

Lessons Learned from Coordination Theory: Towards a Model of the Networked Enterprise

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Abstract

This paper discusses IT-enabled collaboration of business units (Business Networking) on the business process level. Its goal is to develop a model which helps companies in the “networked economy” to design and manage their cross-company business processes. We elaborate an approach which combines findings of network theory and business process re-engineering using results of coordination theory. To reduce complexity, we split the networking problem into five coordination areas. We find that describing business networks with the aid of coordination areas allows a networked enterprise to consistently orient itself towards the processes of its partners, in particular those of its customers and suppliers. The model of the networked enterprise may serve as a framework for the Business Networking discussion on the IT-level.

Keywords: Business Networking, Coordination Theory, Networked Enterprise, Supply Chain Management, Customer Relationship Management

1 Introduction

"The revolution under way will be driven not by changes in production but by changes in coordination." [Malone/Rockart 1991, 128]

"The use of IT for coordination is more complex than much of the academic and practitioner literature suggests." [Kling et al. 1999]

Business Networking - the organization of IT-supported business relationships with internal and external business partners - ranks amongst the most important capabilities businesses will need in the information age [Österle et al. 2000]. The physical disintegration and networking of business units forms the basis for the division of labor and specialization [Smith 1776]. IT (Information Technology) drives physical disintegration to global limits, makes new business relationships possible and leads to new technical and organizational problems [Kling et al. 1999]. Businesses today seek design models for the engineering, implementation and further development of IT-supported business relationships.

This article develops an approach which links process orientation and networking. The result is a model of a networked enterprise for the IT-supported business relationships of a networked enterprise [Sydow 1992], i.e. of an enterprise which sees itself as a node for several business networks. The article is structured as follows:

- Introduction to the practical and theoretical problem
- Interpretation of business networks as coordinated processes, derivation of coordination areas

- Summary of findings on the model of the networked enterprise
- Conclusions

Gap in existing theoretical analysis

Linking up businesses to form networks has been the object of numerous investigations in the fields of economics, sociology and informatics (cf. [Alstynne 1997], Klein 1996], [Sydow 1992]). These investigations describe network phenomena and as a rule offer very abstract approaches to network classification and structure (cf. [Williamson 1991], [Snow et al. 1992]). Neither transaction cost theory, network theory, network economics nor any other of the theories examined provide comprehensive help in answering practical questions.¹

Network theory, for example, describes business networks as an organizational form between market and hierarchy, provides a comprehensive description model of the design areas of a *network* and considers the business unit² or the networked enterprise as the primary *unit of reference*. However, a finer degree of granularity is required for describing and ultimately for designing networks. Practice shows that as a rule businesses participate in several networks simultaneously. They take part in development and

¹ This article attempts to describe new formal findings from the research project within the very limited space available. For this reason it has not been possible to look at existing theories or description and explanation models. A detailed description of this analysis and further findings in respect of coordination technologies is required to make the “connection” with the ideas outlined here transparent. This is included in [Fleisch 1999].

² Business units are economic units, such as e.g. corporations, divisions, national subsidiaries, profit centers or small and medium-sized enterprises.

procurement communities at the same time, for instance, enter into strategic marketing partnerships and are involved in different value chains with different products and/or services. Thus they can be part of several internal, stable and dynamic networks all at once, and at the same time these networks may mutually influence one another (cf. Figure 1-1). In the process, they use different information systems and information technologies, depending on the business processes to be coordinated.

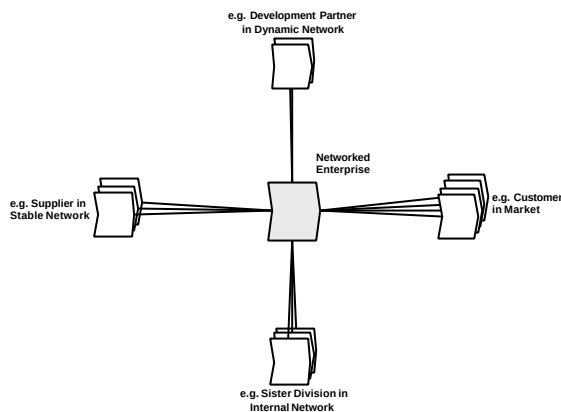


Figure 1-1: Networked Enterprise as Part of Various Networks

Theoretical Question

The theoretical question closes the gap between existing theoretical tools and practical issues, and thus includes the definition of a description model of an IT-supported business relationship. This paper looks at the theoretical question through coordination theory glasses. This choice was primarily motivated by its process orientation, its interdisciplinary nature (in this case the connection between organization and informatics in particular) and its practical focus.

Research Design and Method

The character of the research question determines the concrete research method to be applied [cf. Krcmar 1997, 4]). The question of procedural instructions for designing business unit networkability [Fleisch 1999], in the context of the most recent developments in IT can be described using the attributes problem-oriented, concrete, situational and broad. The action research method is appropriate for answering the question posed. This article is the result of action research after [Checkland/Holwell 1998].

The research topics covered questions in relation to networking within and across company boundaries. They were investigated within the framework of the Competence Centers Electronic Business Networking and Inter-Business Networking of the research program Business Engineering HSG at the University of St. Gallen. The questions were derived from the problems of businesses which were working with a team of researchers headed by the authors. The methods

employed by the researchers in real-world problem situations included e.g. reviews of documents on project work performed in the companies to date, partial assistance with the project work, particularly in respect of preparations for decision-making, structured interviews with project members and stakeholders plus evaluation of the procedural instructions developed by the team.

2 Networked Business Processes

Every interdependency between the business processes of different business units leads to networking. Based on this definition, there are a great many examples and variants of networking to be found in the real world.³

In literature with an economics slant, design recommendations are usually linked to the *business unit* as reference object. For the description of networks on a greater level of detail required for the deduction of concrete procedural instructions for designing and implementing networks, the granularity of a business unit would appear to be too coarse.

In real-world projects, the business process has proved itself to be a suitable reference object for the purposes of networking in addition to the business unit. Here, the focus is on the coordination of the cooperating business processes of different business units. We now introduce the process view in the context of networking business units in order to permit the subtle differentiation of conclusions required for the implementation.

2.1 Networking Through Coordination

The processes of the coordinating business partners, together with the outputs they produce, form the operative side of the business relationship. Figure 2-1 shows two business units - two "average" industrial enterprises - along with their most important business processes. These processes are based on the process models of [SCOR 1998], [Teufel et al. 1999], [Boutellier et al. 1999], [Porter 1992], [SAP 1998] and [GPS 1997]. The networking of processes describes the organization of dependencies between the processes and/or tasks of the various network partners.

[Malone/Crowston 1994] define coordination as the "management of dependent activities". We define networking as coordination in networks. Along with his coordination theory [Malone 1988] provides a "set of principles" for describing and solving dependencies (an up-to-date taxonomy can be found in [Crowston 1994b]). Tasks are then interdependent if they access the same resources. Tasks are performed by resources

³ For case examples see [Österle et al. 2000]

(e.g. personnel) on the one hand and consume resources on the other. According to [Crowston 1994b] resources are all subjects and/or objects which come into contact with a task. Examples of resources are machines, tools, storage spaces and employees.

The resource information takes on a special role in this article. This is due to the fact that while it obeys the laws of information processing and thus, unlike raw materials for example, is reusable and divisible, it can also depict all other resources for coordination purposes. In Figure 2-1 the processes on both sides of the value chain rely on the same information and are therefore interdependent.

According to [Österle 1995] processes are coordinated exclusively by means of outputs. By virtue of this fact, coordination must therefore be an output or part of an output in the sense of the above definition. Consequently, the potential of inter-organizational networking lies in suitable design of the coordination capability (networkability) of outputs and all associated design areas such as process, IT, people, organization structure and culture [cf. Alt et al. 2000]. Business Process Reengineering and integrated information systems have already shown how potentials arising from the organization of internal dependencies can be realized.

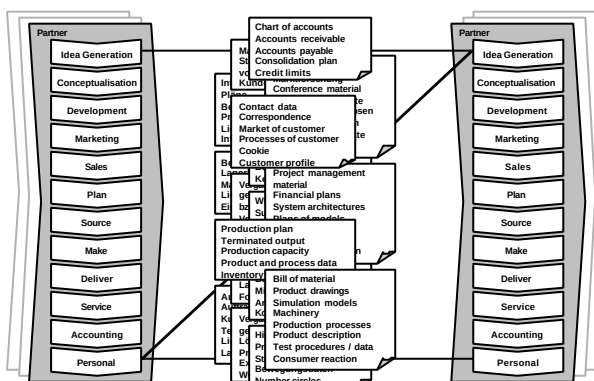


Figure 2-1: Coordination of Business Partners Through Shared Information

2.2 Coordination Areas

Figure 2-1 illustrates the wide variety and great complexity of inter-organizational networking. However, network design requires a level of complexity which is manageable. In order to reduce complexity, areas are sought which show high dependencies. Based on the concept of integration areas [Österle et al. 1993], we refer to processes (of different business units) which are characterized by high dependency and therefore require a high degree of coordination as “coordination areas”. Areas are usefully delimited if the sum of all dependencies between the areas is low and the sum of all dependencies within the areas is high.

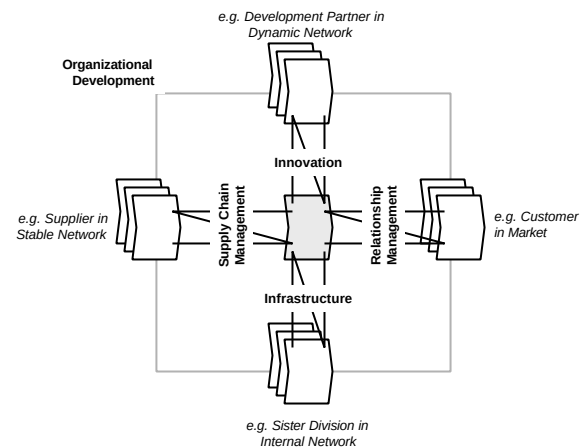


Figure 2-2: Coordination Areas

Integration areas and coordination areas both refer to processes and their tasks. The integration area pursues integration through integrated information processing, the coordination area pursues integration through the organization of dependencies. In addition to integrated information processing this includes for instance the modularization of outputs and the design of new incentive systems for employees. The criteria used for delimiting coordination areas include goal, culture, partners, form of coordination, coordinated processes, resources and information systems. By applying these criteria to the case studies we arrive at the five coordination areas Supply Chain Management, Relationship Management, Innovation, Infrastructure and Organization Development (see Figure 22 and Table 2-1).

- The goal of *supply chain management* is to handle operative planning and execution processes as efficiently as possible. Unlike innovation, supply chain management does not redesign anything but multiplies clearly defined outputs and tries to utilize the effects of economies of scale in order to achieve profit. As a rule, supply chain management realizes its attempts to achieve efficiency through a large integration depth in the coordination of its well-structured processes. High repeat numbers and integration depths require stable structures. Supply chain management prefers the forms of coordination of an internal and/or stable network.
- The goal of *relationship management* is to win customers and/or suppliers and to gain their loyalty. Based on the ideas of the (cooperative) output system [Schögel et al. 1999], relationship management tries to cover as wide a spectrum of customer requirements as possible in order to utilize the effects of economies of scope. Partners in this area are above all customers with whom a market-like relationship exists.
- The goal of the coordination area *innovation* is the rapid creation of new products. In accordance with

the "loose-tight" hypothesis [Gassmann, 1997], innovation requires a dynamic environment in the early phases. As a project advances in maturity so the streamlining of the organization increases. In the case of innovation, a business unit will thus coordinate with a large number of different partners and, depending on the task in question, follow the rules of different forms of coordination.

- The area *infrastructure* distinguishes itself from supply chain management in terms of content (e.g. payroll accounting). In addition, this content does not necessarily show a high degree of repetition (e.g. preparation of a corporate balance sheet), and its transactions may be complex in nature (e.g. outsourcing of IT). As a rule, there is a high level

of dependency between the infrastructure partners which calls for the relationship to be stable.

- *Organization development* secures the willingness of own employees and those of partners to cooperate. It employs special procedures for assessing and honoring performance, developing partnerships and winning partners [Hilb 1997].

Every business unit is always linked to other business units across all the coordination areas described in Table 2-1. The sector and the position in the network determine the priority with which business units approach the task of consistent network design.

Coordination Area	Goal / Culture	Coordinated Processes	Main Form of Coordination (according to [Snow et al. 1992])	Main Coordination Technology
Supply Chain Management	Efficiency through utilization of "economies of scale", large integration depth	Planning, procurement, production, distribution	Stable network	Supply chain planning- and transaction-oriented electronic commerce-systems
Relationship Management	Effectiveness through utilization of "economies of scope"	Marketing, sales, service	Market	Customer relationship management- and document-oriented electronic commerce-systems
Innovation	Rapid development of successful products, dynamic	Idea creation, concepts, development	Dynamic network	Information systems for distributed innovation [Boutellier et al. 1999]
Infrastructure	Efficiency through service culture	Accounts, asset management, master data management	Internal and stable network	Distributed enterprise resource planning-systems
Organization Development	Network-capable employees and partners		All forms of coordination	-

Table 2-1: Coordination Areas

The (inter-organizational) dependencies within areas are contrasted by the (intra-organizational) dependencies across areas. Both play a decisive role in the networkability structure of businesses (cf. Figure 2-3).

- The goal of relationship management is to create a relationship with business partners such as customers or key suppliers which is as close, long-term and thus profitable as possible. The success of relationship management is dependent on the quality of supply chain management and vice versa. In the context of relationship management, businesses make information and capabilities available to their customers for example, which are generated in the area of supply chain management. This information includes things like availability checks or track & trace information in real time, capabilities include things like mass customizing.

- On the other hand, supply chain management relies on relationship management information and capabilities. Examples here are correctly configured customer orders or current detailed information on payment terms and the customer's delivery address. A further indication of the interdependency of these two areas is provided by numerous case studies: as a rule, companies which consistently apply relationship management implement the complementary supply chain management at the same time.
- Relationship management provides the area of innovation first and foremost with market analyses, competitor strategies and products and concrete customer requirements. At the same time, relationship management relies on the area of innovation for information on new products, for

instance, or ongoing research projects with image value.

- Innovation and supply chain management are connected via product design and the process required to produce it. Jointly used documents here include parts lists and production process descriptions.
- The infrastructure area supplies the “operating resource” information to all other areas. Relationship management, supply chain management and innovation rely on information from external and internal accounting as well as from data management.
- Organization development forms the basis for all other coordination areas by ensuring suitable organization structures and/or cultural and political attitudes on the part of the organization units involved. The success of the operative coordination areas is dependent on organization development at both the intra-organizational and inter-organizational levels.

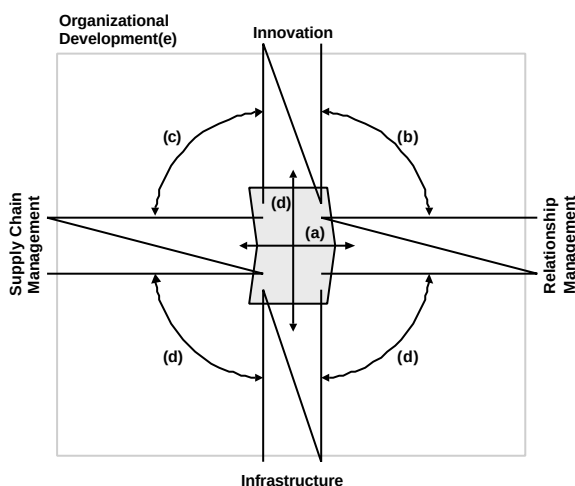


Figure 2-3: Inter-Area Dependencies

3 Model of a Networked Enterprise

“Describing and categorizing organizational forms remains a central problem in organization theory.” [Crowston 1994a, 2]

We know from the fifth phase of computerization that cross-company business processes rely on a new infrastructure, also referred to as e-services⁴, and new standards. Together with the coordination areas they form a basic model of the networked enterprise.

3.1 eServices

Decreasing coordination costs through the use of ERP-, supply chain planning (SCP)-, electronic commerce (EC)- and enterprise application integration (EAI)-systems are leading on the one hand to the *substitution* of IT-supported forms of integration for integration through employees. On the other, we see decreasing coordination costs through *demand elasticity* leading to an increasing number of economical transactions (e.g. small lot sizes, micropayments). Both effects favor the creation of coordination-intensive structures which include eServices (cf. [Malone/Crowston 1994]).

In this context, [Tapscott 1995, 55] expands by saying that: “Every economy needs a national information infrastructure. This is the utility of the twenty-first century - a broadband highway for a broadband, high-capacity economy. And every organization needs to plug into this utility with an enterprise information infrastructure. The new infrastructure will change economic activity as significantly as did electrification. Just as business and wealth creation would be unthinkable today without electrification, so the new economy would be impossible without the power of information.” Frederick W. Smith, Chairman, President und CEO, FDX Corporation, quoted in [Jones 1998], summarizes that: “Mastery of logistics is as vital to success in the digital economy as it was to the extraordinary success of the Roman Empire”.

New IT, such as e.g. the n:m trading systems are often the basis for new services. Every enterprise has the strategic option of offering a new service. The list below gives an overview of the new infrastructure and thus some of the strategic options. In the classification by [Barling/Stark 1998a, 6] the services refer to the business relationship as a whole, business processes, applications and communication. Here we have classified the services according to their outputs [Barling/Stark 1998b]:

Process services perform important tasks for value creation processes (procurement, production, sales, planning) or complete support processes (e.g. accounts or personnel) of a business unit. Process services always offer comprehensive business services. Important process services are:

- The outsourcing of business processes, such as finance, accounts, internal auditing, taxes, procurement, personnel, real estate, etc., to consultants or specialist companies, such as e.g. ADP for payroll accounting.
- The purchase of indirect, simply structured goods to aggregate demand: a large number of small purchasers with small purchasing power form a ‘purchasing club’ which is represented on the market by an intermediary with large purchasing power. Examples are TPN Register from GEIS and Thomas Register, Harbinger, Commerce One, Marshall, etc.

⁴ cf. www.hp.com/e-services/

- The purchase of direct, complex goods (online bidding services): purchasers publicize invitations to bid on the network of a service provider. Suppliers submit their bids online (cf. TPN Post from GEIS).
- Collaborative supply chain services coordinate planning and execution processes of a larger section of a supply chain (e.g. EQOS from GEIS for supporting retailers).

Support services provide value creation processes with the required resources. Support services always offer a mixture of technical and specific business services. The most important support services are:

- Hosting services support the development, operation and maintenance of applications, from simple web pages to SAP R/3 installations (e.g. Oracle, IBM, British Telecom/ Citrix).
- Transport services support the exchange of physical goods between trading partners and may secure integration with the third party distribution and/or logistics system (e.g. FedEx, UPS).
- Customs services support the automatic submission of customs documents (e.g. GEIS).
- Services associated with payment transactions support the exchange of payments between trading partners (e.g. NetTradeFinance from IBM).
- Trust services support the management of certificates. Amongst others, they ensure the authenticity of business partners and shared resources (e.g. CertCo, Swisskey Verisign).

Basic services provide fundamental, very specialized and mostly technical services for conducting business in the information age.

- Directory service management e.g. globally valid coordinates of trading partners at a central point,
- Repository service management e.g. global EDI messages or software components at a central point,
- Translation and mapping services for temporary storage and translation of messages, e.g. from EDI messages into fax,
- Security services for the security requirements of the networked business units, and
- Network access services for the technical access to value-added networks, the Internet and to virtual private networks.

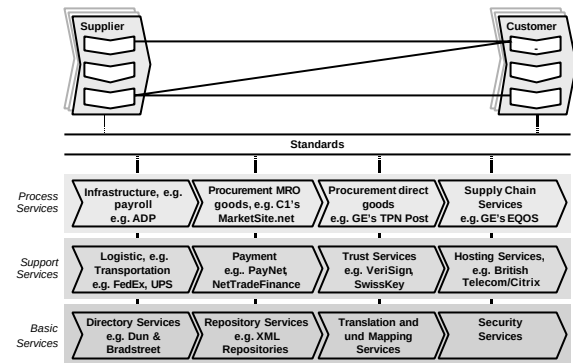


Figure 3-1: Examples for eServices

3.2 Standards

Customers, suppliers and services which link customers with suppliers have to be able to “understand” each other at many different levels of their relationship in order to be able to organize their interdependency. Standards make this “understanding” possible. We define standards as objects which are accepted and shared within a community (cf. [Österle et al. 2000, 225], [Cargill 1989], [Buxmann 1996]). Objects are understood to mean hardware, software, processes, data, function, protocol, etc. Communities are e.g. business units, value chains, sectors or geographical regions. Bodies or enterprises within these communities commit themselves to disseminating the appropriate standards.

Standards are an integral part of the model of the networked enterprise. Just like the DIN standards in engineering (e.g. thread size M8, fit H7, steel grade ST37 or test procedure DIN 68858), they make it possible to realize economies of scale at the same time as individualization, and constitute a central coordination mechanism. Unlike the widely accepted standards in the engineering field, however, those for communication only apply to the technical and/or syntactical level. Standards for semantic and pragmatic integration remain a huge challenge for Business Networking.

3.3 Model

“For every problem there is a solution that is simple, neat ... and wrong”, H. L. Mencken, quoted in [Rodin 1999, 60].

The model derives from a process-oriented and enterprise-centered view of the networking of business units. We do not consider the topology of a network but the networking of partners from the point of view of the individual, “selfishly” acting business unit. In Figure 3-2 a company to be analyzed can equally well take on the role of supplier or that of the customer. It sees itself at the center of its networks and practices networking in order to strengthen its position and/or to improve its profit ratios.

Splitting networking into the four operative coordination areas of relationship management, supply chain management, innovation and infrastructure takes into account the complexity inherent in networking which is observable in practice. These four areas pursue different economic goals, implement different types of network, are characterized by widely divergent cultures, link different partners, have interdependencies based on different resources and use different information systems for coordination purposes. Each business unit must nevertheless be capable of developing all these relationships in the interests of their own business strategy, i.e. of adapting to the new demands of the information age.

Even if a business unit does not operate its own development or outsources every conceivable support process to suppliers, it must nevertheless be familiar with and actively maintain its relationships with partners, which according to [Hagel/Singer 1999] are customers, output integrators, innovators or infrastructure companies. The model of the networked business unit helps here by bringing together in a single architecture those design areas of a company which are most important from the networking point of view. On the one hand it provides an indication of how to usefully break down the networking problem, without neglecting the interdependencies of the delimited areas. On the other hand, the model serves as reference framework for deriving recommended action while taking into account the central role of IT, services and standards.

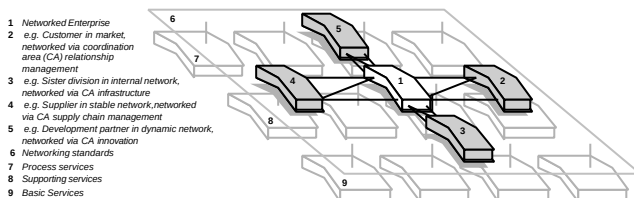


Figure 3-2: Networked Enterprise

4 Conclusions

The proposed model of a networked enterprise combines a company's position being part of several business networks with its needs to organize along cross-company business processes. It helps businesses to identify the importance of processes in the network and to split the networking problem into five clear areas, each of which is homogeneous in itself. At the same time, it shows the connection between the individual areas. Describing networking with the aid of coordination areas allows a networked enterprise to consistently orient itself towards the processes of its partners, in particular those of its customers. The model of a networked enterprise thus provides:

- *An orientation aid for potential analysis.* Networked enterprises can orient themselves

towards the discussed potentials of the individual coordination areas when evaluating their coordination strategies. This article distinguishes between potentials derived from (a) process efficiency through networking, (b) enhanced customer benefits and (c) new business opportunities.

- *An orientation aid for strategy evaluation.* Experience has shown that networked enterprises sometimes have a tendency not to devote enough attention to dependencies between coordination areas. They try to coordinate sales processes within an internal network, for example, and neglect the fact that the organization of master data is a prerequisite for a "global" process network. The model lists the major dependencies between coordination areas and can thus serve as the basis for strategy evaluation.
- *An orientation aid to increase networking manageability.* By splitting up the networking problem into coordination areas, the model of a networked enterprise creates domains which differ in terms of culture, employees, processes and information systems and which consequently the management of networked enterprises can design and run as one unit. At the same time, the model identifies the most important dependencies between the coordination areas and thus creates the right conditions for inter-area management, e.g. for the required calibration of the coordination areas supply chain management, relationship management and infrastructure.
- *A means of deriving management tasks for inter-company coordination.* The model of a networked enterprise supports the derivation of management tasks in a networked enterprise. The most important tasks in connection with networking include (a) strategic positioning of the networked enterprise in the various networks, (b) organization of the coordination areas relationship management, innovation, supply chain management, infrastructure and organization development, (c) organization of internal integration of the coordination areas and (d) organization of IT, standards and services, on which the coordination is built.
- *Infrastructure positioning from the business point of view.* Supply chain management, relationship management and innovation are immediately dependent on the coordination area infrastructure. While most companies recognize this connection, the infrastructure area, in particular data management, is underdeveloped. Companies usually lack the business arguments to support the time and cost-intensive harmonization and networking projects. The model of a networked enterprise establishes the link between the supply chain, relationship management and innovation

processes, which are considered to be strategic, and the supporting infrastructure processes, thus simplifying the business argumentation for infrastructure projects.

- *Positioning of standards and services.* The most powerful elementary goal of networking is the m:n capability. This permits the automation of new business functions and at the same time makes it possible to exploit the effects of economies of scope (n customers generate a demand for individual, comprehensive output systems which can be configured from standardized outputs) and economies of scale (m suppliers specialized in individual outputs). Standards and services are the central mechanisms which permit an m:n network. The model of a networked enterprise positions them accordingly and thus shows the increasing significance of and necessity for a well-founded evaluation process for the selection of standards and services.

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