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INNOVATIVE MILIEU AND SOCIAL CAPITAL - EXPLORING CONCEPTUAL COMPLEMENTARITIES

(Example of the Aachen region, Germany)

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Abstract:

Several concepts that aim at explaining successful innovation driven regional economic development relate to the supportive role of regional inter-organisational collaboration based on trustful personal relationships. The paper picks up two notions - innovative milieu and social capital - whose complementary nature deserves to get further explored in order to enrich our knowledge about underlying mechanisms of regional restructuring. First, major elements of both concepts are juxtaposed which indicates that they complement each other in explaining how personal relationships promote the evolution of spatial concentrations of technology-driven firms. Then the theoretical considerations get exemplified by looking at the German region of Aachen, which has managed to effectively restructure its economy through the growth of innovative technology-based firms. This process is strongly supported by means of inter-organisational collaboration combining distinctive milieu and social capital externalities.

1. Introduction

Local systems of relationships (e.g. networks) between firms and other organisations are commonly regarded as a major driving force of regional economic success and restructuring by favouring industrial innovativeness and competitiveness. A range of concepts try to capture the essence of relevant 'economies of interaction', associated with notions such as the industrial district (Asheim 1996), learning region (Morgan 1998), or creative or innovative milieu (Aydalot 1986; Crevoisier, 2001). Works that engage in clarifying distinctions between and relations among those concepts, however, are still rare and have, for instance, looked at evolutionary aspects linking industrial district and learning region (Asheim 1996), or influences of milieu characteristics on the localised production systems of industrial districts (Maillat 1998). Each notion claims to addresses certain qualities of regional economic communities that prosper due to collaboration, which renders them widely complementary to one another - notwithstanding the existence of some redundancies and tautologies - with the common denominator of emphasising the benefits of local interaction. Yet more detailed reasoning and research is necessary in order to better explore the analytical value that emerges from an expedient combination or juxtaposition of different relational concepts.

This paper picks up two approaches that seem worth regarding in this respect: creative/ innovative milieu and social capital. Both of them put into terms the importance of trustful, information-rich personal relationships between local organisations for creating supportive externalities for innovative and sustainably successful firms. Accordingly, we need to ask: does it make sense to connect both concepts in a complementary way, or are they rather synonymous as they address the same categories of local interaction? Is the recent transposition of the notion of social capital, which goes back to the sociologist Bourdieu (1983), to aspects of economic prosperity and innovativeness (Lesser 2000; Maskell 2000) redundant in the face of the milieu concept that apparently explains the same phenomena already? It shall be shown that, despite some overlap, the milieu and social capital approaches bear distinctions that render their combination a useful basis for better explaining and evaluating the roles of personal relationships in promoting regional development and innovation-based restructuring.

The issue is explored by combining theoretical considerations with the application to a case study. First, major elements of the concepts of innovative milieu and social capital (in the context of regional economic development) will be highlighted. The focus is set on pointing out important distinctions between both approaches, thus their potential for

complementing each other: while the first one emphasises benefits of interaction of heterogeneous groups of agents that creatively combine differing competencies, the second one rather relates to specific collaboration externalities of more homogeneous communities. Then the theoretical assumptions get exemplified by looking at relevant features of economic restructuring of the German region of Aachen. Formerly an 'old industrialised' area based on textile and mining industries, Aachen has managed to successfully transform into a 'technology region' housing many innovative, knowledge-intensive firms. This process, which has gained momentum since the mid 1980s, substantially relies on formally and informally constructed systems of personal collaboration and mutual support. A closer look at the patterns of interaction reveals that this success can much better be explained when distinctions are drawn between milieu and social capital externalities.

2. The concepts of innovative milieu and social capital

Both the innovative milieu and social capital approaches (adapted to economics) stress the important function of personal, trustful relationships for successful regional development in terms of arising agglomerations of innovative firms. Yet, they have emerged from distinct schools of thought, are discussed in widely unconnected circles of debate, and got applied to different examples (with the exception of the Californian Silicon Valley that seems to fit to any model; Cohen and Fields 1999; Gordon 1993). Consequently, a systematic analysis of mutual interdependencies, complementarities or redundancies of both concepts is still lacking.

The notion of the innovative or, synonymously, creative milieu is mainly associated with the Groupe de Recherche Europeen sur les Milieux Innovateurs (GREMI). Since the mid 1980s this set of sometimes over 25 researchers has put substantial effort into theorising on and empirically verifying milieu characteristics and effects with respect to various types of regions, investigating over a dozen predominantly European examples (Aydalot 1986; Camagni 1991; Maillat et al. 1993; Ratti et al. 1997; Crevoisier and Camagni 2000; for overviews see Crevoisier 2001; Fromhold-Eisebith 1995). The notion of social capital, in contrast, has only quite recently been transposed to questions of innovation-based industrial development (Cohen and Fields 1999; Cooke and Wills 1999; Lesser 2000; Maskell 2000; Tsai and Ghoshal 1998; Walker et al. 1997; Woolcock 1998), while originating from the social and political sciences (Bourdieu 1983; Bourdieu and Wacquant 1992; Coleman 1988; Fukuyama 2000; Haug 1997). The fol-

lowing sections depict basic elements of both concepts and explore their complementary aspects.

2.1 Basic conceptual elements

The approach of innovative/ creative milieus, assuming a good regional institutional endowment in terms of universities, research laboratories, public support institutions, some firms and other factors as a necessary prerequisite, focuses on major forces that make these institutions actually interact and be co-ordinated in ways that lead to positive regional outcomes, notably innovating firms. A central definition by a GREMI protagonist describes the innovative milieu as

> "the set, or the complex network of mainly informal social relationships on a limited geographical area, often determining a specific external 'image' and a specific internal 'representation' and sense of belonging, which enhance the local innovative capability through synergetic and collective learning processes" (Camagni 1991, 3).

Later on, essential milieu elements and features have rather been seen in the intersection of dynamic technology development (urging companies to innovate), changing patterns of organisation (e.g. in local production systems or structures of governance), and advantages of spatial proximity (e.g. social, cultural and knowledge-related coherence) (Crevoisier, 2001). This much broader (and somehow fuzzy) characterisation leaves aside the formerly emphasised relational qualities of regional milieus (Maillat et al. 1993). That is why this paper concentrates on a more concrete idea of the creative milieu which relates to Camagni's initial definition and focuses on patterns of personal interaction (see also Fromhold-Eisebith 1995 and 1999).

According to that, three main sets of elements mark creative/ innovative milieus: effective actor relationships within a regional framework; social contacts that enhance learning processes, and image and sense of belonging. The first aspect relates to the fact that co-operation and information exchanges between key actors of economic development are facilitated by the location of these people in the same region and, thus, in spatial proximity to one another, which allows for easy and frequent face-to-face contacts. For actually being able to trigger innovativeness and progress the actors of a milieu need to be decision makers explicitly coming from different types of organisations (manufacturing or service firms, universities, research laboratories, administrative bodies, institutions of industrial promotion a.o.) (Maillat et al. 1993), as creativity mainly emerges

from a new combination of ideas that belong to different fields of activity and were not associated previously (Shapero 1977). Thus those people can combine complementary capabilities and competencies that are necessary to create new technical solutions or implement new programs. The crucial quality of innovative milieus to induce and co-ordinate economic change and the regrouping of productive assets have been stressed by GREMI (Crevoisier 2001; Ratti et al. 1997). Although the relevant personal network is bound to the region, it needs to be open to inflows of know-how from outside, too, in order to prevent 'lock-in' and to enrich the regional circulation of information.

The second set of basic milieu elements relates to specific advantages of socially embedded learning processes. They are favoured by good informal, often also private contacts between individuals constituting the local milieu, who display a high degree of mutual trust (we can figure 'old boys networks'). Via their easy face-to-face communication confidential and non-routine information flows fast, uncertainty is reduced, and learning and innovation accelerated (Sweeney 1987). The effective combination of personal professional and private relationships does not only provide preferential or cost-free access to strategically important news or services but also to emotional support that backs up business decisions to innovate (motivation, encouragement, recognition). Accordingly, creative milieu relationships and the trust inherent to them have to grow by themselves and need time to build up (which leaves low hopes for policy).

Regional image and sense of belonging, the third set of milieu elements, indicate that the actors are aware of forming a coherent unity, which is demonstrated to the outside world as well. This aspect fulfils the important function of harmonising the agents' differing professional background and interests and direct them towards common goals. GREMI also refers to the unifying role of regional culture (e.g. technical tradition, value system) in this context (Crevoisier and Maillat 1991). A motivation for activating milieu relationships and joining forces often emerges from shared objectives of regional development, for instance, triggered by the need to restructure the local economy.

The notion of social capital gets close to milieu characteristics by its basic definition as

> "the sum of the resources, actual or virtual, that accrue to an individual or a group by virtue of possessing a durable network of more or less institutionalized relationships of mutual acquaintance and recognition" (Bourdieu and Wacquant 1992, 119).

Similarly, social capital features "as the wealth (or benefit) that exists because of an individual's social relationships" (Lesser 2000, 4). Whereas these definitions identify the

term with the results of people's interaction, others rather refer to underlying forces that trigger that interaction: "social capital is an instantiated informal norm that promotes cooperation between two or more individuals" (Fukuyama 2000, 3). This indicates that the exact meaning and content of the concept is still a matter of debate, with respect both to social or political processes and to economic development (Dasgupta 1999; Fedderke et al. 1999; Haug 1997). The question how to empirically measure social capital and its impact on industrial development has been solved even less (Maskell 2000). There have been efforts that draw, for instance, on mathematical network analysis (e.g. Burt 1992; Walker et al. 1997); but approaches that search to comprehensively specify its economic implications are still lacking.

Most theoretical work on social capital addresses the positive effects of the embedding of people in relatively stable, community-creating social relationships. While focusing on the behaviour of individuals (people or firms), a majority entertains the so-called egocentric perspective (Lesser 2000). The sociocentric approach, in contrast, values social capital according to the individuals' position within or between given networks. Benefits are regarded as being particularly high when people manage to bridge 'structural holes' that exist between previously unconnected communities (Burt 1992). The notion is often associated with ideas of civil society and peoples' deliberate engagement in associations, parties or other institutional forms that aim at supporting societal groups or the population of a locality (Immerfall 1999; Putnam 1993). Accordingly, social capital and the high level of trust inherent to it are regarded as a favourable asset of entire (local) societies, which helps to collectively solve shared problems (Haug 1997). Mainly this context has provided the background for studies on the role of social capital in regional economic development and its region-specific implications (Helliwell and Putnam 1999; Leonardi 1995; Schneider et al. 2000).

Generally speaking, social capital structures are advantageous because they "facilitate certain actions of actors - whether persons or corporate actors - within the structure [...] making possible the achievement of certain ends that in its absence would not be possible" (Coleman 1988, S98). The main quality of the relationships is seen in their specific capacity to transmit (certain types of) information in certain circles, which helps to apply the concept to issues of economic development and innovation (Lesser 2000). Yet, social capital properties reach beyond that, as its community-related externalities are explicitly distinguished from the trustful information flows of company networks (Maskell 2000). Additionally, it creates obligations and expectations among actors and im-

plements social norms, often constraints of activity. This is relevant for the society and the economy where actions of individuals are shaped, redirected or restricted by social norms and interpersonal trust. It needs to be pointed out that social capital sustains its qualities also in case of changing tasks because actors continue to have this resource available: "One means by which information can be acquired is by use of social relations that are maintained for other purposes" (Coleman 1988, S104).

Explicitly referring to economic activities, social capital is regarded as an important asset for companies that need to raise efficiency and establish linkages across firm boundaries due to the rise of the vertically disintegrated, innovation-driven network economy (Lesser 2000; Maskell 2000). In this environment firms purposefully engage in individual and collective efforts of investing in the creation of social capital which helps them to better organise and co-ordinate their business routines, and to acquire technical know-how. Created by virtue of closed networks, the resulting communities follow common norms for acceptable behaviour, diffuse strategically important information, constrain opportunism and enable co-operation. Open networks that lack social capital render firms' environment much more difficult and make them more vulnerable to negative impacts, for instance, of competitors (Walker et al. 1997). Thus, rich social capital is mainly associated with strong inter-firm ties, certain interpersonal dynamics (primate of trust and reciprocity), and a common context, language and code of individuals integrated in the structure (shared terms and experiences) (Lesser 2000).

2.2 (How) Do both concepts complement each other?

According to the given description the concepts of innovative milieu and social capital appear to refer to the same, or at least very similar, factors of (regional) economic development. They both emphasise the advantages of dense systems of personal and trustful relationships between organisations which create coherence and common values, reduce uncertainty, provide support and improve access to information, altogether helping innovative firms to emerge and to evolve. It could be inferred that this congruence renders their combination in a theoretical framework of regional development more or less redundant. Based on the extensive conceptual and empirical research that has especially gone into the issue of innovative milieus this approach may claim to provide the more complete explanation which implicitly inheres the idea of social capital. In fact the asset of 'relational capital' (yet not social capital) that significantly contributes to the economic externalities of successful milieus gets literally mentioned in the works of

GREMI (e.g. Crevoisier 2001; Crevoisier and Maillat 1991). On the other hand, some conceptions of social capital relate to milieu aspects as well, such as Burt's assumption that social capital needs to bridge 'structural holes' between closely knit networks in order to be valuable (Burt 1992), which relates to the quality of milieus to link previously unconnected information from structurally different sources. Similarly, Coleman associates social capital also with ties between heterogeneous actors or different homogeneous networks that allow "the resources of one relationship to be appropriated for use in others" (Coleman 1988, S109).

Nevertheless, despite a substantial overlap of the two approaches this paper argues that they are distinct enough to allow their complementary combination. A closer look at their differing main foci reveals that social capital signifies aspects which have been underrepresented in considerations on innovative milieus so far, and vice versa. Their concatenation could possibly capture location-specific industrial dynamics more comprehensively. Anyway, the implications of social capital for innovation-oriented regional economic development have rarely been addressed (Cohen and Fields 1999; Cooke and Wills 1999), although the emphasis of this notion on personal, trustful interaction and socially coherent communities of actors suggests a reference to dynamics based on spatial proximity (Maskell 2000). It seems worthwhile to enrich the social capital approach by more explicitly applying it to localised processes, and to enrich the milieu concept by more systematically connecting it with ideas of social capital.

Complementary aspects of innovative milieu and social capital appear to exist with respect to four categories, which represent important relational elements in innovation-based regional development: general purpose of interaction, type of actors and composition of group, main task in the realm of innovation, and time-related character of interaction. Table 1 depicts in which ways both concepts differ and add to one another.

Regarding the first category, the milieu concept focuses on explaining the role of interaction in creating innovative complexes and, at times radically, changing the direction of regional economic development. This overlooks, however, that firms that are subject to a changing and unstable environment also need elements of stability and reliability in order to prosper. This stability is represented, by its nature, by social capital (Bourdieu 1983; Bourdieu and Wacquant 1992, Coleman 1988). Social capital maintains and reproduces the structure of pre-existing relationships and is therefore said to be critical especially "to the success of individuals working in a fast-paced [...] and highly knowledge-intensive environment" (Lesser 2000, 4), where "the extensive innovative activi-

Table 1

Distinctions and complementarities of innovative milieu and social capital

	innovative/ creative milieu	**social capital**
general purpose of interaction	to induce and manage change and implement new plans and programmes	to sustain elements of stability and reliability in an environment of change
type of actors and composition of group	heterogeneous network of decision makers from various private and public organisations (firms, universities, administration)	homogeneous community mainly including the senior staff of firms (of the same or related industrial sectors)
main task in the realm of innovation	to get from invention to innovation, from idea to commercialisation	to master the management of the firm and to remain in the (innovative) business
time-related character of interaction	selective one-time efforts and project-related joint activities	constant maintenance of relationships in the course of regular meetings

Source: depiction by the author

ties of small firms [...] push out industry boundaries into new subfields and increase the level of competition. [...] opportunities for cooperation are created by unintended spillovers and intended agreements" (Walker et al. 1997, 110). In order to survive in the face of the posed challenges some reliable 'safe harbour' in the form of social capital seems necessary, incorporated in a familiar community of partners of the same wave-length and norms that creates a 'radius of trust' (Fukuyama 2000).

In line with the dichotomy of change and stability, innovative milieu and social capital differ also in the composition of actor groups (table 1). While milieus mainly draw on trustful relationships of heterogeneous actors in order to bring about creative outcomes, as mentioned above, the common ground and shared norms that mark social capital rather grow on a foundation of homogeneity. Therefore this asset appears to be best represented in communities of (sectorally related) firms, which might be institutionalised as industry associations or sector-specific interest groups (Cooke and Wills 1999; Maskell 2000; Walker et al. 1997). This distinction relates to Harrison et al. (1996) who point out that the 'urbanization' advantages emerging from the diversity of economic and social institutions and the 'localization' advantages based on the sameness of resident businesses need to complement each other for effectively promoting innovation-oriented regional development.

Accordingly, differing types of tasks are fulfilled by milieu and social capital relationships in the realm of innovation. In its logic of change the creative milieu mainly fol-

lows objectives of enabling the move from invention to innovation and from idea to commercialisation, e.g. promoting the foundation of new technology firms (Maillat et al. 1993). Yet, the companies need other kinds of support as well in order to become and stay commercially successful. A reliable base of social capital helps the firm to master corporate management and remain in the (innovative) business. Many issues typically associated with social capital relate to important everyday routines that add to a company's performance, but are not at the core of its innovative capabilities and often represent particular weaknesses of young technology enterprises: support in questions of organisation and marketing, cross-sale of products, sharing of common reservoirs of skilled labour, or provision of financial assistance. Firm communities, better than milieus, provide information about competitors or advice from experienced incumbent companies and make actors learn about new industry trends (Maskell 2000; Walker et al. 1997). Social capital ties of shared knowledge and contacts, however, are not useful in providing new sources of know-how (Lesser 2000), which requires their combination with the milieu.

Consequently, the time-related character of interaction differs for milieu and social capital relationships. While the networks of innovative milieus get activated in a rather selective way for certain project efforts (for instance, implementing programmes of regional development), social capital needs to be constantly reproduced which requires a continuous and regular maintenance of community relationships.

3. Innovative milieu and social capital in the technology region of Aachen

The German example of the region of Aachen (population 1.15 million), comprising the city and county of Aachen and the counties of Düren, Euskirchen and Heinsberg, serves to illustrate the importance of both creative milieu and social capital for successful regional economic restructuring. Over the past two decades Aachen has managed to evolve from a region dominated by old industries to an outstanding agglomeration of new technology-driven innovative firms (Van Eyll and Eschweiler 2000). The pronounced regional collaboration of actors has fundamentally supported that transformation. The following sections, which draw on information obtained from publications, brochures and personal interviews with a handful of local experts in spring 2002, provide a brief overview of the basis and results of regional economic restructuring and produce some evidence of the influence of distinct creative milieu and social capital externalities.

3.1 Regional economic restructuring

The region of Aachen had to go a hard way, accompanied by high unemployment, from coal, steel and textiles to high technology goods and services (which is comprehensively documented by Eschweiler and Indetzki 2000, and in other chapters of Van Eyll and Eschweiler 2000). Formerly dominated by mining, metalworking and other traditional industries, which lost competitiveness particularly since the 1960s/70s and had to undergo harsh shrinking processes, the focus has since the mid 1980s shifted to the formation of new enterprises predominantly in information technology, engineering consulting, and - lately increasingly - medical and biotechnology. Now the total number of technology firms (production and services) operating in the region is commonly estimated to be in the range of 560-600 that employ approximately 6,000 mostly highly qualified people (technology sectors are not specified in official industrial statistics and classifications; those numbers, though, seem realistic as about 460 firms have provably been founded in the region's 12 technology and start-up centres alone). More accurate figures are currently investigated in the course of a survey by the Aachen chamber of industry and commerce (IHK); the results are expected to come out in summer 2002.

The region's outstanding academic and research institutions, notably the University of Technology (RWTH) Aachen (close to 30,000 students), the Polytechnic College (FH) of Aachen (close to 9,000 students) and the public Research Centre (FZ) Jülich (about 4,300 employees), have been the major basis from which industrial restructuring could successfully emerge (AGIT 1991; Fromhold-Eisebith 1992). In particular the growing numbers of direct and indirect spin-off firms that got established by former or current faculty members and university alumni have shaped the regional take-off in technology industries. Consequently, local technology transfer from academia to industry, almost non-existent before the 1970s, has now become commonplace especially between some engineering departments of the RWTH or FH Aachen and their spin-offs. Although the loss of workplaces in traditional industries has not been fully compensated by those created in new technology-driven production and service firms, the downturn got substantially attenuated, and positive attitudes of could be implemented in the region.

3.2 Manifestation of innovative milieu

In line with regional theory, industrial restructuring could only gain momentum in the Aachen area after several local organisations started to collaborate with respect to com-

mon objectives of regional development, constituting a creative-innovative milieu. Today several interconnected systems of formalised or informal relationships exist in the region. In the following, only the most crucial ones will be introduced (see table 2).

Table 2

Creative-innovative milieu relationships in the Aachen region

manifestation of milieu	participating/ contributing actors	main purpose of creative interaction	image and sense of belonging
AGIT - Aachener Gesellschaft für Innovation und Technologietransfer mbH (established in 1983)	2 local chambers (IHK, HWK), 5 communal agencies of industrial promotion, 3 academic/ research organis. (RWTH, FH, FZ Jülich), local association (ZAR e.V.), 2 service companies (finance)	providing infrastructure: technology & start-up centres; promoting technology transfer from academia to industry; regional marketing and governance	objective to create Aachen's image of a technology region and to unite institutions for initiating economic restructuring
systems of informal relationships between academic institutions and private firms	faculty members of engineering and other institutes of the RWTH Aachen and senior staff of regional spin-off firms	transfer of academic know-how to application/innovation, ideas to commercialisation; provide skilled staff to firms	strong sense of belonging, 'corps spirit', personal trust; cultivation of RWTH image
GründerRegion Aachen (established in 1999)	2 local chambers (IHK, HWK), AGIT, 5 communal agencies of industrial promotion, banks, 3 academic/ research organis. (RWTH, FH, FZ Jülich), Gründerkolleg	motivate and support the founding of technology firms, mainly by providing information, advice and contacts	objective to redefine and strengthen Aachen's technology image; evoke awareness of entrepren. opportunities

Source: information from brochures and interviews; depiction by the author

Based on pre-existing personal relationships of some key actors, a first major step was initiated by founding the AGIT, a regional association for promoting innovation and technology transfer, which represents the joint effort of over a dozen organisations (table 2). Combining the strengths and complementary competencies of its various participants from organisations of industrial promotion, research, and service industries, AGIT created new infrastructural and programmatic approaches that gave a major initial push to regional economic restructuring. One key activity (apart of organising technology transfer from academia to industry, marketing the 'technology region' of Aachen a.o.) has been the establishment of technology and start-up centres in the city of Aachen and other parts of the region, which has served as a model for other agents to follow that example. Meanwhile 12 centres are operating in the area (and more in the planning stage), which mostly specialise in housing certain types of firms and often offer office and consulting services to their inmates, additional to subsidised rents. The resulting density of regional start-up infrastructure is second to none in Germany. Now these cen-

tres are the residence of over 450 innovation-oriented firms with altogether about 3,700 employees (Eschweiler and Indetzki 2000; Foerster 2000). Complemented by other initiatives of regional partners (e.g. special financing schemes by local banks for technology-based enterprises), AGIT's infrastructural approach has formed the basis for other kinds of milieu effects to get activated.

On these grounds informal systems of regional collaboration between academia and industry proliferate which directly effect the innovativeness of local firms (table 2). A majority of Aachen's technology companies are spin-offs of the prime university, the RWTH Aachen: academic inventions and know-how get commercialised and applied by the creation of marketed innovations. Entailing continuous linkages between the young firms and their 'parent institutions', this phenomenon establishes effective systems of local exchanges of information, services, and staff between university and industry based on personal, informal and trustful relationships (Fromhold-Eisebith 1992). The milieu linkages are structured according to major spin-off sources (outstanding RWTH engineering departments) marked by high degrees of social coherence, identity, sense of belonging, and virtually a 'corpse spirit' among the members of each network.

As technology-oriented spin-off entrepreneurship, rather than technology transfer to pre-existing firms, evidently represents the most successful way of restructuring Aachen's economy, more recent milieu-based approaches have adjusted to that task. The 'Gründer Region Aachen' initiative, which co-ordinates and (re-)unifies the activities of close to 20 public, private or public-private organisations (table 2) and profits from their 20-year-tradition of socially embedded interaction, renews and redefines the objectives once designated to AGIT by especially focusing on the promotion of innovation-driven entrepreneurship (GründerRegion Aachen 2000). Again each partner contributes certain assets and competencies for jointly raising the entrepreneurial spirit and triggering industrial change in the region (e.g. IHK: consulting and establishing contacts to regional and external sources of finance; AGIT: help in designing the business plan and finding a location; RWTH: getting from invention to innovation). The approach explicitly aims at also sharpening Aachen's image and creating a common regional label to the outside world. Extensive information, consulting, marketing and networking efforts (e.g. brochures and newsletters, participation in fairs and academic events, organising meetings of young entrepreneurs, offering business awards) address regional and external audiences.

In combination with other institutions that owe their existence to inter-organisational collaboration (such as the 'Gründerkolleg' at the RWTH Aachen, an initiative for educating academics in entrepreneurship jointly supported by local banks and the IHK), these activities are major engines of ongoing regional economic change and renewal. The outstanding success of RWTH alumni in earning state funding for entrepreneurship (75% of their applications for the Northrhine-Westphalian PFAU scheme in the period 1996-2001 were successful against an average of below 45%; Sternberg 2001) hints at substantial positive impacts of Aachen's supportive creative-innovative milieu.

3.3 Manifestations of social capital

According to opinions expressed by Aachen-based entrepreneurs in personal talks, however, the depicted initiatives and networks, despite their important role in providing basic infrastructure, advice or know-how for innovation-oriented entrepreneurship, do not suffice when it comes to solve other crucial business issues. There are many (sector-specific) everyday problems of technology firms or difficulties faced when growing out of the start-up phase which can hardly be overcome by virtue of those milieu structures and their services. Additionally, another category of support is required which relies on relationships between homogeneous firms (sector, age) that share common problems or objectives: the stabilising effect of social capital.

Evidence of such collaboration systems can be produced by referring to institutionalised communities of firms, i.e. sector-specific industrial associations, that have come up in the region in the past decade (table 3 lists some examples relating to producer and service industries). In particular REGINA has grown to a considerable size and managed to capture every fourth of the total of 300 or so IT firms existing in the Aachen Region (Schiffers 2001). Many informally constituted sets of relationships add to the picture, for instance, linking technology firms that reside in the same start-up centre which can easily and unbureaucratically get information and help by knocking at the doors of neighbouring young companies. Social capital aspects appear to dominate those communities: their purpose is less associated with innovation and change (which, as important strategic assets of competition, might only rarely be the subject of contacts), but primarily with intentions to stabilise entrepreneurial activity by creating an atmosphere of mutual support and reliability. Some firms (e.g. technology-driven service providers) explicitly engage in community (and social capital) building in order to substitute for the allegedly insufficient official support by regional authorities.

Table 3

Communities of social capital relationships in the Aachen region

name of the (institutionalised) community	sector(s)	member firms
REGINA e.V. - Regionaler Industrie-Club Informatik Aachen (established in 1991)	information technology	over 80 (incl. other org.)
INTRA e.V. Interessensgemeinschaft innovativer Aachener Unternehmen der Kunststoffbranche (established in 1992)	plastics processing/ engineering	20
LifeTec Aachen-Jülich e.V. (established in 2000)	bio-/medical technology	about 40
AixKurs e.V. Baufachportal (established in 2001)	construction engineering	16

Source: information from brochures and interviews; depiction by the author

Several industrial associations (like REGINA, INTRA and LifeTec in table 3) are connected to the milieu, though, since they are (co-)initiated and continuously influenced by the IHK or corresponding departments of the RWTH Aachen (which are, for instance, represented in the associations' advisory boards). Yet, the activities and interactions organised in the framework of those fora are mainly tailored to fulfil business-centred needs that only indirectly relate to the innovativeness of firms, but rather serve to create common grounds and assets from which every member firm can profit. Since the circles of company executives are often constituted by alumni of the same or technically related RWTH institutes (as in the case of REGINA or INTRA), barriers of trust are low and a basis of shared norms and language exists right from the start.

Personally getting to know each other and informally exchanging experiences usually represent major purposes of community meetings in all of the mentioned associations. Beyond that joint efforts explicitly address sector-specific needs and include, for instance, consulting each other in management issues (e.g. acquiring qualified staff, sourcing capital), collecting and providing information on changes in the legal framework or promotion programmes, carrying out technical seminars, collectively purchasing or exchanging inputs (like software), or launching investigations of common interest, such as a survey on regional wage levels in the respective sector. From that supplier and other formal collaboration linkages of member firms can possibly emerge. Sometimes targeted workgroups combining certain experts add to the regular meetings of the

companies' top managers: REGINA, for instance, has special groups on the operating system LINUX and on the testing of new software (Schiffers 2001).

How important these regional back-up structures are for the growth of technology firms, however, is difficult to estimate. According to a responsible IHK executive (interviewed in February 2002), effects can already be noticed in terms of a reduced sense of competition and increased collaboration among companies, which straightway refers to social capital implications mentioned by Walker et al. (1997). Obviously, the establishment of the first associations more than 10 years ago has produced substantial benefits to firms and, thus, serves as an example for others. The recent trend of new institutions to be formed (those listed in table 3 and others, such as CAR e.V., combining local automotive technology firms) indicate that the building of social capital is seen as an important asset which further supports the development of the technology region of Aachen.

4. Conclusions

Creative/ innovative milieu and social capital - should and could these concepts be combined in order to improve our understanding of the function of trustful personal inter-organisational relationships for successful, innovation-driven regional economic development? This question bears important research- and policy-related implications.

The paper arguments in favour of a positive answer, based on theoretical considerations and confirmed by the case of the technology region of Aachen and its structures of interaction. It shows that aspects of innovation-based industrial transformation and change, which are mainly addressed by the milieu approach, need to be complemented by aspects of stability and sustainable support, explicitly captured in the notion of social capital, in order to provide a more complete picture of the features of local collaboration that promote economic progress. Although, admittedly, the milieu concept implicitly contains ideas of relational advantages that remind of social capital externalities, e.g. by noting the effect of milieus to reduce uncertainty (Maillat et al. 1993), a more pronounced distinction between the characteristics of actor linkages inducing change and those securing a solidifying backup for companies' operations seems due. Both categories of relationships prove to be highly important and fulfil their specific role within regional economic restructuring, yet need to complement each other (similar to the above cited differentiation and combination of 'urbanization' advantages of diversity and 'localization' advantages of sameness suggested by Harrison et al. (1996)).

The paper provides some first ideas how the two categories of local personal interaction could be distinguished and connected by stressing particular qualities and gaps of each the milieu and social capital concepts. The former bears advantages of quite comprehensively capturing major aspects of regional dynamics and important 'initial sparks' for the creation of innovations or new firms, whereas the latter relates to industrial needs of a stabilising counterbalance to those changes which are insufficiently represented in the former concept. But more research is necessary for refining and corroborating the depicted approach, explicitly discerning milieu and social capital specifities.

Another regional example - more prominent than the Aachen one - appears to already confirm the validity of the suggested line of argumentation: the Californian Silicon Valley. On the one hand, Cohen and Field (1999, 110) point out the "focused interactions among [...] the great research universities, U.S. Government policy, venture capital firms, law firms, business networks, [...] and the labor market" as driving forces for the valley's prosperity (mistakenly, and therefore unsuccessfully, trying to associate these truly milieu-specific relationships with social capital). On the other hand, Saxenian (1999) emphasises the supportive function of industry-related clubs and associations of homogeneous, coherent actor groups (e.g. with a common ethnic background or professional orientation) for Silicon Valley's sustainably positive development, which actually indicates social capital formation. Yet, also for this model region the combination of milieu and social capital externalities still remains to be made explicit by a corresponding two-tier analysis (which could dialectically mediate between contrasting opinions on regional factors of success expressed by different authors).

Eventually, the investigation of different types of trustful inter-organisational collaboration could also help to improve policies for promoting technology-oriented regional development. Currently - at least in Germany - the activation of milieu-related effects of interaction appears to be (overly) emphasised. But realisations of the high importance of social capital could lead to wider public support for building this crucial complement.

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