2000

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R. Alt
University of St. Gallen

E. Fleisch
University of St. Gallen

O. Werle
inet-logistics, GmbH

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R. Alt
E. Fleisch

Institute for Information Management
University St. Gallen
Müller-Friedbergstrasse 8
CH-9000 St. Gallen, Switzerland

O. Werle

Chief Executive Officer,
inet-logistics GmbH,
Holzriedstraße 29
A-6961 Wolfurt, Austria

***Abstract*-Business networking - the management of IT-enabled relationships between internal and external business partners - is one of the most important features of enterprises in the information age. Currently, business networking is moving into the center of business engineering and aims at preparing enterprises in becoming part of IT-based business networks and in exploiting new process efficiencies and business opportunities. In this paper we develop an idea for describing, measuring and managing an enterprise's ability to succeed in business networks: the concept of networkability. We illustrate the design objects of networkability using an example from the logistics industry and apply coordination theory to derive mechanisms *which* help to strengthen a company's networkability.**

I. Business Networking

In the information age, the networking of companies is one of the most important business trends [17]. The many factors contributing to this trend include the diffusion of the Internet in the business world, the increasing availability of standards for information systems and data, the global competition in many branches of industry and the appearance of new types of companies, such as mega-mergers (e.g. DaimlerChrysler, MCI/Worldcom, Deutsche Bank/Bankers Trust) and start-up companies (e.g. Amazon.com, eBay, eToys, Yahoo!). Within this context, maximum process efficiency and a continuous search for new fields of business are key success factors. This is the starting point of business networking, a concept we refer to as the design and management of IT-supported relationships with internal and external business partners.

An example of how to profit from the advantages of increased efficiency and from new business segments is Riverwood International, a manufacturer of cardboard packaging in Atlanta, USA. Since two years, Riverwood has been pursuing a business networking strategy in the area of supply chain management, a strategy which aims at improving information exchange with customers (e.g. Anheuser-Busch, Miller Breweries, Coca-Cola). By using a supply chain management system (SAP APO), the current sales plans of the customers were directly linked to Riverwood's production planning. The consequences of business networking were a reduction in stock levels and increased flexibility. With this as a basis, Riverwood is planning to offer a new service which will be responsible for the exchange of planning data for the whole paper-processing industry in the USA. As Fig. 1 shows, this supply chain center uses different electronic services (eServices) and standards (business bus).[1]

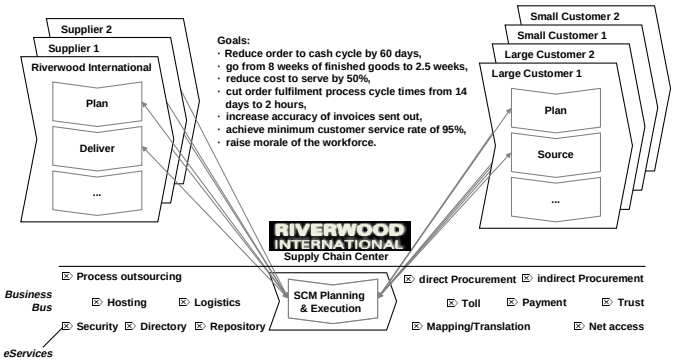

Fig. 1: Business networking service from Riverwood International

For Riverwood, the rapid and efficient linking up of business partners is a basic prerequisite which is crucial for the success of the business networking strategy. There are comparable challenges in relation to other strategies of business networking. Electronic commerce, for example, requires that several suppliers and/or customers can be easily connected to an electronic catalog. This paper develops concrete approaches to defining competitive business networking strategies from the point of view of a specific company.

II. Networkability as Competitive Factor

The objective of business networking is to increase competitiveness through higher networkability. This increases process efficiency and opens up new business opportunities. Business engineering [16] supplies the framework for the consistent and practice-oriented design and implementation of networkability.

A. Concept and Design Objects of Networkability

Business networking tries to increase process efficiency and to enter new business segments by forming innovative networks of value creation. According to [23], new

[1] The example of Riverwood International is described in [17].

innovative strategies are based on three models: (1) forms of organization for rapid and permanent orientation to the market, (2) forms of personnel leadership for developing and utilizing employee potential, and (3) forms of networking for creating an internal and external ability to cooperate. The concept of networkability is developed in the following to take into account all the dimensions of business engineering in addition to the organizational ability to cooperate.

Networkability is the *internal and external ability to cooperate as well as the ability to rapidly and efficiently establish, conduct and develop IT-supported business relationships.* Corresponding to the dimensions of business engineering, networkability has different aspects or design objects, which create dependencies among the business partners. We understand networkability as a continuation of coordination theory, which defines coordination as the management of dependencies [14].[2] Regarding each design object, networkability means (cf. Fig. 2):

- *Products and services*. Networkable products and services can be altered quickly and inexpensively for specific partners or be integrated in other products. This includes the personalization of services, such as mySAP.com, and configurability regarding the information needed (e.g. status information, use of partners' article numbers).
- *Process*. Networkable processes can quickly and inexpensively establish and conduct a relationship of coordination with corresponding processes. Automatic requests for various catalogs or automatic orders when stock levels fall below an agreed safety level are examples of this.
- *Information systems*. Networkable information systems (IS) can be linked up to other IS quickly and inexpensively and support communication on the system level. This especially applies to setting up an EDI link with a business partner.
- *Employees*. Networkable employees are the essence of personal networks. They are oriented to the customer, understand the relevance of win-win situations and are also assessed according to the way in which they maintain and look after relationships between partners.
- *Organizational structure*. Networkable organizations can be adapted quickly and inexpensively to new market requirements. Examples of this are the rapid creation of temporary inter-company teams, the relocation of business processes or the joint execution of processes (formation of so-called shared services).
- *Culture*. Networkable company cultures promote cooperation by being open to change and by basing cooperation between business partners on a relationship of trust instead of mutual checks (on costs).

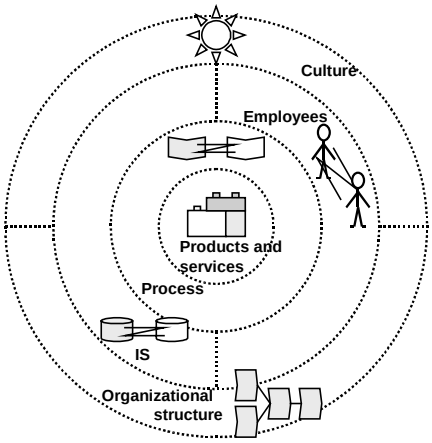

Fig. 2: Design objects of networkability

B. *Approaches to Measuring Networkability*

A precondition for appropriately designing networkability, according to the management cycle of [22], is measurement and evaluation of the design objects. It is only when the existing nature of these objects and the required nature of these objects have been determined that concrete ideas to close a specific networkability gap can be obtained in relation to the design object. Above all, the requirements of the partners involved have to be carefully assessed since the goal is not to achieve maximum but appropriate modification of the design objects.[3] For example, it would be inappropriate to implement an EDI link when the coordinated processes only involve infrequent transactions.

The correct estimation of appropriateness has a direct effect on the cost-benefit ratio of networks because measures for increasing networkability are usually associated with higher costs. In some circumstances, a company which wants to intensify its business relationship with *n* customers will outsource some services and products, adopt new products and services, adapt its information systems to new process and communication standards, introduce new information systems, re-design processes and re-train its employees. The basic criteria for measuring networkability are *time, costs and the quality of the change*. Table 1 shows some examples of criteria relating to the design objects. Networkability thus indicates what changes in business relationships a company can cope with and in what time and at what cost it can do so.

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2 For a detailed derivation of design objects and instructions for action from a coordination theory perspective see [6].

3 For a definition of quality as the relation of performance to expected performance see [7].

Design object	Quantitative change criteria (time/cost)	Qualitative change criteria
Products and services	Costs and duration of combining individualized products and services or integrating additional services, e.g. payment services.	Degree of modularization with regard to products and services Degree of specificity of the adaptations Degree of multiple use of products and services
Process	Costs and duration of adapting planning or handling processes to the processes of the partners (customers/suppliers) Costs of relocating a standardized process to a specialized service Expenditure for establishing cross-company controlling	Transparency of the process for the partners Openness of information exchange Existence of a conflict management system Interorganizational monitoring of processes Coordination scenarios employed
Information system	Costs and duration of automating an IT-supported business relationship, e.g. establishing of an EDI link. Costs of data preparation or syntactical and semantical integration	Use of application and communication standards Form of IT integration (e.g. EDI, shared databases, remote log-in, ERP@Web) Security mechanisms, access rights
Employees	Costs and duration of employee replacement Time needed for building up personal basis for business relationships	Ability to look after and maintain personal networks Ability to organize oneself Degree of harmony of vision Ability to acquire information
Organizational structure	Costs and duration of a decision-making process Duration and costs of establishing new organizational structures, e.g. profit centers or a new regional company Duration and costs of establishing a new external symbiotic cooperative venture	Distribution of power Homogeneity of the organizational structures Granularity and flexibility of the organizational units Number of internal and external partners
Culture	Costs and duration of information acquisition Costs and duration of training	Distribution of benefits between the partners (reciprocity) Intensity of the exchange of knowledge and experience Lived openness Dealing with the question of trust

Table 1: Examples of criteria for networkability

III. NETWORKABILITY AT GEBRÜDER WEISS

One area of application where networkability is traditionally very important is the logistics industry [2]. In the following we will analyze the relevance of networkability for a freight forwarding company.

A. Case Gebrüder Weiss

Gebrüder Weiss (GW) is a freight forwarding company located in Bregenz, Austria. In 1998, GW had a turnover of approximately 6.19 Austrian schillings with around 2600 employees [20]. Since 1994, the IT department of GW has been collecting information on projects for integrating partners, such as customers and carriers. The following is an assessment of 80 projects with 57 different partners.

In the relationships with their customers and carriers, GW offers different technical and commercial services. The technical services include data exchange via the mail systems of General Electrics, Management Data, IBM, the in-house GW Mail as well as via X.400, e-mail, FTP and via WeissNet. The commercial services include information exchanged via IT, such as dispatch data, consignment-status information, unloading reports, warehousing data and invoice data.

With its WeissNet, GW is shaping IS to become the 'spearhead' of their logistic services [20]. WeissNet connects numerous new IT-supported services to form a comprehensive system of services aligned to the problems of customers. The objective of GW is to position itself as a leading logistics partner with this system. WeissNet supports its customers in drawing up shipping documents (label printing, bar-code printing, dispatch lists etc.), processing transport orders and order tracking and, by means of quality assurance and the possibility of influencing the transport flow, thus enables proactive transport management.

Our networkability analysis of the 80 business networking projects at GW revealed various findings. In the first place two types of projects can be distinguished:

- *Project type I*. 16 of the total of 81 projects required a deep and specific integration. For example, GW provided a special warehousing application for one of their customers (HEAD) and set up a link with HEAD's ERP system. For Hewlett Packard, GW implemented a specific article-management and routing solution. Projects involving a high degree of integration usually include activities for integrating applications and are time and cost intensive (16 weeks and 124 working hours).
- *Project type II*. 65 of the projects investigated used a network with a low degree of integration. This mostly concerned simple, standardized links to partners. The costs and time needed for these projects were significantly lower (14 weeks and 14 working hours).

The data suggests that the expenditure and effort for projects of type II decreases every time a link was established. A possible explanation for this is (a) the re-use of interfaces which have already been programmed, (b) the learning curve of the employees and (c) standards which become generally established, such as TCP/IP.

We also found that average cycle times for projects with a low degree of integration were relatively high compared to those of more complex projects. This reflects, above all, the degree of motivation of the partners: the cycle times depend to a large degree on the partner's commitment. Projects with a high degree of integration necessitate a great investment of effort and therefore a large commitment by the partner. It is exactly this commitment which ensures that a great investment of effort is made. If there is no commitment, such projects do not take place at all.

Fig. 3 shows the criteria of networkability for GW's services and IS. GW only provides modular services. Customers and carriers can select the modules they desire in accordance with their requirements. In the projects we found that the commitment of the partners increased as their expected benefit also increased. The latter grew with a higher degree of integration. The projects indicate that the acceptance of WeissNet war not determined by the possibility of electronically transmitting information, but by the availability of additional services, such as label printing, consignment-status monitoring etc. Some partners of GW even made their payments to GW dependent on consignment-status information: every message saying 'Order delayed' reduces the amount to be paid.

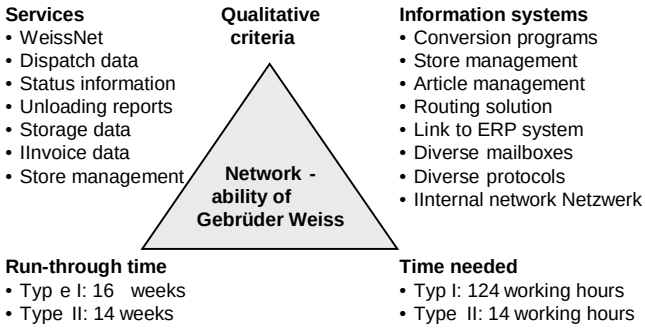

Fig. 3: Networkability of Gebrüder Weiss due to WeissNet

B. *Enhancing Networkability at Gebrüder Weiss*

Although WeissNet brought significant efficiencies and customer value, the system approaches the technological limits of its networkability. The long time required for linking up new partners is mainly the result of the software which has to be installed on the customer's premises. Frequently, many employees of a customer need to use WeissNet. In this case, GW has to install and maintain the software at several workstations. WeissNet necessitates on-site installation and release updates which require personnel and time and are therefore cost-intensive as well.

In a subsequent phase, GW is increasing its networkability drastically with an Internet-based system referred to as logistics browser. With this system, it is not necessary for employees of GW to install software on the customers' computers. The first time a customer logs into the new service, the locally needed software components are installed on the customer's client after a certification using the Verisign service. These software components are in the form of Java classes for screen masks, SQL commands, graphics, functions etc. Three minutes are needed for this and a maximum of two hours for linking up a new customer. Release updates take place automatically and therefore do not involve any extra work by the customer or by GW.

The logistics browser performs all the services of WeissNet and replaces WeissNet. With the logistics browser, GW can further develop or supplement the services continually and without much effort or costs. The most important new services include:

- *Proactive reporting*. In the case of incorrect orders, customers automatically receive an e-mail with all the relevant information. Customers can generally find out about any status change of any consignment automatically by e-mail.
- *Document management*. Directly after an order has been fulfilled, i.e. after delivery, the customer can use the browser to access delivery notes or invoices scanned in by GW.
- *Order input*. Small customers can use the browser to generate delivery orders (human-machine integration). Large customers continue to pass on their orders via EDI (machine-machine integration).
- *Back-end integration*. Large customers, such as Hewlett Packard use their own tracking & tracing (T&T) systems

and can obtain T&T information from GW via a CORBA compatible interface.

The logistics browser improves the qualitative and quantitative networkability of GW's design objects, namely products/services, process and IS. Within the first nine months, more than 180 customers were certified for the new system, much more than for the WeissNet in recent years. The challenge of networkability, however, remains. Although the progress in IT facilitates the use of IS, it contributes little towards increasing the networkability of people, company culture and organizational structure.

IV. Consequences for Management: Design for Networkability

Activities for designing a company's networkability have three basic effects: (1) Reduction of time and costs when new business relationships are established or when transactions are conducted, (2) reduction of the specificity of investments and increased flexibility of existing investments, and (3) improved opportunities for detecting and occupying new market segments at an early stage. These effects can be seen in various examples: the supply chain integration service of Riverwood International described above, the MarketSite.net procurement service of Commerce One [17], or the described services of GW.

Coordination theory is a useful tool which can be used to determine various possibilities of entrepreneurial action for increasing networkability (e.g. drawing up profiles of partners or designing application architectures) because coordination is a basic element for designing interorganizational relationships. Coordination theory regards coordination as the management of relationships of dependence and tries to identify generally applicable mechanisms for regulating these relationships [14]. When recommendations for action are formulated, *coordination mechanisms*, i.e. processes or rules which organize the relationships of dependence between tasks, are the starting point. In order to develop concrete ideas on the action to be taken, we interpret the coordination mechanisms more broadly as *rules for objects with the property of networkability*.

Different coordination mechanisms can be defined for each design object and these mechanisms form the basis for various alternatives of action. The following alternatives of action can be derived (Table 2):

- *Design of products and services.* [3] see the design of products as a very powerful but, up to now, rarely considered alternative of action for integrating value creation in networks. The most important coordination mechanisms include modularization, standardization and digitalization of products and services.
- *Design of processes.* Process coordination describes the consistent design of interorganizational processes of planning and implementation. The coordination mechanisms include process standards and the form of process integration. Standardized processes, such as those developed by OBI (Open Buying on the Internet) or CPFR (Collaborative Planning, Forecasting and Replenishment), reduce the effort involved in coordination and, in the ideal case, lead to integration on a pragmatic level or electronic workflows between anonymous partners. Main mechanisms of process integration are loose and close links of processes.
- *Design of information systems.* The networking of IS is the basis for designing new products/services and new business relationships. Products and services, processes and organizational structures thus depend on the networkability of the 'basis-forming' IS [19]. The most important mechanisms for increasing the networkability of IS are communication and data standards as well as the integration of internal information systems.
- *Design of organizational structure.* The organizational structure in the sense of the network topology describes the individual business units in a network. The coordination mechanisms of virtualization, modularization [23] and distributed responsibilities are used for designing different networking structures, e.g. dynamic, stable or internal networks [21].
- *Design of people's roles and company culture.* The role of the employees and managers in networks is distinguished from the roles found in classical hierarchies mainly by "an increase in the requirements for an ability to make decisions and assume responsibility for complete, customer-oriented processes as well as the capacity for teamwork, communication and innovation […]." [23]. The important coordination mechanisms are openness, the identification and control of goal-conflicts as well as trust-creating measures [cf. 11].

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Design object	Networkability of design object	Coordination mechanisms	Objectives of networkability
Products and services	Rapid and inexpensive individualization of products or services	Modularization Standardization Digitalization	Mass customization [12] Postponement [12]
Process	Rapid and flexible establishment and use of appropriately coordinated processes	Process standardization Process integration	Pragmatic integration Real-time coordination Appropriate flexibility
Information system	Rapid and inexpensive establishment of an individual communications link between information systems	Communication standards and data standards System integration	Semantic integration Making information externally available High data quality Real-time data processing
Organizational structure	Flexible organizational structures which enable participation in several different networks	Virtualization Modularization Distributed responsibilities	Internal networks Stable networks Dynamic networks
Culture and employees	Cooperation-promoting company culture and employees with the capacity for internal and external cooperation	Relative openness Identification and control of goal-conflicts Trust-creating measures	Autonomy Communicative competence Information acquisition Establishing and maintaining personal networks

Table 2: Approaches for designing networkability

The design areas are closely interlinked. Provision of a service or product for the customer, for instance, depends on numerous processes which, in turn, depend on the abilities of the people and IS involved. In addition, the modular design of products and services only leads to an increase in competitiveness if processes and IS support this modularization. The challenges encountered in the formulation of concrete alternatives of action for increasing networkability therefore are in the simultaneous coordination of several objects according to the method of concurrent engineering.

V. SUMMARY AND OUTLOOK

Business engineering enables the transformation of companies to adopt business networking strategies, business models and the 'underlying' information systems. The starting point is always a specific company which appropriately creates its customer and supplier network. This involves the exploitation of process efficiencies by means of electronic information exchange between partners (e.g. electronic order entry, exchange of planning data) and the development of new processes and roles (e.g. gateways, auctions, multi-vendor catalogs). We have argued that the transformation into an efficient Internet company requires coordinated measures in all dimensions of business engineering.

From the point of view of business networking, networkability has been formulated as a management variable in which these dimensions are combined as design objects. For increasing networkability, there are various alternatives of action, starting from the design objects. These alternatives depend on different coordination mechanisms. Two factors are especially relevant to management:

- The goal of networkability is to arrive at appropriate solutions so that the benefits of networking exceed the costs involved. Different criteria can be identified for assessing these solutions.
- Human resources are at the center of new networked products/services, processes, information systems and organizational structures. It is on the individual person that the quality and feasibility of the new solutions depend.

Whereas, today, only innovative companies possess a networkability which contributes to their competitiveness, the cost efficiency of Internet technologies as well as increasing standardization will lead to a general increase of networkability. Networkability will be incorporated in companies' strategies for achieving their objectives, in the development of project methods and in the operative controlling of projects and transactions. The criteria, objectives and coordination mechanisms will be developed further as business networking spreads. In the future, the

challenges to be faced will not just be encountered in the management of networking between organizations and processes but in the networking of everyday goods (consumer goods, raw materials etc.) that are equipped with chips.

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