software. They need to be able to share customer information and have insight in each other's design decisions. Interaction between applications should therefore be reciprocal. Due to the large amount of actors involved and the differences between the applications they require, the exchange of information requires using Internet-protocols.

Philips Business Communications has developed close partnerships for these processes. Philips Business Communications and its partners require the co-operation for their continuity, each is willing to adjust investments and the end of the relationship has not been set. Contracts are therefore merely relational.

However, different applications or different versions are in use with the various actors involved. Output of one application needs to be converted in order to be usable in another, which leads to a significant lose of information. At best, the exchange of information between Philips Business Communications and its partners for software configuration can be characterised as sequential. This frequently results in misunderstandings between the actors, causing delayed delivery of the required functionality. Software configuration, installation and

testing are primary processes. Philips Business Communications and its partners therefore continuously work on improving the exchange of information and the alignment of applications.

Distribution

After assembly, software installation and testing, the PABX and its OEM peripherals are packed and prepared for transportation to the customers. As with the other parts of the physical goods flow efficiency, timeliness and reliability of the processes are critical for customer satisfaction. This requires contemporary warehousing facilities and transportation equipment. These processes can be very well managed through the use of standard software, provided the LSP is given insight in quantities and dates of installation well in advance, preferably using EDI-standards. Sequential interaction will be sufficient.

Philips Business Communications works with a logistic service provider (LSP), who is made responsible for the process on the basis of clearly defined cost/performance measures, laid out in a relational contract. The LSP is expected to proactively adjust his processes to Philips Business Communications problems and priorities. Co-operation has been agreed upon for a certain period, after which it is evaluated and continued if satisfactory.

On Site Installation

On site installation of the PABX and its peripherals requires interfacing the hard- and software with the customer's environment. Generally, the customer has only little knowledge of relevant characteristics of this environment. Another complicating factor is the need to connect the switch to the public network, where the network operator has to make the appropriate preparations. Philips Business Communications has only limited control over preparation of the public network. The installation process can therefore be characterised as highly unpredictable.

The installation teams are either subcontractors or part of local sales organisations. The unpredictability of the installation process requires them to be able to react flexibly to unexpected circumstances. Agreements can therefore only be made regarding performance levels in relational contracts.

Team members should be well-trained specialised workers, capable of specifying and/or implementing adjustments if necessary, through detailed, well-documented, knowledge of the product. The required education of the team members is specific and expensive, so that training them is only attractive if co-operation is guaranteed over multiple projects and a longer period.

Detailed customer order information is required for capacity planning of the teams, for estimating project costs and for performing the installation. Especially, for larger installations the amount of customer information is considerable and often revised due its unpredictability. Customer data should be orderly and accessible. Detailed site information and installed base data therefore be shared and/or exchanged frequently, which leads to pooled or even reciprocal interaction.

Mobile Communication

Allowing users to use a single handset on the public as well as the company network, requires conformance to standards such as DECT and GSM, which are still being extended and developed. For Philips Business Communications it is essential to be aware of, and preferably involved in, the development of these standards.

Intensive co-operation with manufacturers of handsets and public operators is required, not only during product development, but also during specification of customer specific solutions. People involved in this co-operation are engineers and highly educated experts, both at Philips Business Communications and at the partners' sides. These engineers should constantly monitor all innovations in this fast developing field.

All knowledge between Philips and its partners needs to be shared, each contributing maximally according to its competencies, in order to strengthen market position of all actors. This requires adjustment of investments so that co-operation cannot be directed at single customers. The duration of the co-operation can therefore not be determined beforehand and relational contracts should prescribe effort and performance.

The exchange of knowledge in this innovative field is essential, but difficult due to its unstructured nature. So sharing pooled data or reciprocal interaction over the Internet are prerequisites for this type of intensive co-operation. However, existing information systems of Philips Business Communications are not equipped for inter-organisational information sharing. Inter-organisational communication facilities are limited to E-mail and Fax. Although Philips Business Communications possess knowledge to develop and offer the required functionality, it has the problem of being small player compared to its competitors. Its contribution to future market positions of other organisation is limited. This might inhibit setting up the required intensive co-operation with potential partners.

Remote Working

For Remote Working similar remarks as for Mobile Communication can be made. Asynchronous Transfer Mode (ATM) switching allows Line Switching quality using Internet Protocols. These technologies enable low cost remote connection of users to the PABX. Philips Business Communications must at least be aware of, and preferably involved in, developments and innovations regarding ATM switching. Close co-operation with manufacturers of peripherals and the owners of Internet backbones is needed to ensure conformance to standards and find opportunities for quality improvements. Like Mobile Communication, Remote Working calls for involvement of highly educated engineers, future oriented partnerships and reciprocal information exchange. Philips Business Communications has the right people in place, but is developing its relationships with important market players. The sophistication profile for Remote Working is therefore similar to that of Mobile Communication.

In table 7—2 the requirements for the inter-organisational extensions to the infrastructure for each of the primary processes are summarised. The requirements have been compared to the indicators to determine the required sophistication.

Processes	Resources	Relationships	Information Systems	Required Sophistication
Manufacturing & Assembly	❑ product design and work instructions have been well documented ❑ well trained people ❑ multipurpose equipment	❑ recurrent contracts ❑ mutually adjust operations	❑ sequential interaction ❑ human interfaces for transferring information or ❑ exchange and process EDI-messages ❑ wide area network	Elementary/ Professional
Software Configuration	❑ highly educated people ❑ complex configuration software	❑ take up work on the basis of competencies ❑ relational contracts ❑ based on trust	❑ reciprocal interaction ❑ Internet-protocols	Sophisticated
Distribution	❑ contemporary warehousing facilities and transportation equipment	❑ adjust processes problems and priorities ❑ relational contracts ❑ co-operation during a fixed period	❑ carefully selected standard software ❑ sequential interaction ❑ preferably EDI-messages.	Professional
On-Site Installation	❑ well trained experts ❑ detailed, well documented, knowledge	❑ co-operation is guaranteed over multiple projects and a longer period ❑ relational contracts	❑ customer data must be orderly and accessible. ❑ pooled installed base data	Professional/ Sophisticated
Mobile Communication	❑ highly educated engineers ❑ monitor innovations	❑ contributing according to competencies ❑ adjustment of investments ❑ relational contracts	❑ pooled or reciprocal interaction ❑ Internet-based communication with partners ❑ Prerequisite for the process	Sophisticated
Remote Working	❑ highly educated engineers ❑ monitor innovations	❑ contributing according to competencies ❑ adjustment of investments ❑ relational contracts	❑ pooled or reciprocal interaction ❑ Internet-based communication with partners ❑ Prerequisite for the process	Sophisticated

table 7—2: Requirements for the Infrastructure for Primary Services

7.4.2. Secondary Processes

Installed Base Marketing

The existing customer base largely is based on switches that approach their end of life. This presents the opportunity to introduce modern alternatives to existing customers who are probably in the process of selecting a new switch. Philips Business Communications has the advantage of insight in the customer base, so that it can approach the customers with suggestions on new systems, add-ons or upgrades that they may require. In many cases customers are attracted by the offer and do not even consider shifting to another system.

The focus is on selling new systems or upgrades to customers, without going into extensive co-operation. Marketing and sales skills are important to the sales force. They must be able to convince customers of the need to upgrade to a new system, if necessary through promotions (like free trial) or discounts. Installed base marketing[11] does not require extensive customer data. Basic characterisations of the installed base are sufficient for finding out if a customer is potentially willing to buy a new system. Philips Business Communications and its customers do not have to adjust processes or investments. For each transaction, a new contract is drawn up.

Recovery Operations

For customers using the recovery services, Philips Business Communications must be able to provide an emergency solution at very short notice. Often the availability of primary functions of the switch is critical to the customer, so that time is a more important success factor than accuracy. The people who install the emergency switch should therefore be trained technicians able to react flexibly to unexpected circumstances. Their knowledge of Philips Business Communications's products is no priority. Philips Business Communications therefore co-operates with local contractors on an incidental basis.

The advantage of Philips Business Communications over others offering similar services, is its insight in the installed configuration at the customer. Through its position as supplier of the initial configuration and its involvement in maintenance and upgrades of the switch, Philips Business Communications has more

[11] Philips Business Communications used the term 'Customer Base Marketing'. However, the literature uses this term for much more advanced marketing approaches. In order to avoid confusion, this thesis speaks of 'Installed Base Marketing'.

knowledge of the installed configuration. This requires registry of all customer configuration data by the local sales organisation, or the service sub-contractor. In either case, maintenance of uniform customer files is required. In case of an emergency, the appropriate customer configuration data must be made available to the recovery technicians. Since accuracy is not as important for these temporary switches, human interfaces generally suffice for interpretation of the data and planning and managing the project.

Call Centre Extension

The interaction between the PABX and call centre software is ensured through close co-operation with a supplier of call centre software. Both Philips Business Communications and the supplier believe this co-operation to be important for their continuity. The contracts between the two can be characterised as relational. The technology involved is highly innovative, so that engineers should be creative and conscious of state-of-art developments. The required equipment consists of specific software development tools.

The information that needs to be shared consists of interface specifications, software specifications and/or the software itself. The complexity and the amount of this data require electronic, reciprocal, interaction between the information systems of both companies. Because of its unstructured nature, the information should preferably be exchanged using Internet protocols.

Workflow Interaction

Each customer will have its own specific workflow management system, be it a customised software suite or a proprietary system. Furthermore, the functionality of the interaction varies widely between the various customers. This requires Philips Business Communications to develop and implement customer specific interfaces, for the initial configuration as well as in case of evolving customer requirements. Events, organisational changes or redesigned business processes require adjustment of existing interfaces or development of new ones. The importance of telecommunication for the customer's processes demands Philips Business Communications to proactively identify opportunities for business improvements through telecommunications.

Offering Workflow Interaction requires teams that comprise understanding of the customer's business processes, detailed product knowledge and high-level development skills. A consultative role, based on insight in the customer's business, can only be taken up in a relationship built on trust and aimed at long term co-operation. Customers expect Philips Business Communications to deploy

its competencies whenever necessary. The need to act proactively requires specifying performance levels in relational contracts.

It also requires engineers to have remote access to the software on the customer's PABX and to the relevant parts of the workflow management systems. Dedicated software development tools are needed, while intensive co-operation for development and testing with the customer's IT-experts and/or his software suppliers calls for reciprocal interaction between applications. Because of the diversity in systems and software suppliers, the Internet is needed for such interaction. Tools should preferably comply with international standards, but should also be capable of interaction with proprietary formats. Since such standards are not detailed out yet, Philips Business Communications aims to be involved in setting them.

Processes	Resources	Relationships	Information Systems	Required Sophistication
Installed Base Marketing	❑ well trained in traditional marketing and sales.	❑ transaction oriented ❑ discrete contracts	❑ basic characterisations are sufficient	Elementary
Recovery Operations	❑ well trained technicians able to react flexibly to unexpected circumstances ❑ no product knowledge	❑ incidental ❑ discrete contracts	❑ sequential interaction ❑ human interfaces for interpretation of data	Elementary
Call Centre Extension	❑ creative engineers, conscious of state-of-art ❑ specific software development tools	❑ future oriented ❑ mutually adjust investments ❑ division of work in line with competencies ❑ relational contracts	❑ reciprocal interaction ❑ Internet protocols for exchanging information	Sophisticated
Workflow Interaction	❑ understand customer's business processes ❑ detailed product knowledge ❑ high level development skills. ❑ dedicated software development tools	❑ long term co-operation ❑ deploy competencies whenever necessary ❑ relational contracts	❑ remote access to the switch and the customer's software ❑ reciprocal interaction between applications ❑ use the Internet for interaction with others	Sophisticated

table 7—3: Requirements for the Infrastructure for Secondary Services

In table 7—3 the requirements for the inter-organisational extensions to the infrastucture are summarised for the secondary processes. The requirements have been compared to the indicators to determine the required sophistication.

7.4.3. The Process Portfolio

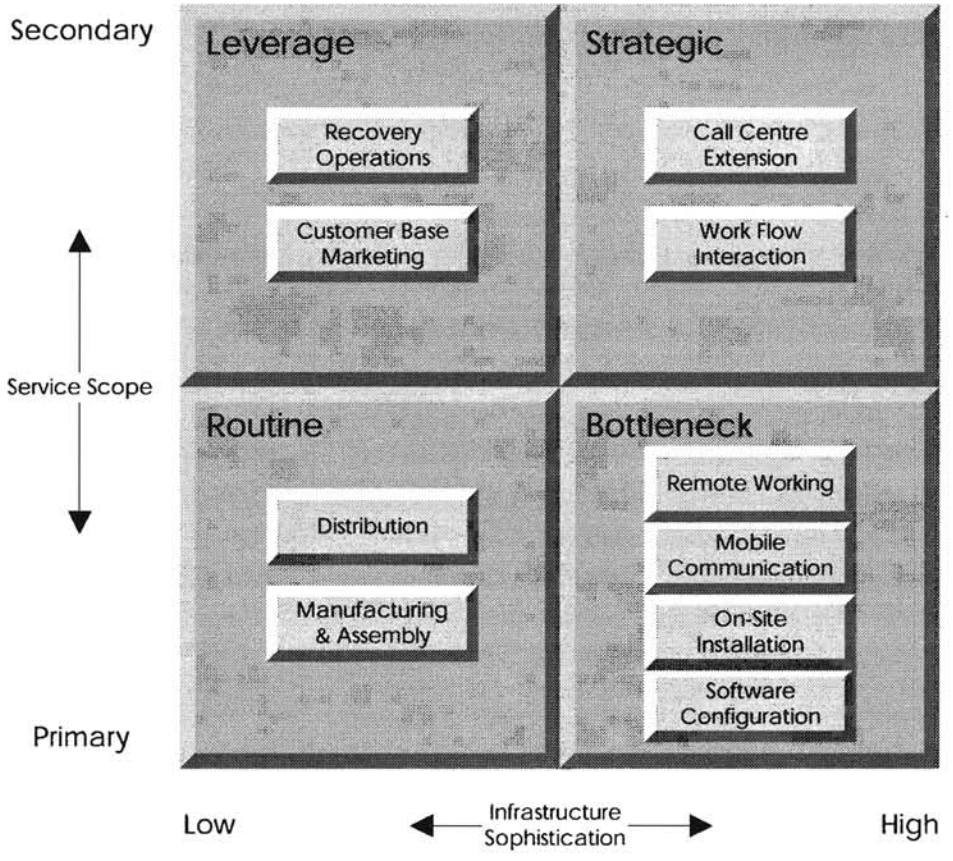

figure 7—1: Processes of Philips Business Communications in the Process Portfolio

The determination of the required sophistication in table 7—2 allows the division of primary processes into routine and bottleneck processes. For manufacturing & assembly the required inter-organisational infrastructure is characterised as elementary-professional, while for distribution an elementary inter-organisational infrastructure is sufficient. Both of these primary processes are therefore classified as routine processes. Software configuration, on-site installation, mobile communication and remote working are all classified as bottleneck processes, because of the need for a sophisticated inter-organisational infrastructure.

For secondary processes the required sophistication of the inter-organisational infrastructure has also been determined on the basis of the indicators in table 7—3. This led to classifying installed base marketing and recovery operations as leverage processes, because for both require an elementary inter-organisational infrastructure. Call centre extension and work flow interaction both require a sophisticated inter-organisational infrastructure, so that they have been classified as strategic processes.

After classification of these processes they have been positioned in the portfolio matrix (figure 7—1).

7.5. Identification of Infrastructural mismatch

From the ten processes, six have been identified as requiring a sophisticated infrastructure. Two are classified as strategic, four as bottleneck. In some cases a serious infrastructural mismatch existed, which limit Philips Business Communications' ability to include them in their offering and achieving the necessary quality and performance levels. Two examples are discussed here. For the other processes, profiles of required and available inter-organisational infrastructure are given in the appendix.

7.5.1. On-Site Installation

For on-site installation, the required infrastructure is classified as professional/sophisticated, due the complexity and unpredictability of the process. Especially for information systems, requirements are extensive. In some countries, Philips Business Communications has been able to build partnerships with partners that employ people with the required skills, although the availability of trained expert varies per country.

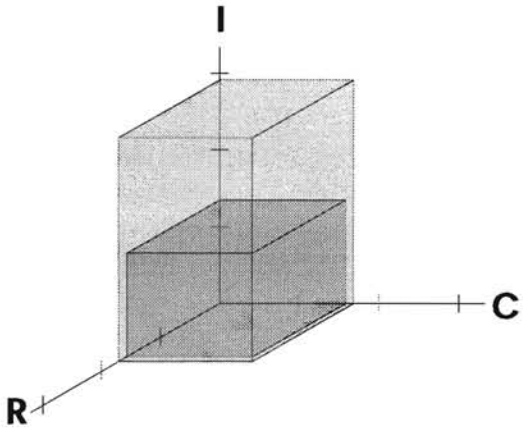

figure 7—2: Infrastructural Mismatch for On-Site Installation

However, only elementary information systems are available for ensuring consistency between site lay out information and installed base descriptions, used by the various partners. A variety of applications and formats is used with all the actors involved, if information technology is in place at all. For new installations, as well as for upgrades, misinterpretations therefore easily occur. Consequently, timeliness and accuracy of on site installation is often not satisfactory. On-site installation is a primary process. Customers require high standards for during installation, the customer's business is seriously hindered. It is unacceptable to exceed the installation planning and/or delivering incomplete or inaccurate systems.

7.5.2. Call Centre Extension

One of the secondary processes for Philips Business Communications is call centre extension. Philips Business Communications has a tight relationship with a supplier of call centre software. Software engineers of both organisations exchange knowledge and specifications. As a result both can offer a more complete product to their customers. Both organisations are willing to mutually adjust investments. The division of work is in line with the respective competencies and each actor is willing to maximally contribute to the mutual success.

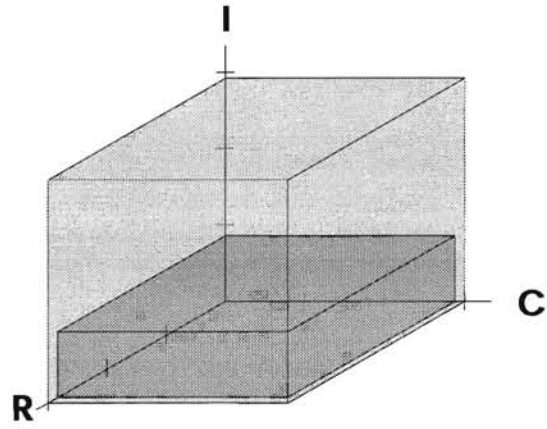

figure 7—3: Infrastructural Mismatch for Call Centre Extension

Like for On-Site Installation, the exchange of information is the weak element in the co-operation for Call Centre Extension. Communication is still largely by fax. Software development tools are not aligned, so that specifications are interpreted and entered by the engineers themselves. This greatly reduces the efficiency and the quality of the co-operation.

7.6. Choice of Management Approach

7.6.1. Routine Processes

The process portfolio analysis identified Manufacturing & Assembly and Distribution as routine processes (see figure 7—1). A low co-operation complexity does not present any opportunities to outperform competitors. Performance will easily be matched or exceeded. Seemingly, Philips Business Communications should eliminate these processes from its portfolio and concentrate on its core competencies. However, as long as these processes are primary services, Philips Business Communications cannot afford to do so. It must continue to offer them to its customers, while at least maintaining existing performance and carry through process improvements if possible.

Outsourcing to specialists allows taking advantage of economies of scale and the supplier's experience with other customers. Since there is not much use in trying to outperform others, it is no problem if this supplier also works for competitors. Philips Business Communications's co-operation with a logistic service provider has shown that market standards can be met through benchmarking and performance contracts.

Most manufacturing activities have already been outsourced to specialists, with whom performance contracts are closed and cost reduction targets have been set.. So far, the manufacturing of printed circuit boards has been considered too complex to hand over to suppliers. However, the shift to leaded PCBs has reduced of co-operation complexity to the extent that co-operation with another organisation no longer requires specific investments and exchanging strategic knowledge. Thus, outsourcing no longer implies undesirable dependence upon external partners. Currently, Philips Business Communications reviews the necessity of in house manufacturing of PCBs and evaluates suppliers in terms of costs, timeliness and reliability.

It has been noted that standardisation of hardware will continue. Within the near future, the PABX can be composed from standard components, available from a large variety of suppliers. If they conform quality standards, configuration testing will not be necessary before shipment, so that assembly can then be integrated in the process of on-site installation. Manufacturing & Assembly and Distribution will then have evolved into low margins business, where focus is on low costs and low prices. This explains Philips Business Communications is extending its involvement in processes that require more complex co-operation.

7.6.2. Bottleneck Processes

The analysis learned that Remote Working, Mobile Communication, On-Site Installation, and Software Configuration require complex inter-organisational co-operation. Since they are primary processes, they are classified as bottleneck processes in the process portfolio. Being on the one hand primary (i.e. required) processes and on the other difficult to implement and manage, they potentially jeopardise the ability to be accepted as a player in the market. Players that are outperformed must leave the market. It is therefore not very likely that a competitive advantage for these bottleneck processes will last.

On the contrary, all competitors of Philips Business Communications are working very hard on developing partnerships and solutions for remote working. Ericsson states on its website: *"Traditional PBXs can only provide communication to*

fixed terminals within the organization. A future-oriented PBX must support mobile communications both on and off site. It must also give people working at home and other off-site locations full access to the corporate information network." (Ericsson, 1997). At a conference held in September 1997 companies like Cisco, IBM, Lucent, MCI Worldcom and Microsoft unanimously acknowledged the shift from line switching to Internet Protocols (Pulver, 1997), thus illustrating importance of this development for PBX manufacturers like Philips Business Communications.

As for mobile communication, Nortel offers its "Companion-portfolio of in-building wireless communications providing cost-effective, mobile communications at work" (Nortel, 1997). Philips Business Communications spends an important share of its R&D budget on remote working and mobile communication, so that it match competitors like Ericsson and Nortel. The need for close co-operation with development partners has caused Philips Business Communications to give top management priority to maintenance or refinement of existing partnerships and setting up new ones. Furthermore, Philips Business Communications continuously works on improving its information systems in order to be able to share applications and data.

The development of standards, and the involvement of global telecom operators, will in time allow documentation of the required knowledge and reduce the dependency on partners for mobile communication and remote working. Philips Business Communications and its competitors must then be able to treat these processes routinely.

On-site installation and software configuration are less glamorous processes, but not less important ones. Hassle free implementation of a new system or upgrade can be key purchasing criteria for customers. They do not accept delays or mistakes, which accounts for Philips Business Communications intensive co-operation with telecom operators and installation contractors. This co-operation also implies developing and implementing formats and systems for exchanging customer information.

7.6.3. Leverage Processes

Recovery Operations and installed base marketing have been positioned as leverage processes in the upper left quadrant of the process portfolio. Recovery Operations has only a minor contribution to Philips Business Communications's turn over. Moreover, customers can easily acquire the service from others, so that it doe not play a decisive role in the customers' decisions to select Philips Business Communications as their Gateway to telecommunication. Philips is able to meet

satisfactory standards, but the advantage of knowing the customer's configuration is easily overruled by others' ability to react more quickly. In case of emergencies, customers generally accept a degree of inaccuracy with respect to the specifications of the temporary switch. Local niche players can therefore easily fulfil the customer's need for recovery support.

Installed Base Marketing has proven to be an efficient sales generator in 1997. In the coming years it must allow Philips Business Communications to increase its turnover, while at the same time decrease sales costs. However, the basis for strength in the market place is small. Installed Base Marketing is not based on intensive customer relationships, and neither are sophisticated information systems used. Success mainly depends on skills of Philips Business Communications's sales force. The local sales organisations have no trouble employing people with appropriate skills. The indicators suggest that co-operation complexity is low, so that customer base marketing is considered a typical leverage process.

The growth opportunity is the result of a focus on new sales in the past. Furthermore, existing customer may still decide to replace their systems by those of competitors. Since the figures are tempting, there is a risk of relying too much on customer base marketing, at the cost of management attention for strategic processes like call centre extension and workflow interaction.

7.6.4. Strategic Processes

Call centre extension and workflow integration are highly valued by particular groups of customers. Being able to successfully provide these services gives a competitive advantage over competitors and allows becoming an important player in these specific markets. Typical customers are in finance, insurance and business services. These customers generate some 60% of Philips Business Communications's turn over. Not being able to offer these services would imply losing most of these customers and leave no choice but to focus on markets where call centre extension and workflow integration are not important. These processes are therefore classified as strategic processes and have been given ample budgets and top management commitment.

7.7. Redefining the Offering

Only secondary processes can be left out and/or replaced by other processes. Redefinition of the offering is therefore restricted to strategic processes and leverage processes.

7.7.1. Strategic Processes

The methodology suggests that Gateways can reconsider including secondary processes for which infrastructural mismatches have been identified. In the case study mismatches had been identified for both of the strategic processes. This might have resulted in reconsidering the need to offer Call Centre Extension and Workflow Interaction. However, this was not considered an option, since Philips Business Communications had decided that these two processes were to provide competitive distinction of the offering. The processes were regarded prerequisites for the strategy and there was no room left for discussing their inclusion. In other words, the processes were treated as if they were primary (bottleneck) processes.

7.7.2. Leverage Processes

An unexpected outcome of the exercise was the identification of installed base marketing as a leverage process. Installed base management had resulted in considerable additional turn over in 1996 and had been regarded of strategic importance for the future as well.

However, its position in the portfolio led to the conclusion that in the long term, focus on selling new systems or additional components would not be sufficient. Installed base *marketing* would have to be followed by installed base *management*. Installed base management does not depend on old switches being written off, but implies pro-actively consulting each individual customer, based on full understanding of his business and detailed insight in the customer configuration, its use and its performance. Installed base management is especially important for large corporations who do not want to select a new PABX for each of their sites. They seek for a partner, who can take up the responsibility of ensuring telecommunication, wherever required in their business processes.

This requires a future oriented relationship between Philips Business Communications and the customer, where the customer must trust rely on objectivity and solution-orientation instead of sales orientation. Also information

systems must be developed, which facilitate monitoring, through generating management information and allowing detailed analysis. The required infrastructure for installed base management is therefore far more sophisticated than that for customer base marketing. Installed base management can therefore not be classified as a leverage process, but should be treated as a strategic one.

7.7.3. Dynamics in the Portfolio

The identification of infrastructural mismatches also raised an interest in the future position of the processes in the portfolio, since it was expected that technological innovation would reduce the required sophistication for some of the processes. With the help of experts the future sophistication was briefly discussed. In figure 7—4, arrows indicate that indeed dynamics in the portfolio were expected.

For example, for hardware focussed recovery operations, it was assumed that customers will in the future no longer require recovery operations as an integrated part of the offering. Because of the reduced complexity of the hardware, local players will be perfectly be able to set up satisfactory services, which customers can acquire on short notice, without the help of Philips Business Communications.

Similar reasoning was given for manufacturing & assembly and distribution. The reduced complexity and increased standardisation of the hardware was expected to further reduce the difficulty of offering hardware. At some point customers will be able to purchase their hardware from others, and require Philips Business Communications to base its solutions on this hardware. These routine processes may soon be redundant elements of Philips Business Communications' offering.

Remote working and mobile communications were expected to remain part of the portfolio. Yet, in the future Philips Business Communications will have to be able to treat these them as routine processes and focus on meeting market standards in terms of performance and costs. As for customer base marketing, Philips Business Communications will also have to make the strategic choice whether to develop an infrastructure for installed base management. If not, this implies choosing to no longer sell to global companies.

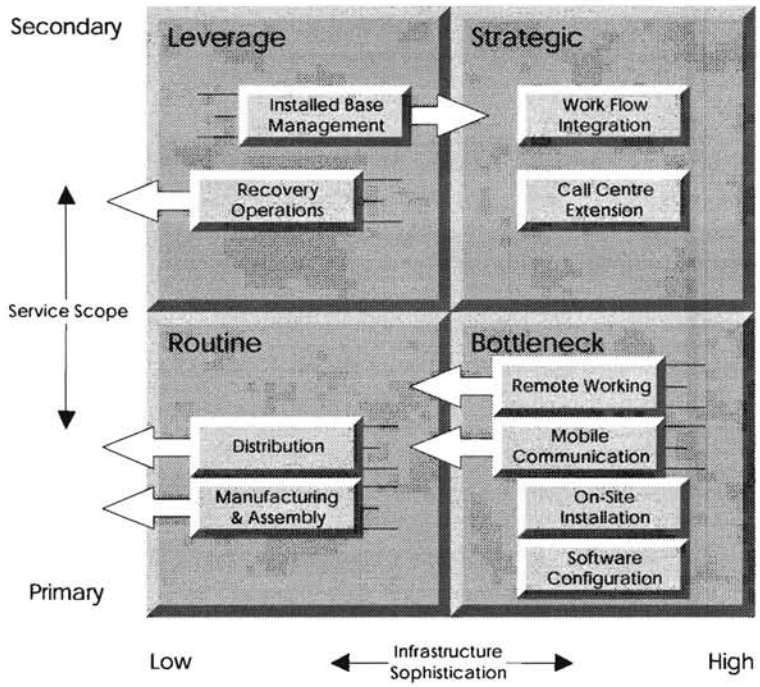

figure 7—4: Scenarios for the Future in the Process Portfolio

7.8. Conclusions

In this chapter the methodology, developed in chapter 6 has been applied in a case study. The indicators for the sophistication of resources, relationships and information systems, turned out to provide a practical basis for determining the sophistication of the infrastructure required for including a process in the offering. All though the methodology had been developed for assessment of inter-organisational extensions to the infrastructure only, it appeared to be difficult to restrict the analysis to inter-organisational extensions only. This might be due to a possible strong correlation between *intra*-organisational and *inter*-organisational infrastructures.

Assessment of infrastructure sophistication and service scope allowed positioning processes in the process portfolio, so that routine, bottleneck, leverage and strategic processes could be discerned. One of the assumed prerequisites was that both managers and experts had to be able to relate to the terminology and techniques used in the methodology. Indeed, the methodology facilitated a discussion in which both experts and managers could participate.

Not only did the portfolio positioning process point out the importance of sophisticated infrastructures to management, it also demonstrated to experts why for some processes, such as manufacturing, improving infrastructures rightfully is not given management commitment. Furthermore, it showed the Philips Business Communications not to rely too much on processes that only require an elementary infrastructure.

An unexpected outcome was management's unwillingness to reconsider including call centre extension and workflow interaction. These processes had been regarded secondary, but were treated as bottleneck processes. The choice to include them had already been made, so that there was no more room for strategic alignment. This shows that inducive thinking can be very strong.

The suggested dynamics in the portfolio illustrate to what extent an organisation has a choice whether to position itself as a Gateway. Philips Business Communications is not by definition perceived as the Gateway to telecommunications by the end-users. Due to the industry's history, in most European countries former national PTT's are holding strong positions as Gateways. In the Netherlands and in Germany Philips Business Communications still generates most of its turnover through the PTT's. However, the hardware, Philips Business Communications' traditional contribution to the PTT's offering, is increasingly standardised. Infrastructure sophistication for the development and manufacturing processes has therefore been reduced considerably and this process will only continue, as figure 7—4 illustrates. This puts Philips Business Communications at the risk of only being involved in the routine processes of virtual corporations, where margins are low and the Gateway may continuously be looking for the cheapest partner.

Philips Business Communications should therefore ensure its involvement in strategic and bottleneck processes in the Gateway's portfolio. This involvement could be achieved by being the Gateway, but also by being a partner of the Gateway. In both cases, Philips Business Communications should therefore develop infrastructures for inter-organisational co-operation. This requires both the Gateway and its partners to assess requirements for resources, relationships and information systems.

8. Conclusions and Recommendations

8.1. Conclusions

8.1.1. Inter-organisational Co-Operation as a Strategic Issue

Increasing customer demand for customised and complex products, in combination with an increasing need to specialise, has led to a need for co-operation between specialists. For such specialists, the ability to co-operate with the appropriate partners may have become as important as the specialisation in itself (thesis I, page 52). Composing customised and complex products therefore directly relates to composing the network that provides these products. Consequently, the infrastructure that enables co-operation in this network can be of strategic importance.

Experts, in the literature as well as in business, have developed concepts for (re-)designing inter-organisational processes, based on their knowledge of the possibilities of infrastructures. Such concepts demonstrably result in efficiency and performance improvements (thesis II, page 75).

The explorative case studies made clear that such concepts impact multiple business functions. However, inter-organisational co-operation is often regarded as a way to deal with operational problems at the outskirts of the organisation. This easily leads to scattering control over customer demand across departments, each with its own targets, procedures and priorities. Information on customer

requirements does not leave the sales department, while knowledge on suppliers' skills and restrictions are not considered when dealing with customers. Any organisation that depends on its ability to co-operate with other organisations should therefore consider inter-organisational co-operation a strategic issue, not a choice to be made at an operational level (thesis III, page 83).

Not all forms of inter-organisational co-operation are equally important. The importance of the co-operation depends on the importance of the processes that it enables. Such organisations therefore require guidelines for evaluating the dependence on inter-organisational co-operation for each the processes they need to provide their services, in order to prioritise and to focus budgets and management commitment (thesis IV, page 84). Existing guidelines, which suggest management approaches on the basis of product characteristics, do not allow such prioritisation and focussing. Segmentation of inter-organisational co-operation should therefore be based on process characteristics (thesis V, page 89). This allows managing a portfolio of processes, in order to offer to a broad range of complementary services, which a single organisation would not have been able to offer on his own.

8.1.2. Include Inter-organisational Infrastructures in Strategic Architecture

Guidelines regarding management approaches for implementation of infrastructures require a clear view on the role of infrastructures. This led to the first research question:

> *What is the relationship between products, processes and infrastructures for inter-organisational co-operation?*

The answer to this question is based on the observation that manufacturers of investment goods are increasingly confronted with customers who require them to take up responsibility for facilitation of the customer's processes over time. Such a manufacturer will be judged for his services. The specifications of the physical product will then be regarded less important. Ultimately, all processes may be considered services, including those directly related to physical products, like design and manufacturing (thesis VI, page 98).

This implies that the offering to the customer is a composition from a variety of services. When taking up the responsibility for facilitation of the customer's processes, the supplier should carefully evaluate which services to include in the offering. Gateway organisations use their ability to co-operate to take up such

responsibility through combining services provided by multiple organisations in one offering (§ 5.1.4, page 98).

Composing the offering therefore goes hand in hand with configuring a network of independent organisations, which together provide a joint product or product family (i.e., configuring a *virtual corporation*, see page 60). Although each customer will demand a specific composition of services, there should be a blueprint (i.e., a *strategic architecture*) of the processes and competencies required for customer specific offerings. The strategic architecture should not only consist of components, but should comprise their interfaces as well. A Gateway should therefore also have developed a blueprint of the *infrastructure* for co-operation between the partners in the virtual corporation that it envisions (thesis VII, page 108).

8.1.3. Inter-organisational Infrastructures Exist of Resources, Relationships and Information Systems

In order to facilitate the discussions between managers and experts, a common and straightforward characterisation of inter-organisational infrastructures is needed. The second research question has therefore been:

> *How can inter-organisational infrastructures be characterised in such a way, that managers as well as experts from a range of disciplines can judge their value?*

The infrastructure for a process can be defined as follows (page 112):

> *The infrastructure for an operation comprises anything a process needs to transform the input of a process into the desired output, provided it can be used repeatedly, by a different process or by another instances of the same process.*

An infrastructure can be described characterised using three dimensions: resources, control structures and information systems (thesis VIII, page 115). Important characteristics for the inter-organisational extensions to the *resource* infrastructure can are people, equipment, knowledge and workflows. Characteristics for the inter-organisational extension to the *control* infrastructure are the basis for co-operation, the level of mutual adjustment between organisations, the duration of inter-organisational relationships and the use of contracts. The inter-organisational extensions to the *information* infrastructure can be characterised on the basis of the interaction between applications, the means for

inter-organisational communication, the use of standards and the role of information technology in the inter-organisational process (§ 6.4, pages 128-138).

8.1.4. Competitive Advantage through Inter-Organisational Co-Operation

The objective of this research has been to develop a methodology for evaluating the strategic importance of designs for inter-organisational infrastructures. This requires insight in the relationship between the strategy and infrastructures for Gateways. The third research question has therefore been the following:

> *What is the relationship between inter-organisational infrastructures and strategy for Gateway organisations?*

Designing an infrastructure exists of developing the optimal combination of resources, control structures and information systems for all required processes. Thus, the infrastructure of a virtual corporation exists of the infrastructures of multiple organisations. Prevailing methodologies for designing infrastructures assume that requirements for the infrastructure can be derived from a strategy.

In an inter-organisational context, the design of processes and infrastructures is seriously complicated, if not inhibited, by the division of ownership, power and loyalty. Therefore, the freedom in adjusting the infrastructure to strategic choices is limited. If partners with the appropriate infrastructure cannot be found or convinced, the offering should be re-evaluated. For Gateways, strategy formulation and infrastructure design should therefore be embedded in one alignment process (thesis IX, page 123).

An important competitive distinction of a Gateway is to be able to set up forms of co-operation that others cannot set up and thus provide a more complete offering to the customer. Therefore, complex forms of co-operation, based on sophisticated infrastructures, offer more opportunities for competitive distinction of a virtual corporation. It is therefore assumed that the more sophisticated the infrastructure that is required, the greater the opportunities for building a distinctive position (thesis X, page 128).

8.1.5. Portfolio Analysis using Service Scope and Infrastructure Sophistication

Setting up a competitive virtual corporation is not simply setting up a combination of processes that are hard to combine. Furthermore, a Gateway should be careful

not to spend too much effort on sophisticated, yet superfluous infrastructures. Assessment of strategic importance of a process requires more criteria than the sophistication of its infrastructure alone. The Gateway requires a clear view on the need to include a process in its strategic architecture. This led to the fourth research question:

> *What considerations should a Gateway take into account when assessing the strategic importance of infrastructure designs?*

Managers should be able to prioritise between investments in infrastructures and subsequently decide which infrastructure to develop and/or maintain. Apart from infrastructure sophistication, which determines the potential uniqueness of the offering, the service scope of a process should be determined. The service scope makes a distinction between mandatory services (primary) and additional (secondary) services.

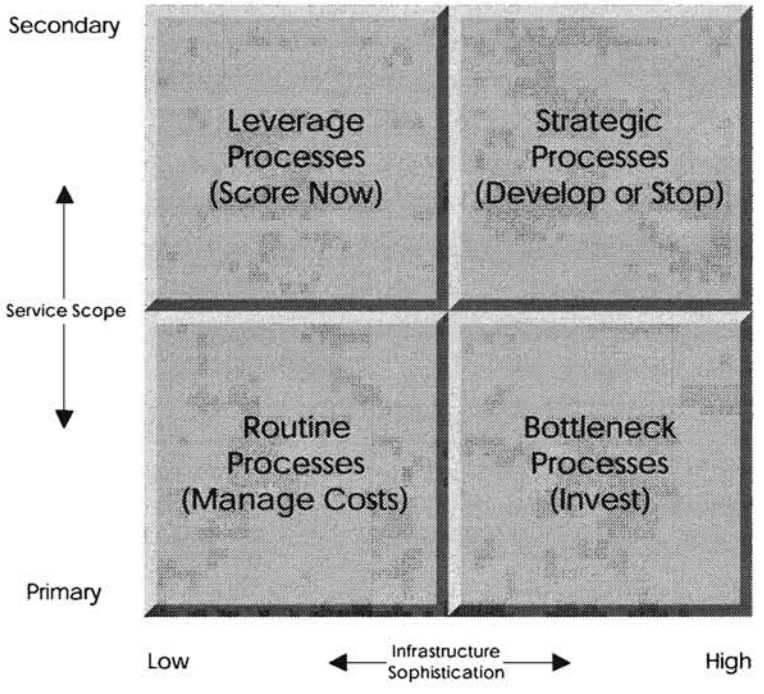

figure 6—12: The Gateway's Process Portfolio

Infrastructure sophistication and *service scope* can be used to divide the processes of the strategic architecture into four groups. Thus, processes can be positioned in a portfolio matrix (figure 6—12, page 142). Each group of processes plays a different role in the attractiveness of the offering. The partnership strategy for a specific process should therefore be based on its position in the process portfolio (thesis XI, page 145).

For *Routine* processes (primary/non-sophisticated infrastructure) focus should be on efficiency and accuracy. Straightforward tough negotiation can be a fruitful strategy to reduce costs. *Bottleneck* processes (primary/sophisticated infrastructure) require investments in the inter-organisational infrastructure in order to close mismatches between required and available infrastructure. Strong inter-organisational dependence should not be considered a problem. *Leverage* processes (secondary/non-sophisticated infrastructure) are easily copied by competitors, and should therefore not be relied upon too much. *Strategic* processes (primary/sophisticated infrastructure) require extensive market research and supplier evaluation before a partnership is set up (thesis XI, page 145).

8.2. Reflection

8.2.1. Infrastructures Used in Multiple Virtual Corporations

One of the conclusions of the research is that the virtual corporation's infrastructure should be included in the strategic architecture of the offering (§ 8.1.2). The implicit assumption here is that the infrastructure is dedicated to the virtual corporation's joint product or product family only, in which case design criteria can be derived from the characteristics of the product in question.

In practice, this will hardly ever be the case. Infrastructures will generally play a role in the provision of multiple products. This does not change the position of a process in the portfolio for a specific product or product family. Yet, decisions on the development of infrastructure for this specific process will be influenced by the position of processes in other offerings that use the same infrastructures.

It is especially interesting to identify infrastructures for primary services in one offering that can be used for additional services in another. Solving bottlenecks for the first will then lead to strategic advantage for the second. If the infrastructure

had not been a bottleneck for the first product, it might not have been legitimate to develop it for the second[12].

8.2.2. Other Factors that Make Co-Operation more Difficult

A starting point in the methodology is relating the ability to co-operate to the ability to implement the required infrastructure. A potential competitive advantage exists where others are not considered capable of implementing such an infrastructure and thus cannot create similar forms of co-operation. This research only addressed competitive advantage that results from being able to co-operate through deployment of sophisticated infrastructures. However, other factors may also increase to difficulty of inter-organisational co-operation.

In most cases, this is a valid position to take. One could however think of other reasons that increase the difficulty of including products of others in its offering. For instance, market imbalance (e.g. monopolies), market regulation (e.g. patents), exclusivity (e.g. brand names) or cultural differences could increase the difficulty to do business with certain organisations. Even if a simple infrastructure seems sufficient to enable the processes in question. Being allowed to do business with such organisations may result in an advantage over competitors who cannot come to similar agreements. Buying such products will then be considered a bottleneck process or a strategic process, although the infrastructure is characterised as simple on all three dimensions.

8.2.3. Inter-organisational Infrastructures and Innovation

Inter-organisational infrastructures are defined as made up from three elements: *Resources*, *Relationships* and *Information Systems*. For each element, the innovation will over time lead to a shift in the portfolio. Information Systems, for example, can at one day be highly sophisticated, but may be replaced by widely available standard applications at the other, due to fast technological developments. After that, the required functionality can also be adopted by less sophisticated organisations. Over time, developments in information technology will cause the required IT-sophistication for a process to decrease, and therefore leads to a shift in

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[12] Note that this relates back to the third criterion of Hamel and Prahalad for indentifying core competencies (see § 5.3.35.3).

the portfolio from bottleneck to routine, and from strategic to leverage. Similar reasoning can be given for resources and relationships.

Furthermore, it can be argued that customers will get used to additional services once competitors can offer them too. From then on, customers will consider such services as part of the primary service package. Strategic services will become bottlenecks, while leverage services end up routine services. This leads to the conclusion that innovation and competition cause all services to eventually move to the lower left quadrant of the portfolio, where only cost leadership allows distinguishing from competitors. In order to remain competitive, the process portfolio should continuously be re-evaluated.

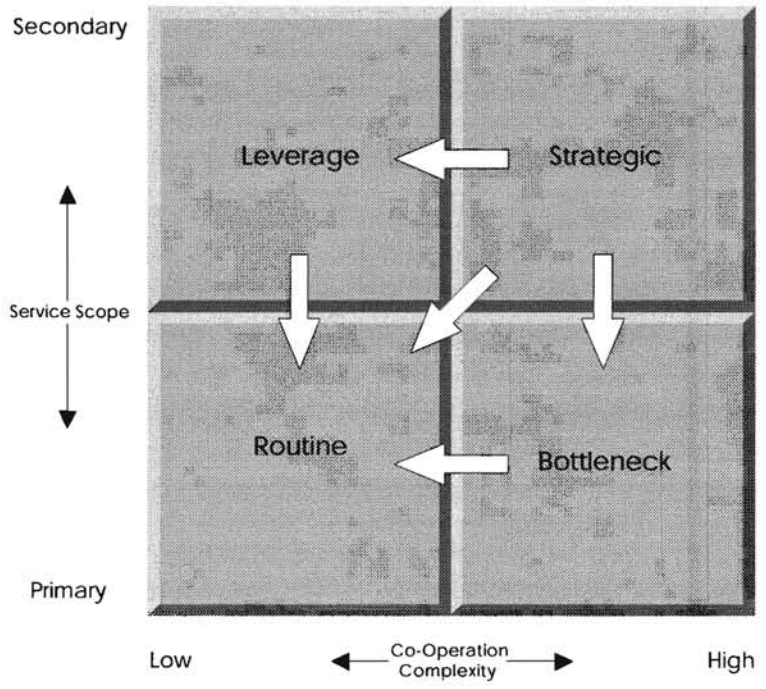

figure 8—1: The Impact of Innovation on the Process Portfolio

8.2.4. The Relation to Marketing

The value of integrating a service in the offering plays an important role in the evaluation of services. In this research, it has been assumed that services can be divided into two categories: *primary* services and *secondary* services. This suggests this division to be imposed upon the virtual corporation by its environment. If so, insight in customer needs and customer behaviour is then essential for evaluating the opportunities that result from inter-organisational co-operation.

For primary services one has no choice but to include them. Leaving such services out of the offering results in dissatisfaction. However, customer expectations can be manipulated through marketing efforts. A different positioning of the offering may allow omitting services that were presumed to be mandatory.

For additional services, the virtual corporation can choose whether to include them or to leave them out. If including such services leads to customer value, it may lead to increased customer satisfaction. Customer expectations for additional services are by definition not high. Therefore, chances are low that customers will decide to purchase the offering, unless the customer is made aware of the benefits that the additional services provides for him. However, the moment the benefits of a service are communicated to the customer, the development of the related infrastructure has become mandatory. Marketing may have resulted in high expectations for additional services can be created, such that the virtual corporation cannot leave them out of the offering, even if competitors cannot include the service in theirs.

Consequently, it is important to look not only at customer benefits that services potentially provide, but also relate the benefits to customer expectations. Only if communication and performance of the infrastructure are consistent, the virtual corporation will profit from including a particular service. Strategic alignment should therefore not only concern alignment of strategy and infrastructure; it should also ensure alignment of the marketing approach.

8.2.5. Recursion in the Gateway Approach and Borders of the Network

In figure 3—4 (page 56), the IMP's vision on networks is illustrated. Their model states that each organisation's network in essence exists of the whole world. Networks are in other words boundless. The first part of the definition on page 60 implies that a virtual corporation is a network, existing of those organisations that are involved in the design, production and delivery of one product. However, in

the IMP's paradigm, the definition of 'involved' can be stretched as far as desired. In theory, one could argue that the network is made up from of all organisations in the world.

The classification of inter-organisational infrastructures from § 6.4 allows the distinction between various ranges of involvement. The more sophisticated the inter-organisational infrastructure, the more the organisations using the infrastructure can be considered 'involved' in providing the joint product (figure 8—2).

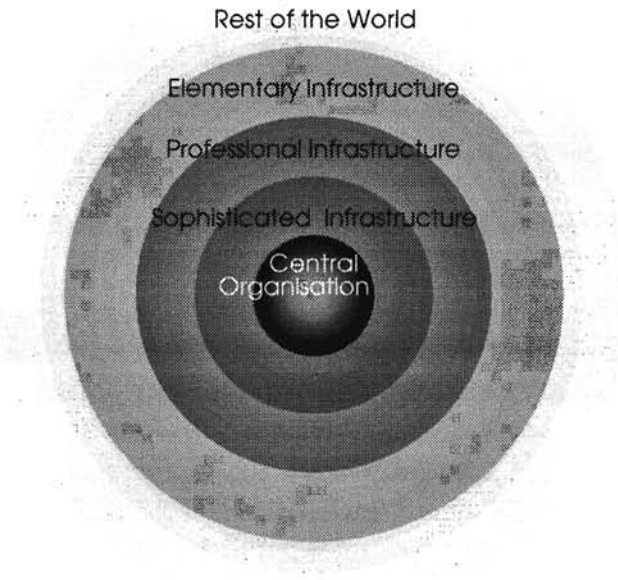

figure 8—2: Various Degrees of Involvement in Providing a Joint Product

Each organisation defines its own offering to the market and decides with which organisations it needs to co-operate, in order to provide this offering. It also determines the required co-operation and the required infrastructure. Thus, it designs its own network. This leads to the conclusion that any organisation is the central organisation of its network. Both with suppliers and with customers,

sophisticated inter-organisational infrastructure may have to be in place, in order to be able to provide an attractive product to the market (figure 8—3).

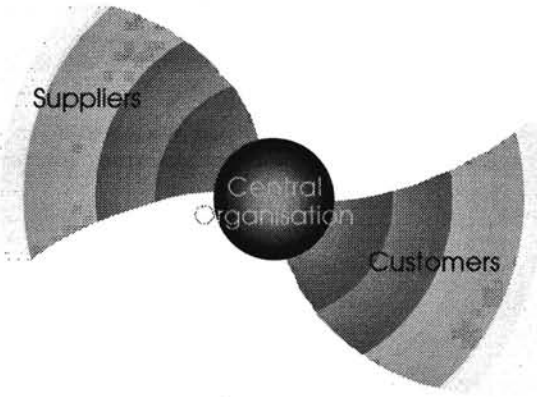

figure 8—3: Each Organisation is the Centre of its Network(s)

In this research, as in most of the literature, being the central organisation in the network has implicitly been considered the same as being the Gateway of the network to the customer and being the co-ordinator of the network. It is argued here, that this is not necessarily the case. The consequence is that the development of a strategic architecture (thesis VI, page 98) is essential for all organisations that depend on inter-organisational co-operation. The manufacturer of trucks and his supplier of tyres may each choose to position themselves as Gateway to Solutions. The truck manufacturer could decide to give transportation companies access to a range of processes that allow him to transport goods. The manufacturer of tyres may develop a strategic architecture that guarantees truck manufacturers Just-in-Time availability of complete wheels at the assembly line, existing of continuously changing combinations of world class tyres and rims.

These examples show how the Gateway concept can be recursive. If a Gateway makes its partners responsible for specific sets of solutions, these partners in turn have to select partners to co-operate with in order to offer a complete combination of products and services. Similarly, it could be argued that even the concept of a virtual corporation is recursive. Since a virtual corporation is identified by its offering (page 60), each Gateway will have its own perception of the virtual corporation in which it operates.

This discussion shows that the definition of the offering can be somewhat arbitrary. However, since it is the starting point for designing the strategic architecture, a Gateway should have a clear view on its offering before it can use the methodology.

8.3. Other Domains

In table 3—4 a typology of virtual corporations is presented to explain the focus of this research. The two criteria used to identify various types of virtual corporations are the *nature of customisation* and the *customer independent orientation.* This research focussed on investment goods that are made customer specific through customised services as well as customised tangibles. The research also assumed a customer independent definition of the product. In this section, the influence of the nature of customisation and the degree of customisation is discussed. In addition, some thoughts are given regarding the validity of the findings to non-investment goods.

8.3.1. Influence of nature of customisation

The starting point for the methodology is drawing up a strategic architecture of the processes required for serving the market. The evaluation of the processes in the strategic architecture is based on the assumption that these processes can be clearly identified. This assumption allows using characteristics of infrastructures for evaluating the attractiveness of co-operating with other organisations.

Services are defined as processes (see the definition of services on page 100), so that for a service provider it should not be difficult to identify the processes for his offering. According to Grönroos, all organisations can consider themselves service providers (see page 101). Grönroos statement implies that tangibles are nothing but enablers for customer benefits. Any organisation can therefore always look for alternative ways to provide similar benefits. When evaluating these alternatives, the sophistication of the required infrastructure serves as a perfect indicator for the ease of including the benefits in the offering. This would lead to the conclusion that any organisation can use the process portfolio in their strategic alignment process, provided it considers itself a service provider.

However, in § 8.2.2 some examples are given of other factors which increase the difficulty of co-operation. Consequently, such factors also provide opportunities for competitive advantage. If a service exists of nothing but supplying specific

tangibles, the sophistication of the infrastructure is not necessarily the only indicator for potential competitive advantage. In those cases, the tangibles themselves may be perceived as the benefits. It is then essential to find a (or *the*) supplier of the tangibles in question and to be allowed and able to do business with him.

Guaranteed exclusivity will make it impossible for competitors to complete their offering. Even if a simple infrastructure is sufficient for setting up the co-operation. The co-operation could after all be nothing but simply buying a certain quantity of the required tangibles. The methodology developed in this research should therefore not be used straight away in cases where the attractiveness of the offering is merely determined by specific qualities of tangibles.

8.3.2. Influence of Customer Independent Orientation

Developing a strategic architecture requires an outline of the functionality that the (future) customer requires and the core competencies needed to fulfil this (see page 108). The methodology developed in this research assumes a customer independent view on the offering to the market.

Wortmann's typology, however, suggests that not all organisations have a clear view on the product that they deliver (see page 64). The customer independent orientation of such organisations is not on products, but on processes or even on capabilities. The question is now if the customer independent orientation determines the usefulness of the methodology. In other words: does the customer independent orientation determine whether organisations can define a strategic architecture, and subsequently evaluate its elements on *service scope* and *co-operation complexity*?

The examples on page 94 illustrate how, in case of investment goods, products are increasingly defined in terms of their benefits, and not so much in terms of their specifications and characteristics. The strategic architecture for such products exists of the processes required to deliver the demanded benefits. The research has shown that the methodology can be applied if these processes can be identified.

Still, the research aimed at customer independent product orientations (§ 2.2.2, page 33). In case of a product orientation, the customer independent architecture is the product architecture. Components of the product architecture may be provided by multiple organisations. Including each of these components in variants of the offering may impose requirements on the customer driven processes. Consequently, one could analyse the required infrastructure and assess its sophistication. Furthermore, it is not difficult to determine whether the

components provide primary or secondary benefits. It therefore seems that the methodology can be applied in combination with a customer independent product orientation.

However, this conclusion should not be drawn too easily. The DAF case study showed that product architectures are often entirely different from network architectures, whereas process architectures have much more in common with network architectures (§ 4.5, page 87). It will therefore be difficult to evaluate co-operation with specific partners in case of a product orientation. The methodology as it is, may therefore not be applicable for those product orientation organisations that cannot shift to a process orientation.

A capability orientation implies that infrastructures can be put in place on customer order. In these cases, investments in infrastructures will be evaluated against their contribution to the (known) requirements of a (known) customer. There is, by definition, no need to develop a strategic architecture of (inter-organisational) processes and infrastructures.

Capability oriented organisations may desire to put interacting infrastructures in place independent of customers. If so they can evaluate these infrastructures on their sophistication. They should also be able to decide whether the infrastructure allows the delivery of primary or of secondary benefits. This is of course perfectly legitimate. It should be noted however, that in these cases, one could no longer speak of a capability orientation, since implicitly a process orientation has been taken up. This might lead to the conclusion that the methodology is primarily useful for the design of process oriented virtual corporations.

8.3.3. Non Investment Goods

Suppliers of investment goods may be forced to position themselves as service providers and look at their offering as a composition of services (thesis VI, page 98). This leads them to take up a customer independent process orientation. The methodology is developed for such organisations. However, a customer independent process orientation is not restricted to suppliers of investment goods. Such an orientation can also be found with traditional services providers. The methodology should be useful for such organisations as well.

Let us look at a railway company, which can develop a strategic architecture existing of all services customers require for conveniently getting from one address to another. For such an integrated service, various modes of transportation must be available for co-ordination. Furthermore, systems need to be in place for scheduling, reservation, billing and accounting. The co-ordination will result in a

better service, than the customer would ever be able to achieve by himself. A railway company could evaluate each of the components of the integrated service on service scope and co-operation complexity. Seemingly, there is no reason why the methodology cannot be applied.

In other cases, it requires some creativity to look at the offering as a service. However, a supermarket may consider its service making groceries available in a convenient manner. It could extend its service by including home deliveries, recipe development and shopping list management. Again, a range of services can be identified. For each of these, service scope and co-operation complexity can be determined.

8.4. Recommendations for Further Research

In § 8.2 and § 8.3 some suggestions for further research have already been given. This section gives an overview of more issues that could be subject of future research

8.4.1. Additional Case Studies

This research resulted in the development of a methodology, which was tested in a single organisation. Although the methodology provided useful results for this particular organisation, there is no guarantee that using the approach in other organisations will lead to similar findings. Each organisation that wishes to use the approach will have to determine for itself if the underlying mechanisms also exist in its own particular context (see § 2.4.2, page 38).

Such a guarantee will never be possible, yet additional case studies may increase the understanding into the mechanisms that determine the success of the methodology. This understanding could be helpful to managers and experts when they consider using the methodology.

8.4.2. Research in Other Domains

Applying the methodology in entirely different contexts may provide more explanation for the underlying mechanisms than additional case studies with suppliers of investment goods would. Heterogeneity between organisations studied will strongly facilitate assessing the applicability of the approach in

specific situations (see page 39). Successful experiments in other domains indicate a wider area in which the methodology can be used. Potential domains for further research are therefore traditional service providers (such as the railway company in § 8.3.3) and retailers (like the supermarket in § 8.3.3). Seemingly, the approach may be applicable in those domains.

Unsuccessful experiments allow refining the conditions for applicability of the methodology, or they may lead to domain specific variants. Research in areas where the portfolio is expected not to be applicable is therefore very valuable. In particular, the use of the methodology by organisations with a customer independent product orientation (like manufacturers of discrete products) could be subject of such research.

8.4.3. Non-Infrastructural Characteristics of Inter-Organisational Co-Operation

Including non-infrastructural characteristics of interorganisation co-operation for evaluation of the co-operation complexity could influence the position of processes in the portfolio considerably. Additional research could focus on the relative importance of infrastructural and non-infrastructural characteristics. The aim of such research could be to integrate them in a single methodology.

8.4.4. Relation to Innovation

In § 8.2.3, some remarks have been made regarding the impact of innovation on the positions in the process portfolio. Innovation may also impact the validity of the indicators for sophistication of the infrastructure. What is sophisticated one day, may no longer be sophisticated the other. While users of the portfolio should consequently continuously re-evaluate the position of processes, researchers should continuously criticise the indicators for sophistication.

8.4.5. Relation to Marketing

Marketing and strategic alignment are inseparable, as is explained briefly in § 8.2.4. However, this research has not addressed marketing to in detail. Within the domain, as well as in other domains, interesting questions can be raised with respect to marketing and the composition of complex products.

For participants in virtual corporations it is important to know how and to whom the benefits from being able to co-operate can be communicated to the

market. In this respect, it is essential to be aware of the interference between the marketing efforts of the various organisations involved in the offering. Because of the need for consistency between the strategic architecture and the marketing approach, further research should address the alignment of strategy, infrastructure and marketing.

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Appendix: Sophistication Profiles for Philips Business Communications

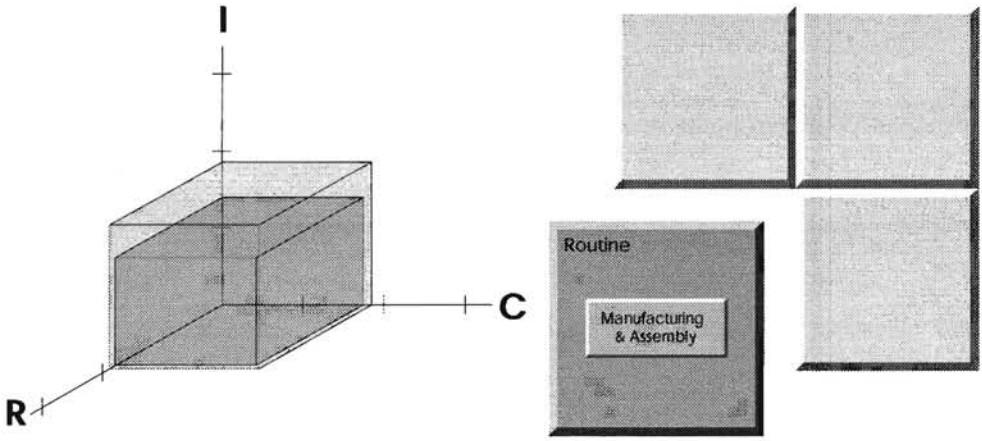

figure A- 1: Sophistication Profile for Manufacturing and Assembly/
Position in the Process Portfolio

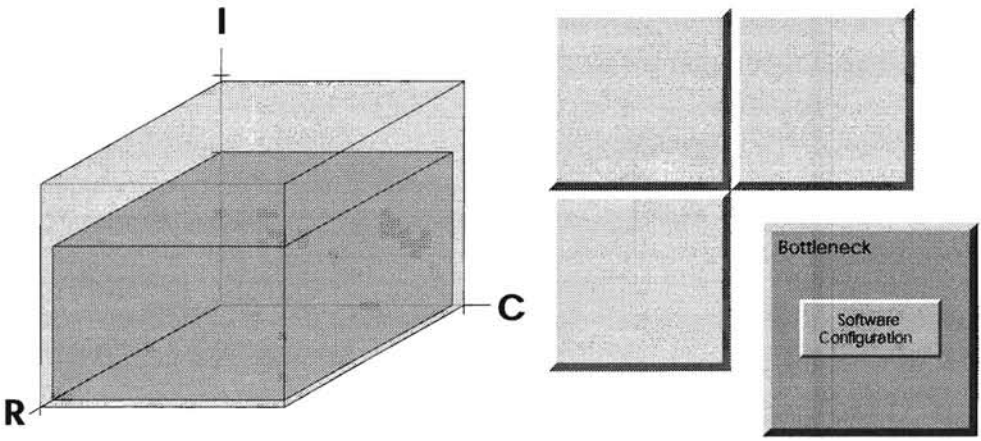

figure A- 2: Sophistication Profile for Software Configuration /
Position in the Process Portfolio

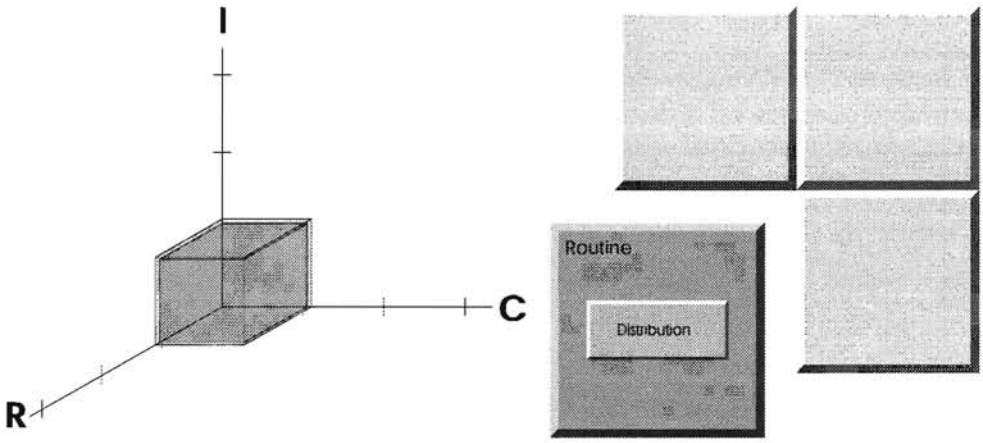

figure A- 3: Sophistication Profile for Distribution/
Position in the Process Portfolio

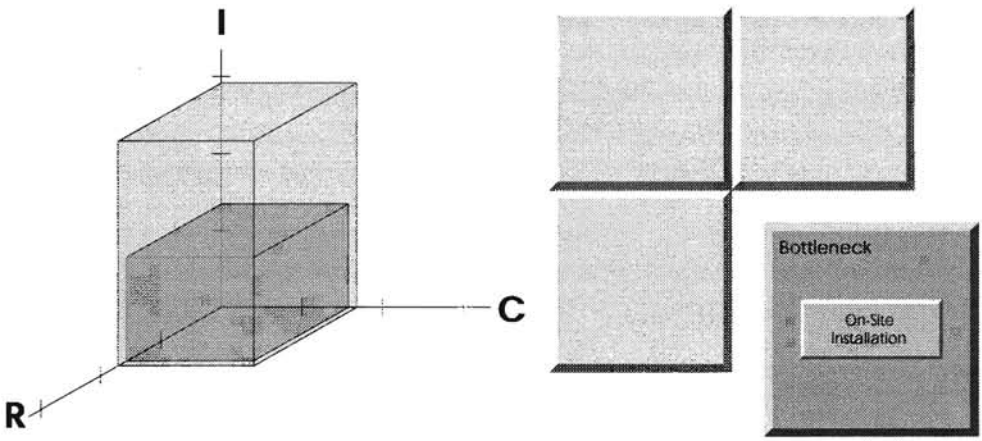

figure A- 4: Sophistication Profile for On-Site Installation/
Position in the Process Portfolio

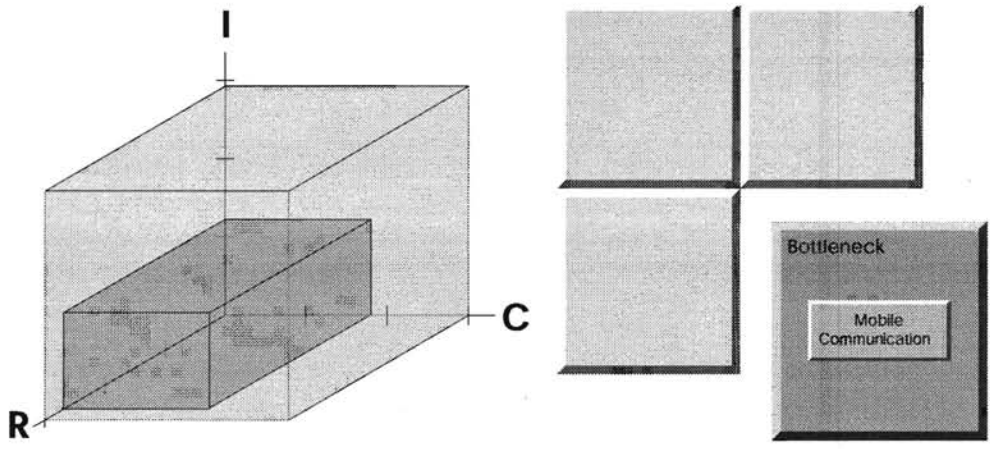

figure A- 5: Sophistication Profile for Mobile communication/ Position in the Process Portfolio

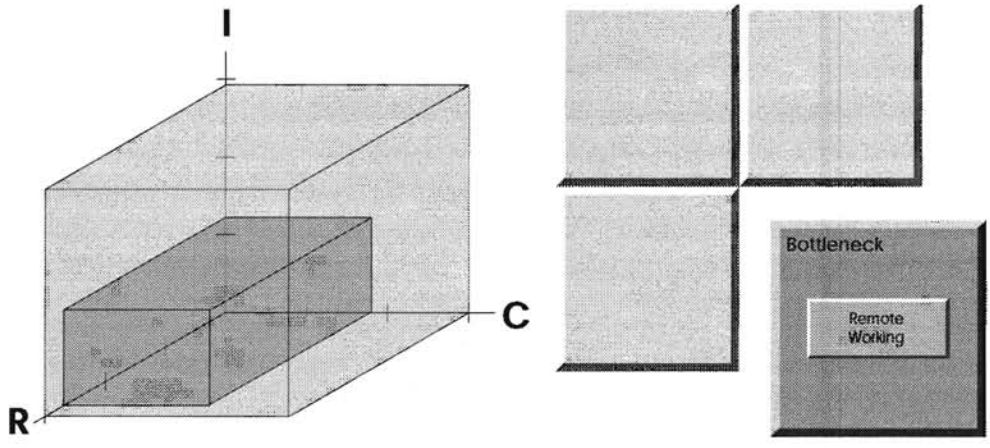

figure A- 6: Sophistication Profile for Remote Working/ Position in the Process Portfolio

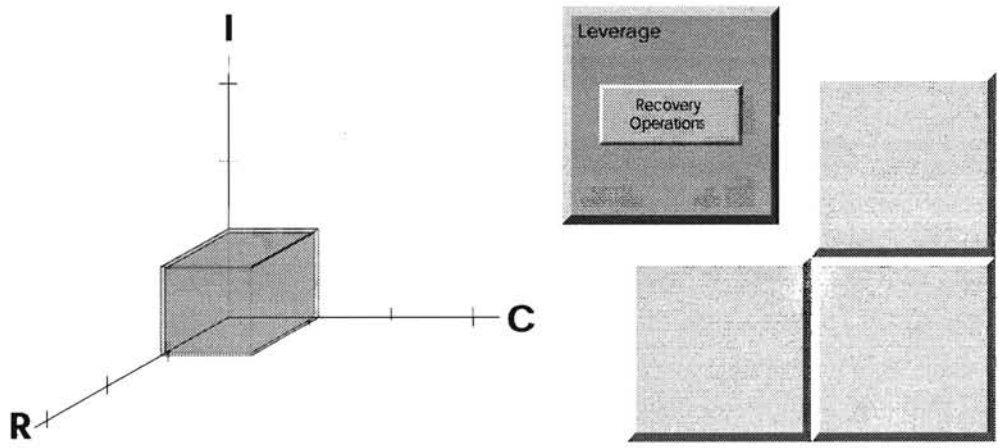

figure A- 7: Sophistication Profile for Recovery Operations/
Position in the Process Portfolio

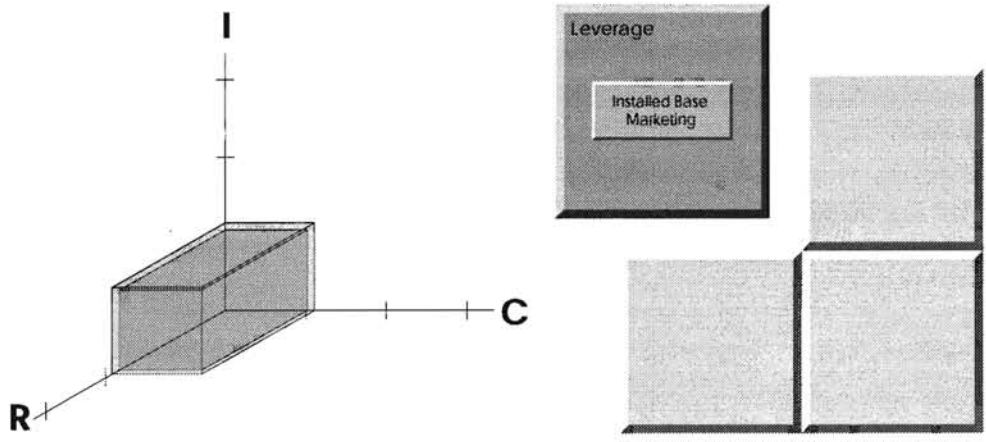

figure A- 8: Sophistication Profile for Customer Base Marketing/
Position in the Process Portfolio

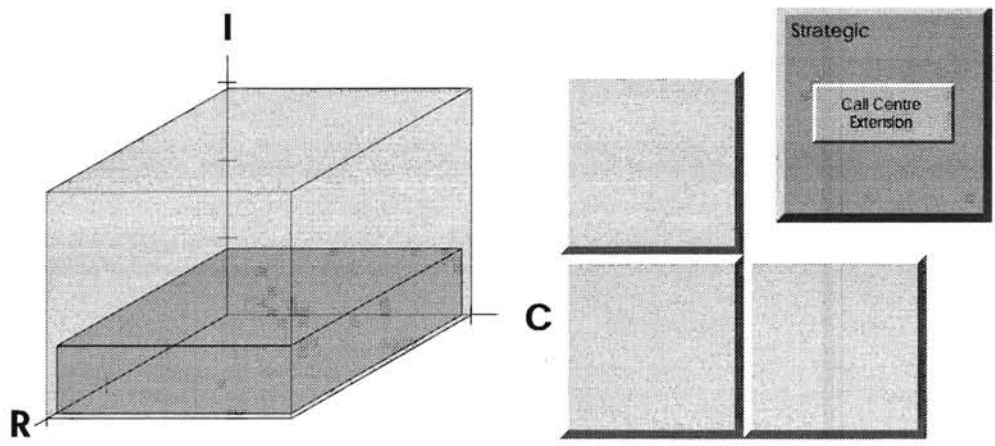

figure A- 9: Sophistication Profile for Call Centre Extension/ Position in the Process Portfolio

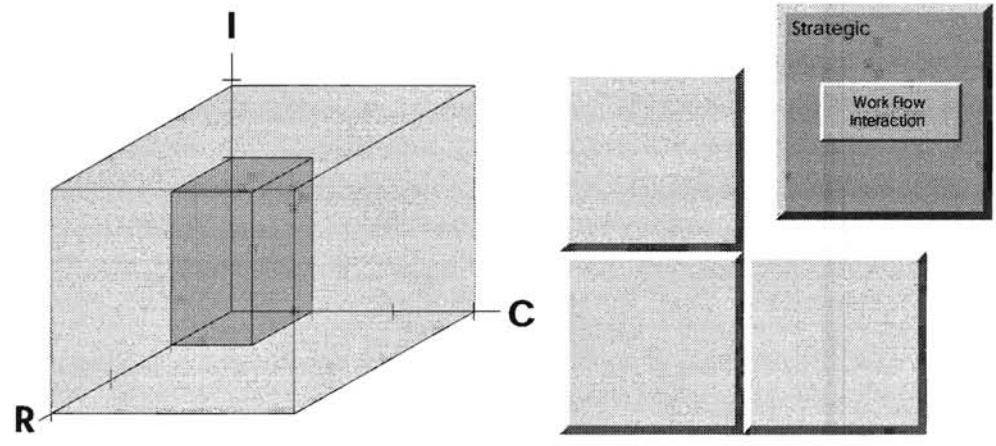

figure A- 10: Sophistication Profile for Work Flow Interaction/ Position in the Process Portfolio

STELLINGEN

behorende bij het proefschrift

Inter-Organisational Infrastructures for Competitive Advantage

Strategic Alignment in Virtual Corporations

van

Luuk Kornelius

9 juni 1999

I.

Door een toenemende vraag naar klantspecifieke producten in combinatie met een door technologische innovatie gedreven specialisatie, kunnen veel aanbieders alleen nog door samenwerking met anderen een compleet product leveren.

(dit proefschrift, pagina 52)

II.

Teneinde deel te kunnen nemen in virtuele organisaties moet inter-organisationele samenwerking gezien worden als onderdeel van de strategie, niet als een keuze die op operationeel niveau kan worden gemaakt

(dit proefschrift, pagina 83)

III.

Bij segmentatie van verschillende vormen van inter-organisationele samenwerking ten behoeve van het bepalen van het strategisch belang van de samenwerking moet worden uitgegaan van proceskarakteristieken en niet van productkarakteristieken.

(dit proefschrift, pagina 89)

IV.

De vereiste kennis voor het ontwikkelen en produceren van complexe producten kan zo specifiek zijn dat klanten dergelijke producten niet willen kopen, maar in plaats daarvan van leveranciers eisen dat deze de verantwoordelijkheid op zich nemen voor het ondersteunen van het proces van de klant. De leverancier wordt daarmee dienstverlener in plaats van fabrikant

(dit proefschrift, pagina 98)

V.

Het ontwerpen van een virtuele organisatie begint met het opstellen van een strategische architectuur, bestaande uit de processen die nodig zijn voor het leveren van de samengestelde dienst en uit middelen en structuren die nodig zijn voor het integreren van deze processen

(dit proefschrift, pagina 108)

VI.

De distributie van eigendom, macht en loyaliteit in een netwerk beperkt de organisaties in zo'n netwerk in het ontwerp van processen en infrastructuren. Daarmee wordt de flexibiliteit ten aanzien van het ontwerpen van de gezamenlijke dienst beperkt. Strategische keuzes en het ontwerp van de infrastructuur van de virtuele organisatie dienen daarom met elkaar in overeenstemming te worden gebracht in een iteratief proces.

(dit proefschrift, pagina 123)

VII.

Een Gateway onderscheidt zichzelf door samenwerkingsvormen te realiseren die anderen niet kunnen inrichten. Naarmate de vereiste infrastructuur geavanceerder is, neemt de kans op concurrentievoordeel toe.

(dit proefschrift, 128)

VIII.

Het beoordelen van het strategisch belang van processen aan de hand van 'service scope' en 'infrastructure sophistication' vereist dat kennis over marketing en kennis over infrastructuur even sterk zijn vertegenwoordigd in managementteams.

IX.

Een organisatieverandering kent vele dimensies. Adviesbureaus die dergelijke veranderingen voorbereiden en/of begeleiden moeten zich derhalve zodanig organiseren dat het werken in multidisciplinaire teams wordt gestimuleerd.

X.

Indien alle systemen in een verkooporganisatie goed functioneren, behalve het bonussysteem, zullen de verkeerde producten en diensten worden verkocht.

(J.C. Rosenberg, San Fransisco Consulting Group

XI.

Zolang PC's lelijk, grijs en groot zijn, zullen ze in de meeste huiskamers niet doordringen en zal het Internet geen grote rol in het dagelijks leven spelen.

XII.

Het is veelzeggend als moeders die vier dagen werken gevraagd wordt of ze dat niet te veel vinden, terwijl vaders die vier dagen werken de vraag krijgen of het wel genoeg is.

XIII.

Het afleveren van een proefschrift wordt wel vergeleken met een zware bevalling. Deze vergelijking doet geen recht aan de pijn die vrouwen tijdens een bevalling doorstaan.

XIV.

Door het gebruik van de huisstijl van de onderzoeksschool voor de omslag mag de definitieve versie van dit proefschrift met recht de Beta-versie worden genoemd.