Design and Implementation of Virtual Organizations

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Abstract. Current literature on virtual organizations describes a richness of different aspects that contribute to the emergence of this new organizational form, like customer orientation, the use of information and communication technology (ICT), time-based competition or decentralization. However, there seems to be one common theme in this literature. „Virtual“ organizations are frequently (re-) created, sustained to capture the value of a market opportunity and dissolved again to give way for the creation of a next virtual organization. The paper therefore approaches the concept of the virtual organization from the organizational routines or design processes, which drive the design and implementation (D&I) of the virtual organization.

As step towards a conceptual theory the article contributes a model of D&I processes for virtual organizations in order to contribute to the study of virtual organizations. It does so by summarizing eight propositions from previous literature and empirical evidences. The model is concerned with the impact of the design and implementation processes on the effectiveness of virtual organizations. The case of ELEKTRO is selected from ongoing action research in the European Telematics Engineering Project TELEflow to illustrate the model. The company has been chosen as it is actively enhancing its existing competence to design and implement virtual organizations.

1 Continuous Design and Implementation and the Virtual Organization

There is a proliferation of literature on virtual organizations [1, 153] [2], [3], [4], [5]. However, there seems to be a common theme in the literature. Virtual organizations are frequently restructured, sustained to capture the value of a market opportunity and dissolved again to give way for the creation of a next virtual operation from within the network of independent partners. For Byrne „a virtual organization is a temporary co-operation of independent companies - suppliers, customers, even erstwhile rivals - linked by information technology to share skills, costs, and access to one anothers markets“ [4, 37]. Thus virtual organizations center on continually restructuring to capture the value of short time windows of opportunity. Value can be realized with a new business opportunity, a new technology or a better source of supply. This dynamic view of competition apparently goes beyond traditional terms of stable competition like „rival“, „customer“, or „supplier“. Goldman, Nagel and Preiss therefore employ a sports metaphor that „virtual organizations assemble an all-star-team every day tailored to the challenge posed by that days competitors“ [2, 208].

The idea of virtual organizations implies that continually new business processes are designed and implemented. In stable organizational hierarchies restructuring used to be the exception between long periods of stable operation. In virtual organizations, however, restructuring becomes the normal day-to-day business. Many momentary constellations and organizational structures pass with the time like the pictures of a movie. In order to understand the story line of this movie and the course of managerial action an additional description is required, like the film script in cinematography. Design and implementation (D&I) processes describe the course of restructuring in the virtual organization. In other words, writing on virtual organizations seems to propose, that

Proposition 1: *Higher competence to design, implement (D&I) and operate temporary organizational structures [6, 7] leads to more successful virtual organizations.*

„Everyone designs who devises courses of action aimed at changing existing situations into preferred ones.“ [8,129] New roles for designers have been described for dynamic organizations and related to the writing on the virtual organizations as "broker" [9], "entrepreneur" [10] or "promoter" [11]. Professional services for organizational design, on the other hand, exist in specialized departments for planning, organizational development, investment and engineering within the

traditional organization. However, in the virtual organization, where independent business units continually establish temporary co-operations new questions arise: Who designs? Where does he get his authority from? How can partners be motivated to join effort? How is the design being done? The D&I of virtual organizations requires additional methodologies.

It is the objective of the article to develop a model of D&I processes for virtual organizations. With design and redesign processes at the core of virtual organizations this model may contribute a theoretical basis for further study of virtual organizations.

The relevance of such a model for the academic community is to propose a dynamic theory of the virtual organization. Managers in virtual organizations who are designers of the new business processes will find it useful to have a framework for their decisions in this complex environment. It will allow them to simulate (in the sense of reflection, not in technical terms) the impact of intended actions and possible side effects. And it is useful to rationalize the design processes to guide the development of new methods and tools for virtual organizations.

The remainder of the paper therefore is structured as follows. First, propositions are derived from a survey of literature on organizational and technical design processes. This has a dual purpose: first, to provide a compendium of adaptable approaches in this early state of research on virtual organization and second, to lay the foundations of the model, which will be presented in the following chapter. A case study then is described and discussed to illustrate the propositions and the model. Conclusions will be drawn from the discussion of the case study in the last chapter and some further research issues will be derived.

2 Propositions on the Design and Implementation of Virtual Organizations

This chapter surveys multidisciplinary literature in order to generate propositions, which can serve as building blocks or theoretical underpinnings for the concept of the virtual organization. In doing so the foundation is laid to develop the model in the subsequent section. A proposition states that in a large number of cases there will be a tendency for the stated relationship to be observed. Further testing of hypotheses will confirm the propositions or reveal any systematic exceptions to them. The propositions are presented in three groups. First, the role of three facilitators for the D&I of virtual organizations (market mechanisms, ICT and trust) is summarized and second, the role of the designer is surveyed. Third, design methodologies and approaches are reviewed.

2.1 The "Invisible Hand" and the Design and Implementation of Virtual Organizations

Market mechanisms are predicted to gain importance for the design of the virtual organization [9] in the form of the classical economic metaphor as the „invisible hand“ that guarantees optimal resource allocation. A shift from hierarchy towards markets is backed up by transaction cost economics [12] that assumes that markets themselves create cost for the market transactions and that the organizational designers build hierarchical organizations to minimize the cost for transactions. Searching the right partner, specifying the transactions among others cause transaction costs. Networked ICT will reduce these costs and therefore increase the range of market mechanisms. Miles and Snow point out that information technology will „substitute for lengthy trust building processes“ [9, 57] during the implementation of dynamic networks. Thus,

Proposition 2: *ICT use is likely to favor market mechanisms instead of conscious D&I to create virtual organizations.*

Hierarchy was the traditional means that allowed managers to reduce transaction costs through planning and controlling within the organization. ICT extends the range of managerial design in various dimensions. Among these are first, the extension beyond existing limits of planning and simulation tools, second, beyond the boundaries of the traditional firm. And, third, the automation of implementation gives the designer more direct impact on operations. Thus for Upton and McAfee the „real virtual factory“ is an enhanced Internet with a new breed of information brokers [13] that realize the CIM-vision of fully computerized operations planning and control. Kimura focuses the scope of virtual manufacturing on computerized engineering when he defines it as a „modeling and simulation approach of all the necessary manufacturing activities“ [14, 345]. As this stream of writing predicts, artificial intelligence and the World Wide Web may replace human action in the design and implementation of virtual organizations [15, 52]. And virtual reality as a form of simulation is not limited to manufacturing. There is an increasing number of applications that support managerial decision making, planning and education through simulation in the virtual corporation [16]. In other words

Proposition 3: *ICT use increases the power and range of D&I in the virtual organization.*

Trust is widely assumed to be the psychological facilitator of virtual organizations. If there is an „open and honest sharing of views, expectations, ethics, and values“ [2, 166] or simply „trust“ [4, 37] the design of

organizational regulations and hierarchies becomes superfluous, because „there will be an incentive to solve problems in a mutually suitable way“ [2, 166]. In doing so the tradition of scientific management is adapted, where „general harmony“ [17, 26] and the assumption of the rational man [18] that pursues only one objective simplifies the design process to one-dimensional optimization. As opposed to this stream of research there is an emerging literature where trust is seen not as a prerequisite but as the result of successful managerial action and therefore a design parameter for the virtual organization [19, 20]. In view of the several proceeding arguments, it seems reasonable to believe that

Proposition 4: *D&I of virtual organizations is limited to the level of trust among the co-operating partners.*

Three facilitators for the design of virtual organizations have been summarized in the propositions 2-4. In some popular writing the facilitators are presented as alternatives (invisible hands) to rational design process and managerial action. The alternative interpretations of markets, ICT and trust as enabler, however point to the changed role for the design process, which is performed by the human designer.

2.2 The Role of the Designer

Miles and Snow identify and personalize the designer as the broker of the dynamic network [9]. It is their objective to prescribe additional strategic opportunities that stem from exploiting existing resources in the industry and that create the possibility to revitalize mature industries. In contrast to the traditional strategic model of the „war for the bigger part of the pie“ [21] Miles and Snow present the design of co-operative dynamic networks as a way of creating a 'bigger pie'. The broker creates mutual benefit and the perception of 'win-win constellation', which is the motivation of partners to cooperate. In other words

Proposition 5: *The extent of D&I of virtual organizations is limited to the perceived mutual benefit of its partners.*

A variety of empirical forms of the broker is reported, characterizing him by his role of changing the temporary organization. The „Impannatore“ in the Italian industrial district of Prato is the owner of the customer order. He is described as an entrepreneur without firm [22] who brings together and coordinates the independent textile manufacturers of the region (e.g. [23]). Design authority for the Impannatore is based on his position as an intermediator between the external market and the internal supply in the district. Another form of the designer is the focal organization or hub firm [24]. In strategic or supplier networks, such as Nike or Puma in the sports industry, Nokia or Motorola in the telecommunication industry or the car manufacturers in the auto industry economic, power is the source of authority to change the virtual organization. In summary,

Proposition 6: *Recognized authority facilitates the rapid D&I of virtual organizations.*

The broker manages the design process, which points to the identification of an individual or organization and his or her roles for the virtual organization. Miles and Snow attribute three roles to the broker, which he is performing in the life cycle of the co-operation, first the architect of the co-operation, second the lead operator and finally the caretaker [6]. Katzy, Schuh and Millarg take a similar approach in the development of a regional network by implementing six broker roles [25]. In complex temporary co-operations, like projects in civil engineering, specialized engineering companies, project managers or prime contractors often have neither power nor central position in the network. However, their services are essential throughout the life cycle of the co-operation, when the interdependence of partners increases, technological complexity of the product is high or uncertainty about the service to be delivered is high. Overall the preponderance of arguments and the available empirical evidence suggests that

Proposition 7: *Management competence of the designer facilitates the D&I of complex virtual organizations.*

So far three facilitators, ICT, market mechanisms and trust, have been reviewed to point to the question of how much design is needed in virtual organizations. Then, the role of the designer in the virtual organization has been addressed to point to the question, how design and implementation is possible in virtual organizations. In the following section, the question of a methodological basis of design and implementation in virtual organizations is addressed.

2.3 Design Methodologies

Virtual organizations are generally described as a distributed network of independent partners. This, however, limits the range of any systematic design process (e.g. software life cycle, strategic planning or budgeting process) to the perceived benefit of all partners (P 5) and the trust (P 4) among the partners. To achieve the D&I of virtual organizations, therefore, managers can only partly rely on top-down approaches from business plans or business strategies. Instead the partners in the network, their individual goals and perceptions as peers are the outset of a partly evolutionary process. Nevertheless pur-

poseful managerial action can be based on the specific characteristics of the network [26].

The network has been summarized by the descriptive concept of the „industrial network“ [27]. It has no life-cycle but instead is characterized by the evolution of its actors, activities, resources and relationships over a long period of time, like it is the case for example in the Swiss watch industry since the 18th century. Even though the integration process has no end and no final goals it is not purely evolutionary; instead design processes still are applicable and essential to it. It is the design of the evolving organizational system [8, 158] where goals (e.g. business opportunities), strategies [28] as well as network structures (e.g. competencies [29]) are established during the design process and through manifold implementation activities. Senge characterizes the design of organizations as a systemic discipline [30] and summarizes the evolutionary design process as a learning process that is based on system thinking. Senge focuses on understanding the dominant forces driving the system as an entirety. However, system thinking as a design discipline is as well at the core of “entrepreneurial action” [31] to generate innovation inside the network and to implement them. In other words,

Proposition 8: *Successful D&I of virtual organizations leads to more trust among the partners and higher management competence.*

2.4 Towards a Conceptual Theory of the Design and Implementation of Virtual Organizations

Research on virtual organizations is too new and its application is too limited for a generally accepted theory to have evolved. As a result, the propositions set forth here have not been derived from an accepted theory. Instead, they were compound from multidisciplinary sources of research on organization, information systems and manufacturing. A theory may be defined as a set of related propositions that specify relationships among variables, which are falsifiable [32].

Two environmental variables, (E_1) rapid change and (E_2) complexity of co-operation, eight design variables, (D_1) Competence of Design, (D_2) Use of ICT, (D_3) Trust, (D_4) Perceived benefit, (D_5) Authority, (D_6) Substitution of management with market mechanisms, (D_7) Range of design and (D_8) D&I of virtual organizations and one performance variable (P_1) business success, have been included in the propositions. The set of eight propositions is falsifiable and it is related -at minimum- by their common design variable "D&I of virtual organizations" and thus passes the definitional test of a theory.

Still, if other connecting relationships can be found, which allow for a more conceptual theory, a framework could be provided integrating the propositions. The identified set of propositions would serve as a set of building blocks for this theory. As a step towards the development of a conceptual theory of D&I of virtual organizations a conceptual model is offered in the following section, which integrates concepts that are based on constructs. Constructs summarize the ideas, which have been raised in the propositions. The constructs, at the same time, are a step towards generalizing the theory, because the ideas are extrapolated from the specific context of their proposition. Concepts, then, connect these ideas [33].

3 A Conceptual Model on Design and Implementation of Virtual Organizations

3.1 The Conceptual Model

Concept 1: The opportunity of business value (Construct A) drives the D&I of specific virtual operations (Construct B). Value is the force that drives the virtual organization to restructure. This value is the business opportunity, which is embodied in the network or (future) markets but not yet exploited. Once the value of the business opportunity is captured the virtual operation is dissolved to allow for new restructuring. Virtual operations are the co-operative processes that combine competencies and resources for the period needed to realize the value. Since the efficiency and effectiveness of the virtual operation represent the core of the virtual organization, both terms are used interchangeably in literature. The concept follows from propositions 1, 2, and 5.

Concept 2: The success of (re-)D&I of virtual operations is dependent on the network (Construct C). The relevant pre-existing industrial structures form the network. Thus the construct of the network summarizes relationships with partners in a trusted co-operation or a market place, pre-existing resources as well as experienced routines and processes. The concept follows from propositions 1, 2, 3, 6, and 7.

Concept 3: The D&I of virtual operations leads to the evolution of the network. Virtual operations are the motivation to restructure existing networks in order to serve the actual business opportunity. Past virtual operations provide the experiences, which lead for example to competence and trust among the partners. The concept follows from proposition 6, 7 and 8.

Concept 4: Extended networks lead to increased opportunities for the D&I of virtual operations. Most cited

archetypes of virtual organizations are embedded in strong networks, such as Prato with its history of textile manufacturing dating back to the 13th century, or the Japanese keiretsu. This is in line with the findings of Penrose that the development of the management team and its competence is the limit to internal growth of the firm [34]. The concept follows from propositions 3, 4, 6, and 7.

Concept 5: The competence to design and implement virtual operations leads to new business opportunities. The virtual organization, thus, builds on dynamic competition with a permanent process of “creative destruction from within” the industrial process [10]. This capability to restructure itself makes the concept distinct from e.g. projects on the one side, which are temporary, but dependent on their predefined external goal, and on the other side, network organizations like joint ventures or strategic alliances, which are decentralized but stable. The concept follows from propositions 1, 2, 3, 6 and 7. Figure 1 resumes the theory.

The offered model is not linear but systemic [30], which allows understanding and predicting dynamic phenomena. Thus, the advantage of dynamic theories is that certain "chaotic" or "spontaneous" phenomena can be re-interpreted as the result of timing of the design processes in the virtual organization.

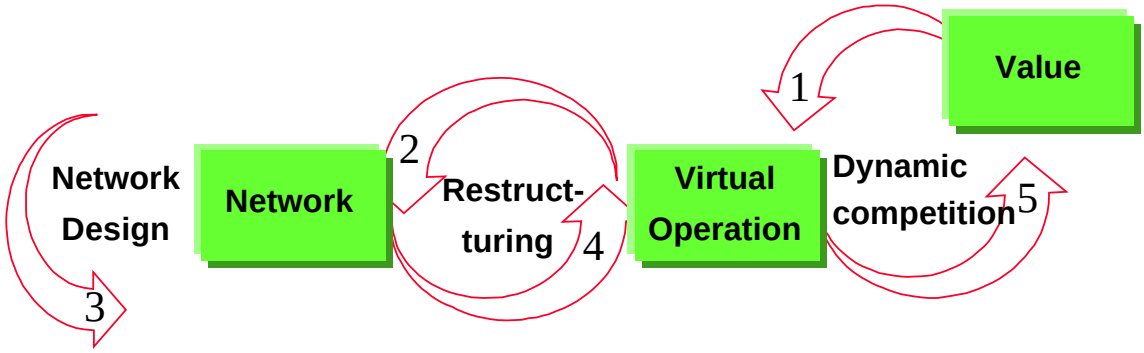

Figure 1: A conceptual model on Design and Implementation of Virtual Organizations

3.2 Implications for the Management of Design and Implementation in Virtual Organization

The model that was offered in the previous section has implication for managerial interaction in the virtual organization. These can be summarized in form of three types of design processes, which require distinct management competencies. First, managerial interaction will contribute to the evolution of the network, second managerial interaction results in the restructuring of a virtual operation and finally managerial interaction leads to creation of new business opportunities in dynamic competition.

The types of design processes are distinct in their characteristics. Table 1 gives the initial typology based on the criteria process characteristic, people involved, power distribution & authority and performance criteria for the process.

Managerial interaction is determined by achieving the business objectives in the competitive environment. The client is the customer and systematic planning processes will be most likely applied to efficiently realize concrete objectives. The designer in dynamic competition will be the lead-operator whose authority to change the virtual organization stems from the customer to be served or the solution created.

The restructuring process of the virtual organization is a negotiation process between independent partners thus peers. The process, therefore, is likely to have dialectic characteristics, where argument and counter-argument are produced that may lead to the innovative solution [35]. Clients of the restructuring process are the team members of the virtual organization and the designer plays the role of the architect of the new business process. His authority

to change the virtual organization is derived from the new business opportunity and the win-win situations he creates for all partners. The competence to integrate partners is required in this phase of the virtual organization and methodologies like soft systems analysis [36] will most likely be applied to effectively integrate the virtual organization through the commitment for the developed concrete goals.

Process	network design	restructuring	competition
Characteristic	evolution	dialectic	teleological
People/ Client	network partner	project team	customer
Power/ Authority	position in network	win-win situation	order
Performance Criteria	creative capability	efficiency "fit"	effectivity

Table 1: Characteristics of Design Processes

As we have seen, the network is characterized by its evolution. The Clients of the network design process are the network partner, individuals as well as business units. The designer in this process is the caretaker of the network. His authority to change the network relies on his position within the network [37] and his social competence [6]. However, the core capability of the virtual organization, „agile" self-restructuring requires the designer. Systemic Thinking will be most efficient to incite the emergence of new goals and initiatives in the network.

The performance criteria for the three processes are distinct. It is effectivity for dynamic competition and operational efficiency (time, cost and quality) restructuring process. Creativity or learning capability [30] can be expected to become the performance criteria of the network design process.

Successful virtual organizations assume effective managerial competence for design and implementation. Even though all three design processes have distinct characteristics they can all three be simultaneously active. Preparing the proposal for a customer, for example, is at the same time active competitive behavior regarding its contents and it is the restructuring of a virtual operation that is build to deliver it. And the preparation of the proposal is a joint experience of its members, which contributes to the network design.

4 An illustrative Case

The case is based on ongoing action research with a company that is actively enhancing its existing competencies and structures to manage global dynamic manufacturing networks. The project was initiated in 1994 and

is to last until 1999. It is described to illustrate the implications of the model and to draw some conclusions for the further research.

4.1 The History

ELEKTRO AG is a medium-sized (SME) manufacturer in Switzerland. The division that is described in this case is a supplier of radio frequency inter-connectors for the telecommunication industry, e.g. connectors for GSM-nets. With the market growth of the 1990ies in the Telecommunication Industries and the globalization of both, its markets and its key customers (Motorola, Nokia, Ericson), ELEKTRO AG created new opportunities for growth.

Up to 1980 ELEKTRO AG´s two factories have concentrated activities on conventional cables and connectors. They mainly produced for the regional Swiss market and were based - for the manufacturing of connectors - on the traditional décolletage technology that used to be the technological basis of precision mechanics of Swiss watch industry. Its restructuring in the 1980ies became known as the Swatch-Story. Décolletage describes a special technology of metal cutting of difficult profiles, which allows for mechanically controllable machining as an alternative to (CNC-) turning for big lots. Blackwood-Forest and Switzerland are two regions where this technology is prevalent and supported by the industrial tradition of watch manufacturing.

After 1980 new activities were started in the market of high frequency cables. By 1987 this business reached about 60 Mio SFr turnover per year with about 200 employees. A new division was created within ELEKTRO AG in 1987 that today can be characterized as one of the „international Swiss manufacturers“. In contrast to the „domestic manufacturers“ ELEKTRO AG is known to be efficient, aggressive in markets and innovative niche players on a global scale [38].

4.2 New business opportunities drive the creation of ELEKTRO AG's virtual organization

Purchases have increased from 40-50% in 1992 to 65% in 1997 of ELEKTRO AG’s manufacturing costs. With the further growth and the decision not to expand this part is expected to raise up to 80% in 2002, when the peak demand of the business opportunity in the GSM market is foreseen. This additionally increases the motivation to develop the business interrelations within the regional networks on the supply side.

Export makes about 95% of the turnover. The turnover of ELEKTRO AG in this business reached 170 Mio SFr in 1996 with 650 employees. Due to its limited size the core competencies could be leveraged only when it is embedded in a network of suppliers and distributors. ELEKTRO AG has intensive relationships with 15 main suppliers (more than 1 Mio SFr each per year) and about 40 suppliers in total in the décolletage-industry. The development backs propositions 7 in the way that ELEKTRO AG acted as the innovator and later as the lead-operator to design the virtual organization.

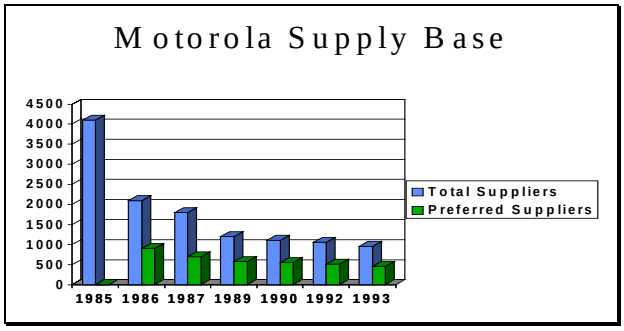

Figure 2: Motorola’s Supply Base, (Source: Motorola Corporation)

Close network relationships are effective as well on ELEKTRO AGs demand side that can be best observed with the example of the industrial network of Motorola. Motorola is the champion of cultural harmonization in the telecommunication industry. With the other large manufacturers of telecommunication equipment it dominates the market (Ericson, HP, Nokia, Motorola, AT&T). ELEKTRO AG makes 80% of its turnover with only 3-4 customers. ELEKTRO AG’s customers are rigorously striving for a global-sourcing strategy, forcing its suppliers to join the companies supplier network if they want to be part of the small, attractive pool of preferred suppliers. The evolution of the Motorola supplier base given in Figure 2 shows the tendency.

4.3 Design Processes at ELEKTRO AG´s Networks

Like Motorola all manufacturers of the industry enforce common objectives within their supplier network using quality assessment procedures with a broad range of criteria (TQRDCE: Technology, Quality, Responsiveness, Dependability, Cost of Ownership, Environment). Feedback from single orders in the network [39] is formally collected and feedback about the partners is collected on a regular trimonthly or yearly basis. This is installed to create a learning culture in the network. Total Quality Management and Learning are integral parts of

this culture. ELEKTRO AG is a preferred supplier for Motorola since 1994, when it passed a supplier assessment by Motorola and has taken corrective actions. Total quality assessment procedures have been implemented by all main customers that are performed on a regular basis between every three months and one year and varying in intensity. Proposition 6 is backed up in the way that the customers monitor results and improvements of the performance of ELEKTRO AG.

4.4 ELEKTRO AG´s Networks Create New Opportunities for Virtual Organization

The role of ELEKTRO AG, as it can be interpreted in the light of the model, is the designer of virtual operations that gear the regional décolletage network to the network of the telecommunication industry for the lifecycle (approximately until 2005) of the niche market for GSM-net installation. ELEKTRO AG has taken the role of a lead operator during the emergence of the market niche until 1992 with over 80% in-house production. Then its role shifted towards being the designer of the virtual operations, when the market volume increased between 1992 and 1997 and the purchasing rate of ELEKTRO AG with it. ELEKTRO AG frequently co-designs new products with customers and was recently involved in the IRIDIUM project, which is a major innovation project in the telecommunication industry. On the other hand ELEKTRO AG invests in a number of co-operative technological development projects in its supplier network. The case, thus, provides supporting evidence for proposition 8.

4.5 ELEKTRO AG´s Experienced Limitations in the Design and Implementation of Virtual Organization

To be able to deliver on short notice has been stated as a most critical success factor by the manager in the network. Concerning all steps in the chain high attention is paid to keep supply high. But an unintended effect could be observed in the network. For one order it has been traced that through the supply channel the initial end customer order on 10.000 connectors has been forwarded by the distribution center with doubled amount to the manufacturer. In expectation of increased demand and in fear of a dry run of the stocks this decision was based on generally accepted logistics rules. As the same procedure has been followed by all steps in the value chain a resulting orders for 100.000 connectors arrived at the décolletage supplier. This example of demand dynamics by a factor ten was no single exception. Due to the cumulating of these effects production volume dynamics in general have been measured to attain the factor 3 at the ELEKTRO AG factory and up to a factor 6 at the décolletage supplier. All partners in the network perceive the benefit (proposition 5) of better capacity planning, and have expressed their need for instant information about the quantity of any one specific part that is warehoused somewhere in the distribution channels of the network. On the lines of proposition 3 ELEKTRO AG is on its way to implement a new logistics software package that is intended to increase transparency and the range of planning throughout the network. But the implementation project is facing some obstacles.

Interviews showed that the introduction of the system stipulated a fear among network partner that the power balance could shift towards more centralization with ELEKTRO AG. This gives empirical evidence for proposition 4. This fear is not directly expressed, but several attempts to form teams to solve the problem failed, as the wrong people have been assigned to it and people have been exchanged between the meetings.

We can conclude from the case and the model for D&I that the logic of all three design processes has to be fulfilled for successful restructuring of the network. Transparency on the warehouse data in the network of the case apparently has been accepted to improve operation, shorten lead-time, save costs and improve quality. Even though the problem and its possible solution are commonly agreed the conflict on the network side leads people to withhold commitment to the process of restructuring the network. To unlock this situation management could concentrate on the development of confidence within the network until a solution to this problem comes into reach of the network.

5 Summary, Conclusion and Further Research

Eight propositions that relate the success of virtual organizations to its design and implementation processes have been compound from empirical sources and multi-disciplinary literature. Then constructs and concepts have been offered to summarize the ideas of the propositions. This second step towards a conceptual theory of the design and implementation of virtual organizations has been undertaken to provide a more conceptual framework. In the following part of the contribution the implications of the model for managerial interaction in the virtual organization have been extended and illustrated with a case. While the empirical evidence supported the individual propositions, further research is needed to prescribe their interrelations. The conceptual model can serve as a framework for this.

The contributions to research are threefold. First, a structured survey and multidisciplinary compendium of frequently cited approaches and design methods has been produced for an emerging stream of research. Second, a set of constructs has been proposed to structure the field from the point of its most probable innovation. This is the dynamic perception of competition and the related organizational form of dynamic interaction between the organization and its environment. Finally, a case has been described for the application of the virtual organization concept to manufacturing industry. The proposed model links the effects of managerial activity to the value created and in doing so it is a model of managerial effectivity. For practitioners this contributes a framework to understand the complex environment of networks and allows to analyze or to simulate the side effects of any interaction they intend to undertake.

Further research direction can be derived from the model. Among others it seems to be promising first, to further investigate the processes and procedures within the network that define the competence to restructure from within or the „agility“ of the network. Second, the identification of design parameters and their fit to environmental conditions will allow enhancing the effectiveness of the virtual organization.

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