

# Mechanisms of Coordination in Regional Networks

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## 1. Introduction

Networks and network-like cooperative relationships between firms become more and more a subject when the future of small and medium sized enterprises is the matter. However, such relationships can be found not just today but have been existing for a long time. Thus, for organizational practice network relationships seem to be nothing new. However research in interfirm networks could be described as relatively new research area. Although the amount of network literature is growing there are some “blind-spots” in network research (see for an overview e.g. Ebers, 1997, Sydow/Windeler 2000). Empirical investigations to analyse mechanisms of coordination in networks as well as advises for network in practice are two of those neglected aspects.

The paper is divided into three parts. The first part gives a view over mechanisms of coordination, integration, and selection in networks described in literature. There has been a growing interest in the international business and management literature in the role of the mechanisms of coordination and management of networks (Grandori/Soda 1995, Bellmann/Hippe 1996, Ebers 1997, Kickert et al. 1997).

In the second part we provide empirical illustrations from a case study. This study deals with a regional network, called “AMTEC” (application centre for micro-system-technology), which is a regional network of 16 enterprises mainly developing and producing micro-systems, e.g. medical equipment and corresponding services. We describe the development of the network and try to identify relevant mechanisms of coordination, integration, and selection.

Finally, we will discuss the question what implications are there for network in practice and which advice should be followed for successful interfirm co-corporation.

## 2. SME networks - a definition

We understand networks as historically evident phenomenon of interfirm collaboration. The concept of SME network presented here rests upon perennial analysis of network literature and our own empirical investigations. Due to the limited space of the paper we cannot present all results of this analysis here, although in the summary of the analysis significant characteristics of such networks can be seen (see among others Sydow 1993, Kilper/Latniak 1996, Powell 1991, Miles/Snow 1986, Grandori/Soda 1995, Ebers 1997):

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- **Coexistence of competition and cooperation:** Interfirm networks are seen as rather cooperative than competitive kind of collaboration. Particularly they are a special kind of inter-organisational cooperation.
- **Divers actors (normally more than two):** Interfirm networks consist of divers actors with partly different interests and goals. All actors are involved in the dynamic interaction of network formation and organisation.
- **Existence of coordinating elements from both hierarchies and markets:** Within network-like relationships there is both, hierarchical and market-like (e.g. prizes, quality) coordination.
- **Complex relationships on several layers:** Inter-organisational interaction within networks take place on several layers (e.g. personal, informational, cultural, economical layer). These are interwoven and interactive.
- **Reciprocal relationships:** Relationships in networks are reciprocal. That means partners are exchanging something (e.g. goods, services, values, staff, information, norms).
- **Economic interdependence:** Because of the reciprocal relationships network actors are economically interdependent. Particularly in very intensive relationships economic interdependence can be seen in the fact, that the quit of one network member can jeopardise the existence of the whole network.
- **Power and the authority to make decisions are spread polycentric:** As well as within networks controlled by a focal enterprise and within decentralised networks power and the authority to make decisions are never permanently in the hand of one or a few actors but are shared polycentric. Moreover, with changing tasks the constellation of actors can change and thus power relations and decision competencies.

To sum up these characteristics, SME-networks can be interpreted as long-term, inter-organisational, complex, and reciprocal relationships of interactions between individuals, parts of organisations, organisations as well as groups of organisations (see Sydow 1993). In the following presentation we will use the terms “network”, regional networks and interfirm networks synonymously, however, we always focus on regional networks of small and medium sized enterprises.

### 3. Mechanisms of coordination, integration, and selection in networks

Within networks there are sets of coordination, integration and selection mechanisms. The following presentation focuses on several of these mechanisms. Partly we follow the argumentation of Grandori/Soda (1995) because in their article they gave a first overview of so-called network mechanisms. However, we elaborate their findings and will add own mechanisms. This paragraph should give a comprehensive overview of known coordination, integration and selection mechanisms in networks. Thus, it serves as a theoretical basis for our empirical investigation.

It should be mentioned here that the separate presentation of these mechanisms is suitable only on an analytical level. In network reality most of these mechanisms function simultaneously and are interwoven. Therefore, they should be studied in combination.

#### 1. *Communication, decision and negotiation mechanisms*

According to Grandori/Soda (1995) these are the less costly and more ubiquitous mechanisms in interfirm networks. To organise a long term relationship in networks repeated communication, decision making, and negotiation is necessary. In connection with this, as

network literature shows, the process of formation of communication, decision and negotiation structures is power dominated (see among others Sydow 1993, 1995; Sydow et al. 1995; Boje/Whetten 1981; Hoffmann et al. 1990; Scheff 1996; Ness/Gulbrandsen 1997; Hardy et al. 1997). To acquire a dominant position and to defend it on the one hand and the attempt to avoid domination on the other hand are seen as normal strategies of network actors (Aldrich/Whetten 1981). In our view political processes in networks are different to those in other organisations because of the specific qualities of interfirm collaboration. The more collective collaboration requires different, partly new competencies and behaviours, particularly because a) there is no established and stable hierarchical organisation in networks, b) the actors are loosely coupled (Aldrich/Whetten 1981), and c) it is difficult to specify the boundaries of network systems (Alderfer 1975 and 1981, cited in Cummings 1984, speaks of „underbounded systems“).

From this point of view the inter-organisational decision making process is also a political process. However, it is no rational process but it is influenced a) by the different and temporally unstable motives of the involved actors, b) by perceptions of potential sources of assistance (e.g. coalitions), and c) by activities of the network actors to control interaction between other network actors (e.g. to launch conflicts between opponent parties) (see Elg/Johansson 1997).

Through repeated interaction, communication, decision and negotiation mechanisms become stable and develop towards structures. The resulting set of rules and resources is not just a result but also a necessary medium of network formation (Sydow et al. 1995). The inter-organisational world is not introduced from the outside but is negotiated by the network actors themselves (McMillen et al. 1997, Hardy et al. 1997).

## *2. Social coordination, integration, and control*

The fact that cooperative inter-organisational relationships also take place on a social level is not new. Personal or social closeness is seen as positive and also necessary pre-condition for the formation of networks (Sydow et al. 1995:387; Nesheim et al. 1997). According to this theory, social relationships within a network do have a steering and controlling impact on the network. However, this is often neglected (Granovetter 1985).

The analysis of network literature shows that up to now mainly mechanisms like power and trust have been the subject. The formation and socializing impact of a network culture is addressed only sporadic (Sydow 1995, Sydow et al. 1995, Schaap/van Twist 1997, McMillen et al. 1997). We already addressed power and influence relationships in the last paragraph and the reader will find this aspect also in the following paragraphs, therefore here we will concentrate our presentation on trust and culture as mechanisms of social coordination, integration and control.

### ***Trust***

Often trust is seen as central social aspect within networks. However, if trust is a pre-condition for a successful network relationship, a result of such a relationship (see Powell 1996, Bachmann/Lane 1997, Uzzi 1997), or both this, is not clear yet. The term “trust” has various definitions. A summarization of different definitions could lead to this one: trust is anticipated positive behaviour of the other network actor and thus is a mechanism to reduce uncertainty and a functional substitute of power (see e.g. Barber 1983, Luhmann 1988, Siu-lun 1996, Bachmann/Lane 1997, Bierhoff 1995, Gill/Butler 1996, Loose/Sydow 1994, Hosmer 1995, Powell 1996; Gambetta 1989, Ring 1997).

The development and maintenance of trust requires investments from all actors involved. These investments are monetary as well as non-monetary advance concessions. As a result it is unsure that these investments will remunerate (Lorenz 1991). This often leads to the fact that

especially financial advance concessions are brought only hesitatingly. All in all, at the beginning of network-like cooperations there is an ambiguous and uncertain situation. The actors involved do not know each other well and they are reserved in their behaviour. On the other side they are interested in interfirm cooperation and want to see countable results but being reserved and waiting what the other will do will not lead to positive results. This situation is a dilemma for the network actors because trust is, in our opinion, both pre-condition and result of successful cooperation (see also Cummings 1984). Especially in the beginning of the formation phase the actors should allow backstrokes to happen because in this phase a lot of investment is necessary to build up trust while returns from the network are still low (Sydow et al. 1995). It seems to be useful that in the beginning there should be smaller transactions where risk can be calculated and only little trust and money are necessary (Lorenz 1991). If these small transactions are seen as positive by the network actors, they could serve as basis for further extensive collaboration and the development of a trustworthy relationship. Summing up, trust within networks leads to a situation that the behaviour of the network actors could be predicted in a certain scale, because it could be assumed that the other actor will not behave opportunistically. This implies that inter-organisational collaboration has to be less formalised legally (Lazerson 1988:340; Ring/Van de Ven 1994:105). However, there will always be room for individual interpretation whether certain behaviour is seen as cooperative or opportunistic. Insofar trust, although seen as effective lubricant, will only function in combination with other mechanisms of coordination (Loose/Sydow 1994).

### ***Culture***

Network research has largely neglected the subject of formation and existence of a network culture. Statements regarding this topic are very sporadic (Sydow et al. 1995). Sydow (1995) as well as Sydow et al. (1995) argue that joint patterns of interpretation and value systems serve as mechanisms for integration within networks.

Networks emerge under participation of different actors. Within this formation process different cultures from different firms collide. Therefore network culture is a product of interaction and, similar to dyadic interfirm cooperation, there could be a so-called process of acculturation (Hermann 1989, Steger 1997, Nahavandi/Malekzadeh 1988). Within such a process different cultures of the network firms adapt, conflict, are being assimilated, or coexist. Acculturation is a process of socialisation and construction in which the new social reality emerges through communication and interaction between the involved network actors (Schaap/van Twist 1997). The pre-condition for such a process is the reciprocal recognition of differences in cultural backgrounds (McMillen et al. 1997). Network actors are not just firms but also parts of firms or individuals. This quality makes it very complicated to describe the formation and existence of a network culture because acculturation takes place not just between different cultures but also between different subcultures of the firms.

Like organisations also networks (especially regional networks) are embedded in a regional social milieu. This milieu, as a superior cultural framework, influences network culture (Staber(b) 1996). Additionally the culture of a network will also be influenced by changing societal values (see e.g. Von Rosenstiel 1990, Klimecki et al. 1991) as well as by cultures of different professions or branches of industry (Zündorf 1993, Zündorf 1994).

Mechanisms of social coordination and control take effect consciously as well as unconsciously. Moreover, they must be analysed in a wider context because on the one hand former individual experiences of the network actors will have effect on their behaviour in the network (see Gunz/Jalland 1996) and on the other hand experiences with interfirm collaboration will have an effect on further intra- and inter-organisational behaviour of these actors (see Human/Provan 1997; Kanter/Myers 1991).

Because cooperative interfirm relations are social relations between the actors involved and because work in networks takes place primarily in groups we think that such phenomena like group norms and group pressure, conformity, free riding, diffusion of responsibility, reputation, bargaining, power, and inter-group relations (see e.g. Sandner/Meyer 1997; Scheff 1996; Larkey 1996; Mulvey et al. 1996; Argyle 1983, 1989; Staehle 1994; Smith et al. 1995; Ring/Van de Ven 1994; Wagner III/Hollenbeck 1992; Wagner III 1995) should also be the subject of analysis.

### *3. Integration, coordination and linking pin-roles*

Horizontal responsibilities and linking pin-roles (Grandori/Soda (1995, Aldrich/Whetten 1981) are key mechanisms within the formation of networks. As far as we know the term “linking pin-role” originates from Likert/Likert (1976:183ff.). They argued that a person fulfilling this role is at the same time member in different groups of an organisation with the function to ensure information flow between the groups and to stimulate and maintain collaboration of the groups. Thus linking pins are more than just a representative of the group. Following Likert/Likert advantages of such roles are:

- Linking pins encourage mutual exchange.
- Actors in such roles are psychologically closer to each group than every other member is to any other group.
- Linking pins are an accepted member in each of the linked group and therefore could influence the group more effectively than an outsider could.
- Linking pins can communicate more effectively because they know on the one hand the vocabulary and jargon and on the other hand the norms, values, and goals of the group. Thus, they are enabled to understand several groups.

These advantages of linking pin-roles within organisations can also exist with integration and coordination of inter-organisational networks. On the interfirm level, such roles could be defined as actors, which are at the same time members of different firms or more exactly of parts of different firms. In networks linking pins have two functions. Firstly they should integrate the different network actors concerning the purpose and the idea of the network. This task should solve the dilemma of organisational differentiation and integration which can be found in networks, too. Secondly, linking pins are the central nodes of interaction and communication within the network, whereby within different kinds of relationships (exchange of goods and services, information and knowledge flow, social relationships) linking pin-roles could be fulfilled by different actors. Concerning communication there are interesting empirical results from work psychology with linking pin-roles (“Grenzgänger”) on the shop floor in the framework of inter-organisational projects (Endres/Wehner 1996).

Regarding integration, another point which should be mentioned here is the fact that within organisations the fixed structure as well as the codified rules and processes fulfil a large part of the integration task. On the interfirm level, however, there is no such formal structure or codified rules (see. e.g. Alderfer 1977, 1981, cited in Cummings 1984, Brown 1980). However, also in interfirm networks structures will develop but the processes of development are only scarcely studied (see Grandori/Soda 1995; Sydow 1993; Ring/Van de Ven 1994; Ebers 1997). As a first result research shows that inter-organisational structures are less stable than those within firms. This implies on the one side that there is more space for individual behaviour and on the other side that these structures and rules could change more rapidly than traditional interfirm structures.

### *4. Common staff*

Especially when networks are large and have a high amount of interactions, coordinating activities become more and more important. This could be a reason to establish a central post within the network to coordinate the activities of the network actors. Examples for the establishment of such a position could be franchising networks (see Freichel 1992) and SME-networks in Saxony, which are coordinated by a so-called “networker” and evaluated in an action-research paradigm at the Chemnitz University of Technology, Centre for SME (Freitag et al. 1997). However, such a position could also be useful in smaller networks, especially when the network is in a formation phase and the firms do not know each other well. But one has to take into account that such a central position is not necessary in every situation and kind of network. It is also possible that the network firms coordinate their activities by themselves (Grandori/Soda 1995).

### *5. Hierarchical and Authority relationships*

Speaking about hierarchies, we often think about power and dominance. However, it is often neglected that hierarchies have two functions: Firstly, to coordinate the activities of the divisions of an organisation which are organised after the principles of division of work and secondly, to establish and maintain a system of authority relationships and therewith protect dominance within the organisation. As we will see in the following mostly the last function of hierarchies is also being considered in network literature.

Especially in normative network literature hierarchical and authority relationships (especially regarding power and domination) within inter-organisational SME-networks are partly proscribed and are seen as hindering the effective collaboration within such networks. However if one looks at SME networks from a social science perspective there will always emerge hierarchies between social actors - also in networks. From this perspective, approaches which proclaim relationships free of authority are at least problematic.

Also, within cooperative relationships between firms there will develop power relationships and dependencies. In our opinion the special quality of SME networks is on the one hand that normally there are no stable leader-follower relationships but the fact who is leader and who is follower will be newly negotiated according to certain situations and problems from time to time (e.g. Wimmer 1994). In this negotiation the actors are driven by individual as well as collective goals and interests. On the other hand there is no traditional firm hierarchy serving as formal power source within networks. Moreover, in relevant resources of interfirm relationships, central positions, and powerful behaviour are seen as important sources of power (Boje/Whetten 1981, Ebers 1997, Håkansson 1989). However, these sources have less binding impact on behaviour of the other network actors than a firms hierarchy has.

According to Grandori/Soda (1995) within cooperative networks, authority relationships will not be the prevailing mechanism of coordination but will function besides a set of other more proportional mechanisms.

### *6. Planning and control systems*

The establishment of cooperative relationships within a network also arises the problem how to control and steer cooperative behaviour towards a certain collective goal. Outcome based planning and control systems could be an opportunity to solve this problem. In Franchising networks such systems are most popular (Grandori/Soda 1995). However, as we believe, also in long term networks which are arranged along the value chain such systems could be useful because they, although labour-intensive in their introduction, could support planning of joint projects, controlling of outputs, and controlling of the performance of the involved network firms. A problem could be that the firms have to disclose certain details and practices how they do business (see Sydow et al. 1995). Often the firms perceive this as a risk, especially if the relationship is only slightly developed and therefore they often reject the introduction of such

systems. However, only the disclosure of internal details enables the firms to steer the interfirm cooperation in the network by using planning and control systems.

#### *7. Incentive systems*

In network relationships which are embedded in a complex context and in which the performance of the single members is difficult to evaluate so-called incentive systems are one of the dominating mechanisms for coordination (see Grandori/Soda 1995). Formal rules how to distribute joint profits or certain rights could be examples here. Just if there is high uncertainty about the success of the cooperation there is increased risk for opportunistic behaviour of single network firms. However, such behaviour can have serious consequences for the whole network. Mutual commitments (e.g. guaranties) and the specification of shares in joint profit could be instruments to coordinate behaviour and to ensure cooperative behaviour within the network (see also Williamson 1985). In our view also so-called trust substitutes (see Loose/Sydow 1994) serving as safeguard mechanisms should be included here.

#### *8. Systems of selection as mechanisms for integration and coordination*

Network members consciously as well as unconsciously establish certain criteria to specify who is in and who is out as well as how to behave in the network. These criteria are established on the basis of former experiences and perceptions and could be an effective means to coordinate behaviour in the network. In this regard Krebs/Rock (1994) speak about context control or framing, that means the selective strategic choice of partners according to their scopes of behaviour.

Grandori/Soda (1995) argue that the more intensive cooperation between the network firms is, the more strict are the rules for access of new network members. For instance the access to certain associations of interest normally only requires that the firms meet certain formal criteria and legal norms. However, the evaluation whether a firm will gain access to a franchising-network includes all economic, social, and organisational aspects of the potential member.

Rules of evaluation of the behaviour of new or existing members do not have to be formally established or codified but also exist on an informal level. Additionally, these rules are not set a priori but are developed in repeated interaction and are embedded in the specific social context of the network relationship.

#### *9. Information systems*

For a long time information systems have only been seen as mechanisms for vertical integration within and between firms. Just recently the coordinating effects of such systems also on the horizontal level of interfirm network relationships is being recognized (Ciborra 1990 und Ebers 1993, cited in Grandori/Soda 1995). Information systems are frequently seen as effective opportunity to decrease interfirm communication costs. Moreover, the analysis of network literature shows that such systems are partially seen as the one and only mechanism to coordinate the behaviour of network actors. On the other hand the costs to build up and operate such a system are often neglected. However, these costs could be problematic for small and medium sized firms. Moreover the installation of an extensive inter-organisational information system implies a long term relationship but in the formation phase of the network this could not be foreseen by the network members. Furthermore, an inter-organisational information system must be compatible to the information systems already used by the network firms. The use of the internet could provide a solution here, although creating an internet based information system also takes time and other resources. One additional point should be mentioned here. Information systems are only useful for numeric or quantitative data - the computing of, for instance, social processes will overcharge them. For example such systems could not explain why two network firms, although there are economic advantages for both of

them, will not cooperate because of the absence of good personal relationships.

To sum up, the installation of inter-organisational information systems seems to be useful only with long term relationships whereby the idea that such systems are the one and only mechanism to coordinate the behaviour of network actors is very problematic. Such an assumption could lead to an overestimation of the performance of such systems like those of management information systems (MIS) and marketing information systems (MAIS) in the eighties. In current discussions the notion of knowledge management in networks gains more and more impact. This concept includes technical information systems as well as social mechanisms (e.g. Scheff 1997, Schöne et al. 1999, Freitag 2000, BMBF 2000)

#### *10. Public environment and infrastructure*

Interfirm networks are embedded in a larger geographic environment. This environment on the one hand influences the formation and organisation of networks and on the other hand is influenced by the activities of the network itself.

Therefore, if regional networks are the subject of investigation it is necessary to study them also under consideration of the regional and institutional context in which they exist (see Staber(b) 1996). Moreover, for a comprehensive perspective on networks the regional embeddedness of network activities should be included in analysis. Particularly one should focus on the influence the region/location exerts on the formation and organisation of the network. Especially such aspects as density of population and level of urbanity as well as connected aspects like educational and technological structure, level of industrialisation, economic structure should be recognised (see Brussig et al. 1997). Additionally the historical development of society and the economic development as well as the institutional and political conditions are seen as specific regional influence factors having an effect on networks.

Public environment and infrastructure operate as influence factors because they constitute the social, economic, legal, and political framework for the network. The creation of a supporting infrastructure could stimulate the formation and maintenance of interfirm networks (see Staber(a) 1996, Staber(b) 1996, Piore 1990, Pyke 1995, Hirst/Zeitlin 1992, Powell 1996, Sydow 1996, Louzada 1995, Schöne/Freitag 1999).

#### *11. Contracts*

Articles of agreement as well as codified rules are the formal-legal side of inter-organisational cooperation. In market relationships the classical law of contracts is predominating. This law follows the paradigm of isolated transactions (see Krebs/Rock 1994). However, in interfirm networks as hydride kinds of organisation (Fischer/Gensior 1995) contracts are a kind of coordination for the purpose of the establishment of a long term contractual framework. Here the point of reference is not the single transaction but the whole relationship. It is a kind of relational contracting (see Krebs/Rock 1994). However, this does not exclude the existence of contracts for particular problems (Macaulay 1963).

Following Gerybadze (1995) there are three kinds of contracts in networks: Firstly, the so-called ownership contracts. These contracts regulate the rights of the contracting parties. More exactly they regulate the level of disposition of the resources brought in by the partners, the value of this resources, and certain control rights of the parties (Gerybadze 1995). Sales, service and rental contracts secondly regulate the exchange of resources on the base of service and service in return on a general level. Thirdly, there are cooperative contract modes. These modes allow inter-organisational institutions (e.g. interfirm project groups, work teams) the use of certain resources whereby the resources will still be owned by single network firms (Gerybadze 1995).

As we can see most of the contracts identified by Gerybadze are relational contracts - established to define a contractual framework for the relationship and not just to regulate a

single transaction or problem. Most of the approaches to explain the effects of formal contractual relationships base on transaction cost approach and try to describe the economic organisation of interfirm networks as a contract problem (Williamson 1985). In our view this will not work, because the transaction cost approach could only explain single transactions and not so-called relational contracting.

### *12. Prices*

On markets coordination takes place because of an operative price mechanism (Krebs/Rock 1994). We can also find such market based mechanisms in networks. One example could be the existence of systems of prices for internal clearing of the activities of the network members (Sydow 1992). Those systems also serve as coordinating mechanism. However, such price-mechanisms only work on network levels which could be rated with prices, costs, and other quantities (e.g. classical economic level). On the level of social and cultural networking this mechanisms will fail respectively will be substituted by mechanisms of social coordination and control.

## **4. Illustrating example: the network AMTEC<sup>4</sup> in Chemnitz, Saxony**

### *4.1 Origins of the network AMTEC*

The network AMTEC – „Anwendungszentrum für Mikrotechnologien Chemnitz“ (application centre for micro-technologies Chemnitz) exists since the 27<sup>th</sup> of February in 1997. The network unites 16 small and medium sized enterprises (SME) of the region Chemnitz with a total of nearly 500 employees. All 16 firms are shareholders of the network-enterprise, the AMTEC GmbH with the legal structure of a limited liability company (Ltd., Plc). The companies of the network stay legally independent and in all cases they have additionally own lines of business. The main tasks of the AMTEC GmbH are the coordination of joint projects and the marketing of the network and its products and services. In addition AMTEC GmbH with its 6 employees has its own independent line of business: software distribution of software programs and appropriate services from the fields the 16 companies work in (e.g. micro-systems, medical equipment).

There are two additional network institutions: a business board and a scientific advisory board. The business board is responsible for counselling and controlling the CEO. In the scientific advisory board, which only gives advice, there are mainly representatives of regional universities and research institutes.

The main goal of setting up the network AMTEC was to develop innovative products and services in cooperation. The cooperation is organised in projects. In every project a subset of the 16 firms cooperate and in some cases there are associate partners members of the project team from outside the network. Many projects constitute a value chain from research and development to distribution and application of new technologies, therefore business to business customers and sometime even end users (e.g. employees of hospitals which use the medical equipment) are part of the project team and guarantee the relevance of the products.

### *4.2 Technological background*

AMTEC is a network of high-tech firms in the fields hardware and software development. The main goal is to develop innovative products and services, especially user-specific solutions, in the field of micro-system-technology. Micro-system-technology is getting more important. This technology is used to produce integrated solutions which serve as sensors (physical, chemical, biological signals), actuators or complex control systems.

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<sup>4</sup> <http://www.amtec-chemnitz.de>

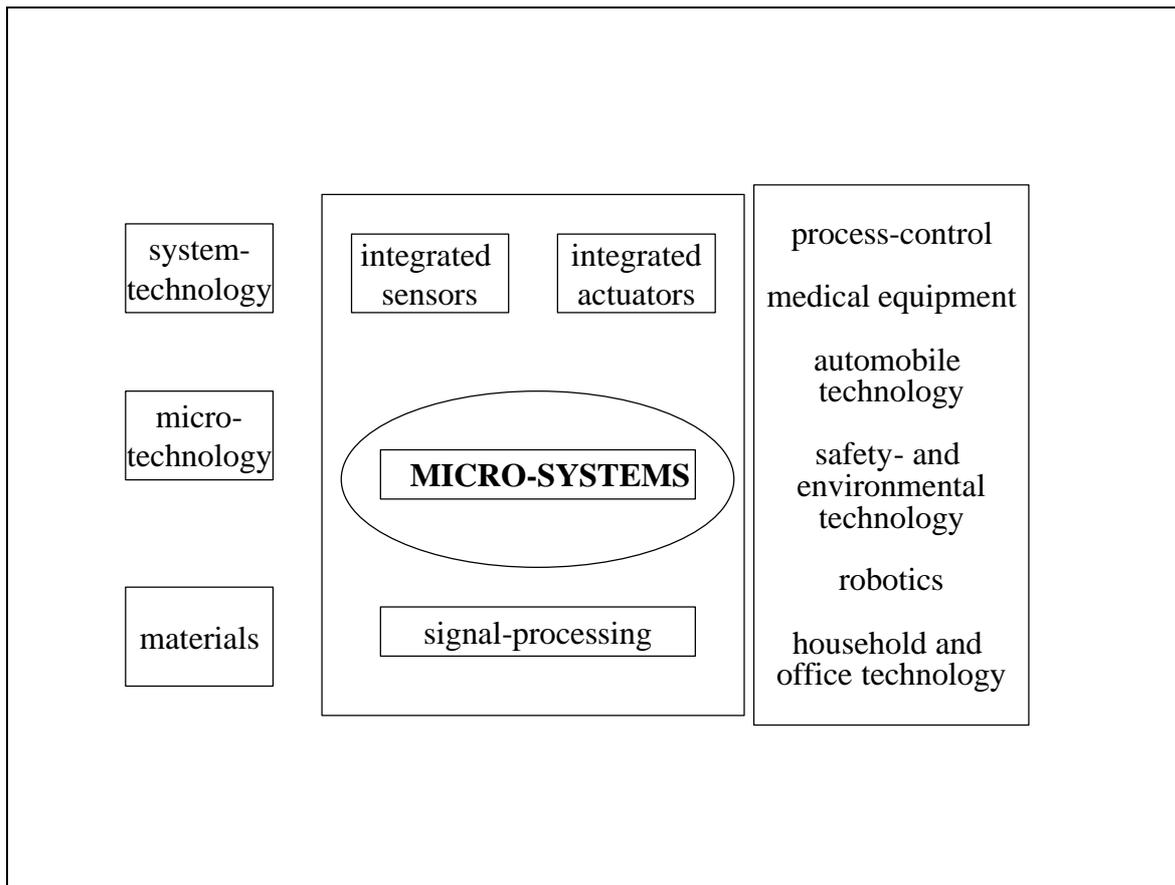


Figure 1: Overview of micro-system-technology

Micro-system-technology is a typical example for a new hightech-field which requires the integration of different disciplines, technologies and in many cases the cooperation of basic science, industry and end-user. There are certain characteristics, which make it difficult for SME to act in this market:

- the solutions/applications are in many cases very specific; regional and national markets are limited – it is necessary to act globally
- SME are lacking the necessary distribution channels
- customers need face-to-face advice and services
- costs and risks for R&D are high
- highly qualified and specialised employees are needed
- expensive special equipment is needed

On the other hand analyses show that the field of micro-system-technology is promising for SME, many of them are already active in that business. The often small numbers of units and highly specific and user-oriented applications make it an attractive market for SME.

The regional characteristics and potentials of the Chemnitz region are the following:

- In the Chemnitz University of Technology there is a centre for micro-technology, which is leading in basic research and the production of prototypes of micro-systems.
- In the region of Chemnitz many SME with highly qualified employees are working in

that field, many of them university spill-offs

- There are also many business users of micro-system-technologies in the region of Chemnitz (e.g. automobile industries, mechanical engineering).

These factors led to the foundation of the AMTEC network. The network was an attempt to integrate regional potentials and resources in R&D and production of micro-systems. Therefore it was possible to realize cost-intensive innovations, share the risks of R&D, adapt solutions from other fields and to shorten development time and the time-to-market.

#### *4.3 The foundation and structure of AMTEC*

To understand the enterprises' motives for founding a network it is necessary to take into consideration the historical background, because inter-organisational networks are embedded in a larger geographic environment which influences their formation and organisation. Especially the historical developments and economic and political situation give useful information to understand the network. After the reunification of Germany in 1990 enormous political, economic and social changes took place in the former GDR. Most of the firms in the AMTEC network have their origins in the former combines or research institutions e.g. the research centre mechanical engineering, the textile machinery combine or the Robotron combine (office automation, electronics). Most of the present employees and entrepreneurs of the AMTEC network are former employees of these important R&D institutes and combines of the region Karl-Marx-Stadt (former name of Chemnitz). After 1990 the transformation process led to a restructuring process, privatisation and the division of combines to small and medium sized companies. The second group of companies resulted from the restructuring process of the Chemnitz University. Many of the scientific employees founded their own technology-oriented enterprise. Due to contacts already existing in times of the combines the thresholds to cooperate were not very high. A focal enterprise in the process of founding AMTEC was GEMAC mbH, an enterprise which develops and produces user-specific circuit boards and ASICs (application-specific integrated circuits). For the development of complete solutions GEMAC mbH had to cooperate intensively with its suppliers and its customers. GEMAC mbH was additionally the project leader in a regional R&D programme of the European Union and therefore had to establish working contacts to many other companies in the region. This network, which was based on informal contacts and formal, bilateral contracts, was the core of the AMTEC network development.

In the last decade there was a growing governmental and European support for cooperative projects which integrate different enterprise and scientific institutions. As stated above, public environment and infrastructure operate as influence factors because they constitute the social, economic, legal, and political framework for the network. The creation of a supporting infrastructure in the region of Chemnitz stimulated the formation and maintenance of many inter-organisational networks. The development of the network AMTEC was supported by different governmental institutions of the Federal Government, institutions of the Free State of Saxony, institutions for the promotion of regional economic development and the Chemnitzer Wirtschaftsförderungs- und Entwicklungsgesellschaft GmbH (CWE Ltd.), an enterprise owned by the city of Chemnitz for the promotion of the economic development of Chemnitz. CWE financed an analysis of regional potentials in different branches of the high-tech industry and the SMEs' willingness to cooperate. Based on this analysis a pool of 20 enterprises was

interested to cooperate in a network. CWE GmbH assisted in finding a legal structure and legal contracts. Among the different models (e.g. e.V./eingetragener Verein – nonprofit organisation, GmbH – Ltd., e.G./eingetragene Genossenschaft – cooperative society) the enterprises decided to choose the following model:

- the AMTEC GmbH (Ltd.) was founded and registered
- all enterprises are shareholders
- every shareholder gets an equal share (with one exception). This formal agreement, seen as a coordination mechanism, should support the idea of proportionality
- the minimum lockup period for shares is two years
- the spheres of operations are: coordination of joint projects and marketing of joint products and services. These lines of business do not just define the purpose of the network but also serve as common goals and thus as integration mechanism.

There is a business board consisting of 4 shareholders, selected in the meeting of shareholders, and additionally the CEO of CWE GmbH. It has the duty (§ 9) to „...counsel, support, and control the CEO. The CEO has to give reports to the business board concerning the state of affairs“. The CEO of AMTEC is bound by directives of the business board. This paragraph among others is an example for a codified rule how to behave in the network.

AMTEC has a scientific advisory board which only gives advice and has no power, consisting mainly of representatives of regional universities and research institutes.

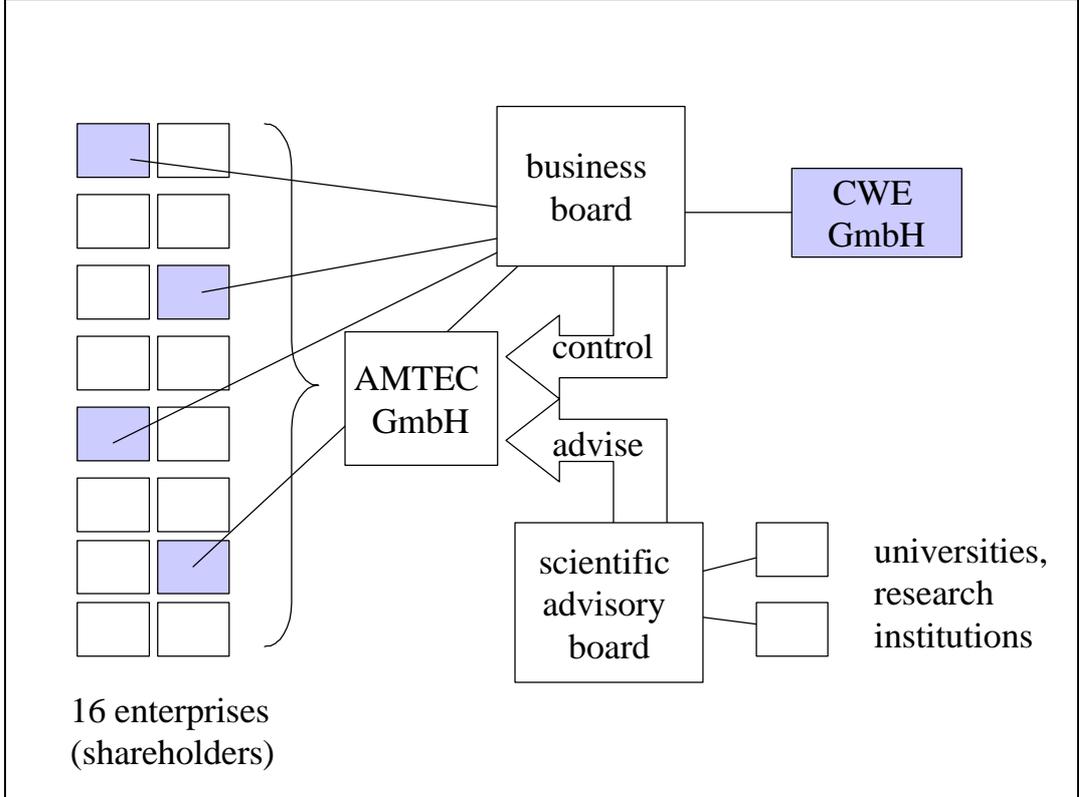


Figure 2: structure of AMTEC GmbH

Finally 16 of the 20 enterprises were willing to sign shares and founded the AMTEC GmbH. 15 hold shares of 1700 Euro each, a very small enterprise holds a share of 250 Euro. The fact that only 16 companies were willing to pay for a share could be interpreted as a kind of mutual commitment. The necessity to pay a certain amount of money in advance is also a kind of

selection, to find out who really wants to cooperate and who does not.

A vision of the founding companies was to establish a sustainable vertical cooperation, a co-operative value chain. Therefore these enterprises come from different branches of the industry like electrical and mechanical engineering, medical equipment and work in different fields like R&D, hard and software production, services and even end-user participate. There is evidence that the cultural differences of the involved firms due to different branches are problematic according to the establishment of joint patterns of interpretation and value systems which could serve as mechanisms for integration within networks.

<b>electrical engineering electronics</b>	<b>mechanical engineering</b>	<b>medical equipment</b>	<b>services</b>
GEMAC mbH	Lernstatt GmbH	Medizin&Service GmbH	AMEC e.V.
GPP mbH	EAAT GmbH	IVS GbR	Seerig&Hübner
Unterberg electronic GmbH		CINDATEC GmbH	CPL GmbH
SIMEC GmbH&Co. KG			AMTEC GmbH
CMS GmbH			Ingenieurbüro Flach
ICA GmbH			

Figure 3: founding members

Following the articles of association (§2, 25<sup>th</sup> February 1997), which can be seen as a kind of relational contracting to establish a long-termed legal framework for the cooperation, AMTEC has the following spheres of business:

"... technological and commercial consulting, project management, marketing, distribution, technical support and human resource development in the areas electronics, microelectronics, micro-system-technology, hard- and software and businesses which are related to that."

Intentionally this definition of the spheres of business is very broad. This is interesting, because a narrower definition could serve as integration mechanism. However to define the collective goal too narrow in the formation phase of the network could hinder the development of the network because the direction of development is defined too strictly and changes would be difficult to make.

The definition allowed a broad scope of action and fostered the strategic development. During the last years AMTEC additionally has also served as a service enterprise for the shareholders (e.g. technical services, software services).

Decisions concerning the spheres of business need a majority of 2/3 of the shareholders.

In case that AMTEC GmbH successfully acquires a project, a so-called "virtual alliance" is build, consisting of a subset of AMTEC shareholders (those enterprises who can contribute to the project) and additional enterprises from outside the network, so-called "associate partners". These enterprises cooperate with the network but do not hold shares.

Cooperation is internally defined by multilateral contracts among the enterprises contributing to the project and the AMTEC GmbH, e.g. contracts for work and services, cooperation contracts. AMTEC GmbH provides a set of standard contracts, which are used regularly. AMTEC GmbH is the party to the contract for external partners like customers or

governmental institutions providing promotion funds. Here we see that the relational contracting is supported by different contracts for single problems.

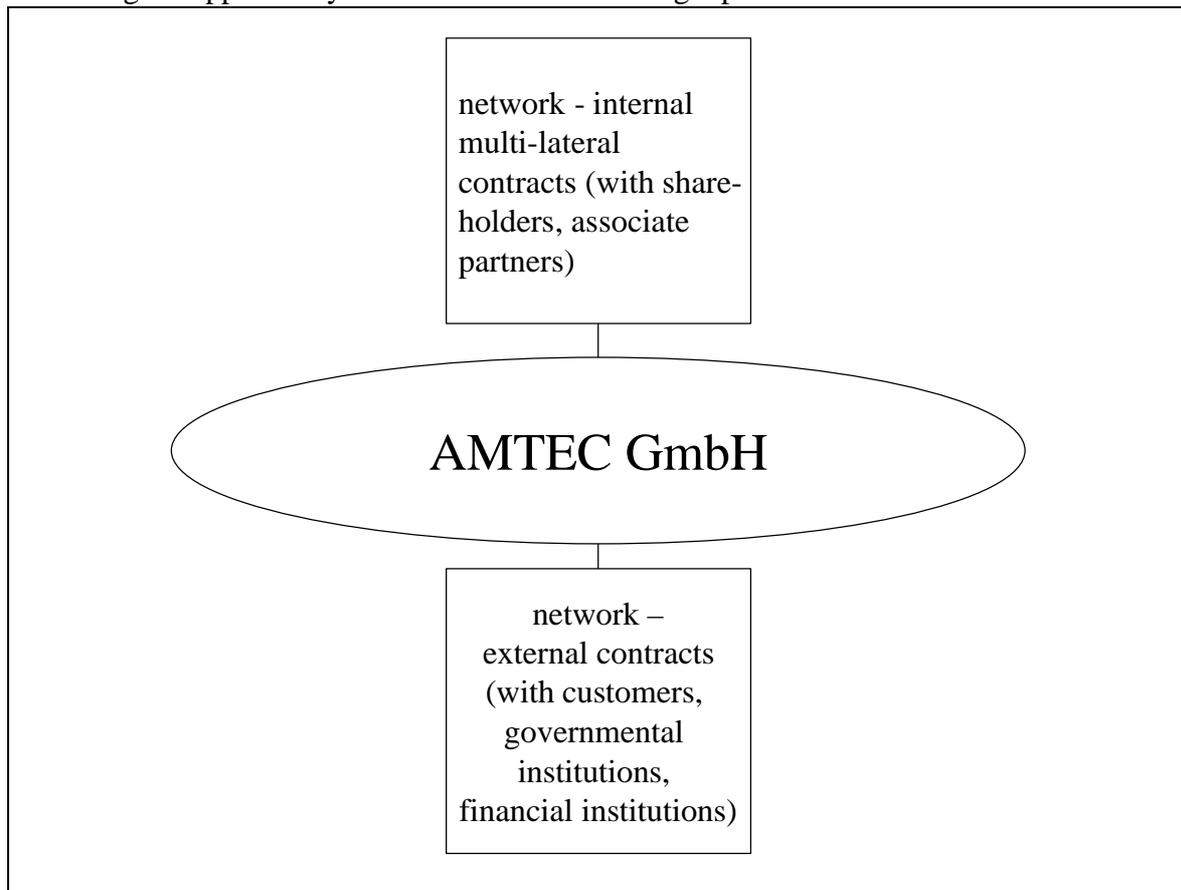


Figure 4: internal and external contracts

In the last years AMTEC GmbH was successful in terms of turnover and there was a rise in the number of employees in the shareholder enterprises and AMTEC itself. But three years of co-operation experiences show also that the legal structure has certain disadvantages:

- For the expansion it is necessary to integrate new shareholders. This is difficult and expensive because a notarial change in the articles of association is necessary.
- In the meetings of shareholders it was often difficult to find a 2/3 majority for necessary decisions concerning the strategy.
- The financing for a Ltd. enterprise with 16 shareholders is very complicated and needs a lot of contracts.

Although the network firms jointly decided to organise their activities within the scope of a limited liability company the development of the network has shown that this form of co-operation does not seem to be suitable for them anymore. The chosen legal structure defines too rigidly who is in and who is out of the network. Moreover there are difficulties when shareholders leave or new partners want to join the network and buy shares. Additionally, we see that the legal form could only partly integrate different interests and goals towards a collective goal. Therefore the AMTEC GmbH is planning a transformation to a stock corporation (Aktiengesellschaft).

The CEO of AMTEC GmbH is supported by an assistant, a coordinator called “networker”. The network coordinator should on the one hand serve as a staff position for the CEO of AMTEC GmbH and on the other hand as some kind of central post to stimulate and coordinate activities of the network enterprises. The most important task of the networker is to manage joint projects and to coordinate communication and transactions between involved enterprises. The experiences in joint R&D projects were that the advantage of a joint parallel development –shorter time of development- was ineffective due to coordination and communication problems in inter-organisational project teams, e.g. because of different cultures, missing feedback and control, time-consuming meetings.

An important task of the networker was to structure the inter-organisational cooperation on the shop-floor and in project teams and to develop the inter-organisational project management.

Thus, the position of the network coordinator includes several network mechanisms. Firstly the coordinator could be seen as a central post within the network to coordinate the activities of the network actors. Secondly, he serves as a linking-pin, a central node of interaction and communication within the network. In a linking-pin role he stimulates and partly maintains communication, decisions, and negotiation-mechanisms and thus the establishment of communication, decisions, and negotiation-mechanisms.

#### *4.4 The future of AMTEC*

There will be a transformation to the new legal structure stock corporation. Advantages of this legal structure are:

- The number of shareholders is unlimited
- It is easier and inexpensive to integrate new enterprises as shareholders
- The network has a broader scope of action concerning financing and therefore it is easier to finance large scale projects
- Coordination is easier due to the statutory board of management and the statutory supervisory board of a stock corporation
- The large number of shareholders does not impede decision-making and the ability to act
- Stocks can be used to commit high qualified employees
- Exchanges of shares are possible without a notary

This transformation will be the basis to build a new joint R&D and production centre.

Here we see the dynamics of mechanisms of coordination. Once established they are permanently evaluated and if necessary changed or replaced. The chosen legal structure of cooperation (limited liability company) is now, after 3 years, seen as an obstacle for further development of the network. It is seen as negative and thus will be replaced by a new legal structure seen as more suitable to meet the needs of the network and its members.

As we could see from the above presentation there are several mechanisms of coordination, integration, and selection in the network. Although this short case study is just an illustrating example it shows that the mechanisms in networks function simultaneously and are interwoven.

## 5. Implications for network practise

So far we have shown that there are a lot of different mechanisms of coordination, integration, and selection in networks. In addition, we have seen that they are existing not just in theoretical literature but in real networks. However the question remains which implications are there for network in practice and which advice should be followed for successful interfirm co-corporation?

In this part of the paper we will try to give some advice for network in practice. Our base of experiences is not just this paper but extensive review of network literature (see Winkler 1998a, Winkler 1998b), own investigations (see Winkler 1999, Winkler 2000; Freitag et al 1997, Freitag 2000), and our experiences with several networks. However one restriction is to make. We explicitly address regional cooperative networks of small and medium sized enterprises, whether our statements are relevant for other kinds of networks or not, is not verified yet.

1. Network actors should know that there are always several mechanisms of coordination, integration, and selection in networks. They should know the different kinds of mechanisms as well as their possible positive and negative impacts on network formation and organisation. On the one hand such knowledge is the precondition to use certain mechanisms seen as relevant and useful. On the other hand network actors become more sensitive to perceive and to interpret the effect of network mechanisms specific to certain problems and situations. If one knows these mechanisms he will be able to understand certain behaviour patterns of the network members and developments of the network itself.
2. The different mechanisms are not independent from each other and are applicable to every kind of network. Moreover, in different kinds of networks we will find different mechanisms of coordination, integration, and selection, with different characteristics, and in different combinations. At the same time we will always find different mechanisms in a network having different and partly opposed effects.
3. The effect of different mechanisms on network development could be interpreted differently by the network actors. What is seen as useful by some member firms could be interpreted as problematic by others. However, this also means that certain activities and instruments to steer and control the network will have different effects on the behaviour of different network members.
4. As mechanisms of coordination, integration, and selection in networks emerge through interaction, networks could never be planned fully in advance. Apart from that it will not be possible to control all processes of network development. Moreover there will be unexpected and uncertain developments and of course also backstrokes. This is normal with networks. From our point of view networks should be seen as a result of both proactive design and complex and uncontrollable, sometimes unconscious processes.
5. It seems to be useful to establish a central position of a network coordinator to stimulate and coordinate communication, decision and negotiation. Especially in an early phase of development the network coordinator could function as central node for information and communication. He could identify problems and could support the networks firms in solving these problems and establishing a climate of cooperation and trust. However, especially the so-called social mechanisms like trust or culture can not be managed in the same way as prices, for instance. The coordinator can not directly design but can try to drive development in a certain direction, however, if a predicted culture will emerge will not be secure.
6. As we could see, the impact of network mechanisms can change over time. Formerly useful mechanisms could be seen as an obstacle for later development. Therefore it is necessary to

permanently evaluate the mechanisms of coordination, integration, and selection in a network and to check whether they are still seen as useful for further development.

7. A supporting environment seems to be important for network formation. Especially such an environment should provide financial support, consulting, infrastructure and contacts to other networks. On the other hand one has to be careful not to promote networks as artefacts of the promotional money.
8. Redundancies and opportunities to choose different partners are important. A network-internal market linked with the external market ensures, e.g. with offers, that market mechanisms will not be completely withdrawn within the network. In other words the conscious establishment of market mechanisms within the network could ensure the survival because the networks stay competitive against other networks and firms.
9. In the beginning of network development it seems to be useful to limit economic activities within the network to smaller transactions where only little trust and money is necessary. If small transactions are repeated over time and become interpreted as positive and successful by the network actors, they will serve as basis for further extensive collaboration and the development of a trustworthy relationship. However trust has to be reproduced over and over again.
10. To build up networks takes time. Especially a stable relationship over time is seen as vital characteristic for the establishment of a good personal relationship among the network actors. Yet the necessary coordination of points of view, normative orientations, and visions how to adequately use resources between nearly equal powerful actors is heavily time-consuming.

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