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**Network building, motivation and learning in
inter-organisational R&D collaboration projects
- Theoretical considerations**

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Abstract

Discussing previous research on R&D collaboration networks, new modes of knowledge production and inter-organisational learning, this paper presents the theoretical considerations guiding the component ‘Network building, motivation and learning in inter-organisational R&D collaboration projects’ of the NEMO-project. The paper concludes with outlining the working hypotheses, which highlight the basic assumptions underlying further empirical research.

1. Research task and definitions

The general research task of this study is to investigate how the partnerships in EU-funded R&D collaboration projects are formed and dissolved, what motivates individuals and organisations for collaboration or non-collaboration with certain partners, and how does knowledge production and inter-organisational learning take place in inter-organisational collaboration projects.

The main concepts of the study include structural concepts, which describe the participants and their collaboration structures in inter-organisational collaboration, and procedural concepts, which describe the activities taking place in the structures and between the participants. The structural concepts include actors, partnerships and networks; and the procedural concepts include learning, inter-organisational learning and knowledge production.

Structural concepts

Actors can include both individual actors, such as researchers, and organisational actors, most typically research groups, who engage in collaborative activities in R&D projects. The actors together in a project form a partnership, which is thus primarily an organisational concept. The concept of network adds a dynamic element to the partnerships. According to the most basic definition, a network can be seen as a “set of actors and the ties among them” (Wasserman and Faust 1994). For instance Pohoryles

(2002b) defines research networks as “formalised or informal patterns of transaction between research institutions and/or researchers that enable, facilitate, or manage the production and/or application of scientific knowledge”.

In the context of high competition over value-added, it has been argued (e.g. Gibbons et al 1994) that the most effective organisational form is not a necessarily a hierarchy but a network, where each node represents a research actor possessing a unit set of skills, their knowledge endowment, and is linked to the other nodes through lines of communication. Gibbons et al (1994, 122) argue that is crucial for the competitiveness of firms, who must be permeable to new types of knowledge, possessed not only by other companies but also of government research laboratories, research institutes consultancies and universities. (c.f. Dal Fiore 2007.) Powell (1990) has argued that networks, as a particular form of collective action, have the following benefits: “cooperation can be sustained over the long run as an effective arrangement; networks create incentives for learning and dissemination of information, thus allowing ideas to be translated into action quickly; the open-ended quality of networks is most useful when resources are variable and the environment uncertain; networks offer a highly feasible means of utilizing and enhancing such intangible assets as tacit knowledge and technological innovation.” The motivations for participating in networks include reduction of uncertainty, fast access to information, reliability and responsiveness. (Powell 1990.) “When the locus of innovation is found in an interorganizational network, access to that network proves critical” (Powell et al 1996, 142).

Emphasising the self-organisational voluntary nature of research networks, Jansen (2004) treats networks as a type of governance structure between markets and organisations (see also Powell 1990, Dal Fiore 2007). In this definition she makes a distinction between this, governance-oriented definition of networks and the more methodological definition favoured by the network analysis. Following the notions presented by Pohoryles and Jansen, the definition of a network for the purposes of this study starts from the individual FP-funded research project, which constitutes a network consisting of organisations and individuals involved in the research project. This very practical definition enables attention to focus on the formation of each of the project networks and the relationships between the individuals and organisations participating in them. While focussing on the micro-scale project network, its individual and organisational participants and the ties between them, this study provides information about the dynamics of network formation and knowledge production at the grass-roots level. The extent, to which this can be directly aggregated to the larger scale network dynamics on the European level, is limited. The theoretical framework emphasising path-dependent, contextual and cultural characteristics of inter-organisational collaboration and a sample consisting of nine cases allows us to concentrate on the in-depth analysis of the individual collaboration paths, motivations, expectations and interaction. The results are not, however, necessarily generalisable to the overall population of EU-funded collaboration projects, consisting of over 7000 projects just in the 6th Framework Programme.

Procedural concepts

Knowledge can be divided into two types: explicit and tacit knowledge. Explicit knowledge is codified knowledge, transmittable in formal, systematic language. Tacit knowledge on the other hand has a personal element, it is hard to formalise or communicate. It is embedded in action, commitment and specific context. (Polanyi 1966, 4, cited in Nonaka 1994, 16) Knowledge is related to two processes, knowledge production and learning. In this study these related concepts are used to refer to two analytically separate activities. Knowledge production refers to creation of new scientific knowledge either by individuals and research groups themselves, or by groups of individuals and research groups across organisational boundaries. Knowledge production refers specifically to the process and outcomes of research: conducting of research resulting in research papers, technical innovations, patents and other research outcomes produced by the project's participants. Knowledge production primarily refers to explicit communicable knowledge aimed to be disseminated to a wider audience (c.f. Gibbons et al 1994.) The NEMO project adheres to a moderate constructivist epistemology, implying that knowledge is socially constructed and assuming "that an observer produces a 'construction of an object from reality' which can be handed over from the sender to the recipient in such a way that the receiver can 'recognise the features of the object'." (Paier et al 2007). Learning, on the other hand refers to internal process of acquiring new skills, norms, values and new ways of thinking within the inter-organisational collaboration. Learning refers to the meta-level process resulting from the internal communication within the collaboration projects, such as leaning to use particular theories or technical infrastructures, or new ways of solving problems arising in the course of the research. Learning is not communicated outside the participating organisations, nor is it necessarily always explicitly recognised by the project partners themselves. Learning encompasses both explicit and tacit knowledge. (c.f Booth and Beeby 2000, Nonaka 1994, see also Argyris & Schön on organisational learning 1996). The approach to knowledge, sharing knowledge and learning in networks is a pragmatic one, stemming from the idea that R&D network links are forged to acquire or create knowledge and thus the knowledge endowment of the prospective partners is one of the key criteria in choosing partners for R&D collaboration projects. (Paier et al 2007.) The knowledge endowment of individual agents and the network consisting of agents and ties between them co-evolve during the collaboration project. (Paier et al 2007). In other words, joint knowledge production and learning takes place in networks, which learn and thus evolve at the same time.

Knowledge production and learning can take place collectively and in inter-organisational settings. Powell et al (1996) have argued that learning and knowledge creation are contextual processes and takes place in a community, in flexible evolving networks and in interstices between companies, universities, research laboratories suppliers and customers. Knowledge is path-dependent, what is learned is affected by what is already known (Powell et al 1996). Inter-organisational learning can be defined as "collective acquisition of knowledge among a set of organisations" (Larsson et al 1998, 287). Inter-organisational learning can be achieved by a strategic alliance of two or more organisations changing their inter-organisational routines or repertoire of possible joint activities. (Larsson et al 1998).

2. R&D collaboration within EU Framework Programmes

The internal dynamics of the EU induced R&D collaboration networks are influenced both by the governance rules set by the European Union, as well as by a set of factors and internal rules related to the organisational cultures, network positions, norms and values of the participating organisations and disciplinary groupings. There has been a considerable push towards larger cooperative research projects in the 6th Framework Programme compared to the earlier Framework Programmes. This has resulted in the introduction of new instruments for the FP6, including the large scale integrated projects, and networks of excellence aimed at durable integration between research partners. (Kutz et al 2007.) It has also been suggested that one of the aims of the FP6 and its drive for larger networks and critical mass, is to increasingly shift responsibility and coordination away from the public sector and the European Commission to large private sector corporations and public research institutes (Pohoryles 2002a). This on the other hand may allow for a greater autonomy for the partners in the design and management of projects (Okubo & Zitt 2004).

There is plenty of evidence that the Framework Programmes have had a major influence on networking, especially in strengthening existing networks rather than creating new networks. The integration between collaborating R&D organisations has increased over time, as has the involvement of organisations within simultaneous multiple projects. The size and length of the ventures has increased. The networks have shown themselves to be highly durable with cooperation, both between individual researchers and between research institutions, continuing after the initial joint projects. All this indicates a move towards a more integrated European Research Area, and that collaboration within European funding frameworks has lead into more durable links between collaboration partners. (Pohoryles 2002b, Barber et al 2006, Georghiou 1999, Caloghirou et al 2001.) There has also been a significant tendency for the same organisations to participate in consecutive Framework Programmes and that there is recurring collaboration between the same organisations within the Framework Programmes. Furthermore, the clustering of organisations seems to have increased over time. (Roediger-Schluga & Barber 2006.)

These results suggest that there are factors which encourage organisations to repeat their collaboration with their previous partners. Such elements may include complementarity of resources, compatibility of organisational cultures, norms and values, and trust between partner organisations. For instance Geisler (1995) suggests that universities and industrial partners are more likely to engage in cooperative R&D if they perceive their organisations to be resource interdependent, that cooperation is more likely to survive the more there is trust, good will, favourable prior beliefs, mutual psychological commitment and prior relations between parties, and that high institutionalisation and high intensity (active interaction) of the relationship increase the likelihood of its survival. (See also Ring & van de Ven 1994.) Geisler's theory is supported by Pohoryles (2002) and Okubo and Zitt (2004), who have shown that sustainability of FP funded R&D networks is dependent on good personal relations, institutional ties, availability of funds, joint publications work, easy communication and sharing a research paradigm.

According to Pohoryles (2002) especially communication and personal relations are crucial aspects in sustainability of cooperative networks. Ring and van de Ven (1994) have discussed the evolvement of inter-organisational partnerships as interplay between personal interaction and trust, and more formalised organisational arrangements. They have proposed that congruent cognitive and psychological sense-making and negotiation, as well as continuous interaction increase trust first between individual partners who act as representatives of their organisations and later contribute towards institutionalising those relationships into more durable structures. Formal structures on the other hand may become less important for cooperation as the trust between partners increases. This indicates that social capital (Coleman 1988) is essential for formation and sustainability of cooperation. Social capital can be defined as networks of relations, through which trust, reciprocity and exchange of information become possible and thus facilitate collaboration by reducing the need for formal agreements and control. Obligations and expectations, information and social norms are all forms of social capital. (Coleman 1988, Putnam 1993.) Social capital can institutionalise as societal status, and can in some cases be changeable to money, e.g. the position of organisations in ranking lists (Bourdieu 1986).

The relationship between close collaborative ties and productivity can also be turned around. The collaboration networks do not only consist of actors and relationships between them, or even of communication between the actors, in which the relationships are manifested. Law (1992), although using a wider concept of network, has pointed out that textual, conceptual and material objects may be the glue that keeps the networks together. These objects may comprise the knowledge products, such as scientific papers, innovations and patents, produced by the actors. Interactions between the actors are mediated through these objects which have a variable durability: a conference paper may have short durability, whereas a published paper in a peer reviewed journal has more permanence. (Law 1992, Greener 2002). We may thus suspect; that not only are closer networks more productive, but also that productive networks may have closer and more durable ties.

Inter-organisational collaboration, be that in the form of networks, consortia or other types of arrangements, presents an opportunity to access additional resources which each organisation would not otherwise have. For the universities, such resources may include good quality research or teaching, high position in the league tables, good reputation and high prestige, well-known academics, good infrastructure or favourable geographical location. (Beerkens 2004, Dassen et al 2007.) Inter-organisational collaboration enables the organisations to develop their absorptive capacity (Cohen & Levinthal 1990), increase their skills to manage cooperation; it increases their awareness of new developments and possible further collaboration possibilities, as well as helps them to develop a reputation as a valuable partner. (Powell et al 1996). Barriers to collaboration include a lack of trust between parties, difficulties in relinquishing control, the complexity of joint projects, and different ability to learn new skills. Also the partners' size and position, level of technological sophistication, resources and prior experiences with alliances may play a role. (Powell et al 1996.) The primary motivations for industry to get involved in joint ventures is related to achieving research synergies, keeping up with major technological

developments, sharing R&D costs or to developing particular products and processes and markets for them. In two recent studies on R&D collaboration, companies reported main benefits arising from university cooperation to be related to enhancing their knowledge base and improving production processes and/or markets. (Caloghirou et al 2001, Luukkonen 2002.) These so called technology and market orientations are approximately equally important to companies, although larger companies tended to emphasise technology orientation where as SMEs emphasised market orientation. Moreover, the majority of the projects are pre-competitive research projects rather than the project being close to marketable application, which may be attributed to difficulties arising in near market research related to issues of confidentiality, intellectual property rights and relative slowness of the EU funding decisions. (Luukkonen 2002.) Also the individual motivations to participate in FP collaboration networks maybe related to intellectual or financial incentives. According to the INNOCULT study conducted amongst the participants of the FP4 and FP5, intellectual motivations and opportunities for interdisciplinary collaboration were more important than funding opportunities, although also those were important amongst university researchers in certain countries, like UK and France (Pohoryles 2002b.)¹ The results may, however, reflect motivations which may be socially desirable in different countries.

Besides the rational, resource-oriented approach to inter-organisational R&D collaboration, path dependence, institutional and structural elements may explain the formation and success or failure of collaborative arrangements. According to path dependence “what happened at an earlier point in time will affect the possible outcomes of a sequence of events occurring at a later point in time” (Sewell 1996, 262-263, quoted in Pierson 2002, 252) Organisational structures are constituted by the institutions and processes present in them, and mediated by e.g. technology and resources. Organisational change is often incremental rather than radical. (Greener 2002.) According to the institutional view organisations symbolically comply with the norms and values of their institutional environment, such as organisational and disciplinary culture of the partners, EU regulations, implicit codes of conduct of the network itself, and are more likely to cooperate with other organisations representing similar values and norms (Powell & DiMaggio 1991). In collaboration, therefore, a certain level of institutional compatibility is required for the collaboration to be deemed successful (Beerkens 2004). Van der Meulen (2002) has discussed the relationship between Europeanisation (the pronounced importance of European cooperation and the involvement of researchers in European cooperation) and the organisational culture in universities. He hypothesises that entrepreneurial universities (Clark 1998) oriented towards mode 2 knowledge production (Gibbons et al 1994) are more likely to be Europeanised than traditional universities, and that those researchers who were strongly oriented towards their organisational community are more Europeanised than those who were oriented towards their disciplinary community. As the study did not provide conclusive results on the hypotheses, van der Meulen speculates that while the rhetoric of the EU framework

¹ Financial incentives were also a significant motivation for Finnish researchers participating in EU-funded research collaboration. Other motivations included gaining experience and increasing the international visibility of units, research training and career advancement through new knowledge and methods, and finally, opportunities to disseminate research results. See Hakala et al 2002.

programmes emphasises mode 2 knowledge production and entrepreneurial universities, its procedures favour more traditional scientific researchers and notions of performance and quality (c.f. Bruce et al 2004).

The institutional and structural elements may also have an effect on the styles of cooperation within collaborative networks. Pohoryles (2002b) has identified three different cooperation styles - hierarchists, individualists and communitarians - amongst the EU funded R&D networks. Hierarchists, the least common of the styles, emphasise the dominant role of the coordinator and clear division of labour. The most common group, individualists, concentrate on developing their own part of the project and put less emphasis on integration. Communitarians on the other hand focus on the corporate identity of the entire group without a dominant role of any one partner or the coordinator. Establishing core groups to share the management responsibilities alongside the coordinator were more typical amongst larger networks. Previous personal and institutional contacts play a significant role in entering the network: 65,7% of individual researchers knew at least one project partner before, and 70,8% knew partner institutions from previous collaboration, whereas 57,3% of researchers reported having previously worked for a partner institution.

Roediger-Schuga and Dachs (2006) have shown that the type of research collaboration is related to the structures of the industrial sector. According to their quantitative study of research collaboration in two specific EU programmes pertaining to telecommunications industry and agro-industrial industry, collaborative research projects in the telecommunications industry tend to involve more participants and require a greater amount of funding than in agro-industrial industry. The role of scientists is more important in agro-industrial networks than in telecommunications networks. They attribute these results to the differences in the underlying knowledge bases and organisations of knowledge production, and to the different research trajectories pursued in EU funded R&D programmes and suggest that future research should explore the motivations of participants from different organisational backgrounds for participating in EU R&D projects, their different participation strategies and why and how they choose their partners. Similarly, Kyvik and Larsen (1997) have shown that the profiles of internationalisation and international cooperation vary between different disciplinary fields, with “hard fields” being more international due to their highly codified language, specialised audiences and focus on topic with universal relevance, whereas “soft fields” have fewer incentives for internationalisation.

While the Framework Programmes have been successful in increasing and strengthening networking, they have fallen short of some of the explicit policy goals such as encouraging organisations to interdisciplinary research. Bruce et al’s (2004) study on interdisciplinarity in the FP5 funded research projects indicated that few projects could be described as clearly interdisciplinary, although there was a tendency for interdisciplinarity to increase over time. Researcher involved in interdisciplinary projects emphasised the importance of careful coalition building and communication as facilitators of interdisciplinary research. Issues such as weak career prospects, weak prestige of interdisciplinary research, and the concerns about the ability of FP evaluators

to evaluate interdisciplinary projects were suggested to be amongst the factors impeding interdisciplinary research. Okubo and Zitt (2004) argue that regardless of the Framework Programmes, network patterns have remained quite fixed and build on previous cooperation, and the EU policies have done little to change the collaboration ties especially for the large European countries such as Germany, France and UK. Europeanisation has been more common amongst smaller European countries. They also argue that co-authoring articles still remains primarily limited to national collaboration rather than international collaboration.

3. Inter-organisational knowledge production

Some of the trends behind the increased drive towards collaborative research networks include the changing forms of knowledge production; and the calls for increasingly socially accountable and applicable knowledge production. Most countries and regions, including the European Union, are trying to achieve further cooperation contributing to a more integrated innovation system, often termed Triple Helix and consisting of university-industry-government relations (Etzkowitz & Leydesdorff 2000). The objective is to create a knowledge-based economy (Etzkowitz & Leydesdorff 1996) with an innovative environment through university spin-off firms, strategic alliances among firms, government laboratories and academic research groups, as well as fostering other trilateral initiatives for knowledge based economic developments and ventures (Etzkowitz & Leydesdorff 2000). In a Triple Helix the institutional actors are also expected to change through the cooperation processes they are involved in.

According to Gibbons et al's (1994) famous thesis, the production of knowledge has assumed a new set of methods, values, ideas and norms, which they have called mode 2 knowledge production. For Gibbons, the mode 2 concept is intended to override the inadequacies of the conventional terms such as applied research, technological research, or research and development. The mode 2 knowledge production is characterised by five features: knowledge production in the context of application, transdisciplinarity, heterogeneity and organisational diversity, social accountability and reflexivity, and quality control. (Gibbons et al 1994, 1-8).

Gibbons et al argue that in mode 2 knowledge production, knowledge is produced in the context of its application, negotiating the different interest of the various sets of users of knowledge and is distributed throughout the society. Rather than being institutionalised in universities, mode 2 knowledge is produced in interaction by heterogeneous actors: universities, non-university institutions, research centres, government agencies, think-tanks, different types of businesses and industry. Mode 2 knowledge is transdisciplinary, utilising theoretical and empirical elements from different disciplinary contexts to construct frameworks for problem-solving. It is produced close to the end user of the knowledge, so diffusion of knowledge takes place as part of its construction and application to solve specific problems, rather than through traditional channel of publishing articles in scientific journals. The various sites of knowledge production are organisationally, electronically, socially and informally linked together, while at the same time they are they are specialising into more and more specialised fields of knowledge,

which gets reconfigured in the networks of transdisciplinary knowledge production. (Gibbons et al 1994.)

In mode 2 knowledge production, the entire process from setting of research priorities and defining research problems to interpreting and diffusing its results is increasingly socially accountable. This requires negotiating the interests and expectations of the multiple users, investors and stakeholders of knowledge. At the same time the participants of knowledge production are increasingly reflexive because they have to negotiate what stands for knowledge and because the multiple producers of knowledge cannot function effectively without understanding and taking into account the standpoint of all the others. Finally, the quality control of the mode 2 knowledge production has broadened to take into account a set of intellectual, political, economic and social aspects such as the social acceptability and market viability of the solutions. (Gibbons et al 1994.)

Gibbons et al's (1994) thesis of a radical change in knowledge production has not gone uncontested. Godin and Gingras (2000) have argued that although the sites of knowledge production have diversified, the role of universities has not by any means diminished. Instead the involvement of universities in knowledge production, as counted by participation in published papers, has even increased from 1980 to 1995. Although their sample consisting of Canadian research papers could be criticised, the overall result does seem to indicate that the prediction by Gibbons et al that the university role in knowledge production is diminishing. Instead, Godin and Gingras suggest that the diversification has further stimulated university research through collaboration. Benner and Sandström (2000) have suggested that the institutional mechanisms also have an effect on the knowledge production such as the institutional regulations of academic research emerging from the activities of the agencies funding research. The institutional regulations of academic research and the coercive, normative and mimetic processes emerging from those practices, have the capacity to influence the constitutions of the organisational fields of knowledge production. The funding bodies, including the EU, may regulate research e.g. by favouring certain criteria of research over others, e.g. collaborative research or research done in isolation, interdisciplinary or disciplinary research, and basic or applied research. They may also influence the establishing, steering and structuring of the research networks. Benner and Sandström argue that these institutional structures may play a considerable role in the emergence of new normative, cognitive and organisational models within the field.

Mode 2 knowledge production thesis seems to provide a valuable point for looking at knowledge production in the EU-funded inter-organisational R&D collaboration networks, and the theory of mode 2 has certainly influenced design of the EU Framework Programmes. The wide set of institutions involved in knowledge production, applicability of research results and the involvement of the users and stakeholders of knowledge in negotiations regarding the usability of knowledge appear to be central features in the EU Framework Programmes. The EU FP's also seem to encourage interdisciplinary collaboration, aim to disseminate their results in several ways, including patent applications and the partners are linked with each other through various means of

communication, social ties and formal organisational agreements and procedures. Similarly, the emphasis on the accountability and quality of research is built into the EU funding processes. An important question arising from this is, whether the framework programme funded research confirms mode 2 thesis. If mode 2 thesis is valid, we would expect to find interdisciplinary research projects consisting of many different types of partners; a significant amount of research being done by other partners than universities; consideration for social and economic accountability; and a reflexive and negotiating process of knowledge production, where new knowledge is produced in genuine interaction between different types of partners. Our small sample may not, however, be able to answer all these questions.

4. Organisational and inter-organisational learning

The organisations studied in our research aim to produce new knowledge, and engage in inter-organisational collaboration in order to do this better, more efficiently and more effectively. Inter-organisational collaboration and knowledge production require inter-organisational learning. In this study, the concepts of organisational and inter-organisational learning are used to describe the internal learning processes that take place within and between the participating organisations.

Organisational learning can be defined as both a function of access to (new) knowledge and the capabilities for utilising and building on such knowledge (Powell et al 1996), or as “the social production of organizational rules based on experience that leads to a changed organizational behaviour” (Holmqvist 2003, 98). It is related to individual learning, but is influenced by organisational factors, such as organisational policies and procedures; or a lack of critical mass of people with the new knowledge and ability to work together, which impedes the organisational learning processes. (Beeby & Booth 2000). Organisational learning implies that the organisational beliefs and cognitive systems change, rather than there just behavioural patterns of the organisation. (Holmqvist 2003). Organisations can learn by using their capabilities in their everyday activities, learn by feedback from their markers and customers, or, in the case of non-profit organisation, from their stakeholders. Similarly, they can analyse and change their learning strategies to meet the needs of the changing contexts, form networks and partnerships in order to learn from others, or even “unlearn” capabilities which have proved obsolete. (Gilbert et al 2007) Gilbert et al (2007) argue that organisation can either improve their knowledge and capabilities incrementally; or radically change to meet completely new demands from the markets, clients and stakeholders. Similarly, Holmqvist (2003) has argued that organisations learn through exploitation and exploration. Exploitation is related to organisations learning to refine their capacities and to exploit existing knowledge, focus activities on certain domains and learn which activities are successful and which are not. Exploration on the other hand refers to experimenting, innovating and taking risks.

Inter-organisational learning refers to learning processes which take place between and in cooperation with multiple organisations. Inter-organisational learning is not just a sum of

organisational learning of the partners, but a unique learning entity, in which inter-organisational experiential rules are created which are separate from intra-organisational rules of the participating organisations. (Holmqvist 2003). Learning should not be viewed solely as a way of compensating for the lack of knowledge or skills in the organisation or a set of discreet transactions. Rather it is a process in which both (or all involved) organisations develop further. (Powell et al 1996). The inter-organisational collaborative arrangements vary in terms of how receptive and how transparent the participating organisations are. These characteristics define the organisations' learning strategies, which can be typified as collaboration, competition, compromise, accommodation and avoidance. The organisations are likely to learn most when they choose a collaborative strategy with high transparency and high receptivity. (Larsson et al 1998.)

Inter-organisational learning is facilitated by structural and institutional factors. A company's ability to learn from an inter-organisational collaboration project is related to its R&D investments (Powell et al 1996), and absorptive capacity (Cohen & Levinthal 1990), which refers to an organisations ability to value, assimilate, and utilise new external knowledge. It may refer to both problem solving capacities (creating new knowledge) as well as learning capacities (learning new skills). It is related to the firm's prior related knowledge base, and is dependent on its prior investment in increasing its knowledge base. However, it can not simply be "purchased" by hiring new personnel or contracting consulting services, but instead it needs to be integrated into the structures and processes of the organisation. An organisation's absorptive capacity is related to the capacities of its individual members, but not limited to it. Instead, the ability to transfer knowledge across and within the organisation's subunits is related to the structure of communication, including the shared language and symbols, within the organisation and between the organisation and its external environment. (see also Holmqvist 2003). Also the type of knowledge to be absorbed plays a role in the process. Cohen and Levinthal argue that if the external new knowledge is less targeted to the company's specific needs, as is often the case with universities engaged in basic research, the company's own R&D plays a larger role in enabling the company to recognise, value, assimilate and apply the new knowledge.

Like the possibility of inter-organisational collaboration, the efficiency of inter-organisational learning may also be dependent on the institutional fit of the collaborating organisations, and dialogue, through which the different organisational (sub)cultures can be understood, and shared concepts can be constructed. This suggests that the different organisational perspectives and discourses, and the differences between organisational and national cultures affect the learning process, and should be taken into account (Beeby & Booth 2000). Prior cooperation and interaction in a related area, high learning stakes and trust, as well as long-term orientation and commitment to the partnership are likely to contribute to the collective learning process. Strategically related partners - as opposed to any partners with prior collaboration- are most likely to learn in inter-organisational collaboration. (Larsson et al 1998, see also Powell 1990). This conclusion has lead Larsson et al to suggest, that in order to forest collaborative learning, organisations need to include collaborative strategies as part of the strategic portfolio, and to ensure that adequate procedures and absorptive and communicative capacity are in place.

Lane and Lubatkin (1998) argue that absorptive capacity is an inter-organisational feature rather than just dependent on the receiving organisation. It is dependent on the similarity of both organisations' knowledge bases, organisational structures and compensation policies, as well as dominant logics. Although Lane and Lubatkin base their arguments on an empirical study of R&D alliances between pharmaceutical and biotechnology companies, they suggest that similar elements may play a role in inter-organisational learning also in collaborative projects between different types of organisations. They propose, for instance, that the more familiar the 'student organisation' is with the dominant logic of the 'teacher organisation', i.e. the types of problems and projects that the 'teacher organisation' prefers, the more able it is to commercially apply the new knowledge acquired from the 'teacher organisation', and that similar organisational structures and compensation policies facilitate inter-organisational learning. We can thus expect that the inter-organisational R&D collaboration projects, typically consisting of universities, enterprises and research centres, face challenges arising from their different organisational structures, cultures and dominant logics.

Inter-organisational learning also encounters many challenges. Competitive partners tend to try to absorb as much knowledge from a partnership as possible, while giving as little back as possible. Thus they may benefit from the partnership more than those partners who willingly share their knowledge with others. Consequently, if all the partners behave in a competitive manner, there may not be much knowledge to share. Other challenges may arise from lack of motivation or ability to absorb and communicate knowledge between the partner organisations, or from the dynamics of power, opportunism, suspicion or different learning strategies. (Larsson et al 1998). Inter-organisational collaboration between different types of partners is likely to be hampered by different motivations or different institutional practices and norms, and facilitated between similar types of organisations, or organisations with similar, e.g. disciplinary, cultures (c.f. Becher & Trowler 2001). However, there probably is less competition between different types of partners, such as universities and businesses, than between similar types of organisations, say two universities or two companies, especially if they operate in a related area and in the same markets.

Beeby and Booth (2000) have also pointed out, that, although networks are a means of exchanging knowledge between organisations, the nature of organisational knowledge makes this complicated. The capacities of each organisation are path-dependent, that is, they are dependent not just on the resources but also on the organisational histories and prior investments and procedural decisions (c.f. Greener 2002, Pierson 2000). Organisations knowledge consists both of communicated, articulable knowledge and tacit knowledge, which is difficult to communicate, and depends on the organisational processes and social context. Only interactive learning strategies may help to convey the tacit knowledge from one organisation to another; passive learning from published sources or active learning through benchmarking, are not efficient means of acquiring tacit knowledge. (Lane & Lubatkin 1998)

Tacit knowledge or culturally and organizationally specific knowledge is more difficult to transfer between organisations and integrate in a new organisation, and thus requires forethought, cultural fit of organisations and trust between them. It is more likely to be transferred between culturally similar organizations, in apprentice-types of relationships, and within converging rather than diverging alliances and networks. It may, also, be transferred unknowingly, and, if captured, may represent a diffusion of the strategic assets of the firm. Explicit knowledge on the other hand is easier to transfer and the issues of cultural fit constitute a smaller problem, though knowledge can still be considered context-dependent. (Beeby & Booth 2000.) We may thus also expect, that there may be explicit and implicit learning between the partner organisations.

5. Conclusions

Based on prior research, six working hypotheses can be formulated for the study. The aim of the study is not to explicitly test these working hypotheses, but rather they are intended to highlight the basic assumptions underlying the study. First, it is expected that the EU Framework Programmes encourage mode 2 research, and thus we should find interdisciplinary research projects consisting of many different types of partners; a significant amount of research being done by other partners than universities; consideration for social and economic accountability; and a reflexive and negotiating process of knowledge production, where new knowledge is produced in genuine interaction between different types of partners. Second, it is expected, that access to various types of scarce resources, prior cooperation and trust between partners, and institutional and structural features and compatibility affect the formation and success of inter-organisational collaboration and EU-funded R&D collaboration networks. Third, the network collaboration is influenced by the regulations exerted by EU, the institutional features of the partners and the shared experiences and interaction within the network itself. Fourth, it is assumed that, in the partnerships, the activity of communication, intensity of personal relations, and the extent to which the organisations are committed to long-term collaboration with the other partners, may vary between partners. Fifth, it is assumed that different partnerships have different cooperation styles regarding the role of the different partners in the collaboration. Sixth, successful inter-organisational collaboration and learning is expected be dependent on the commitment of the organisations to the partnership and the institutional fit between them; and to have an impact on the organisational capacities, beliefs and cognitive structures of the participating organisations. These elements together provide the “rules”, which affect the formation and operation of the networks, and learning and knowledge within them.

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