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Configuring and operating global production networks

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Abstract

Since globalization proceeds, enterprises of every size are forced to establish or to act as a part of global supply chains or production networks. Their decisions regarding the design and operation of their global activities have a strong impact on their competitiveness. In this paper some of the available concepts for the design and operation of supply chains are discussed in the context of globalization. It will be shown, that the current approaches that cover mainly “hard” or quantitative aspects are not sufficient. Especially the communication and coordination of partners from different regional or cultural background require a special look at the “soft” or social and human dimension of supply chain management. An analysis of the different concepts from both supply chain management and social sciences leads to the conclusion that there is no integrated concept available so far. This gap is closed by a two-level concept which is introduced and discussed in this paper. The concept provides an integrated view on the relations between the partners of a supply chain or network. In an empirical investigation in a multinational enterprise evidence was found for the sketched problem and also for the need to integrate the “hard” and “soft” dimension.

**Keywords:** *supply chain management, global manufacturing, communication, coordination, integration, cultural diversity*

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## 1. Introduction

Globalisation is a long-standing phenomenon that has accelerated spectacularly in recent years. Geopolitics and technology have come together to generate a substantial shift in consumption and production patterns across the globe. The emergence of such countries like China, India and the former Soviet Union, has lifted world demand, especially for raw materials and capital goods (Rae & Solle, 2007).

A general globalization of economic activities can be observed (Pain & van Welsum, 2004). This can be shown by the steady increase of total foreign investments over the last twenty years. In the long run, enhanced international engagement can normally be expected to be connected to greater specialisation and competition and to the ability to access foreign knowledge all helping to raise productivity levels and employment (Molnar, Pain, & Taglioni, 2007).

Internationally acting enterprises face a lot of challenges. At least they are part of a supply chain, which is composed of partners from different countries. This means that they have to plan collaboratively with partners (customers and suppliers) from abroad. At an advanced level, they establish their own production network with subsidiaries in different countries. Especially in this case, a lot of decisions have to be made: Where should the subsidiaries be located? What competencies should they have? Should decision and planning processes as well as other functions be decentralised or centralised? How should structures and processes be designed? (Edwards, 2003; Michael F. Zäh, 2005)

Those questions and decisions can be subsumed under the topic Supply Chain Management (SCM). As will be shown later, the concepts provided by SCM so far focus mainly on hard facts like time (due dates, lead time), quality and costs (production costs, logistics costs, risks etc.) (Busch, 2004; Corsten & Gössinger, 2001). But the effective and efficient functioning of a supply chain or a production network does not depend only on its cost efficient and robust design. The physical and informational transactions in supply chains and networks depend merely on the decisions and actions of people and groups which in turn are embedded in organisations and in a particular regional and therefore also in a particular cultural context.

For that reason, we argue that it is not sufficient to consider only the hard factors quality, time and costs when designing and operating supply chains and global production networks. It is rather necessary to include also soft factors like culture, individual and group behaviour and social relations and their dynamics into the existing concepts of SCM. In the paper, a concept is presented that integrates hard and soft facts into a two-level model of production networks and supply chains, respectively. The necessity of this view is first derived from existing theoretical approaches from different scientific fields. Second, it is substantiated with empirical insights from a central planning department in a large multinational, globally operating enterprise.

The paper is composed as follows: First, the results of a literature review are presented. In this research, not only existing concepts in supply chain management and modelling are considered but also newer approaches that emphasize soft factors like culture and trust in SCM. In this section, a closer look is taken onto those soft factors. Furthermore, we analyse the existing approaches in international management. The section ends with an evaluation of the existing approaches concluding that it is necessary to integrate hard and soft factors. Second, the two-level concept of networks and supply chains will be developed. The two dimensions are derived from theory; their interaction is illustrated with an example. Based on the concept, some ideas for modelling are developed. In the third part, some empirical insights are described and analysed in the context of the concept. The empirical results are based on expert interviews in a multinational enterprise. At the end of the paper, some conclusions are drawn regarding the relevance of the paper for theory and practice. Some ideas are pointed out how the concept can be used in practice when designing, analysing and optimising processes in supply chains and production networks, from both a quantitative as well as a qualitative, especially a cultural and social perspective.

2. Literature review

2.1 Approaches for the management and modeling of supply chains

Supply chain management (SCM) is an integrated management tool for the information and materials/services flow among different facilities and stakeholders (C. W. Lee, Kwon, & Severance, 2007). Different subject literatures divide supply chain management into different perspectives; Simon for instance puts forward 11 perspectives: purchasing and supply literature, logistics and transportation literature, marketing literature, organizational behaviour, industrial organization, transaction cost economics and contract view literature, contingency theory, institutional sociology, systems engineering literature, network literature, best practices literature, strategic management literature, economic development literature (Simon Croom, Pietro Romano, & Giannakis, 2000).

Samuel H. Huan classified SCM into three categories: operational, design and strategic. The operational area is concerned with the daily operation of a facility such as a plant or distribution centre to ensure that the most profitable way to fulfil a customer order is executed. The design of the supply chain focuses on the location of decision spots and the objectives of the chain (Samuel, Sunil, Sheoran, & Ge, 2004). Four categories of models can be found in the literature: deterministic analytical models (Cohen M A & Lee H.L., 1989), stochastic analytical models (H. L. Lee, Billington, C. and Carter, B. , 1993), economic models (Christy D.P. & Grout J. R., 1994), and simulation models (Towill, 1991).

There are many analytical and numerical models, stemming from conventional business and engineering principles, which have been proposed to handle supply chain operational and design issues (Chopra S. & Meindl P., 2001). One of the most accepted supply chain models was provided by PRT&M in 1996. It is generally accepted because non-profit organizations (e.g. “Council of Logistics Management”) as well as profit organization (e.g. “The supply chain council”) are using the SCOR model to generate various supply chains and to determine best practices. In addition to SCOR there are some other supply chain models like those from Bowersox, Lee, Cooper, Lambert and Pagh (Corsten & Gössinger, 2001; Stewens, 2005).

If we follow the main views, SCM is the management of the material, information and financial flows between the customer and the manufacturer. As shown, there are a variety of methods and management tools. The main focus of SCM is the information technology-driven improvement of the information flow as an integrated and interface-free part of the supply network in order to get a more fluent material and financial flow.

So the basic enabler for effective supply chain management is information sharing and coordination among the business partners, and this has been supported by advances in information technology. A variety of electronic media including electronic data interchange (EDI), electronic fund transfer (EFT), bar codes, point of sale systems (POS), fax, automated voice mail, CD-ROM catalogues and a variety of others complete the information transaction. However, the deployment of IT tools in a supply chain is not free from barriers (S. Moon & D. Kim, 2005). Using tools like APS (Advanced Planning Systems) (H. Stadtler & Kilger, 2000) may allow to define a global planning including all the partners of the chain. The various partners in one supply chain usually belong to several supply chains and they may deliver their products and services even to competitors at the same time. Therefore, a centralized approach for planning and information sharing is poorly consistent with the autonomy of the various partners, who cannot share confidential information like for instance internal costs. So IT can not totally solve the coordination problems in a supply chain.

There are some empirical studies trying to address this problem. Shepherd and Günter examined supply chain and performance parameters and grouped them according to the SCOR process classifications (Shepherd & Günter, 2005). As Figure 1, which is based on this work, illustrates, there are more quantitative performance parameters than qualitative, except of the parameters based on quality. Currently, SCM is mainly done by

using IT-based solutions. But that is not enough. IT communication solutions like email or business software usually are a necessary prerequisite but these solutions are not at all sufficient for a good information exchange (Endres & Wehner, 1999; Large, 2006). Behind every process, department or function there are humans acting and interacting.

Moberg et al. (Moberg Christopher R, Cutler Bob D, Gross Andrew, & Speh Thomas W, 2002) present a conceptual model for the relationships between supply chain variables and information exchange. The variables affecting the quality and extend of operational and strategic information exchange are information quality, IT commitment, organization size, SCM commitment, trust and relationship commitment. Palaneeswaran et al. categorize the integrative forces in a supply chain into hard and soft factors (E Palaneeswaran, M, Kumaraswamy, & Ng, 2003). The hard factors cover binding needs to achieve contractual agreements, short-term benefits and contractual commitments for liability. The relational binding forces, however, could be developed from sources as trust, involvement, mutual respect, sharing of risks and rewards, effective communication, transparency, ethics and discipline and other non-contractual measures. In theses papers it is recognised that there are indeed soft factors which determine the success of coordination and communication in supply chains.

## ***2.2 The cultural and social perspective***

### ***2.2.1 Culture***

One way to define culture is that “culture is to society what memory is to individuals” (Kluckhohn, 1954). It includes what “has worked” in the experience of a society, so that it was worth transmitting to future generations. Elements of culture are shared standard operating procedures, unstated assumptions, practices, tools, myths, art, kinship, norms, values, habits about sampling the environment, and shared meanings. Dawkins called the elements of culture memes (Dawkins, 1989). They could include a word, tune, idea, clothes, fashions, ways of making pots, etc. The essence of a meme is that is a replicating entity, identity, coordination and integration, order, legitimating, and complexity coverage.

Culture has two levels: a “conceptual” one which is not visible and intangible, and a “perceptual” one that is perceivable and observable. Based on different groups sharing the same culture, culture can be classified into corporate culture, branch culture and regional culture. For the regional culture, there are several approaches for analysis, description and explanation as shown in figure 2 (Dülfer, 1997; Hall, 1990; G. Hofstede, 1980; Hofstede, 1982, 1983, 1997; Trompenaars, 1993; Trompenaars & Hampden-Turner, 1997).

Humans and their environment are inevitably the carriers of culture. There has been a long research tradition in both cultures in general and culture-specific characteristics. Best-known are the investigations of Hofstede and the derived cultural dimensions (Hofstede, 1980). Research in culture can also be found in other disciplines, such as psychological or sociological research, or in the specialized field of cross-cultural small group research. A second cultural aspect of „doing business“(corporate culture) describes the specific ways and means of how organizational members interact and communicate with each other within a confined setting. Basically every corporation is assumed to have an own, distinct corporate culture, or at least a certain congruency of various local cultures of parts of the organization (Schein EH, 1991).

When business takes place in different locations, culture will have more influence on business management and become more complex. And researchers and managers are paying more and more attention to it. In the field of Operations Management and Supply Chain Management there are a few studies focussing on the role of culture: Freeman and Browne (Susan Freeman & Emma Browne, 2004) developed a model that explains the impact of (national) culture on dissolution strategies. McAfee et al. (R. Bruce McAfee, Myron Glassman, Earl D, & Honeycutt Jr, 1992) examine the interaction between different firms' cultures and their importance

for SCM. Very important are different role expectations, i.e., a shared understanding of what is expected based on a history of interactions. The variables influencing the relationships of partners of a supply chain mentioned by Mc Afee are, among others, reciprocity, satisfaction with the relationship, environmental uncertainty, dependence, values/ beliefs, bases of power and trust. Pagell (Mark Pagell, 2004) develops an integration model that supports the understanding of the factors that enable and inhibit efforts at building integration across operations, purchasing and logistics. The factors that are critical for the performance of an integrated supply chain are culture, structure, communication, measurement, level of consensus as well as Job Rotation and cross-functional teams. It is obvious that especially within the areas of partnership (which covers also mutual trust), structures and processes cultural influences play an important role. Furthermore evidence is provided that culture also has a strong impact on the acceptance, adoption and usage of information technology, see for instance (Christian Korunka & Pascale Carayon, 1999; Johns. L, Sharon K, Murphy Smith, & Carolyn, 2003).

2.2.2 Trust

Most researchers analysing trust adopt the integrated view proposed by Mayer, Davis, and Schoorman (Mayer R.C., Davis J.H., & Schoorman F.D., 1995). They define trust as the willingness of one party, the trustor, to be vulnerable to the actions of another party, the trustee, based on the expectation that the trustee will perform a specific action important to the trustor, irrespective of the trustor's ability to monitor or control the trustee (Jarvenpaa S.L., Knoll K., & D., 1998). Making oneself vulnerable is taking a risk. Trust is not taking a risk per se, but rather a willingness to take a risk. Many other definitions of trust are based on similar views regarding willingness to take a risk (Boon S. & J., 1991; Ishaya T & L., 1999)

Trust surely has a strong relation with culture. Within culture, trust grows quickly. This is partly because trustees can better anticipate the preferences of same-culture trustors and can, thus, signal more efficiently (Bacharach M. & Gambetta D., 2001; Spence, 1974). However, in cross-cultural encounters, "a lack of convergence in cultural proclivities may result in a virtual collapse of trust-building mechanism" (Doney P. M., Cannon J. P., & Mullen M. R., 1998). The absence of credible signs or the presence of unexpected/undesirable ones can create cultural misunderstandings which impede the trusting choice (Aulakh P. S., Kotabe M., & Sahay, 1996; Das & Teng, 1998). Differences in concepts of trust may be particularly stressed in interactions between people with different cultural backgrounds, especially when each person takes a certain concept of trustworthiness for granted, and fails to consider the possibility that the other may assess trustworthiness on quite different grounds. The crucial role of trust in supply chains and in supply chain management has already been analysed in several studies. Kidd (John Kidd, Frank-Jürgen Richter, & Xue Li, 2003) highlight the importance of culture (and its differences) for the trust-building process and learning processes within a supply chain. R. Duane Ireland (R. Dune Ireland & Justin W. Webb, 2007) did a research on the balance of trust and power. He identified and discussed four strategies that partners participating in a strategic supply chain can use to develop optimal levels of power and trust. Ik-Whan G. Kwon (IK-Whan G. Kwon, St Louis, & Taewon Suh, 2005) put forward that a firm's trust in their supply chain partner is highly associated with both parties' specific asset investments and social exchange theory. Information sharing has a primary impact on reducing a partner's uncertainty behaviour which, in turn, would improve the level of trust. In this particular paper it is also stated that effective supply chain planning is based on shared information and trust. The same conclusion can be found in the paper of Riddells et al. (Riddalls, Icasati-Johanson, Axtell, Bennett, & Clegg, 2002) which examined the critical role of trust between supply chain partners and for the information flow in a supply chain that is processed by those partners. Other interesting results are provided by Handfield and Bechtel (Handfield & Bechtel, 2002) which analysed the impact of trust on supply chain responsiveness and by Lin et al. (Fu-ren, Yu-wei, & Yi-pong, 2005) which analysed the effects of trust on

supply chain performance. Finally, the level of commitment is strongly related to the level of trust, supporting Morgan and Hunt's hypothesis (Morgan R.M. & Hunt S.D., 1994).

Participants in supply chains are unique entities, created through a complex integration of factors, with interdisciplinary players, varying roles, responsibilities, goals and objectives. Therefore, collaboration and teamwork are crucial since sharing up-to-date information between participants' leads to a minimization of errors, reduction of time delays and breaking the widespread rework cycle. Benefits of collaborative, rather than adversarial, working relationships within construction organizations are well documented (Walker & Hampson, 2003). Teamwork itself as well as information sharing or the sharing of responsibility is highly tight to trust.

### 2.2.3 International management and intercultural communication

To some degree, supply chains make companies more and more international, in terms of both sales and manufacturing, and the role of international companies has to change to adapt to the global market. Pursuing the best network of manufacturing and supply facilities with regard to the marketplace does not only apply to firms operating in a worldwide context but to all kinds of companies that have multiple sites (Rudberg M & Olhager J, 2003). Since companies established business abroad the term multinational enterprise was created which sometimes has different meanings. Most common is the definition that a multinational enterprise (or transnational corporation) (MNE/TNC) is an enterprise that manages production establishments or delivers services into at least two countries. Very large multinationals have budgets that exceed those of many countries. Multinational enterprises can have a powerful influence on international relations and local economies.

In MNE it is necessary to coordinate the different activities. This is necessary because of the division of tasks, the interdependencies of the particular units, the activities, and the resulting interfaces. Figure 3 gives the details on different co-ordination strategies. Most well known is the concept of Bartlett and Goshal. Related to their concept of MNE, Bartlett and Goshal developed coordination strategies for the particular types of MNE: coordinated federation, decentralized federation, centralized hub structure and integrated network (Bartlett & Goshal, 1989). A different approach is provided by role typologies for subsidiaries. An overview is given in the following picture (Figure 4) (Kutschker & Schmid, 2006).

The coordination strategies are focussed on the processes and activities in an MNE, especially between different sites. But because most of the times the different sites contribute to one product and are therefore part of a (intra-organisational) supply chain the coordination strategies might be applied to inter-organisational supply chains.

And of course, coordination inevitably becomes more difficult as the geographical dispersion of a company's sites increase. The ever-present issues of, for example, where to allocate production in order to be most responsive and how to maintain low production and transportation costs, how to transfer related technology at lower cost, become more and more complex because new factors arise when the dispersion increases. Studies on global management usually focus on what has been identified as the two main issues concerning the network management: configuration and coordination.

To facilitate the smooth coordination, companies typically develop common policies regarding manufacturing structure and infrastructure. For example, Intel (Mlynarczyk MM, 1995), Ericsson (Rudberg M., West M., & Olhager J., 1998), and Honda (Sonoda T. , 2002) have created clear and standardized guidelines for manufacturing and related activities in order to better coordinate their manufacturing network operations. Network firms are characterized by strong linkages between supply chain members with low level of vertical

integration. In addition, the lack of influence or power, personified in terms of interdependence, is also seen as a key determinant of an effective supply network structure.

In addition to the structure favouring the coordination in the supply chain, one additional factor is the intercultural communication. Communication presupposes that there is a particular cultural framework that allows “translation” of the message by the recipient to maintain the true meaning of the sender. Many international business failures have been ascribed to a lack of cross-cultural competence on the part of business practitioners (James P. Johnson, Tomasz Lenartowicz, & Salvador Apud, 2006).

**2.3 Conclusion**

Above, we gave a brief introduction on different concepts related to supply chains in general, SCM, varying perspectives of SCM, supply chain modelling. Many researchers as well as managers in practice pay significant attention to the IT tools helping in supply chain management. At the same time, soft factors which include culture, trust, mutual respect and so on, have been attracting the attention of researchers in recent years.

As the basic and essential soft factors, culture and trust have strong relationships with SCM and to some degree, they could determine the efficiency and effectiveness of coordination and cooperation. They also play an important role in international management, especially in multinational enterprises. Thus, the participants within a supply chain are not only related by information technology but also by personal relations and mutual understanding.

When looking in detail at the concepts developed in the scientific field of Supply Chain Management it becomes obvious that the “physical and monetary dimension” is at a very advanced level. There are also some attempts to link this “hard factors” or quantitative view to aspects like culture and trust. But there has been no real integration. So far, the human and social dimension serves only as an interesting addition or extension. But in order to gain an overall (or holistic) optimum, an integrated view is definitely needed.

In social sciences, however, a lot of research has been done regarding cultural differences, trust etc. But even though the relations in supply chains are based on social relations, Supply Chain Management is not a special field of application in this area. The only applications which are available are “do's” and “don'ts” in international business or intercultural trainings applied to a certain region or to pre-defined business relations. It becomes clear that there is a gap between the requirements in Supply Chain Management - i.e. to pay attention to the human and social dimension and to integrate qualitative and quantitative approaches - and the state of the art in science and practice.

Some operational methods are known but they are not yet connected with the supply chain design or structuring models like SCOR. Intercultural communication is a wide scientific area. Cultural trainings for managers are known, too. Additionally, there have been studies on how to handle change management in different cultures. Psychological analyses or moderation, case-based studies might be used. Most common is the use of experienced managers (Abele, 2006; Köppel, 2003; Zentes, Swoboda, & Morschett, 2004). But, currently, no modelling approaches are known to depict this content together with a supply chain or global network. This gap will be bridged by the framework that is discussed in the following section.

### 3. Extending the view – the value network

#### 3.1 Two different levels

As shown above the management of a global supply chain management may be a difficult task, with many multifacet problems. One success key factor is the information flow within the chain. It is common knowledge that many factors will influence this flow and the way of communication and information exchange. The Question is how could the information flow correctly in a whole global network? Will just the use of email, videophone, internet or business software be the answer? Furthermore, cultural differences can affect the information exchange or the willingness to exchange information.

A defined method for the structuring and visualization of information flow interfaces, personal relations or possible options, especially in the field of global (production) networks, does not exist. Additionally, the SCM modelling methods like SCOR, those from Bowersox or Cooper Lamber and Pagh do not really offer such a view. Therefore, the objective is to extend the supply chain level with a human or social view.

In order to expose the personal and inter-personal relations, culture spanning understanding problems, the extension of the logistical supply network level, which covers the relationship level is proposed. The concept of this extension is displayed in figure 5. There are two levels by expanding the supply chain to a value network. At the first level, the material, information and financial flows build the (traditional) Supply Chain. At this stage, companies, facilities, departments or processes build the content, and they are connected by physic relations like IT driven information, financial or material flows. At this first level, the functions and competencies are distributed among the several production sites in the network, depending on several factors (product, technology maturity, regional influences, infrastructure, etc.). Processes like research and development, quality planning, customer relationship and product lifecycle management interacting with SCM are considered. The relations in the supply chain will depend on the company structure, the product and other influences as already mentioned. Thus will create more or less important interfaces between companies, customers or supplier, departments, functions in an intra- or inter- organisational network.

Now at the second level, the particular functions and competencies are coordinated and integrated into a value (creating) network. Here it is mentioned to take a look into the interaction of the humans which belonging to the first level processes. The above named interfaces on level one can be bypassed by a good relation on level two, but also new interfaces on the second level can be created and will affect the level above. If problems are detected countermeasures have to be taken in order to reduce social “friction losses”. The focus must be on the attitudes, the behaviour or the qualification of involved people and on the communication processes and structure, used channels etc. An expert from a different field (psychologist, sociologist) might be needed to moderate the process or to mediate between the partners. Additionally, a method is needed to depict this level and its content in a clear and easy way.

Finally value Networks means that not only the performance of the physical supply chain has to be measured and analysed but also that the quality of social relationships, the effectiveness and efficiency of communication and information sharing, the satisfaction of the relevant people or groups and also potentially interfaces, misunderstandings etc. have to be evaluated and drawn to getting design issues.

3.2. The application of level two

To understand how a value network works and where the problems of the relevant interfaces are hidden, it is necessary to take a deeper look onto the personal level, on the relations, the individuals or groups and their connections and the supply chain requirements defined on level one.

So the interfaces at the second level are influenced by the design of the supply network level. For example an complex product might require another supply chain structure and organisation as a simple product. The same structural influences may occur depending on different productions strategies, like build to stock compared to build to order. The coordination and integration task is different, also the second level can avert a desired supply chain due to a too difficult integration task on level two. Figure 6 Intend to visualize different cases. The design of the process level influence the second level and the interfaces inside level two becomes more important for the performance at the level one activity. In such a supply chain design, for example, people have to work closely together, more closely than in the first example, as shown in Figure 6.

It is obvious that the levels affect each other. For an adequate design of a global production network, it is necessary to have a closer look at the important connections on both levels and their mutual impact. So the factors which are already named in this paper, the so called “soft factors”, e.g. culture, relations, trust building or ways of communication become more important and need to be examined.

To give an idea of the way the levels can be connected and how the modelling approach will be used at level two, an example is explained next. As shown in figure 5, there are three members of a company (arrow and No. 3), who can join a group (dark grey). One of them has a key role because he is connected with more than one supply chain participant, with one customer down and one supplier up the stream (arrow 1 and 2). Additionally, it seems that there is a problem or an interface with a participant in the supply chain downstream. It might be possible that there is a communication problem because of (very) different cultural backgrounds. At this point, an additional and proper modelling method is needed.

The first step is the modelling of the (communication) relations between the interacting people. By this way it should be possible to depict some of the networking problems.

3.3. Approaches for modelling

As a method to visualize social and communication relations, Me2Ko was developed by Krause et al (Krause, Baum, & Schütze, 2005). To illustrate the content of the second Level, the Me2Ko seems to be an appropriate modelling tool. In a so-called participant diagram, persons as well as the connections that exist between them through relationships or/and communications can be depicted. The main challenge is to define a uniform set of characteristics and levels to describe persons, relations and communication connections. This is conjoint with a simple visualization by selected icons, fixed sets of colours like red or green, arrows and so on. The participant diagram (see figure 7) can be used to visualize social competence, for example green means positive, negative is red, additionally a qualitative rating from level 0 to 7 is designated. Furthermore, the information about the formal persona like being member of the high, middle, basic management or just an employee can be visualized. The relationship diagram then illustrates the social position, the expected or existing relations between persons or groups. As shown in figure 7, the relationship quality (e.g. green = positive, red = negative, grey = neutral), the type of relation and the characteristics, the intensity of the relation (expected, existing) can be made visible.

A communication diagram is provided by Me2Ko, too. Topics like permanent, sporadic or periodically communication, the frequency and running time of the communication can be enrolled. Additionally, the

subject of the communication and commonly used channel (Email, phone, talk, post, document, or an electronic document) can be displayed.

With such tools, like Me2Ko provides, the intangible relations within the second level can be displayed. Such a visualisation will identify communication problems or coordination barriers. This is the first step to solve the above mentioned problems in nowadays global networks.

#### 4. Empirical validation and methodology

The first research was conducted with a case study in a multinational enterprise. The research focussed on supply chain management and organizational problems within them and during the related processes like product development, customer relationship management, etc. The staff of a internal consulting department for production process, planning and supply chain management was interviewed and is the sample of the first study.

To validate the Framework and the necessity of a second level, a further investigation was carried out. The idea of the concept and the findings in literature was counter-checked with experts. Production, supply chain and logistics consultants were asked. All of the experts had worked for several years in the field of designing and optimizing (global) supply chains. The investigation was done by a guided semi-structured interview. The questions referred to interfaces within the company as well as the surrounding network and the distribution of supply chain associated functions (e.g. which modelling methods were used and which influencing factors were relevant for the designing of a global production network).

The results of the empirical verification confirmed the developed conceptions. Various problems with the IT and information connection were expressed. For example, data quality, unclear responsibility and data input were mentioned. During the supply chain, not all members implemented a integrated data connection. In that case, there is often an interface where employees handle data manually. Especially in low cost countries, it is not economical to develop highly integrated IT processes in all cases. Therefore, some data will be acquired by hand and, thus, there will be additional interfaces and a higher possibility of malfunctions or errors. The importance of these problems depends on the requirements of the specific supply chain needs. Another finding of the empirical research, as what talked in the conceptual framework, is the willingness to share information which can be influenced by cultural differences or traditional functional separation, even within one company. A functional separation can lead to conflicts of interests between the persons involved, as well as different targets and/or priorities to these targets. Dealing with such problems in a multi national company and cultural-diverse supply network seems to be a quite difficult task.

People empowerment, commitment or their willingness to work with a continuous improvement program and a focus on monetary incentives was furthermore named as problems in a global acting company. It can be connected with the cultural distance between the planner and the operator and the processes as planned will not work properly and then programs or strategies will fail. In this case, it would be good to know where interfaces or barriers are and which possible solutions exist in advance.

Furthermore, the measurement of a supply chain is perceived as problematic. Key performance indicators (KPI) are developed in different ways but it is not reasonable to benchmark KPI from different countries without a research on the background. Some of them are only meaningful when put together or used with a cultural or local condition "filter". KPI Systems also can drive goal differences between departments, which was labelled as a problem already.

When developing new production or supply chain processes, opportunism can become important. To get a process that meets the local requirements, you need a local know-how and also a designer who is willing to create an appropriate process.

Frequently, interfaces exist between strategic and operational functions. A manager in a strategic or tactical planning, for example, has not enough information or not the correct information about the operational level. The reasons may be varied. For example, in some cultures a manager will never get a critical answer about his (bad) decision from an inferior. Furthermore, if somebody is not a member of a specific personal network, it is impossible to get information. According to the understanding of supply chains in western countries, information sharing plays an important role. But in many countries, few people are allowed to have a look inside the business. Therefore, the strategic department may make the plan, but it will never work in the way as what intended.

Due to this, a look at the second level of the production or supply networks is strongly recommended. As some of the presented examples reveal, especially for the information sharing and the organisation of the consistent information flow. It seems that a closer look will expose some important interfaces on the social - relations level affecting the performance at level one. Last but not least, it should be mentioned that not only the IT-solutions are capable of solving these supply chain problems. Behind every action or process, a human acts and will have an effect on the supply chain and its performance.

5. Summary and Outlook

Since the later of 20<sup>th</sup> century especially 21<sup>th</sup>, the blooming of IT does help the management in the international company. But technology can never solve the person-to-person relationship problems, like social and cultural differences, which are the soft factors in the supply chain management and can be another important factor for the global business success. This is emphasized in our article and also is our initial motivation for this research and paper.

There are many approaches for the modelling of SCM, material, information and finance flows. But until now, none is related to the soft factors. The main problem with the soft factors is that most of the key factors in this level are not easily measured and even hard to be exposed. So a concept of an extended supply chain model for global production networks – the value network – is introduced in this paper. The main target is, at first, to depict the network especial the soft factors in an easy and transparent way, to visualize the network as soon as possible. Two levels are defined in this ‘value network’. One is on the material, information and financial flows and the other is on the personal or inter-personal aspect. When performance problems arise, empirical analysis has been done in both levels as well as on the interaction and dependencies of both levels.

Then the second level is modelled in detail using a proposed Me2Ko method. Currently it is a software tool and it need to be pared-down for a quick use. The integration of information about social and cultural conditions to a supply chain network “construction” could be one first step to solve current problems. But it is necessary to develop a consistent method for the design and operation of supply chains, including the social interactions. The common research on culture and cultural differences is controversially discussed and seems to be not immediately useable to easily depict problems or content-specific details. The current empirical research only gives some ideas of the differences and some kinds of occurrence in some spots of global management.

Further on, for the future, the interactions between level one and two should be examined in detail to figure out which has a strong relation, or when a detailed view on the second level is needed. A framework or toolkit providing case- based solutions or a best practices compendium appears to make sense, perhaps in form of an (references) extension to the SCOR Model.

It might be also possible to develop software that is able to automatically compile and depict information in the annotated way. For this, social networking data could be used. Within a global acting group, it might be possible to get access to the required information via intranet platforms. IBM® just launched a solution called Lotus connections, which tries to integrate social services into (IT-) networks and workflows.

To sum up, this concept offers some ideas for the investigation on relations and communications and their influences on the supply chain performance. This will provide a reference to the configuration and operation of the global production network.

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Figure 1: Empirical approaches on regional culture

Figure 2: Different coordination strategies of MSE international management

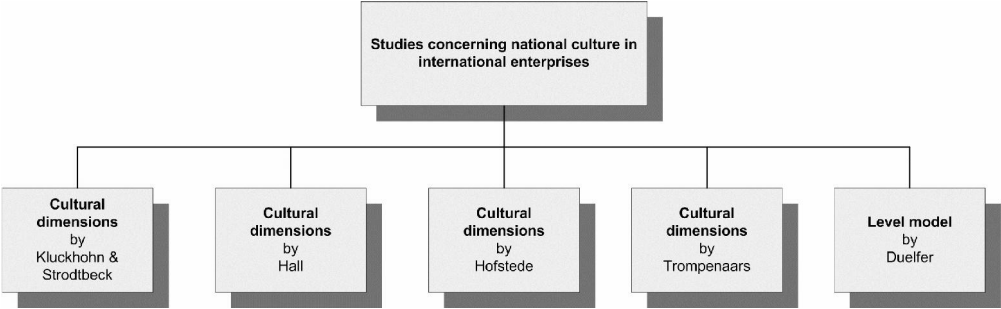
Figure 3: Role typologies for subsidiaries, according to

Figure 4: supply chain performance measurement factors

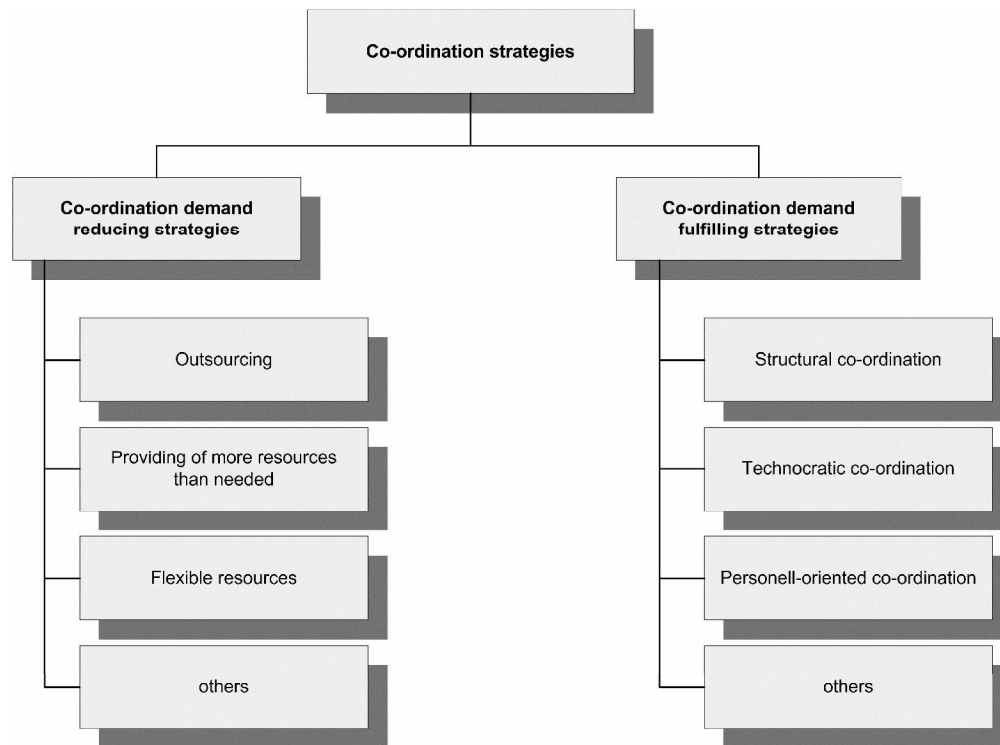
Figure 5: the value network - extend the supply network with a 2nd level

Figure 6: Interaction and effects between both levels.

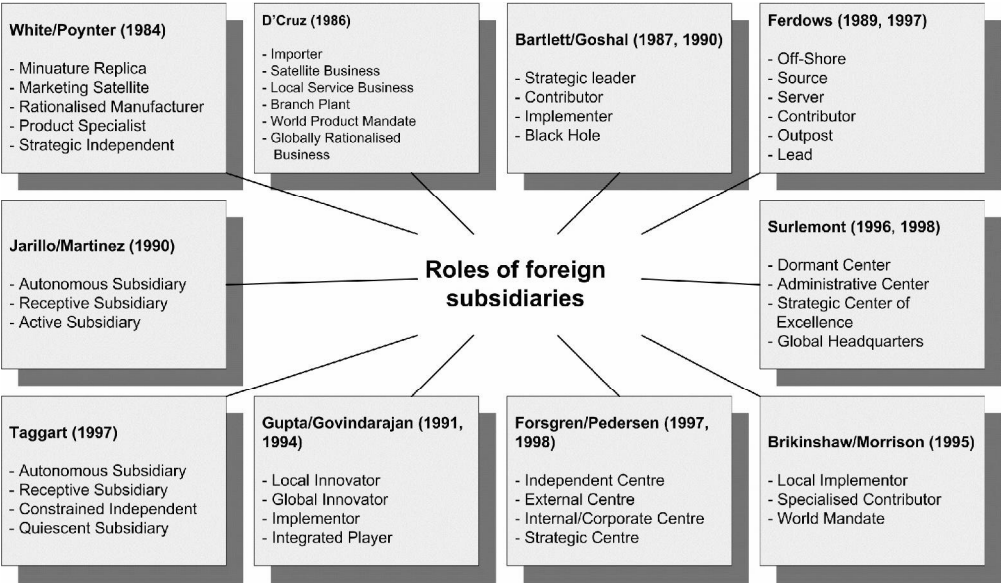
Figure 7: Relationship diagram (person related)



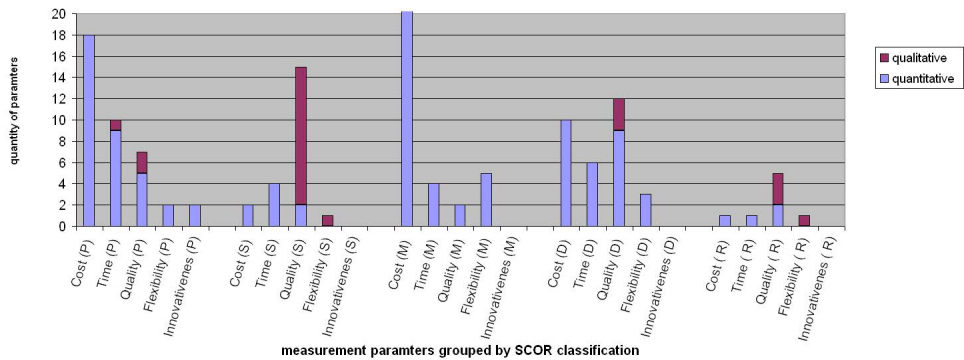
**Empirical approaches on regional culture**  
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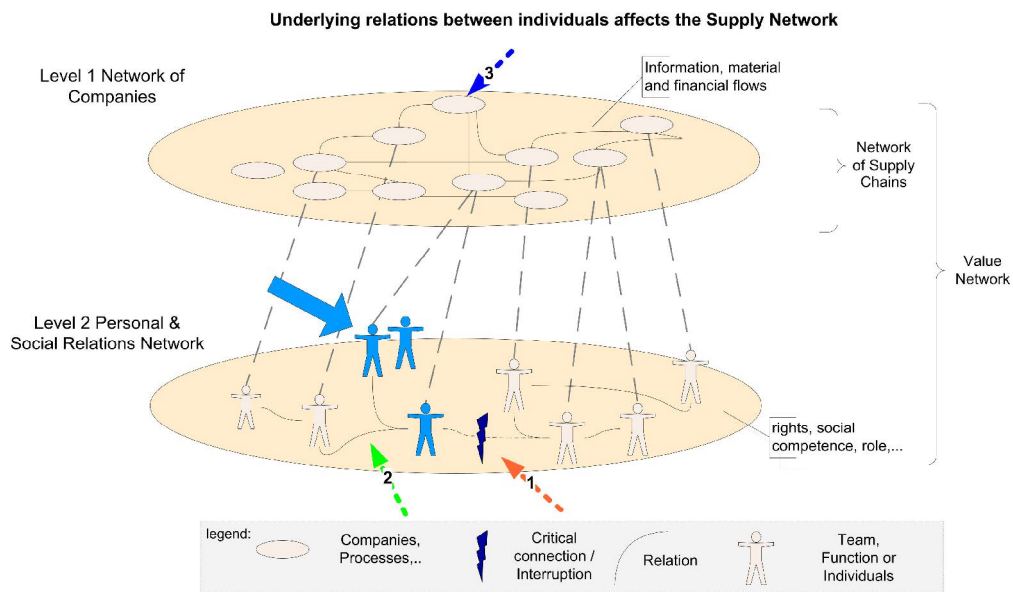
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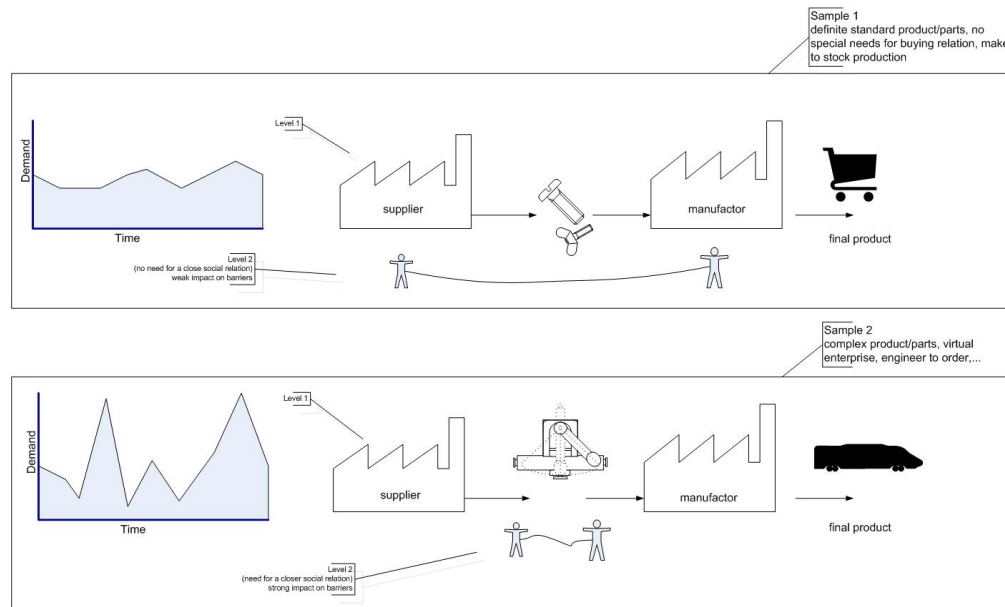
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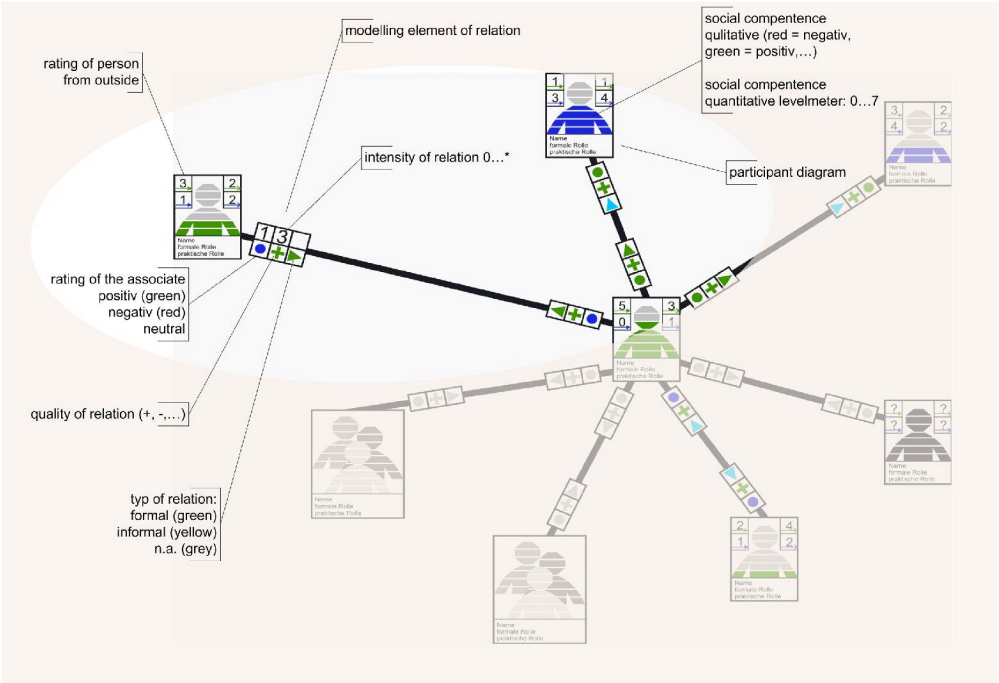
supply chain performance measurement factors



**the value network - extend the supply network with a 2nd level**  
141x82mm (600 x 600 DPI)



**Interaction and effects between both levels**  
370x224mm (96 x 96 DPI)



**Relationship diagram (person related)**  
102x69mm (600 x 600 DPI)