

Indicators for Establishing SME Product Development Networks

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The results of research into SME product development networks are presented. The paper provides insight to the process of establishing such networks and the use of indicators in the design and monitoring of this process. It is based on five extensive case studies and in addition on several in-depth interviews with SME entrepreneurs and business managers. The practical experiences in these case studies and the indicators used by practitioners in network development are briefly described. These experiences together with theoretical insights were combined into a comprehensive set of indicators, describing the progress and effectiveness of the network formation and operation process. The discussion closed with more generic conclusions about establishing inter-organisational networks and monitoring network development processes in practice. Implications for further research have also been put forward.

Introduction

Over the past decades or so, we have seen a growing attention to the role of organisation networks and industry relationships in product development in academia as well as in practice. Inter-firm networking is increasingly important to economic life because of its capacity for regulating complex transactional interdependence as well as co-operative interdependence among firms¹. Inter-firm networking has been encountered in various forms and areas and that was undertaken for numerous reasons.

An increasing number of companies were convinced that (or experienced that) they no longer could develop, manufacture and market their products without the help of external partners. In product innovation the 'go-it-alone' strategy has been more and more being frustrated by lack of (technological) competencies, high uncertainties, increasing costs and financial risks, and problems related to scale. The pace of technological change and the increased technological complexity of new products (products based on multiple technologies and competencies) forced companies to collaborate and to develop partnerships with companies in

control of complementary skills and capabilities². It applied to large corporations, but especially also to small & medium enterprises (SMEs) with their more limited knowledge base. Furthermore, such inter-firm co-operation has also been important for SMEs in developing countries, if they wanted to compete internationally in more knowledge intensive products.

According to management gurus, industrial historians and economists the current industrial society has been gradually transforming into a knowledge society. Every now and then a picture has been drawn of society on the threshold of a new post-industrial era dominated by knowledge workers and virtual enterprises heavily relying on modern ICT^{3,4}. Nonaka and Takeuchi⁵ postulated that the rising knowledge society would thrive on other capabilities and competencies than those applicable in the past. Reflecting on the ever increasing number of knowledge intensive firms in the triad-regions, knowledge creation has been predicted to be the key to competitive advantage in future. Anticipating this, organisations have been expected to prepare for a new form of competition and invest in and adopt new ways of managing knowledge and hu-

man capital. According to some, R&D management has been developing into a business of integrated and network oriented approach, characterised by an increased focus on corporate flexibility, speed of development, quality and other non-prize factors^{6,7}. Knowledge sharing – via horizontal linkages within or between organisations – was supposed to contribute heavily to the competitiveness and survival of the R&D incorporated enterprise in future.

This paper reports on SME product development networks in the south-east region of The Netherlands. Dutch SMEs competed on price and quality. As a result of global industrial developments and the changing international competition, Dutch government policy now stimulates SMEs to increase their efforts in R&D and to compete also on knowledge and innovation next on competition on cost and price. The potential of SMEs with regard to product innovation and technology management often has been dependent on links with other (and sometimes larger) firms and strengthened by the development of inter-organisational collaboration and networks of SMEs. Inter-organisational collaboration offered SMEs the opportunity to capitalise on their flexibility and entrepreneurship (stemming from interdependence) and to utilise at the same time additional capabilities and competitive strengths resulting from inter-firm complementarity. It has been proved true for Dutch SMEs getting into the habit of knowledge intensive competition and preparing for a new era of tier-based industrial configuration. It might also hold true for industries in developing countries creating a business infrastructure for industrial innovation. SME product innovation and business development could be guided by the adage “innovation by combination”. In a wider context Ohmae⁸ referred to the phenomenon as “the global logic of strategic alliances”. Recent research demonstrated or hypothesised about the importance of local impetus for networking. So, inter-organisational relationships, networks, clusters and industrial districts would play a key role in improving innovative capabilities of SMEs.

Research on Networking

Inter-organisational relationships were studied in two different research streams. In the first type of analyses *emergent networks or clusters* of geographic concentrations (or industrial districts) of interconnected companies and institutions were emphasised⁹⁻¹⁷. The research stream was encountered within industrial eco-

nomics as well as in historical and evolutionary approaches¹. The second type of research dealt with *intentionally formed or designed networks*, based on distinct collective interests and explicit co-operation agreements like strategic alliances, franchising, licensing, co-development and joint ventures¹⁸⁻²⁴. In this paper on the latter type of intentionally formed networks have been described, which might, by the way, be created on the basis of prior existing emergent networks.

In literature, these intentionally formed inter-organisational networks have been treated as an intermediate or hybrid form of organisation of economic activities between markets and firms or as a ‘third type’ organisational arrangement, with its own characteristics and properties¹. As in a ‘common’ organisation (or ‘hierarchy’), the basic issue in an organisation network was the creation of effective and efficient co-operation between its constituent individuals or groups. In an inter-organisational network this joining of forces lacked the support of the ‘classical trinity’, present in common organisations: *ie* unity of ownership, power and loyalty. Realising business results in networks was different and often more difficult, because networks had distributed ownership, power and loyalty^{2,3}. Among other things, it necessitated consensus-based decision making and negotiation. These were the processes that did not always fit the nature and personal characteristics of entrepreneurs. On the basis of extensive literature review Grandori & Soda¹ described several network forms and mechanisms. Characteristics of these forms differed strongly depending on diverging antecedent variables. Networks differed strongly with regard to centralisation, formalisation and co-ordination mechanisms employed in practice.

Whereas organisational collaboration has been considered to be important, many companies lacked experience and networking skills necessary to develop successful and sustainable partnerships and to deal with the absence of the classical trinity in managing innovation projects. Networking has been a relatively ‘new art’ of management that would develop in the near future. As a result of many years of academic research and reflection on practical experience there is a vast array of literature on the phenomenon of organisational networks and related concepts has been created. However, there are some limitations in academic research and the resulting body of knowledge on networks have been noticed:

- Predominant use of quantitative research designs, often resulting in indirect and single-factor explanations and quasi-correlation;
- Treating the firm as a black box as opposed to clarifying and explaining the managerial discourse;
- Emphasis on dyadic relationships;
- Focus on non-industrial sectors;
- Focus on initial stages of network development;
- An under-socialized view of networking, resulting in a strong preference for formal arrangements in comparison to the attention paid to the role of entrepreneurial action embedded in social networks.

On the other hand non-academic management literature presented many success stories – offering a “speakers corner” for entrepreneurs and corporate spokesmen claiming ‘best practices’ – without, however, revealing underlying mechanisms and explanatory frameworks. In fact, the absence of stories about network-failures and traumatic collaboration in this literature was remarkable. Although small firms might benefit substantially from network involvement, much of the research on networks has been on large-firm strategic alliances or non-profit networks²². Whereas much attention has been given to the ‘front end’ stage of networking, only a minority of these publications dealt with the actual construction and operation of such networks. Academic management literature on organisational networks dealt primarily with issues as:

- *Definition* of the network concept/forms (what is this network phenomenon?);
- (Theoretical) *advantages and disadvantages* (benefits and doubts);
- *Contingencies* (when is the network form feasible?);
- *Strategic decision making* (what trade-off’s/considerations need to be made?);
- *Partner search* (how to find and involve suitable partners);
- *Acquaintance and mutual trust* (how to create a social basis for the network?);
- *Blocks, barriers and pitfalls* (what problems can arise?).

There seemed to be little empirical research that demystified the success of some network activities and explained failure and problems that arose elsewhere. Academic research tended to explain network perform-

ance through fairly simple causal models. However, the complexity of network development in practice called for qualitative designs in addition to or in combination with commonly used quantitative research designs. As networking turned into a ‘modus operandi’ for SME product development, there was an increasing need to get more insight in the intricacies of network formation and network operations. Of special interest was the question of how the entrepreneurs and SME-managers involved monitored the progress and evaluated the results of these processes. In practice many of different sources of information have been used to create a general picture of the situation in a given network. Nevertheless, often entrepreneurs and SME-managers, concentrated on a few key indicators to access the situation. The objective of the present research was to identify these key indicators. The paper dealt with issues beyond the rationale for inter-firm collaboration and the very initial stages of networking, but focused rather on the overall process of network formation and network operations. Particularly, the research focused on SME product development networks. Forms of inter-organisational collaboration that concentrate on other business processes (e.g. shared facility management, collaboration for new market entry, business contact groups) were left out of consideration. Also dyadic relationships were not considered.

Research Questions and Research Design

The research was based on the following questions:

- How was the process of networking monitored and evaluated by entrepreneurs and SME-managers, participating in the formation and the deployment of SME product development networks?
- What indicators did these practitioners use in network monitoring and evaluation processes?
- How (due to what underlying mechanisms) did these indicators relate to network performance?

As proposed by Human & Provan²², referring to the lack of comparative empirical research on SME networks, an inductive study not by starting from a clear cut theoretical perspective but aiming at theory building in an explorative empirical way was conducted. The method was based on multiple case studies and literature research. The research started with a literature review resulting in a preliminary model of the network development process. An inductive reflection

on the researchers' consulting experience resulted in a number of additions and adaptations of the research model. The model was used to reveal "sensitising concepts"²⁵ to be used in communication with practitioners and in analysing the compiled qualitative data. Subsequently, five networking-cases were studied from close up and in-depth. The main criterion for selecting cases was accessibility. The studied networks were selected from the client-base of Syntens, Dutch Innovation Network for Entrepreneurs. The paper describes the findings of the analysis of these cases with regard to the research questions described above. Some background information on these cases is given at the end of this section.

The study was conducted in the region of North Brabant, presently the most industrialised region in the Netherlands. In this region the economic situation deteriorated dramatically in the beginning of the 90s. Some major industries were facing serious problems and ended up in downsizing, reorganising and sometimes even collapsed and went bankrupt. These developments among large OEMs had their impact on the supplier industries – among which many SMEs – as well. In order to turn the tide the Dutch government and the European Union assigned this region as the so-called "Region 3 status" which implied that it was given preferential treatment above other regions and involved considerable "European" investment funding and innovation oriented subsidy schemes. The population of firms in this region consisted of a mix of small, medium and large companies. These industrial enterprises - especially the large ones - demonstrated a relative high R&D and export performance¹¹. According to Pavitt's taxonomy the networks studied could be categorised as predominantly "specialised suppliers" with some hybrid characteristics of "scale intensive industries".

In each network two and up to four key participants were interviewed, and each interview lasted 1.5 – 2.5 h. The interviewees were chosen from different participating companies and sometimes from different organisational levels (business owner, operating manager, project manager, etc). The main issues (sensitising concepts) of the interviews stemmed from the network process model represented in Figure 1. Each person was asked for some background information on the participating company they represented. Special interest was shown for the motives that drove their company towards inter-organisational networking and

the companies' expectations of the collaboration. Secondly, the interviews dealt with the *general characteristics* of the network process. Interest was shown in the various process steps and activities undertaken, the throughput time of the process and the basic orientation with regard to network design and implementation.

With regard to the *initial network process* the interviews concerned issues like: Where did the initiative come from? Have any external parties (brokers, facilitators) been involved? What was the basis for partner search? How did the acquaintance process proceed?

As for the network design, information was gathered concerning the process of *joint strategy development* and the issue of *network structuring* (task differentiation, centralisation and formalisation). Subsequently the *operations* stage of the network was addressed. Interviewees were asked about their judgement on the functioning of the network and the underlying processes.

Finally, the interviews went into the issue of the continuity of the network initiative and their basic feeling towards networking after having experienced it in practice.

With regard to each of the sensitising concepts interviewees were asked to describe the process in a retrospective way and to express their experiences and feelings about the process. Based on the assumption that entrepreneurs and business managers had limited time and capacity to monitor network activities in detail interviewees were asked to indicate so-called key-indicators subject to the monitoring process. As a narrative check interviewees were asked to express their ideas about key success factors related to inter-organisational networking and business collaboration and to formulate their 'lessons learned'. The texts of the interviews were laid down in interview reports that have been checked and authorised by the interviewees. For each network the results of the interviews were combined into a case report. The interview and case reports were analysed on the basis of the qualitative paradigm. Statements of interviewees that were relevant within the (evolving) framework of the research were categorised and (if possible) analysed on interrelated patterns. A cross-case analysis of these patterns resulted in causal schemes, a comprehensive theoretical

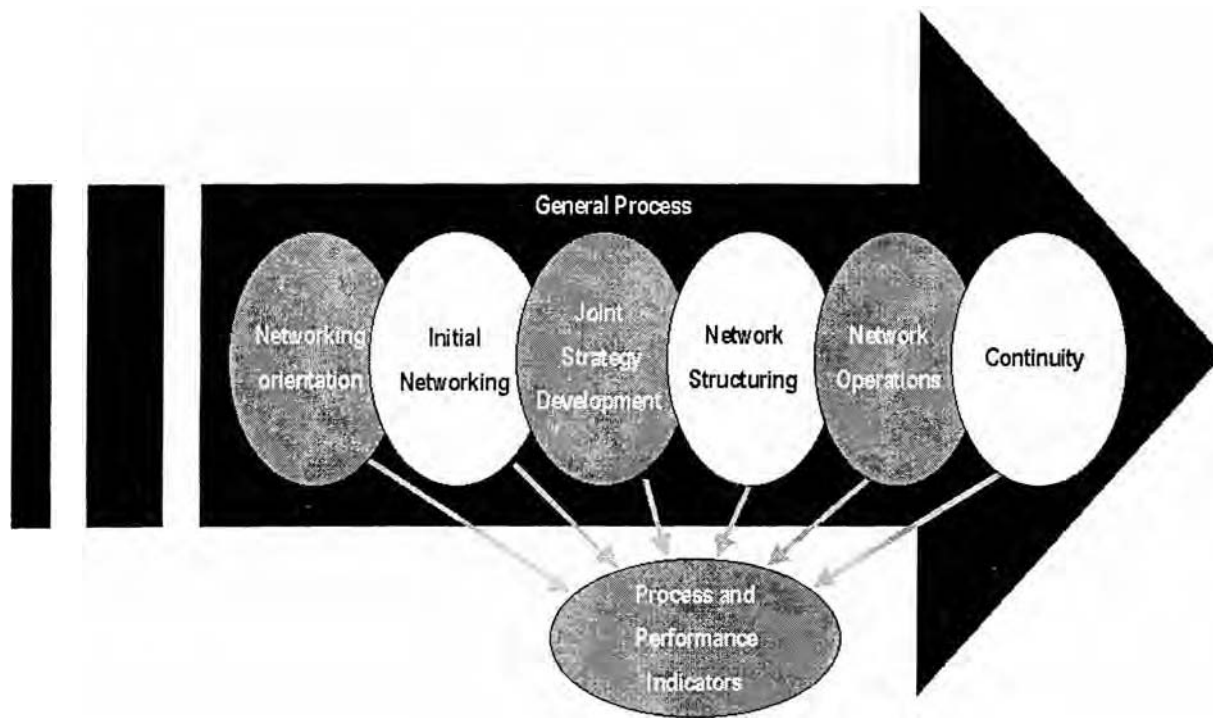


Figure 1— Research model and sensitising concepts

framework (descriptive element), and design guidelines to be used in practice (prescriptive element).

The quality of the gathered data was controlled by triangulation strategies²⁶ using multiple sources and media. The quality of the data analysis and interpretation was controlled by a mixed strategy consisting of member check among interviewees and peer debriefing²⁷ or consensual validation²⁸. Before generalising the research findings additional literature review was conducted and experts were consulted to reflect on the research findings and conclusions. Before going into the results of the study, some basic information about the cases was given. Because of reasons of confidentiality, the cases were described without detailed specifications and alias names were given.

Mainsup was a network of five companies operating in the metal and electronics industry. At the time of the interviews the network existed for seven years. It aimed at a concentration of technological strengths and market contacts in order to become a co-supplier or main-supplier for various Original Equipment Manufacturers (OEMs). The network developed from a market study conducted by an external consultant who also took a part in the network governance in later life-stages of the network.

Hospinstall was a three years old network of three core partners and several secondary participating com-

panies aimed at developing, manufacturing and installing for hospitals a system that integrated several telematics systems converging around the hospital bed. The initiative came from a lead user hospital looking for a proper solution to the traditional fragmentation of bedside systems and was taken up by the core partners of the network each providing a core module of the integrated system.

Cargas was a two years old network of three companies working together on a new car LPG system. The system was meant to replace the existing system that one of the partners had been producing for several years and that was nearing the end of its technical life-cycle. Due to the technological complexity of modern engine control systems the development of a new car gas system needed the integration of specialist technological expertise. Also time-to-market was an important motive for pursuing the collaborative approach towards product development.

Paperfold was a network consisting of three partners: a printing-binding company, a machine engineering company and an electronic components manufacturer. The network initiative came from the printer who identified market opportunities for a new environment-friendly wrapping/printing technique. In order to work out the ideas a new machine needed to be developed and the contact with the other network partners was made. At the time of the interviews the net-

work existed for three years and a prototype of the machine was put into operation.

Optilens was a two years old network of five companies working together on a machine for producing optical lenses at a speed 10-times as high as for conventional machines. The principal of this project was an international optics company. One of the participating companies – a mechanical engineer with an international reputation in the field – was contacted by this client and served as a main-contractor for this project.

Results and Discussion

The results of the research are given below, following the research models' network issues and process characteristics of the research model of Figure 1; this paper unfolded through orientation on networking at the level of the individual enterprise, general characteristics of the network development process, initial networking, joint strategy development, network structuring, network operations and follow-up. Per sub-section a description of the case-experiences was worked out in brief. Because of lack of space the single case analyses would not be discussed, but confine to the results of the cross-case analysis on the indicators used by the interviewees.

Orientation on Networking

In the orientation phase our interviewees used two key indicators to evaluate the situation and to decide on the efforts to continue the network formation process:

- *Rationale for Networking;* and
- *Management Commitment.*

The experience and attitudes of the interviewees demonstrated the need for a solid basis for networking. Simply put, collaboration and entrepreneurship were two worlds apart. The 'classical' entrepreneur would prefer the 'go-it-alone' product development strategy, since it brought along management control and discretion. Most interviewees would only consider inter-organisational collaboration out of need in combination with high expectations on network potential: without such a clear rationale for each of the partners network formation had little chance

for success. Expressed motives for turning to inter-organisational collaboration aimed at product development included:

- Sharing costs and risks;
- Access to complementary technical know-how;
- Access to additional markets;
- Improving flexibility by deploying more R, D&E capacity; and
- Speeding up innovation (time-to-market).

In most cases a combination of the motives mentioned above was encountered. In all five cases, however, the main driver for collaboration was the access to additional/complementary technical know how, development skills and market contacts in a cost-efficient way against minimal risks. Acquisition and exploiting of such competencies in a 'go-it-alone' strategy would be far more demanding in terms of financial resources and lead-time required. As simply relying on 'traditional' market relationships (buyer-supplier relationships) would be too risky, a significant degree of partner involvement was needed.

Crises and other negative motives were considered by the interviewees as contra-indicators for network participation. Inter-organisational networking was no panacea and especially not a sort of "castor oil for SMEs suffering from a terminal economic disease". Participating in SME product development networks required a solid state of health for all partners. If not, one was required to first get things organised in ones own company before turning to collaboration.

Next to a sound rationale, networking required solid management commitment. One of the interviewees told about his participation in another SME network initiative on the basis of a "it can't do any harm and it may do some good" attitude. The large number of network participants and the presence of competitors within the prospected network prompted his personal reservations with regard to this network. At the same time he wanted to be "in" in order to "see what would happen". His reservations and attitudes towards this network initiative, in combination with the network starting conditions, turned into a self-fulfilling prophecy. Even if the chances for network revenues were better, these revenues could only be established when management was dedicated to the network cause – not

only in words but in action as well. The latter was not a matter of course in a situation wherein the entrepreneur had to deal with in-house issues and problems as well.

The cases also demonstrated that support and commitment was regarded not only from general management but also from other participating functions. Depending on the authority structure within the firm and the intensity of the prospective network relationships, a certain degree of commitment from all functional parties involved in the prospective network initiative was needed. Such commitment could be established by participation in the network orientation and development process. Most cases demonstrated the need for employee involvement, but also showed that in practice this involvement was often brought about in later stages of the network development process. In the beginning top management commitment might be sufficient.

General Process

The cases demonstrated the network issues depicted in Figure 1 to be relevant and encountered in practice. Unintentionally, the model might suggest a sequential relationship between the different network issues. Although the sequence of the network issues suggested in Figure 1 was interpreted as a "natural" one, the cases showed that the timing and sequence of attention given to these network issues would differ significantly.

The cases demonstrated how in the initial stages the tone was set for the general network development process. The cases show a preference for an incremental approach towards networking. A synoptic and design oriented approach is rejected and regarded as contra-productive. Most interviewees expressed the need to tackle the network issues in a stepwise manner, in order to prevent the process being frustrated by problem congestion and sluggish headway. Furthermore, the general process followed in the cases could be described as pragmatic and satisficing (rather than optimising).

The cross-case analysis generated the following indicators as being relevant to the general process of SME product development networking:

Process Consensus — As described above the success of the network was supposed to be positively in-

fluenced by a tailor made process design. The *nature*, *pace* and *sequence* of dealing with network issues were required to be matched to the actual starting conditions of the network and the partner preferences. Interviewees' experience in most cases strongly favoured an incremental and pragmatic orientation above a synoptic, design oriented approach towards networking.

Network Driving Force — The cases demonstrated the value of a driving network initiator. The initiative could come from one or more network participants or an external party. The cases showed how the network initiative was related to 'business ownership'. If one of the partners demonstrated a significantly greater interest in the network than other parties (and if the other partners accepted this) it was likely that this most interested party took the lead in the network formation process.

Networking Competence — The cases demonstrated the importance of networking skills. The chances of a network depended on the experience of parties with regard to inter-organisational collaboration, trust building, joint decision making and negotiation. Some cases capitalised on the presence of a 'network champion', guiding less experienced partners round pitfalls and barriers scattered over the networking track.

Initial Networking

Taking the perspective of a company initiating the network development process, once the decision was made to pursue the 'collaborative challenge' one of the most critical steps that needed to be taken was partner choice. Most theoretical contributions advocated a rational and instrumental approach of searching and selecting partners. Preferably, objective sources of information were required to be utilised. In one case a lengthy list of criteria that a prospective partner needed to meet was drawn up aimed at selecting the best possible partner, while the other cases demonstrated a more intuitive and satisficing approach of selecting prospective partners. The cases also showed differences in the process of getting acquainted. Most of these differences resulted from differences in the partner search process. When partners were selected from the initiators personal network, introductions were realised beforehand. When partners were selected via intermediary organisations or network brokers additional acquaintance activities were necessary. It is beyond the scope of this paper to deal with the used acquaintance techniques in detail.

The cross-case analysis induced the following indicators being relevant to the process of partner choice:

Business Fit — The cases strongly stressed the need for business fit. The found fit-dimension strongly corresponded to the criteria mentioned in literature: strategic, operational and organisational criteria. The interviewees stressed the need for technological complementarity and matching operational characteristics (batch size, machine and tooling precision etc.)

Proximity — The geographical, cultural and social distance between the partners was seen as important for partner consultation and knowledge sharing and, therefore, also the partner selection: distant prospective partners were less likely to be induced in the network.

Trust — As was to be expected, the cases stressed the need for trust in collaborative processes. In practice trust took two dimensions: rational trust (often based on demonstrable past performance) and social trust (based on interpersonal chemistry and therefore subjective to some extent). The cases demonstrated a strong use of trust being “passed on” when partner search was facilitated by intermediate organisations or colleague businessmen. “Your friends are my friends” seemed to be a guide for partner search in practice.

The use of the indicators proximity and trust by the interviewees showed the importance of the social aspects of partner search.

Joint Strategy Development

The cross-case analysis generated the following indicators as being relevant to the strategy development of SME product development networks:

Strategic Consensus: The various partners of a network were required to have a certain degree of consensus on the objectives and strategies of the network and this consensus was further required to be maintained even under changing circumstances or adaptations of the network;

Strategic Alignment — Whereas strategic consensus referred to network-internal issues, strategic alignment referred to network-external issues, *viz* the alignment of the network objectives and strategies with the objectives and strategies of each of the partners. In this respect it was also important to what extent the

various partners did also business outside the network; such business might compete with the network for resources and managerial attention.

Creating an inter-organisational business based on joint product development called for a collective notion of *what* needed to be achieved and *how* this could be done. Although the participating companies to some extent could pursue different goals and might even have conflicting interests; some basic understanding of the networks’ mission, vision, objectives and strategies was needed. The timing of the process that was required to lead to such an understanding depended on situational circumstances and personal preferences of the entrepreneurs involved.

The cases demonstrated the existence of personal preferences with regard to strategic planning. The interviewees clearly identified doers and thinkers amongst their colleagues. *Doers* would prefer to ‘get cracking’ as an early test for the networks’ opportunities. Not before this test turned out to be successful, the exchange of thoughts with regard to long term ambitions and strategy was considered. *Thinkers*, on the other hand, would prefer to consider things over and over again before getting into action. Which group gained the upper hand partly depended on the situational circumstances. In the case of a lead user and detailed customer requirement the doer-approach would prevail in the network process resulting in a more operational start of the network, assuming that the required resources and competencies were available within the network.

Network competence and the strategic content were interrelated to each other. Partly the necessary network skills could be deducted from the strategic mission. In addition to technological, managerial and market skills networking required collaborative and developing skills as well. The cases demonstrated that to some extent these skills could be developed “on the job” partly by socialisation processes between network partners⁵. Yet, a certain “critical mass” of networking skills and developing experience was required to guarantee that the collaboration will yield the required results.

The cases demonstrated differences with regard to strategic alignment and the balance of partner interests. In some cases the network was of vital importance to one of the network partners while other participating companies had less compelling arguments for their presence in the network. Other cases demon-

strated a more balanced distribution of interest amongst network partners. Sometimes the alignment of network strategy and the background and the ambitions of the participating companies revealed itself in a complementarity of capabilities and diverging – yet compatible and restorative – interests. If this diversity of interests and imbalance of expected returns gained the upper hand network continuity was at stake and might even be doubted.

Network Structure

In the majority of the cases the participants took a short term orientation towards network structuring instead of creating a governance structure that was aimed to fit a desired future far ahead. The structure of the network was above all required to fit the short-term activities and conditions of the network. “We’ll cross that bridge when we come to it”, was the pragmatic adage heard in several interviews. While inexperienced partners worried about network structuring issues, entrepreneurs frequently operating in a network context often refrained from making structural arrangements before there actually was a need to do so. Network structuring was done in a problem-solving mode, not on the basis of a preconceived grand design. The interviewees stressed that in the long run the network structure was required to be flexible enough to adapt to changing conditions and emerging strategies. Again structural pragmatism was the best safeguard for the future.

The case-analysis pointed to two important structural dimensions:

Centrality — Once a network was operational, there were various network functions to be fulfilled, like co-ordination, order acquisition or sales and operations. Furthermore, these network functions needed resources. ‘Centrality’ was the issue to what extent these functions and resources were distributed over the various partners or centralised at the network level. For instance, network co-ordination could be distributed, *i e* co-ordination by mutual adjustment, or could be centralised by having the lead partner doing the co-ordination or by hiring a central officer (possibly with a staff) to do so. Whatever the degree of centrality, network participants experienced network governance and partner co-ordination as a far more social process than intra-firm supervision and co-ordination. In addition to centrality, lateral relationships and negotiations played an important role in the co-ordination of network activities.

Formalisation — Perhaps the biggest concern to entrepreneurs facing the process of collaborative product development was the issue of formalisation. “What do we have to lay down in contracts and procedures?” was an often-encountered question in discussing networks with entrepreneurs, for the first time considering networking. The cases showed that the degree of formalisation was required to be carefully chosen in order to facilitate networking where possible without turning into a nuisance. The cases indicated that the degree of formalisation partly depended on the degree of trust among network partners. To some extent trust and formalisation were seen as “communicating vessels”.

A ‘central office’ if present in the cases studied, was rather small (mostly existing of one person) and played an internal role in co-ordinating distributed activities as well as an external role in acquisition and marketing. In other cases these co-ordinating activities as well as external contacts were taken care of by an “arachnid partner” or by all of the network partners. But the cases clearly illustrated that the capacity for mutual adjustment among partners was limited. The cases illustrated how two contingencies played an important role in the decision making with regard to network centrality:

- *Size* — When the number of partners was relatively small, mutual adjustment was the standard mode for solving internal co-ordination problems. Also direct linkages could take care of external co-ordination between customer organisations and individual network partners. As the number of partners increased the co-ordination task became more and more complex and the call for a central co-ordinator was heard.
- *Business Ownership* — This concept related to a shared notion of ‘whose business, resources and intellectual capital is keeping the network afloat’. With regard to business ownership (which not necessarily meant that this was confirmed by formal or legal arrangements) two options were possible: *focused business ownership* (when one of the partners had a dominant interest in the collaborative efforts) or *distributed business ownership* (all partners had a similar interest in the network activities). The cases showed how

in the case of a focussed business ownership the most interested partner took care of the internal co-ordination as well as external contacts. When the ownership of the network business was distributed it was more likely to have the co-ordination task rotating amongst the partners or to designate an “externally hired” co-ordinator. The latter was recommended when the partners had limited time (or expertise) available for this co-ordinating role.

As the term collaboration already implied, the balance of power in a network was somewhat different from the situation within the participating companies. The absence of authority relations brought forward the need to make clear agreements and to put the key ones on paper (sometimes-legal contracts) as well. With regard to formalisation the cases illustrated that a network should refrain from extensive issuing and formalisation of internal affairs. All interviewees agreed that it made sense to make good financial arrangements and to think of possible pitfalls that might be found on the way. But it did not seem wise (nor possible) to enforce a co-operative attitude amongst partners by contracts and regulations only. A proper balance between personal trust and formal arrangements seemed appropriate.

Network Operations

Most interviewees demonstrated a multiple perspective with regard to the monitoring of network performance. They were not only interested in bottom line results but were also triggered by other aspects of functioning. The following categories of performance indicators came forward:

- *Operational Results* — Partners evaluated the networks’ performance among other things by assessing the operational performance (timeliness and quality of technical results, turnover, time to market, etc) of the network and comparing these with the ex ante expectations.
- *Financial Results*— Operational results were seen as conditional requirements for creating financial outcomes of the collaboration (*e.g.* profit, return on capital).
- *Learning* — A greatly appreciated outcome of networking was organisational learning. Collaboration facilitated processes of knowledge sharing and knowledge development. Getting in contact

with other entrepreneurs and other clients brought along opportunities for knowledge and experience transfer. The cases demonstrated how participation in networks resulted in an increased (tacit) knowledge of product development, technology, marketing and collaboration.

- *Social Relations* — Many interviewees saw the quality of the social relations as a key performance indicator. Social relations were more or less treated as intermediate variables that enabled performance in other areas. For creating a co-operative climate with a high quality of social relations the necessity of personal fit was frequently stressed. This fit seemed to be influenced by personal characteristics, management and business style, cultural differences and other factors. Also the way in which problems were solved (or avoided) was given much attention. In some cases the relationship between the participating companies had developed into a situation in which entrepreneurs consulted each other with regard to issues that did not relate to the domain of the network. This consulting potential was greatly appreciated.

One case clearly illustrated that outcomes other than solely financial and operational regarding network performance could be sufficient to hold the network together. Though there were changes in the partnership composition and regardless of sometimes disappointing financial and operational results, partners thought the collaboration was still worthwhile. Social factors as well as the increased marketing base might have caused this. Participating entrepreneurs often consulted each other on various business and non-business issues. Furthermore, they experienced that the collaboration within the network offered them a wider network of external contacts.

Continuity

Reflecting on the network performance SME network participants developed ideas and plans concerning their participation in the network concerned and other forms and modes of inter-organisational collaboration. With regard to a specific network three basic options were available:

- *Continuation* — Though the network form was generally seen as a temporary inter-organisational structure, in practice some networks demonstrated a strong durability. When the scope of a network

Table I — Indicators and theoretical support

Network issue	Key indicator and theoretical support with regard to networking and/or product development within firms (empirical contributions as well as literature research)
Orientation on networking	Rationale ^{29,30}
General process	Management commitment ^{31,32} Process consensus ^{33,34} Driving force ³²
Initial networking	Networking competences ^{19,32,34} Business fit ^{29,32} Proximity ^{35,36} Trust ^{32,37-39}
Joint strategy development	Strategic consensus ^{32,40} Strategic alignment ^{12,22,32,41}
Network structuring	Centrality ^{1,9,22,24,42-45} Formalisation ^{1,22,31,40,43,46,47}
Network operations	Operational results ^{22,32} Financial results ^{31,32,48} Learning ⁴⁹⁻⁵²
Continuity	Social relations ²² Network potential ³² Portfolio potential

was beyond that of a single innovation project and encompassed a programme of projects – e.g. the development of a series of new products based on a specific technological innovation – the network life cycle could appear to be more durable than that of the average SME business venture.

- *Adaptation* — External as well as internal network developments (economic, technological, and social) could make the continuation of the network contingent on adaptations of the original set-up. Strategic intent was one thing; performance was another thing. Practice showed that network initiatives also were often confronted with emerging strategies and unintended side effects. These experiences could call for adaptation of the network ambitions, strategies and structure.
- *Withdrawal or Dissolution* — As network outcomes from time to time might be disappointing or as innovation projects once came to an end, the network might be dissolved. Sometimes entrepreneurs and SME-managers had an a-priori position with respect to networks; viz. as a temporary construction to be dismantled once the initial project was finished. Sometimes networks were regarded as a lasting yet continuously changing construction with movement of SMEs to and from the network.

The decision with regard to continuation, adaptation or dissolution of a specific network seemed to be influenced by two factors:

- *Network Potential* — The interviewees stressed that their attitude towards continuation of a specific network was based on the perceived revenues of this network at present and in the future. ‘What’s in it for me?’ is a crucial question. The network performance indicators described in section 4.6 were required to play an important role in the decision making about continuity.
- *Portfolio Potential*: The cases clearly illustrated that the decision on network continuity was based on other things than the actual and expected revenues of the network initiative solely. The question of network continuity was answered also taking into consideration the costs and benefits of other network initiatives and other strategic alternatives (including the non-networking mode). As networking turned into a ‘modus operandi’ for SME product development, entrepreneurs might experience the need to be selective in their network participation. Networking required management attention, as personal networking, personal contact and trust played an important role in the networking process. Several interviewees expressed that there was a limit of network initiatives that could be handled by them and their companies. A portfolio attitude towards networking seemed to be appropriate.

Conclusions

In Table I, the key indicators resulting from the research are given. These 18 indicators captured together a very important part of the overall picture of a net-

work. These indicators have been put into a wider theoretical perspective. Without having the ambition to be exhaustive, some indicative grounding in literature was given by listing for each indicator a limited set of supportive theoretical contributions. While part of this supportive literature had an empirical basis, other references were conceptual contributions.

The research once more indicated that networking aimed at joint product development called for close management attention and needed to be well monitored. In order to monitor the networking process entrepreneurs used a limited set of key indicators reflecting the progress and results with regard to the central networking issues. The identified key indicators strongly related to the process of networking and stressed the need for a close fit between network design and situational conditions. The establishment of reliable network relations called for a balanced change process and required collaborative skills. The research demonstrated the importance of sound orientation towards networking before acting in that direction. Also the importance of partner search and acquaintance was stressed. In this initial stage of networking the foundations of the network were being laid. Yet in some cases it might be necessary to quickly get to work. In those situations acquaintance was requested to be established 'on the job' and afterwards.

The cases also demonstrated the importance of having a common vision of the network ambition, objectives and strategy. It was shown that the vision could be established at any moment during the networking process. It was advisable to take into account the actual starting situation of the network as well. The starting situation seemed to have implications for the internal structure of the network and the boundary spanning relationships. It was shown that (managerial and resource) centrality and formalisation were important indicators and that network size and business ownership were important structural contingency factors. Further analysis of the empirical data and additional data gathering with regard to specific network issues would take place in the future. This research would lead to more detailed insights and design rules to be used in developing and improving SME product innovation networks.

In general, whereas innovations were more and more being generated at intersections of multiple technologies, the need for SMEs to join forces became obvious. Arms length relationships as well as business integration could lead to higher transaction costs and/or

poor effectiveness. Networking as a form of inter-organisational collaboration could help SMEs to overcome problems of technology and scale and to gain competitive advantage. The described key indicators can be used to monitor the process of network formation and were supposed to support practitioners in their decision making with regard to the central networking issues.

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