

# The Virtual Enterprise

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## **Abstract.**

In this chapter, the concept of the virtual enterprise is developed. A motivating case at the beginning points to dilemma that acting manufacturing managers are facing. For the conditions of unpredictable change and dynamic markets the concept of the virtual enterprise is characterized, first, as a business model to create business value, second, as an operational model to co-operate temporarily and third, as an organizational model of restructuring. The concept of the virtual enterprise, then, is structured in three elements that form a coupled system, first, the business value that drives the change, second, the virtual operation that is temporarily configured to capture the value, and finally the network, that provides the platform for rapid restructuring. Contemporary manufacturing practices are placed in the context of the virtual enterprise to synthesize the development towards the enterprise of the global information society.

## **Keywords.**

Agility, Competition and Co-operation, Manufacturing Management, Manufacturing Strategy, Virtual Enterprise

## 3.1 INTRODUCTION

### 3.1.1 The Scenario

One morning, Mr. Jack, Director of Manufacturing, was called to the product division. It was the final point in a series of discussions his department heads had had about late delivery, poor manufacturing quality and overcost. Unfortunately, the discussions had not come to a solution. Manufacturing had declined all responsibility, pointing out that the poor quality of externally manufactured parts as well as last-minute product specification changes by the product department were the reasons behind these problems. As the director of manufacturing, Mr. Jack now had to avoid the risk of losing the lion's share of work for the factory and its 400 people. Since the profitcenter organization had been adopted some months ago, product divisions had become more and more demanding, behaving as "customers." Although the factory now had to compete with external suppliers, it lacked the skills to do so. The problem was not in technical competence or efficiency, which had been improved to world standard in the last years with several TQM programs including intensive Benchmarking and BPR. Instead, the factory did not have the marketing skills of external suppliers. The factory had been used to filling the master production plans, but had never marketed their competencies (a marketing function) or set up intensive relationships with different product departments and design teams. Thus, they could not get their foot in the door for new products. While making his way to the fourth floor of the main building, Mr. Jack went through his strategy to defend the performance of the factory and to regain his customers' confidence.

The meeting started out as he expected. The product department produced a long list of criticisms about the factory. However, most of these issues were not really the factory's responsibility. Instead, it seemed to Mr. Jack that the message behind these points was the search of the product department for a partner who could provide problem solutions. Mr. Jack listened to all the points. The meeting members went through technical drawings and design specifications. And, together, they sketched out possible solutions. Mr. Jack committed himself to solving the issues raised by the product department. After several hours of negotiation, the tension had cooled down and Mr. Jack could feel that the product department was willing to give him another chance. However, all would depend on fulfilling what he had promised.

By the end of the meeting, there was even room for some small talk and some thoughts on the general development of the factory as well as new product ideas. The product manager occasionally pointed to another pile of technical drawings lying on a sideboard. "This new tool machine would have been a great surprise at the next product fair, but the prototype failed and with only seven months to the fair, we do not have enough time to complete a new model. It is too bad; next year

will be too late.” Mr. Jack was interested. Obviously, the tool-machine needed at least 4000-h additional design. This time, along with the time needed for manufacturing and testing, made it impossible to complete the project inside the factory. But the manufacturing order would fit nicely into other capacities. Mr. Jack remembered that factories in the region, as well as other factories in the organization, had low capacity utilization at the moment. They would be happy to fill this order. So he asked for the predicted market volume for the tool machine. "We calculated 9 machines for the first year and a life cycle of 4 to 5 years," answered the product manager. Mr. Jack calculated the manufacturing hours for these machines. If he could meet this order, it would guarantee the existence of the factory for several years. The target price was not easy to reach and would need some thought, but he felt it would be worth trying. "Would you mind me taking the drawings with me?" he asked the product manager "I could give you an answer by next week." The product manager agreed.

On his way back to the factory, Mr. Jack recalled the unexpected change of this meeting. He went there to defend the actual work of the factory, and came back with new work, which could be a foundation for the factory for the next several years. But it was too soon to celebrate; there was still a lot of work to do. So he went to work on what to do next. First, he had to call a number of meetings. He thought of those people who could quickly solve the manufacturing problems. For some time, he had been involving both his department head and key operative people in problem-solving. Sure, initially it took more of his time and this style was unfamiliar to the hierarchy, but once people had committed themselves, solutions came more quickly. The same would be necessary for the new tool machine. To begin the project, he needed design competence, manufacturing competence and supplier management. The next day, Mr. Jack and his team met to analyze what had been achieved, what needed to be done, and, most importantly, how the tool machine could be structured in modules that could be completed by different partners. A first rough analysis took about two hours, then they decided to separate and work out a more detailed analysis for the second meeting. At the second meeting, they made the decision to start the project. A first round of contact meetings with the other suppliers was arranged for the following week. By the end of the week, Mr. Jack called the product manager to announce that he could deliver the re-designed tool machine within seven months.

### **3.1.2 Operations faces Dilemmas in its Organization**

Studying the above case with classical management approaches creates two main dilemmas.

#### *The Flexibility Dilemma*

The objective of classical operations management is to supply products. These products are specified in the strategic process and documented in the master production plan, which is forwarded to the operations function. Operations

management then optimizes delivery time and cost in breaking this plan down to detailed schedules. However, in the above case, Mr. Jack, the operations manager, takes the unpredicted new production order himself.

### *The Overhead Dilemma*

Operations creates value in both the labor performed and resources consumed. Thus, the organization should provide stable conditions for the operational core to create high added value with "direct labor" performed (Thompson 1967). Furthermore, information, document, work, and decision flows should be altered to optimize the material flow in the value or supply chain. However, the case centers on the increasing portion of activity no longer related to the transformation of material. In the case scenario, operations co-designs the new machine with their customer and organizes the network to supply it. However, both design and supply services result in increasing "overhead" rates that can often exceed the cost of "direct" labor. If no reward balances this effort, the "overhead" rates lead to competitive disadvantages with low cost suppliers.

This chapter focuses on the concept of the virtual enterprise. In the next section, the essence of this concept is established as the capability of dynamic restructuring for short term market opportunities. In the subsequent sections, the three basic elements of the virtual enterprise--the value of the market opportunity, the virtual operation and the network--are surveyed in more detail. After a discussion of the elements of the virtual enterprise, the dynamic processes of restructuring and appropriate management competencies are reviewed. The chapter concludes with a discussion of the further development of virtual enterprises and expected trends.

## 3.2 THE CONCEPT OF THE VIRTUAL ENTERPRISE

### **3.2.1 Definition**

The virtual enterprise is based on the ability to create temporary co-operations and to realize the value of a short business opportunity that the partners cannot (or can, but only to lesser extent) capture on their own.

### **3.2.2 Key Characteristics of the Virtual Enterprise**

The purpose of the virtual enterprise, as defined here, is to provide a new solution for an unpredicted opportunity. Therefore, the enterprise is more of an action, rather than an institution. The virtual enterprise is nimble: quick to grasp the new opportunity and create the solution. This feature leads to three characteristics of virtual enterprises.

*In the virtual enterprise, value is created, not added.*

First, the goal of the virtual enterprise is to create value from changing opportunities in its environment. This feature makes the virtual organization distinct from traditional management approaches. For F. Taylor, the essence of scientific management was to increase individual efficiency, measured as output per labor unit. He assumed tasks to be given and showed how avoiding waste of labor time could create additional value. His case was to increase the amount of pig iron handled by an individual from 12 to 47.5 tons per worker and day. The added value then was shared with the worker, whose wages were increased by 60 percent (Taylor, 1911). For organizational science, the essence of an organization is to increase the efficiency of the organization (Barnard, 1952). Division of labor and co-ordination are the parameters to be designed (Mintzberg, 1979), taking into account the interdependencies that can hamper the execution of tasks. In this sense, the goal of scientific management on the individual level matches the goal of organizational science on the corporate level. However, this is not the source of value creation in the virtual enterprise. As we have seen in the introductory case, the new solution that Mr. Jack creates for his customer is the source of value to be created. This new opportunity as "economic motor" can be fueled from different sources (Schumpeter, 1943). For example, it can stem from;

- a new market,
- a product or technology innovation (Teece, 1986), or
- a new industrial co-operation (Axelsson, 1989).

As in the introductory case, where the new tool-machine could only be achieved with a new co-operation of partners, the confluence of more than one source of value can create strong opportunities as

- a favorable constellation in the competitive environment (Savage, 1996; Pümpin, 1995).

The virtual enterprise has the ability to identify these opportunities, which require a distinct set of methodologies.

*The virtual enterprise is a temporary co-operation to achieve objectives.*

Second, the virtual enterprise is an alternative way to differentiate and integrate work under dynamic conditions. To capture a new opportunity quickly, co-operation between distributed sites is necessary. This co-operation is structured for a limited period of time, with a limited purpose, and with a minimum of overhead for coordination. Again, this feature makes the virtual enterprise distinct from existing paradigms where stability supports task execution efficiency. In traditional management approaches, organizational routines, bureaucracies, strategies and planning procedures protect the operational core from the uncertainty of the changing environment. In contrast to these approaches, the introductory case shows how Mr. Jack has brought together a team of internal and external operational people to develop a solution for the new tool machine. In this scenario, the

operative core was not only exposed to external uncertainty, but also took an active role in creating the new machine and building the industrial structure to manufacture it. As we have seen, Mr. Jack's departure from a traditional hierarchical role facilitated co-operation. In a virtual enterprise, then, the operational structure is closely linked to its adaptation to the new opportunity. The managerial issue in the virtual enterprise is to develop the routines for this structural innovation.

### *The virtual enterprise facilitates permanent restructuring*

Finally, if the virtual enterprise is permanently adapting, it follows that solutions to support it must share dynamic characteristics. For Schumpeter, it is the entrepreneur who provides innovation of industrial structures with the process of "creative destruction" (Schumpeter, 1943)

Although the entrepreneur provides innovation, this innovation must be translated into systematic routines for change. This translation represents another difference between virtual enterprises and traditional organizational approaches. Positions, job profiles and organizational charts all describe elements of the organization at one *point in time*. However, restructuring is a *change-process over time*. In this new context,

- the "size" of the organization is a moment in the process of "growth" (Penrose, 1968),
- transactions are embedded in their relationships (Williamson, 1975),
- the virtual operation is a temporary configuration that is frequently re-configured, and
- the "skill profile" is a momentary state in the "learning processes" (Clark and Wheelwright, 1993).

In other words, we define the enterprise from its maneuvers rather than from its command structure, from the operations rather than from the organization. For acting managers, the virtual enterprise provides recognizable patterns of change over time.

## 3.3 THREE ELEMENTS OF THE VIRTUAL ENTERPRISE

The virtual organization is restructured from within, with the goal of capturing value from short-term opportunity. Three basic elements define this system: 1) the value that is the opportunity or reason restructuring takes place, 2) the virtual operation or result of restructuring and, 3) the network, or source of restructuring (Figure 3.1). In the introductory case, Mr. Jack identified the drawings as a valuable business opportunity for his own factory as well as the network of external partners. Within one week, he and his team created the virtual operation to deliver the machine within seven months.

The following section discusses how the three elements--value, virtual operation, and network--contribute to the success of the virtual enterprise (Figure 3.2). These elements can be implemented in numerous forms and methods. We examine several of these to indicate the nature of the virtual enterprise. After a discussion of the three elements, the chapter provides a review of the processes of restructuring and the management competencies for the virtual enterprise.

### The Essence of the Virtual Enterprise



Nimbleness, is the capability  
to thrive on unpredictable change

**Figure 3. 1** The essence of the virtual enterprise is restructuring from within

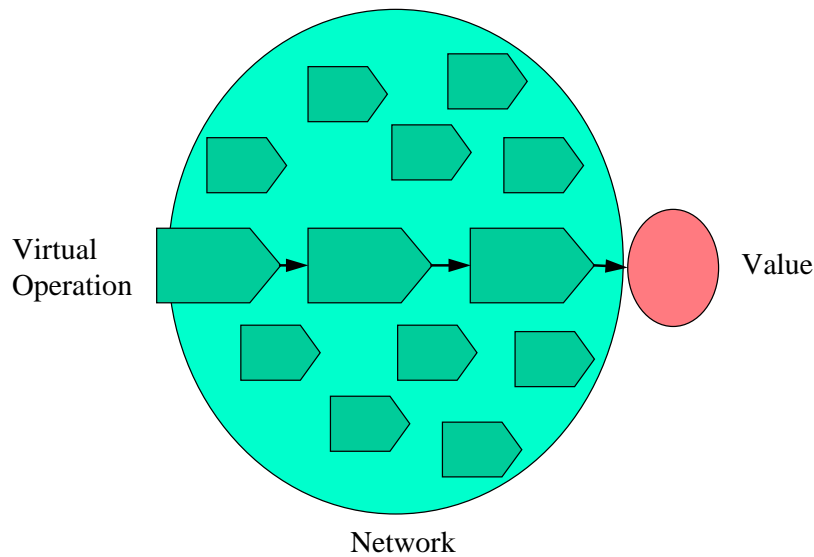
#### **3.3.1 Value: The Motor that Drives the Virtual Enterprise**

Potential value is the force that drives the virtual enterprise to restructure. This value is that which is embodied but not yet exploited in temporary constellations of (future) markets and the network.

##### *Value in situations of dynamic competition*

The source of value for the virtual enterprise is the proactive exploitation of dynamic competition rather than the transformation of raw material into finished products. In the traditional view, value is created in the form of labor performed and resources consumed (Norman and Ramirez, 1993), both of which can best be achieved under stable conditions. In contrast, the virtual organization is an organizational structure that supports entrepreneurial innovation to create new

industrial structures from competencies, resources and partners that have never existed before. Thus, value is created in the virtual organization when new opportunities are identified and new industrial structures are implemented to exploit these opportunities. To understand new opportunities, we first examine potential sources of value identified in empirical literature. We then discuss virtual operations as a temporary industrial structure designed to exploit these opportunities.



**Figure 3. 2** The Three Elements of the Virtual Enterprise

*Potential sources for dynamic value*

1. Dynamic value can be created through several forms of customer-focus strategies.

- Customer-individual products

Customer-individual products represent one potential source of value under dynamic competition. The customer-individual product is an alternative to globally fierce competition for products that can be purchased off-the-shelf. Since highly automated production and technology availability have affected management impact on competitive advantage, customer-specific solutions can create value for an organization. Simultaneous engineering and product co-design with the customer both build entry barriers for competitors with specific products that are difficult to imitate.

- New industrial services

A second source of customer value can come from new services. For example, an elevator company reports that the margin on their elevators is about 2 %. But they sell availability of the elevators as a service. To achieve this service, elevators have been equipped with self-diagnostic systems that identify potential failures and automatically connect to service technicians before the failure occurs. Efficient service operations have been designed (e.g., using remote diagnosis) so that the technician only needs one visit to maintain the device. The solution is reported to generate an 8 % margin.

- Market development

A third source of customer value is market development. For example, in consumer markets, Diesel Casualwear SA (Bielle, 1997) creates customer value by creating a "Diesel Planet" lifestyle, with the marketing of casualwear only one element of this lifestyle. To this end, a Diesel detergent has been sold, which has no manufacturing synergy to textile operations. In general, 40% of the turnover is spent in communicating the "Diesel Planet" lifestyle.

From a manufacturing point of view, customer-individual solutions create complexity and numerous variants. One company uses mass customization (Pine, 1993) and flexible manufacturing (Upton, 1995) to cope with this complexity. However, as the case of Diesel shows, virtual operations provide an additional range of options. Diesel concentrates on creating market opportunity without in-house manufacturing. Diesel designs the customer solution and restructures virtual operations from the manufacturing service provided by partner companies. In other words, virtual operations are used to provide a manufacturing lever to the customer focus strategy.

2. Another potential source of value in dynamic competition is the offering of specific, difficult-to-imitate manufacturing service. To achieve a world class level of manufacturing services, organizations adopt:

- focused manufacturing (Hill, 1993). This strategy leads to competitive advantage through manufacturing excellence (Wheelwright and Hayes, 1985).

From this perspective,

- concentration on core competencies (Prahalad and Hamel, 1990) guarantees world class standards.

The relevance of the virtual enterprise for focused strategies in dynamically changing environments is obvious. Concentration implies that all activities that do not contribute to the core must be outsourced. The resulting business relations can be described by the metaphor of a dynamic network. This view characterizes the virtual enterprise as a consequence of managerial concentration. The virtual enterprise provides, first, demand for the manufacturing capacities and, second, varying contexts of application that further the development of the manufacturing

service. In other words, virtual enterprises provide a marketing lever for the strategy of focused manufacturing for dynamic competition.

3. A third source of potential value for the organization is the:

- specialized service provided for the network.

For example, Electrolux developed the competence of restructuring undermanaged companies. It then applied this process to a large number of companies in the industry (Pümpin, 1995). In this case, multiple application of the restructuring service was possible only from within the industry. The value that was exploited existed in the form of management deficit. In other words, virtual enterprises can be used to implement an interactive network strategy.

#### *Value is created with effective virtual operations*

Potential value drives the restructuring of virtual operations. Extending this principle, we expect that virtual operations will be highly differentiated. Thus, virtual operations will be most appropriate for the market opportunity they have been created for. Indeed, within virtual enterprises, a number of new industrial structures are observed, which are independent of the traditional physical supply chain. For example,

- the media value chain for the telecommunication industry can be seen as an analogy for the physical value chain, with necessary steps to deliver entertainment through content development, packaging, distribution, advertisement, and customer access (Philips, 1997).
- Similarly, digital business can be viewed as a substitute for physical sales, in the form of internet-communities (Armstrong and Hagel, 1996).
- Finally, electronic virtual markets with virtual marketing channels (Benjamin and Wigand, 1995) represent a new locus of value creation in the virtual market space (Rayport and Sviokla, 1995).

These examples illustrate that the virtual enterprise can be an appropriate structure to explore the emerging opportunities for creating value in the information society. They also illustrate the impact of the virtual enterprise on specialization within an organization. That is, when value drives the restructuring of virtual operations, a new pattern of specialization for the individual company can be expected. As the above cases show, there is a trend towards unbundling value components in both market communication and manufacturing.

- De-coupling of virtual operations for each value component can be observed  
Within the virtual network, specialized partners provide services. This specialization, or de-coupling, can be seen in the pricing process for the Dutch flower auction, where prices are derived from the logistics of flowers (Heck and Ribbers, 1997). The operations in this case are distributed among different partners in the network for the pricing process in the auction and the logistics process of

flowers. The value created by the auction is to provide good prices, leading to more transactions. The value of logistics is to deliver flowers kept fresh through constant cool temperature and quick transportation. Today, flowers are transported to the auction hall to be physically presented to buyers for pricing. De-coupling operations, in this case, means releasing auction transactions from slow logistics and releasing logistics from transport delays. Another example of decoupling is the case of a global manufacturing network where customer interaction is de-coupled from the flow of goods. In this case, a regional sales point may win a contract to supply parts to a global customer. These parts may be delivered to a different region of the world, or manufactured and shipped by other partners in the network. However, traditional sales margins on shipped physical products, in this situation, would prevent the restructuring of virtual operations.

- New reward systems are required to capture value.

In this case, the sales point that wins the contract would prevent margin loss through its logistics process. In other words, with a new pattern of value creation, a new pattern of reward distribution must be designed that allows partners to capture the value of virtual enterprises. For the case of network manufacturing, this need may result in a change of the transfer pricing systems.

### **3.3.2 The Virtual Operation**

Virtual operations are processes that combine competencies and resources for the period needed to realize the value of a business opportunity. Since the efficiency and effectiveness of the virtual operation represent the core of the virtual enterprise, both terms are sometimes used interchangeably.

#### *Opportunities and risks of virtual operations*

To be competitive, the virtual enterprise must provide operations as competitive as those in a traditional enterprise. However, virtual operations do not incorporate most of the attributes of the traditionally-integrated operation. Indeed, most descriptions of virtual operations point out which attributes to avoid (Scholz, 1996) rather than which features the organization should adopt.

- Virtual operations are a form of intensive outsourcing.  
"Would not it be wonderful to run a profitable enterprise without doing the work?" asked Semich (Semich, 1994). An example of this philosophy can be found in Tomasko. Lewis Galoob Toys is an organization that in 1985 achieved about 50 Mio \$ turnover with only 100 employees. They accomplished this task by getting toy ideas from independent inventors, having the toys manufactured in Asia, then shipping, selling, and billing through independent partners in the US. This case shows that neither
- traditional hierarchies nor

- a legal "roof" in ownership are prerequisites for virtual operations between globally-distributed partners.
- Traditional business relationships are expected to be replaced by full-enclosure information and communication technologies.

For Upton, the real virtual factory (Upton, 1996) is thought of as an enhanced Internet with information brokers who plan and control virtual operations via computers. Virtual organizations, then, perform like a switchboard for drag-and-drop-connecting resources (from the virtual network) into integrated virtual operations. This organization form represents the ultimate in flexibility,

- substituting for lengthy trust-building processes (Miles and Snow, 1986).
- As a corporate model, virtual operations free management from the burden of resource ownership without losing the economic availability of these resources.

Although virtual operations provide distinct advantages, they also carry risk, through the loosening of traditional managerial certainties in the context of "globalization" and the emerging "information society." However fascinating virtual operations may seem, to neglect that virtual operations are embedded in their organizational setting may lead to hasty decisions. The hollow organization (Business Week 3.3.1986) loses its critical success potentials for sustainable competitive advantage when it abandons organizational structures and management competence.

### *Integrating virtual operations*

The virtual operation is integrated to capture the value from a business opportunity. In contrast to the traditional hierarchy, virtual operations cannot (and do not want to) rely on pre-existing vertical integration. Instead, integration within the virtual context requires a set-up process, similar to the set-up for a project. The success of the virtual operation depends on the degree to which independent partners can be unified for the time necessary to capture the value of the business opportunity. Successful integration of virtual operations requires several conditions.

- First, to unify a virtual operation, partners must have a commitment to the common effort.

This commitment can stem from sources ranging from pure opportunism (Byrne, 1993) to a win-win mentality (Preiss, Goldman and Nagel, 1996). Regardless of the reason, maintaining this commitment to the goal is the core of management competence for virtual operation integration (Bleicher, 1997).

- Second, although integration of the virtual operation is bound to the life cycle of the business opportunity, partners should preserve the knowledge and relationships gained from the experience.

Virtual operations will be successful to the degree to which partners can retrieve this common body of knowledge in the network platform for the start-up of

future virtual operations. Thus, highly integrated virtual operations complement the lowly integrated virtual network (Katzy, 1997).

- Third, integration of the virtual operation is strongly determined by governance among the peer partners (Snow and Thomas, 1993).

Governance may come from shared values (Goldman, Nagel and Preiss, 1995), trust (Byrne, 1993) or general harmony (Taylor, 1911). However, where such conditions are not given, explicit governance structures may be necessary to achieve a limited harmony among the partners. This may be, for example, an enforced professional standard, which can be implemented by an assessment of business practices. Other governance instruments are co-operation institutions, such as management roles (Schuh, Katzy and Eisen, 1997) or common boards (Davies, 1995), or even markets that limit partner harmony to narrow market mechanisms. It is a management task to design and implement the right profile of integration for the virtual operation.

#### *Operating virtual operations*

Successful virtual operations represent effective and efficiently-integrated partner activity. In other words, these operations are based on the partners' competence in working together apart (Grenier and Metes, 1995). Virtual operations mark the integration of trends in developing efficient or lean (co-) operations. One trend is business process re-engineering.

- Within the organization, business process re-engineering (Hammer and Champy, 1993) overcomes functional silos through the re-design of business processes that cut across existing departmental boundaries.

This approach applies as well to co-operations with suppliers and customers across existing organizational boundaries in inter-organizational processes (Brooks and Reast, 1996).

- A second trend marks the role of information in organizations. Innovation in information technology has moved from early local automation of isolated business functions with stand-alone applications to network-wide integrated information infrastructures.

Entire new business processes now become possible from the perspective of information management. Analogous early EDI-applications (and future www - applications) provide technologies for interorganizational information infrastructures and create the opportunity to re-design the information flows of entire business networks (Venkatraman, 1994).

- Finally, a development from transport optimization between two sites towards integrated logistics and supply chain management (Christopher, 1992), and efficient consumer response (retail) has taken place.

*Two common principles can be found*

As these trends merge, two common principles for organizations can be identified.

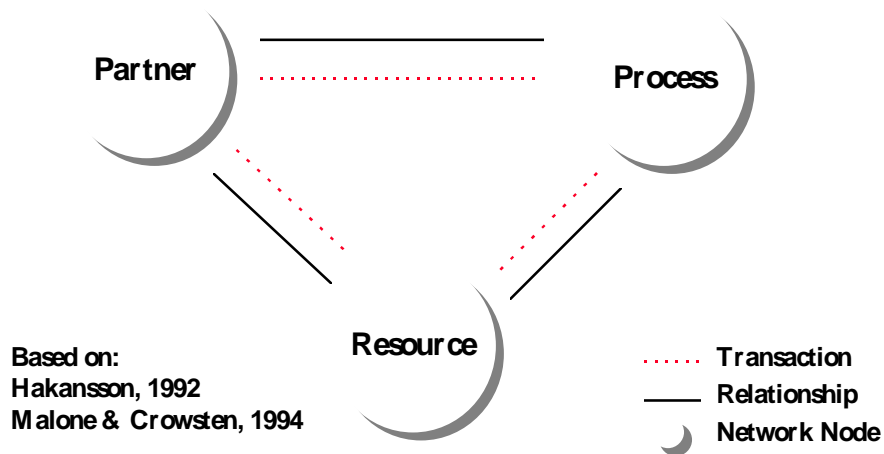
- First, the system boundaries for optimization have been extended to the entire value chain.

The objective of improved central planning is to reach the total optimum in the value chain rather than local optima in each company. Narrow functional optimization strategies within the existing functional disciplines are overcome by more balanced or holistic approaches.

- Second, the flow principle of operations has become more relevant than the company hierarchy. In other words, it has become more important to identify what is done, rather than who does it or what structure is given to it.

**3.3.3 The Network: A Pool of Partners**

Entrepreneurial manufacturing strategies are particularly successful when existing industrial structures can be reconfigured for new opportunities. Relationships with partners, pre-existing resources as well as routines and processes from the network model can be reconfigured (Figure 3.3).



**Figure 3.3** A network model

### *Virtual entrepreneurs exploit the potential of the network*

When networks can be used for a new market opportunity, they can reduce the specific investment for the market opportunity. Setting up resources and processes from scratch and building the necessary competencies limit market penetration. Therefore, fast growing companies draw on existing industrial structures to feed their growth. Electrolux, for example, made its way from a regional SME to a world class company through acquisition of undermanaged white goods companies, restructuring and integrating them into the Electrolux distribution system (Pümpin, 1995). Textile companies, such as Diesel or Benetton, do not manufacture, but draw on the regional network of Prato in northern Italy to select from 7000 small suppliers, enabling them to provide four collections per year (Ritaine, 1990). It should be noted that the networks in these examples exhibit multiple facets and characteristics. Furthermore, their boundaries are defined by varying criteria. Therefore, to identify and exploit the virtual network, it is useful to develop a checklist of relevant network criteria and boundaries from theoretical and empirical literature.

### *The facets of networks*

- One facet of the network in the virtual enterprise is that geographic regions regain importance in the global information economy.

As we have seen from Prato, the region is the relevant boundary for the networks of small companies. Piore and Sable (1984) have rediscovered traditional European craft traditions as models for the post mass production structure of industry. Popular as well as historical examples of regional industrial structures are reported from the Japanese keiretsu, the Italian industrial district of Prato, and the German guilds. Within a region, business often is a heritage from ancestors in long chains of tradition. This distinction reduces workforce mobility for the business. A strongly-coupled system of manufacturers, suppliers, toolmakers, professional schools, and entrepreneur organizations with frequent and intense contacts creates an idiosyncratic regional competence that cannot be easily copied elsewhere. This competence is a source for innovation. Silicon Valley and Hollywood are further examples of highly innovative regions, illustrating that regions can emerge in short periods of time. In the information age, this model regains importance, leading managerial and organizational theorists to exploit it as a source of continuing global success (Piore and Sabel, 1984).

- Second, network boundaries can be derived from industry boundaries.

Miles and Snow (1986) propose dynamic networks as a strategic framework to exploit additional strategic possibilities from co-operation within the industry. Co-operations exploit the comparative advantages that stem from the specialization of successful companies in three types of generic strategies: the prospector, the analyzer, and the defender. The dynamic network model builds on the widespread model of competitive advantage (Porter, 1985). From a distinct strategic position,

the broker uses the instrument of the network as an effective organizational form to create value in the industry (in new niches, demand pockets) and to capture value for the individual company. Dynamic networks revitalize (Miles and Snow, 1986) the industry, restructuring from within.

- Third, the relevant network boundary may stem from an ownership or holding structure, especially for big multinational companies.

The network emerges as the decentralized form of the (former) integrated company. ABB, Nike, Puma and IBM are frequently-cited examples of this phenomenon. From this perspective, the network organization marks a further step in the development towards more organic organizational forms, from the integrated, divisionalized, or matrix organization to the new or networked N-form.

- Fourth, from a marketing perspective, networks can function as a metaphor for valuable industry relationships.

The Stockholm School of Economics has studied the success of comparably small Swedish companies in global markets since the 1960s. Hakansson (Hakansson, 1992) explains this success by the companies' competence in building, maintaining and using relationships with customers and suppliers. From this point of view, he creates a model of industrial networks. These networks have no boundaries or lifecycle. Instead, they represent the memory of all activities among the business partners as a valuable, scarce and difficult-to-imitate business capital. This type of network can be exploited in two ways. First, close relationships or intense networks allow for exploitation and second, the networks can be restructured to fill "structural holes," (Walker, Kogut and Shan, 1997) as in the linking of the Swiss watch and telecommunications industries.

- Fifth, information and communication technology's strongest impact is that it connects individuals worldwide through computer networks.

From this point of view, geographically-distributed individuals form virtual teams and virtual business networks (Venkatraman, 1994). Connected into an extended enterprise by the Intra- and Extranet, individuals can co-operate over globally-distributed sites. Today's worldwide infrastructure allows quick establishment of contact partnerships. However, these networks require boundaries to achieve reliable information sharing, protected from external penetration.

The above characteristics outline the elements necessary for a network to exploit the potential of existing industrial structures. However, in addition to successful network characteristics, entrepreneurial judgement and management competencies are needed for successful restructuring of the virtual enterprise. The leverage of dynamic networks, for example, needs to be carefully assessed in industries with blurred boundaries, such as home entertainment and telecommunications. Secondly, the degree of decentralization within many companies and the intensity of external co-operations has washed out many organizational boundaries. Additionally, regional networks, which have strong

potential as an industrial structure, need a corollary for co-operation in the global economy. For example, when a regional company has strong global relationships, its resulting networks can overlap. This overlap is favorable for the virtual enterprise.

With the three elements of the virtual enterprise identified, the scene is set to review the process of restructuring, the core of the virtual enterprise.

### 3.4 ROUTINES OF CHANGE IN THE VIRTUAL ENTERPRISE

The virtual enterprise is based on the ability to create temporary co-operations and to realize the value of a short business opportunity. Thus, the virtual enterprise is a dynamic concept. In other words, the change processes over time of its temporary structures distinguish the virtual enterprise. Dynamic thinking cannot be grounded in stable structures. The concept of the virtual enterprise, therefore, leads to observable patterns of change over time, or routines of change. Thus, the concept of the virtual enterprise raises several questions about change.

*First, is the virtual enterprise a deliberate strategy or a reaction to an emerging opportunity?*

When an opportunity emerges, the virtual enterprise provides access to capacities and scarce competencies, which (especially for small and medium-sized companies) are a means to gain "virtual size." However, larger companies such as Puma and Nike are also cited as examples of virtual enterprises. In this case, the two companies are focal players--the strategic center of their networks. They create market opportunity, design and re-design their strategic network and coach individual suppliers in developing competencies. For these corporations, "Buy" (in the virtual network) instead of "Make" is a deliberate strategic option for flexibility.

*Second, is an encompassing management needed or can virtual enterprises rely on pure self-organization?*

Empirical literature on virtual enterprises provides contradictory results. For some researchers, the virtual enterprise is an approach for achieving high efficiency in inter-organizational supply chains. Supply Chain Management (Christopher, 1992) and Efficient Consumer Response (ECR) are seen as early examples of virtual methodologies and tool sets. From this perspective, the focus of development is to improve inter-organizational co-ordination and control. Integration of information flow (e.g. EDI) and material flow creates transparency in the entire value chain and reduces waste and doubles effort in the virtual enterprise. However, for others, virtual enterprise means self-organization. For example, in Hollywood, a number of agents provide the solution for each task in a film. Using professional standards as a basis, workers self-coordinate (Goranson, 1997). There is no central planning or

management. Instead, co-operation emerges spontaneously from markets. Natural selection of those workers that do not perform guarantees quality in the long run.

The above questions are important considerations to which a one-size-fits-all solution should not be expected. However, the concept of the virtual enterprise provides the chance to improve dynamic restructuring through analyzing the routines of change.

*Four building blocks of change processes help us to understand routines of change (van de Ven and Poole, 1995)*

- Lifecycle, which is a linear sequence from birth to death, of a system's immanent change,
- Teleology, which assumes that the final cause of change is a purpose and that change processes proceed from the identification of goals towards a goal,
- Dialectic, which is based on a pluralistic view of the world, where contradictory interests compete for domination or win-win situations, and
- Evolution, which is taken from the biological model of change as a continuous cycle of variation, selection and retention.

In the virtual enterprise, several basic patterns of change are active concurrently. As in the case of Mr. Jack, long-term relationships evolve with partner companies, which can be activated for short term restructuring to realize an unpredicted opportunity. Mr. Jack planted the seeds for new opportunities in his relationship with the product department when he managed to settle the conflicts in the active project. From the basic building blocks of change, routines of change can be constructed, which have distinct characteristics. Different time frames, for example, apply to the routines of short-term restructuring of a virtual operation on the one side and the long-term evolution of relationships in the network on the other side. Yet, as good relationships were in place when Mr. Jack needed them, both processes can be mutually supportive for outstanding business success. In quantum physics, this effect is called virtual material. That is, when material is created for a short period of time, it has greater mass than would be possible under the classical physical law of material continuity. This phenomenon is produced by synchronization of high-energy processes. The potential of the virtual enterprise, in analogy, is to temporarily create stronger business success than would be possible under normal economic conditions, by synchronizing routines of change.

Three routines of change seem to have strong impact on the success of the virtual enterprise: 1) customer interaction, which links the virtual enterprise to the changing business opportunity, 2) the routine of restructuring, which permanently (re-)creates the virtual operation, and 3) the evolution of the network. The three processes are examined below.

### 3.4.1 Customer Interaction

Quickly grasping a new opportunity requires systematic processes to identify that new opportunity in the environment. New forms of past customer interactions facilitate the creation of the virtual enterprise.

#### *Supply chain integration versus virtual enterprise*

In the virtual enterprise, close integration with customers is one form of customer interaction. It is the objective of the virtual enterprise to improve the overall efficiency of inter-company processes for a given purpose and shared reward. Supply Chain Management (SCM) and ECR are examples of methods that follow a teleological pattern. For a specified goal, such as placement of a well-known brand (e.g., Coca-Cola) in big retail chains (e.g., Aldi, Albert Heijn), the operation is designed and implemented in all facets, including communication technology (EDI), governance institutions and organizational structures. The operation is a stable chain where the network extends to the partners involved in the supply chain. This inter-organizational structure does not include restructuring capability. Instead, the supply chain requires long brand name lifecycle. However, demand flexibility can be efficiently covered.

#### *From mass-customization of products to process configuration in the virtual enterprise*

With the fragmentation of markets and decreasing product lifecycles, methods have been fine-tuned, so that remaining demand pockets in fragmented markets can be reached with an increased number of customized product variants. Manufacturing has reacted to this increasing number of different products by increasing the flexibility of production systems to mass-customize (Pine, 1993), or manufacture small lots of product variants within a mass production system. With this system, the goal is to structure many individual products with short lifecycles into product groups with longer lifecycles. Operations, then, covers the product flexibility of all targeted variants, following a teleological pattern of change. In the virtual enterprise, in contrast, the business opportunity is seen as an evolving, and thus unpredictable, event. From the evolutionary pattern of change, it can be concluded that the virtual enterprise must select from varying business opportunities and adapt to the chosen opportunity. The virtual operation, then is a process created for the opportunity. Flexibility and change in the virtual enterprise exist on the process level.

#### *Co-design with the customer in the virtual enterprise*

For some researchers, virtual enterprises support strategic opportunities beyond reaction to product lifecycles. They see business opportunity as following a dialectic pattern of change. From this perspective, the value in the opportunity is co-created through dialogue with the customer. Prosumer, a term that merges "producer" and "consumer," identifies the dynamic development of a business

opportunity and the parallel restructuring of the virtual operations. Co-makership or co-design (Preiss, Goldman and Nagel, 1996) are further concepts that build on creating additional value in dialogue with the customer. In other words, the value in a business opportunity is not the absolute value of a product on a shelf, but the relative value in a specific context. Specialized partners play an active role for this customer interaction process. Diesel, for example, spends 40% of the price of a pair of jeans in communicating the lifestyle of the "Diesel Planet," which is closely linked to the consumer community through feedback cycles such as trend scouts, who live with customers and report emerging styles. Test marketing ensures that the new collection will be accepted by the community of the Diesel Planet. This approach is used in other areas as well. For example, industrial networks were found to be a source of success for the Swedish industry during the 1970s and 1980s (Easton, 1992). In industrial markets, User Groups serve a similar purpose. On-line communities (Armstrong and Hagel, 1996) transform this development into the electronic space.

In the introductory case, Mr. Jack created the new business opportunity in his customer interaction with the product department when he solved the problems and engaged in co-creating the new tool machine.

### **3.4.2 Permanent Restructuring**

Restructuring is the core of the virtual organization and is thus expected to be an organizational model for success (Flaig, 1993) in dynamic competition. Restructuring processes range from deliberately managed organizational change to the instant opportunistic switching of resources.

#### *Restructuring virtual operations by market mechanisms*

In restructuring, market mechanisms become important for the virtual operation (Miles and Snow, 1986). Markets are an efficient means to allocate resources to evolving business opportunities with no hierarchical overhead or central management. Here, the classical economic metaphor of market mechanisms as the invisible hand regains popularity as the coordinator of change. In other words, the creation and management of the market (which in the virtual enterprise is a specific network of partners) is excluded from reasoning. Transaction cost economics (Williamson, 1975) calculates the cost for market transactions, such as searching the right partner or specifying the transaction. These costs are also relevant for restructuring in virtual operations. However, information and communication technology will reduce this kind of transaction cost in the information age, leading to more market coordination in virtual organizations.

#### *Restructuring virtual operations electronically*

Restructuring in the virtual enterprise can be achieved through computers. Tapscott suggests that as information shifts from analog to digital, physical things can become virtual (Easton, 1992; Tapscott, 1996). According to this view, the real

virtual factory is an enhanced Internet with a new breed of information brokers that realize the CIM-vision of computerized modeling, simulation and planning of operations (Upton, 1996). New technologies such as virtual reality and artificial intelligence automate the restructuring of virtual operations. Yet, it is still too early for empirical and business experiences to indicate reliable routines for change based on information technology.

#### *Restructuring virtual operations as a management issue*

Despite information technology advances, restructuring virtual operations and their networks remains a human task. Miles and Snow (1986) identify and personalize the broker as the Designer of the Network. In their view, the business value does not emerge, but is strategically set. The broker's objective is to prescribe new strategic opportunities to revitalize the existing network, which is the industry. To overcome the lifecycle of the industry, the broker interacts with the partner in the network in designing temporary new organizational forms.

### **3.4.3 Evolution of Networks**

In some cases, like Prato in Italy or the watch industry in Switzerland, the network as a platform for the restructuring of virtual operations has evolved from a long-term, historical process, with only recent attention paid to business value. In other cases, networks have emerged in shorter time-periods. However, the evolutionary pattern of change in the network, its formation as well as the change of its governance structures, requires a considerable time horizon.

#### *Trajectories in the Formation of Networks*

Network formation can exhibit several different evolutionary trajectories.

- Intensified co-operation of small- and medium-sized companies with broad objectives.

Intensified co-operation can evolve from single projects or successful joint ventures between partners. More dynamically redefined co-operations can emerge that lead partners to provide a framework for the partnership in setting up membership regulations and common business rules. Many companies are members of pre-competitive co-operations (e.g., for sharing infrastructure or qualification programs). These networks can be expanded for use in common entrepreneurial activities. Furthermore, networks are not always driven by companies. Other institutions, such as governmental programs or university grants, with a goal to stimulate economic activities, play an important role in the evolution of the networks.

- Restructuring of industries with intensified vertical co-operation.

Manufacturers in fragmented industries, such as the automotive or telecommunications industries, are restructuring their supplier relationships.

Intensified network relations are established with a few "preferred" suppliers, which frequently engage as Tier 1-suppliers in the design and supply of entire subassemblies of the product (Davis, 1994). Tier 1 suppliers take over new functions, such as design, purchasing or service, requiring more frequent vertical coordination with other suppliers. Tier-1 suppliers are not only members of a network; they can also create and lead their own networks of Tier-2 and Tier-3 suppliers in a similar fashion. Networks in this situation are frequently driven by engineering infrastructures to share product specifications, CAD data or NC-programs and MRP data.

#### *Development of Governance in the Network*

Restructuring draws on the achievements in the evolution of the network to contribute to this evolution. If there is an open and honest sharing of views, expectations, ethics, and values (Goldman, Nagel and Preiss, 1995) or simply trust (Byrne, 1993; Davies, 1995), organizational regulations and hierarchies become superfluous. Because there is an incentive to solve problems in a mutually suitable way, restructuring is easy. Trust, then, is an assumption for virtual enterprises, much like general harmony (Taylor, 1911; Semich, 1994) was the assumption of scientific management, where the rational man (Schein, 1984) was considered easy to manage since he pursued only one objective--to earn money. However, an emerging literature views trust not as a prerequisite, but as a result of successful managerial action that must be built into the partner network (Handy, 1995). Over time, trust emerges from the socialization of partners in the network as well as emerging professional standards (Snow and Thomas, 1993). Thus, explicit governance institutions, such as common boards, associations, or partner assessments, can moderate the evolution of the network.

### 3.5 TWO EXAMPLES

#### **3.5.1 The virtual factory in the Region of Lake Constance**

The objective: In a project called 'Virtual Factory', more than thirty companies in the Lake Constance region joined to develop new entrepreneurial solutions to gain competitive advantages for their industrial region through dynamic cooperation.

The background: Production in this traditional region of precision mechanics was faced with constantly intensified pressure to reduce costs to remain competitive with cheap suppliers from East Europe and Asia. Global competition was perceived to increase demand flexibility and, by extension, to reduce average capacity utilization. In this situation, companies had been reacting with decentralized organizations in profit centers. For operations management, in this situation, there was a challenge to acquire new entrepreneurial skills for dynamic competition.

The concept: To prepare the basis for the creation of a virtual factory, reciprocal confidence had to be created in the regional network. This basis for

reliable behavior among the partners was a set of explicitly accepted "rules of the game" with a definition of the "roles" and responsibilities that individual partners would play in the virtual factory.

Six different kinds of roles were developed in the course of the prototypical manufacturing in the network of the region of Lake Constance (Figure 3.4).

**The broker:** He is responsible for the marketing of the network and for the sale of the competencies of potential virtual factories. He is the entrepreneurial person responsible in the early phase of a virtual factory, functioning as a broker between customer and production in the acquisition of new project products.

**The competence manager:** He provides knowledge about available technologies and competencies in the network to the customers. He is responsible for the configuration of the virtual factory and the selection of the best partners for the given order. Moreover, he defines the services that are necessary to fill the order.

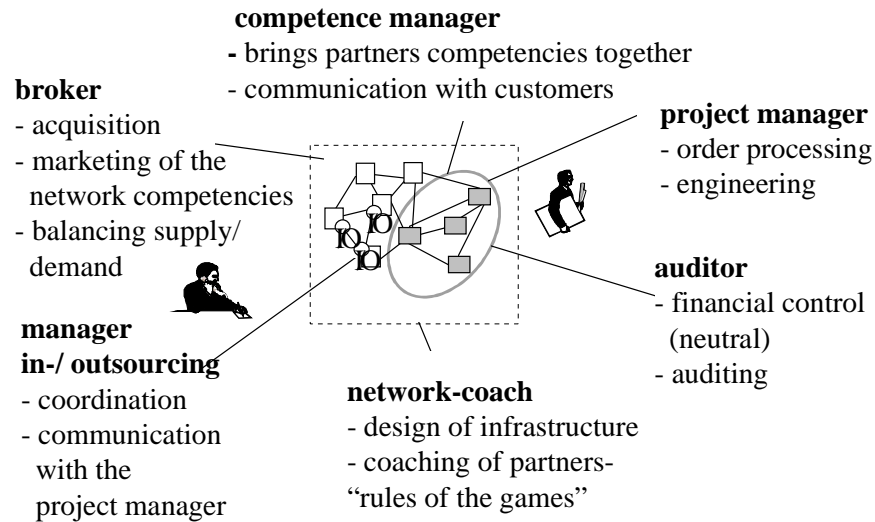
**The project manager:** He is the manager of the operations in the virtual factory. He leads the project management and replaces partners who do not perform or produce on time. Internally, he communicates with the in-/outsourcing-partners and guarantees the quality, target cost and delivery dates of the products to the customers.

**The manager of in-/outsourcing:** He offers the technological know-how of his enterprise, the resources and the technology to the virtual factory. He is responsible for a step in the value chain of the virtual factory and represents the interest of his company to the other partners.

**The network-coach:** He coaches the network, caring for a minimal technological infrastructure and managing relationships.

**The auditor:** He serves the virtual factory as a neutral, independent financial auditor, providing objectivity and solidity when no track record can be presented.

**Experiences in the project:** The project began in January 1995 with more than thirty enterprises from the Lake Constance region participating. Since then, a number of contracts in virtual factories with changing partners have been performed. In these cases, special value was created for the customer when resources and competencies were urgently needed and when the optimal solution to an exotic problem had to be identified. The short-term value for the network-partners was smoother capacity utilization. The long-term value of the network was perceived as increased motivation of the workforce and learning effects.



**Figure 3. 4** Roles in the Virtual Factory (Katzy, Schuh and Millarg, 1996)

### 3.5.2 Global virtual manufacturing with the TELEflow Approach

The objective: In the second project, the goal was to develop a set of methods and tools to serve emerging market opportunities by dynamic reconfiguration of resources and competencies in a global network.

The background: Since European manufacturing companies are generally smaller in size than those in the U.S. or Asia, they frequently have to choose a co-operative strategy to achieve global presence. Global manufacturing, in contrast to regional networks, cannot rely on highly developed pre-existing industrial structures. Instead, the manufacturing network itself needs to be established with partners from multicultural backgrounds.

The concept: In this example, the value system is a strategic network of globally distributed partners. The value system maintains its nimbleness in form of adaptation processes for dynamically reconfiguring its participants' resources and competencies.

The Value System concept, thus, can be broken into two processes. The first process is the lifecycle management of the co-operative network of the globally-distributed partners. Global networks, in contrast to regional networks, cannot rely on pre-existing industrial structures or historical evolution. Instead, partners have to be selected and their commitment achieved before the operative processes can be designed and operated. In the absence of strong exit barriers, the coherence of the network has to be maintained by manufacturing management.

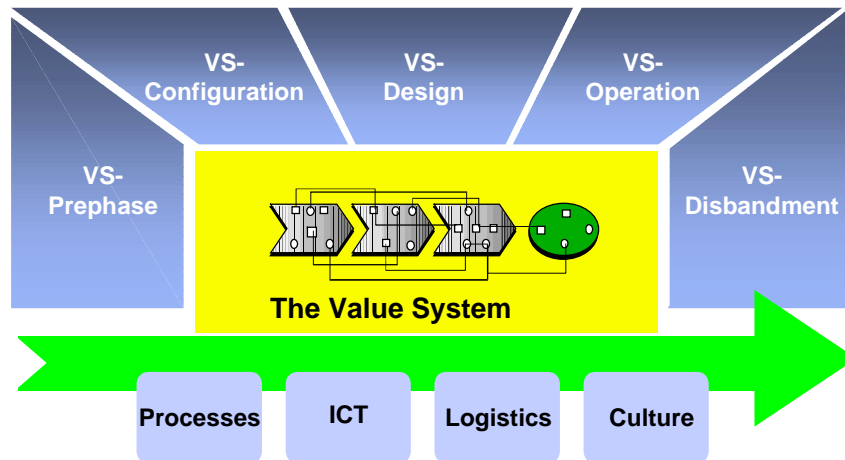
Nimbleness is achieved with the second process of network restructuring. Building relationships with partners in the network entails major investments of

time and money. For the conditions of dynamic competition, therefore, organizational routines for change turn the investments in the network into first mover advantages (Figure 3.5) in emerging markets and niches.

Organizational routines cut through traditional boundaries of management and engineering functions. The impact of each management function is seen as an "enabling view" on the design of the Value System. The methods and tools developed encompass these four views:

- First, re-engineering of the business processes in the network. Traditional process re-engineering methodologies are enhanced to cover the multicultural and inter-organizational setting in the network.
- Second, set-up processes of information and communication technology are developed with the goal to allow frequent and rapid restructuring of the IT platform in the network. Reliable and secure information is a necessary project basis, which can be provided by IT solutions in the markets. However, in order to achieve strategic flexibility and form co-operations rapidly with changing partners, an organizational routine is required to set up this integrated technology from existing heterogeneous systems.
- Third, strategy-based redesign of logistics processes in the global network. Logistics engineering tools today are strongly focused on improving the efficiency of stable supply chains. In order to support strategic flexibility, a method (and a scenario simulation tool) have been developed to adapt network operations processes to changing strategies, for example, adapting from time-based competition to cost leadership.
- Fourth, organizational routines of change in a network environment where management can rely only to a limited extent on hierarchical structural are strongly influenced by the motivation of individuals to co-operate. The development of a co-operative culture among globally-diverse partners marks the fourth enabling view of the concept.

Integration of these management functions is achieved around common principles, such as the flow principle of process and networks.



**Figure 3.5** The Value System concept for global virtual manufacturing

### 3.6 SUMMARY AND CONCLUSIONS

Dilemmas herald the change of paradigms. In other words, a basic function of paradigms is to provide shelter against dilemmas, to have to make choices between two equally unfavorable alternatives. A valuable paradigm provides orientation for good managerial instinct in the face of practical managerial action. As a generally accepted set of basic assumptions, a paradigm provides the common basis of understanding between practitioners, theorists, and providers of tools and methods. Obviously, this general fit between practical needs, theory and organizational reality has been lost (Bleicher, 1995). For practicing managers, this situation results in frequent crises and unpredictable events that create the feeling of lost control. For research, it results in a lack of context. Intensive discussion and an unusually high number of new approaches show that the general orientation has become lost.

Establishing new paradigms means searching for new orientations. Advances in practice and research in times of stable paradigms create additional knowledge in the form of specialized theories, methods and tools. But, as Kuhn (1962) points out, these normal times are interrupted by periods where advances require

establishment of a new general orientation. In these intermediate periods, research has to propose new general assumptions. At the end of the intermediate period, a new paradigm for a new "scientific management" will emerge as a new consensus on "evident" assumptions. And, as Kuhn found, it is the nature of these revolutions that the new worldview emerges before empirical proof can be found for it. It is therefore the task of research to crystallize candidates for basic assumptions from diverse sources (Senge, 1990). Two ongoing pilot projects on virtual manufacturing point to the contingencies for the virtual enterprise. During this intermediate period, practice finds itself faced with alternative approaches without criteria for choosing among these approaches.

In this chapter, the concept of the virtual enterprise has been described as a candidate for a manufacturing paradigm. A review of empirical as well as theoretical writing on the topic has been offered as a possible context. The essence of the virtual enterprise is to thrive on unpredictable change and to permanently recreate the industrial structures for the new opportunity. Further, the virtual enterprise has been structured, first, in the value of the business opportunity, which is the motor for restructuring, second, in the virtual operation, which is temporarily created to capture the value and finally, the network, which is the platform for restructuring. The virtual enterprise has been characterized as a dynamic concept. Thus, the virtual enterprise is not a new institutional form or a type of corporation, but an economic activity in the expectation of return. A synopsis of the routines of change has been offered.

The hypothesis behind the concept of the virtual enterprise is that the synchronization of these routines of change will result in outstanding business success that is not possible with "normal" business. Looking back to the scenario that began this chapter, the first copy of the tool machine was delivered on time for the fair. Early mover advantage in the market turned out to be rewarding. Indeed, instead of the nine machines that were planned, more than forty were sold.

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