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Regional innovation systems and the globalising world economy

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Abstract: For more than twenty years a strong case has been made that territorial agglomerations are growing in importance as a competitive location of economic activities. The paper identifies forces of duress acting upon such agglomerations, and raises questions as to the continuing importance of localised learning. On the one hand the paper emphasises the role of increasingly 'distributed' knowledge bases, the use of temporary organisations such as projects, and the role of both inward and outward foreign direct investments as potential forces of de-territorialization. On the other hand the paper argues that the stickiness of idiosyncratic knowledge bases and divergent institutional foundations of organisational learning processes continue to constitute strong forces of territorialization. The paper further argues that processes of inward and outward FDI as well as the formation of networks related to distributed knowledge bases constitute interfaces between localised - regional or national – 'business systems', and systems of corporate governance. This leads the authors to conclude that globalisation poses questions as to the complementarities between localised systems of ownership, learning and innovation that interface through FDIs or networks, thus redefining without reducing the importance of such systems themselves.

Key words: Regional innovation systems, multinational corporations, foreign direct investments, knowledge transfer, endogenous learning, cluster, industrial districts, varieties of capitalism, corporate governance, globalisation, internationalisation, TESA

JEL codes: B52, G32, G34, L64, M1, N20, O30, P12, P51, R11, Z13

Introduction: The global challenges

For more than twenty years a strong case has been made that territorial agglomerations are growing in importance as a competitive location of economic activities (Asheim and Isaksen 2002, Cooke 2001a). An important empirical background for this position has been the rapid economic growth of territorial agglomerated and networked SMEs in industrial districts in the 'Third Italy' (Asheim 2000), in which firms are embedded in spatial structures of social relations. The purpose of this paper is to explore the relationship between on the one hand such territorial agglomerations and their local or national institutional foundations, and on the other their connections to non-local learning interfaces and non-local institutional incentives and constraints represented by international user-producer networks, research collaborations and not least foreign direct investments. The goal of this paper is firstly to generally analyse the tensions between local learning and globalisation. The second aim is to discuss how this interplay should be conceptualised and then applied in empirical research.

Arguments have been presented that cast doubts on the sustainability or importance of localized learning processes in the globalising economy. At least five different processes could be identified challenging the role of localized learning and endogenous growth in regional economic development. These five processes are the following:

1. Industrial districts in the Third Italy have been the paradigmatic example of localized learning and endogenous growth. One of their characteristics was that they consisted of operations which covered the whole value chain. This is no longer the normal case, as specific phases of the value chain, typically the most labour intensive or/and the most polluting phases, are increasingly being located outside the districts in previous East-European countries and/or countries in the Third World. This has resulted in a concentration of only certain phases of the industrial activity in the original industrial districts.

2. Many studies of regional innovation systems have shown that even if regional resources and knowledge bases are very important for the innovativeness and competitiveness of local firms, linkages to regional innovation systems only are not sufficient to remain competitive. These in particular applies as individual firms initially embedded in the system, through specialisation, deepen their cognitive focuses and hence individually find themselves in need of specialised external knowledge and collectively create divergences in the system as a whole. Thus local firms must have access to national and supra-national innovation systems, as well as

to corporate innovation systems for the local firms that have been bought up by MNCs or TNCs, which requires a multi-level approach to innovation systems (Asheim and Isaksen 2002).

3. We are observing a transition from an internal knowledge base in specific industries (i.e. high tech sectors) or agglomerations (e.g. sector specialised industrial districts) to distributed knowledge bases of firms or production systems, caused by a general increase in knowledge intensity in all parts of the production chain. This implies that the relevant perspective on the knowledge base of firms is neither the individual firm, nor always the local system of firms but often extra-local production or learning systems. Questions have lately been raised as to whether spatial embeddedness of learning and knowledge creation thus might be challenged by alternative organisational forms (i.e. temporary organizations), which are said to become more prevalent (Asheim 2002, Grabher 2002). Wenger's (1998) and Nooteboom's (2001, 2002) work hint at the difficulties of establishing deep learning interfaces (i.e. in the form of temporary organisations). These are related to a paradox. On the one hand, complementary cognitive variety is an important rationale behind the establishment of a project team. On the other hand, it creates difficulties in achieving the deep levels of interactive learning necessary to realize innovative potentials. Further, Lam (1998b), argues that the dilemmas of knowledge *accumulation* represented by temporary organisations, and of continuously identifying the best participants of such organisation, are best solved when these are formed among clustered firms.

4. Furthermore it has been argued that as a result of globalisation and codification processes the competitive advantage of high-cost regions and nations are steadily being undermined as local, tacit knowledge are destroyed by the ubiquitification process (i.e. rapid global availability of new production technologies and organisational designs at more or less the same cost) (Malmberg and Maskell 1999, Maskell 1999). This creates pressure on actors in those regions to be in a state of continuous learning, which often implies a stronger focus on the core competencies of firms and an increase in the importance of social and institutional structures promoting distinct learning processes.

5. An increased number of FDIs in industrial districts types of clusters is clearly observable, and typically, it is the most innovative and competitive middle-sized firms that are being bought up. As a consequence of this there may be a potential conflict between the innovation network or system in the districts and the incoming corporations due to the integration of the acquired district firms into the innovation

and business systems of the corporations. As will be argued below, incoming FDIs carry "foreign" institutional incentives and constraints (e.g. corporate governance system characteristics through their internal capital allocation and monitoring system (Porter 1998)) not necessarily compatible with or complementary to the regional innovation and business systems it interacts with.

These processes will undoubtedly have consequences for the relative importance of local vs. non-local conditions and relations for future regional development (Bathelt et al. 2003, MacKinnon et al. 2002). In what follows we shall look closer into these tendencies, and especially the consequences for the role of regional innovation systems with regard to the capacity for upgrading the knowledge bases of firms in regional clusters.

Regional innovation systems and localised learning

Regional innovation systems and learning regions have been looked upon both as explanatory concepts, and as policy frameworks or models for the implementation of long-term development strategies initiating learning-based processes of innovation, change and improvement (Cooke et al. 2000, Asheim 2001, Asheim and Isaksen 2002). The concept itself is a relatively new one, which first appeared in the early 1990s (Cooke 1992, 1998, 2001a), a few years after Chris Freeman first used the innovation system concept in his analysis of Japan's economy (Freeman 1987), and approximately at the same time as the idea of the national innovation system was becoming more widespread, thanks to the books by Lundvall (1992) and Nelson (1993). To a large extent the 'system' dimension was inspired by the same literature, and the rationale of different territorially based innovation systems (national and regional) the same, i.e. that there are historical technological trajectories based on 'sticky' knowledge, localised learning and distinct institutional structures that are continuously competitive by promoting co-ordinated, systemic relationships within the production structure and its spheres of actors (i.e. owners, employees, banks, suppliers), and between the production structure and regional knowledge infrastructures (ranging from local vocational training schools through regional R&D institutes and elements of the national system, such as universities). In addition, the idea of regional innovation systems was inspired by agglomeration theories within regional science and economic geography (e.g. growth pole theory etc.) as well as the observed success of regional clusters and industrial districts (Asheim 2000, Asheim and Isaksen 1997).

Research on regional innovation systems (Isaksen 1999) has, on the one hand, demonstrated that the innovative activity of firms to a large degree is based on localised

resources such as a specialised labour market and labour force, subcontractor and supplier systems, a unique combination of different types of knowledge, spillover effects, local traditions for co-operation and entrepreneurial attitude, supporting agencies and organisations and the presence of important customers and users. On the other hand, the research revealed that the regional level is neither always nor even normally sufficient for firms to remain innovative and competitive, and pointed to the additional importance of innovation systems at the national and international level for firms in regional clusters.

The importance of the regional level is confirmed by results from the European comparative cluster survey (Isaksen, forthcoming), which shows that regional resources and collaboration are of major importance in stimulating economic activity in the clusters. In this study it was found that in many clusters firms increasingly find relevant research activities and other supporting services inside the cluster boundaries (Isaksen, forthcoming). Isaksen found that this was supported by formal organisations and social institutions, which helped to co-ordinate activities and manage transactions in the clusters. However, the survey found an increased presence of MNCs in many clusters, and also that firms in the clusters increasingly source major components and perform assembly manufacturing outside of the clusters (Isaksen, forthcoming). Also Tödtling et al. (forthcoming) found support for clustering, because of the importance of social interaction, trust and local institutions. Yet they also note that both local and distant networks are often needed for successful cooperative projects, in particular for projects of innovation and product development when it is usually necessary to combine both local and non-local skills and competences in order to go beyond the limits of the region (Tödtling et al., forthcoming). Interactions and connections with non-local innovation systems, thus, add cognitive variety, enable individual specialisation paths and serve to prevent the path-dependency of the local industry and the local network to culminate in negative 'lock-in' situations. This risk is of course built into an innovation system strategy, as the key rationale precisely is to support the positive effects of economic path-dependency and industrial specialisation.

Hence, the innovative activities of firms rely both on place-specific experience based tacit knowledge as well as competence, artisan skills *and* R&D-based knowledge. As firms specialise along a certain path, they experience a narrowing internal cognitive focus (Nooteboom 2002) and thus – ceteris paribus - increase their need to source complementary knowledge from outside the organisation, region or even nation. Thus, in spite of the important role of place-specific, local resources, firms in regional clusters are in need of innovative co-operation and interaction with world-class, national and international competence centres and innovation systems in order to stay competitive – hence

collectively through the process of growth and specialisation redefining the actual role and potential of those regional innovation within which they initially sourced knowledge and to which they initially contributed. With this we argue the need for a dynamic, multi-level approach.

Institutional structures and product market compatibility

As indicated above the concept of innovation systems itself highlight how the structure of co-ordination within a multiple equilibrium, uncertain outcome game is a key explanatory variable behind the emergence and characteristics of such systems, be it on a regional, national, international or/and sectoral level. The abilities of actors to coordinate on a common outcome, and the structure of this coordination, are in turn linked to institutional incentives, constraints and "societal" or culturally embedded expectations concerning collective action as well as within such frameworks developed conventional-relational assets (Storper 1997)[1]. Thus, the discussion about the efficiency of various types of innovation systems with respect to their ability and capacity to promote innovativeness and competitiveness in regions needs to be undertaken in a broader societal context. Soskice (1999) and others[2] convincingly argue that different national institutional frameworks support different forms of economic activity, i.e. that coordinated market economies have their competitive advantage in diversified quality production, while liberal market economies[3] are most competitive in industries characterised by radical innovative activities.

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[1]/. According to Amable (2000) it is important to analytically distinguish between different mechanisms coordinating and regulating collective action, i.e. notably institutions and conventions. As argued by Herstad and Tranøy (forthcoming), institutions can be seen as structural incentives and constraints, independent of actual actors holding positions within the structure, whereas conventions can be seen as developed and carried by such specific actors.

[2]/. Numerous authors have presented research emphasizing both the importance and enduring geographical divergences of incentives and constraints regulating collective action. These include Richard Whitley and his concept of business systems, as well as Robert Boyer and Bruno Amable with the concept of 'social systems of innovation and production' (Amable 2000). The central common characteristic is a focus on complementary mechanisms of coordination, i.e. the structure of collective action in general – for instance between individual companies, capital and labour - and to what extent different sub-systems of coordination counteract or complement each other.

[3]/. While Soskice (1999) distinguishes between coordinated and un-coordinated market economies, Hall and Soskice (2001) distinguish between coordinated and liberal market economies, thus accepting that market coordination (liberal systems) should not be equated with lack of coordination (un-coordinated economies). Hence, this must be understood as a distinction between degrees of relational versus market coordination, not

Following Soskice, the Nordic and (continental) West-European welfare states can be referred to as coordinated market economies, and a main determinant is the degree of *non market coordination* and cooperation which exists inside the business sphere and between private and public actors, as well as the degree to which labour remains 'incorporated' and the financial system is able to supply long term finance (Soskice 1999) based on in-depth rather than proxy-based allocation, monitoring and evaluation (Porter 1998). In a comparison between coordinated market economies such as Sweden, Germany and Switzerland on the one hand, and distinctly liberal market economies such as the US and UK on the other, he found that the economies performed best in the production of "relatively complex products, involving complex production processes and after sales-service in well-established industries" (e.g. the machine tool industry), and that the US performed best in industries producing complex systemic products such as IT and defence technology and advanced financial and producer services, where the importance of scientific based knowledge is significant (Soskice 1999, 113-114). This applies, we argue, even more so on a regional level as the level of cultural homogeneity in general can be expected to be higher than within nation states.

Thus, what Soskice basically argues is that competitive strength in certain markets - e.g. industries characterised by 'diversified quality production' (Streeck 1992) - is based on path-dependent problem solving skills developed through interactive learning and accumulated collectively in the workforce (Soskice 1999), while competitive strength in other markets – e.g. markets characterised by a high rate of change through radical innovations - is based on the institutional freedom as well as financial incentives to continuously restructure production systems in light or search of new market opportunities (Gilpin 1996). While coordinated market economies on the macro level support co-operative, long-term and consensus-based relations between private as well as public actors, liberal market economies inhibit the development of these relations but instead offer both the opportunity to quickly adjust the formal structure to new requirements, and create strong incentives towards such strategies.

Placed in this context the 'archetypical' regional innovation system is embedded in institutional frameworks of the coordinated market economy model, notably long-term and stable structures of ownership and finance, cooperative rather than opportunistic inter-firm relations and a dedicated rather than numerically flexible workforce (the latter dedicated to individual firms in the *organisational community labour market model*, or to the broader

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a distinction between coordination and non-coordination as the market – from a conceptual viewpoint – is a coordination mechanism equal to others.

cluster in the *occupational community labour market model* (Lam 1998b)). Alternatively, Cooke, based on studies of the biotech industry in the UK and USA, talks about the differences between the regional innovation system (RIS) and the new economy innovation system (NEIS) (Cooke 2001a). While RIS is based on the idea of the positive effects of stable, co-ordinated and systemic relationships a) within the production structure, and b) between the production structure and the knowledge infrastructure, the NEIS lacks at least a) and instead gets its dynamism from local venture capital, market demand and incubators. Thus, when Cooke calls this a 'venture capital driven' system it is implicitly short-term and focuses on continuous creative destruction at the expense of path dependent interactive learning. Importantly, this system requires cultural and institutional support (i.e. fluid markets for corporate control and fluid labour markets). This, in term, contradicts the systemic logic of RIS and inhibits the formation of those conventional-relational assets on which the latter is built. Such a system will of course be more flexible and adjustable and, thus, will not run the same risk of ending up in 'lock-in' situations. It does however not have the ability to support the consolidation of and value exploitation within stable technological trajectories, which so far in the history of regional as well as national development have represented the most important long-term growth factor. A key distinction between RIS and NEIS, and thus implicitly both between policy tools aimed at establishing or supporting such systems and the contexts within which they may be successfully implemented, is thus "societal" (Lam 1998b) incentives and constraints supporting relational monitoring (i.e. in the system of corporate control), mutual interdependencies, dedication and peer group recognition (i.e. in labour markets) versus "societal" incentives and constraints towards fluidity and short-termness in contractual relationships between actors.

Local 'sticky' and global 'ubiquitous' knowledge

Thus, the structural frameworks of incentives and constraints surrounding knowledge accumulation and innovation in industries diverge geographically – nationally but not least regionally - hence posing the question of whether or not the results of such processes – i.e. divergent learning processes, divergent knowledge and the appropriation of related technological quasirents (Storper 1997) – remain geographically embedded. In the ongoing discourse on knowledge and globalisation some authors argue that knowledge becomes increasingly ubiquitous, implying that the competitive advantage latent in such divergences are steadily being undermined (Maskell et al. 1998). Others authors maintain that much strategic knowledge is disembodied, and, thus, remains 'sticky', and that important parts of the learning process continue to be localised as a result of the role of geographical

proximity and local institutions in enabling distinct processes of interactive learning (Asheim 1999a). In this perspective, some competitive advantages remain geographically embedded as they are tied to the social and institutional systems by which their related learning processes are structured, and as knowledge is never transferred but at best only duplicated and interpreted by different actors within various social and institutional systems (Brown and Duguid 1996).

Localised knowledge thus cannot be diminished to tacit knowledge, as contextual knowledge also consists of disembodied codified knowledge, and as structural prerequisites for the efficiency of certain processes of learning – as separate from resulting knowledge - can be highly localised. Disembodied knowledge, referring to knowledge and know-how which are not embodied in machinery, but are the result of positive externalities of the innovation process (de Castro and Jensen-Butler 1993), is often constituted by geographically immobile combinations of place-specific experience based, tacit knowledge and competence, artisan skills and R&D-based knowledge (Asheim 1999b). Such knowledge is highly immobile in geographical terms, is generally based on a high level of individual skill and experience, collective technical culture and a well-developed framework for collective action. Storper (1997) defines such contexts as representing ”territorialization”, understood as a distinctive subset of territorial agglomerations, where “economic viability is rooted in assets (including both institutions and conventional-relational assets) that are not available in many other places and cannot easily or rapidly be created or imitated in places that lack them” (Storper 1997, 170). This view is supported by Porter, who by the same logic argues that "competitive advantage is created and sustained through a highly localised process” (Porter 1990, 19).

Similarly, and highlighting the importance of experiences and interpretations in processes of knowledge exploration, duplication and/or exploitation, Lundvall (1996) maintains that “the increasing emergence of knowledge-based networks of firms, research groups and experts may be regarded as an expression of the growing importance of knowledge which is codified in local rather than universal codes. ... The skills necessary to understand and use these codes will often be developed by those allowed to join the network and to take part in a process of interactive learning” (Lundvall 1996, 10-11). Lam (1998a, 1998b) points out that the skills required for knowledge interfacing within and between collective learning processes tend to be highly time-space specific. Interactive, collective learning is based both on institutional incentives and constraints regulating collective action, but also on intra- or inter-organisational routines, tacit norms and conventions and tacit mechanisms for the absorption of codified knowledge. The latter in particular requires that the actors in

question have tight connections to the 'local codes', which collective tacit as well as disembodied codified knowledge is based on.

Following this line of reasoning it seems likely that a combination of contextual disembodied knowledge and 'untraded interdependencies'[4] (e.g. linked to occupational community labour markets or inter-firm relations) will continue to constitute the material basis for localised learning, and, thus, represent important context conditions of regional clusters with a potentially favourable impact on their innovativeness and competitiveness. This represents an important modification of the argument that 'ubiquitification', as an outcome of globalisation and codification processes, in general tends to "undermine the competitiveness of firms in the high-cost areas of the world" (Malmberg and Maskell 1999, 6).

Learning economies, temporary organisations and distributed knowledge bases

The current academic interest in the potential of temporary organisations in the form of projects and development coalitions to promote knowledge creation and radical innovations is an expression of a search for alternative modes of knowledge governance to overcome the limitations inherent in learning-based and spatially embedded organisations, and, more specifically, related to the development towards 'distributed' knowledge bases. Thus, if a tendency towards an increased actual importance of project organisation is to be found, it is important to consider – from a research as well as from a policy point of view – if there is a potential connection between temporary forms of organisations and spatial disembeddedness of learning and innovation, or conversely, if the use of temporary organisations that span geographical space is a prerequisite for sustained localized learning or even themselves based on this (Asheim 2002).

According to Smith (2000), "the relevant knowledge base for many industries is not internal to the industry, but is distributed across a range of technologies, actors and industries" (Smith 2000, 19) – this as a result of outsourcing and individual specialisation paths within different actors of a value chain. This in turn implies a vast need for co-ordination, in particularly when knowledge cannot enter and integrate into the system "normally" as embodied in components (i.e. when new components have to be developed cooperatively) –

[4]/. Dosi defines 'untraded interdependencies' as "a structured set of technological externalities which can be a collective asset of groups of firms/industries within countries/regions" (Dosi 1988, 226).

hence highlighting the need for establishing inter-organisational project teams. Further, Alderman (forthcoming), argue that "from a theoretical perspective, [...], it is hypothesized that low volume project-based production will be predicated on networks that span geographic space rather than being locally focused and that proximity will not be of great importance in learning and knowledge creation". Thus, according to Alderman's (forthcoming) study, "local embeddedness is not a normal outcome". In a study of such traditional project organisations he found that "[p]roject networks, however, were in all cases predominately non-local, especially in relation to core technologies and key areas of knowledge. Basic support and supply services, however, could more easily be procured within the local area" (Alderman, forthcoming). This stands in contrast to the traditional view found in studies of forms of quasi-integration, that oblique quasi-integration of specialised suppliers often benefit from co-location with clients, while capacity subcontractors in a vertically disintegrated supply chain are increasingly sourced globally. Based on this reasoning, Isaksen (forthcoming) argues that specialised suppliers involved in production and other activities that depend on tacit knowledge, face-to-face interaction and trustful relations normally remain in the clusters.

Alderman's cases show that even if access to and acquisition of knowledge is of strategic importance to complex projects, which often would benefit from face-to-face communications and the transfer of tacit knowledge between actors in projects, proximity is not brought about through a process of spatial embedding, but through the embedding of knowledge in projects, where resources are mobilised on a temporary basis at the project site. However, he concludes that much of this knowledge is not geographically mobile due to its embedded character and is, thus, not effectively transferred from project to project. "The socially embedded nature of knowledge limits its mobility" (Alderman, forthcoming). Similarly, Wenger (1998) argues that deep interfaces between 'communities of practice' – i.e. as project teams are meant to represent – are inherently difficult, and often characterised by a trade-off between on the one hand achieving integration *within* the project team, involving issues related to justification, images of knowledge (von Krogh and Grand 2000) and "legitimate peripheral participation" (Brown and Duguid 1996) – and on the other the need for individual participants to simultaneously function as a part of their respective 'home' knowledge communities in which the knowledge meant to be mobilised is embedded/and or subsequent accumulation must take place. This is consistent with the traditional view that "inter-organisational co-operation is frequently cheaper and faster when it takes place at the local level than at a great distance and when their tacitness make the results less prone to be imitated" (Maskell 1999, 50).

FDIs, varieties of capitalism and the transformation of a regional cluster

One way to integrate or link up regional clusters with global value chains is through FDIs. However, the impact and consequences of FDIs should be analysed within a framework of varieties of capitalism and business systems reflecting differences among the structural set-ups of political economies, in particular with respect to strategic control and preferences as well as 'societal' mechanisms of knowledge justification (von Krogh and Grand 2000).[5] This analytical framework is applied in the following analysis of FDIs at Jæren, located south of Stavanger in the south-western part of Norway, which, although much smaller than industrial districts in the Third Italy, is one of the best examples of an industrial district type development in Norway. Jæren is a regional cluster of specialised production with a traditionally high degree of inter-firm co-operation, until the late 1990s institutionalised through TESA (technical co-operation). The cluster has further traditionally represented a local institutional structure characterised by strong positive complementarities (i.e. incentives towards long-term strategies arising out of ownership, industrial relations and intercompany relations), and thus distinct and coherent incentives and constraints concerning collective action and strategy.

The regional cluster, which still is very competitive and export oriented, has undergone considerable changes during the last ten to fifteen years. During this period companies have been bought up and transformed to subsidiaries of multinational corporations, while others have grown to be multinational corporations themselves and at least partly attempted to build corporate innovation systems integrating subsidiaries located worldwide.[6] Further, traditionally important customer firms have applied strategies of European sourcing, either

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[5]/. I.e. culture, history and ideology as reflected in sub-systems of education and training (von Krogh and Grand 2000), and thus in the organizational set-up and learning processes of organizations as these define a) *who* are considered legitimate "knowledge actors" (e.g. all employees versus only university graduates), and b) *what* constitutes legitimate knowledge (e.g. codified versus tacit knowledge) and c) *how* this knowledge is created (e.g. learning-by-doing versus formal study or research).

[6]/. ABB's acquisition of Trallfa Robot in 1988, now called ABB Flexible Automation, which is Europe's leading producer of painting robots for the car industry, was the first major example of FDIs, while Kverneland, one of the world's largest producers of agricultural equipment is the main example of a local firm becoming a MNC. The company has today production facilities in 14 countries, and has during the last ten to fifteen years bought firms in Italy, Denmark, Germany, the Netherlands, France and Australia. Other examples of FDIs are the Swedish Monark take-over of Øgland DBS in 1989 and subsequent integration into Grimaldis' Cycleurope in 1995, and the British company Williams Plc, now Kidde Plc, buy-up of the NOHA group in 1998. The first and last cases, i.e. ABB and NOHA, will serve as the main empirical illustrations in the following as they in many ways represent complete opposite cases.

cost-based (e.g. Kverneland) or technology-based (e.g. ABB Bryne), or they have relocated abroad (e.g. Øgland DBS). These globalisation and corporatisation processes have had considerable consequences for TESA. As a result of the potential tensions between the corporations and their local subsidiaries with respect to control and loyalty, all the firms belonging to or in alliances with large corporations, independent of national or foreign ownership, are no longer members of TESA. This is reinforced by 'functional outgrowth', a result of firms specialising outside the core competencies of the system, creating a danger of the TESA network being closed down as firms following highly divergent development paths no longer see it as in their interest to contribute to the network.

Corporatisation might not be a totally problematic development. On the contrary, both the local firms as well as their (often) global markets are undergoing development processes that may necessitate some sort of corporate integration. As noted, the individual firms are experiencing an increased need to focus their activities, while global presence – and consequently the availability of often scale-sensitive, 'pedestrian resources' such as logistics, sales and marketing – increasingly seems to be a prerequisite for continued localised competitive strength. Furthermore, the TNCs may act as a connection between the individual firm and other knowledge sources - for instance corporate innovation systems or foreign national/regional innovation systems - supplying complementary knowledge to increasingly specialised in-house learning processes which neither the national innovation system nor the regional innovation system at Jæren are capable of supporting. However, such business system interfaces may cause substantial duress on both individual firms and the regional industrial structure as a whole to the extent that they carry institutional incentives and constraints incompatible with local industrial relations, intercompany relations and the demands of product markets.

The most international well-known firm at Jæren is ABB Flexible Automation. The complex synthetical nature (Laestadius 1998) of its activities requires the integration of knowledge from such different sources as mechanics, information technology, chemistry and physics. Evidence from the company suggests that its knowledge base has strong elements of tacit knowledge accumulated collectively in its highly dedicated workforce. The development of these organisational characteristics, to a large extent based on the existence of a well-functioning organisational community labour market model and high levels of decentralisation and informal coordination among workers with high company-specific skills, seems critical to its competitive strength, and must be seen as directly linked to a) the regional institutional framework, notably regional industrial relations, and b) the capital allocation and evaluation system traditionally applied within ABB (i.e. with less focus on transparency and financial control, but with a distinct emphasis on technological

superiority). The company itself states multi-functionality, cross-disciplinarity and company-specific training in a context of long-term employment as a prerequisite for its competitive strength, strategies for which institutional support is of vital importance (Soskice 1999), and the complementary character of these factors – i.e. a dedicated and highly skilled specialised workforce governed by local strategic management and supported by owners representing industrial rather than financial capital – in sum explains the success story of the firm. All in all, ABB's origin in the Swedish and Swiss institutional frameworks seem to have shaped the behavioural characteristics of the business system well suited for handling embedded firm structures such as ABB Flexible Automation.[7]

As well as representing highly localised or 'sticky' knowledge and learning – collective, synthetical, tacit and firm-specific - ABB Flexible Automation illustrates the important interplay between tacit and codified knowledge. As its sticky knowledge base effectively inhibits the establishment of deep learning interfaces in interaction with other organisations - cooperation with ABB Västeraas as well as a few local spin-offs, high-precision/low volume component producers being the only exceptions - the firm, however, is connected to corporate based networks providing advanced codified and R&D-based knowledge related to different component areas, such as chemistry and physics. Mechanisms that seek to secure the effective absorption of this to a large extent *embrained* (i.e. individual and explicit) knowledge have been implemented, and are being continuously improved. However, the interfacing between ABBs knowledge base and external sources are extremely difficult, thus illustrating a general limitation of project-based organisations.[8] Sources in the organisation maintain that product development is normally carried out within the existing organisation – without the establishment of internal project teams – thus highlighting both the innovative dynamic of collective, firm-specific knowledge and the problems of creating interfaces with external knowledge sources which are not part of its 'social community'.

Another still unresolved issue concerns a high-volume producer[9] of a relatively non-complex and standardised product, which through extensive automation projects in the late 80´s and early 90´s managed to attain scale-dependent cost-advantages superior to competitors in

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[7]/. For instance, the corporation has until quite recently consciously avoided exposure to international equity markets (Ruigrok and van Tulder 1995), and an interesting future research agenda would be to trace how ABBs financial structure has influenced its international behaviour.

[8]/. Our respondent indicates that it is extremely difficult to establish and manage well-functioning project teams when individuals outside the organisation are meant to contribute substantially, see next note.

[9]/. This company has asked to be treated anonymously.

low-cost countries. In this process the willingness of the original owner to continuously allocate resources to high fixed-cost technological upgrading, as well as the competence in the TESA network, played an important role. As the product in question is durable and replacement demand therefore low, broad market access and deep market penetration was needed to exploit economies of scale. This was initially achieved successfully through cooperation with external distributors in Europe, Asia and the Middle East. However, during the 1990´s, more and more parts of its distribution system were bought by competitors, resulting in escalating transaction costs and reduced market penetration. The company had to look for a corporate partner. This eventually resulted in the acquisition by a global corporation which was deeply embedded in a liberal market economy setting and had adapted a shareholder value-oriented system of corporate governance.

In this case international restructuring necessitated defensive corporate integration, as the problem was one of the availability of pedestrian, scale-sensitive resources that its new owner effectively can supply. However, there seems to be substantial tensions in the interface between the two distinct business systems of the home and the host country, this in particular as the new parent company is highly focused on "...maintaining a progressive dividend policy". Our data shows that the local company after the take-over has little or no financial leverage to endogenously develop new processes and products. This is the consequence of a 'value extracting strategy' (Lazonick and O´Sullivan 1994). This prohibits further investments in process upgrading. Rather problem solutions are being implemented hierarchically which are driven by short-term financial rather than long-term industrial considerations. This can to a large extent be explained with reference to the external financial embeddedness of the parent company, as this in turn explaines the preferences inherent in its internal capital allocation and monitoring system. Differences in management styles and strategic preferences, profit horizons and industrial relations have created a high turnover of personnel, alienated its formerly loyal workforce, isolated the firm from the regional innovation system and created organisational duress which, if left unresolved, may lead to the disintegration of the specialised knowledge held locally and, thus, reduce the future potential for long-term endogenous development.

Leaving these two opposite cases aside, the overall situation in the cluster is one of functional divergence and increasing cognitive distances between firms, causing a collective withdrawal from TESA and thus reducing the remaining content of the network. The inherent inability of the local innovation system to supply the specialised or pedestrian external resources needed to meet the increasingly global competitive environment faced by the larger and mostly internationally oriented firms in the cluster implies a change in the focus of regional cooperation and networking, in turn a result of the past success of the

same system in establishing and supporting competitive but divergent development paths within its population of firms. Thus, by the beginning of the new millennium TESA started to redefine itself, based on the insight that new firm growth, local complementary competences and local ownership should define its future member firms, and that functional 'outgrowth' by individual firms should be seen as an inherent result of the past success of the network – i.e. as contributing to competitive development paths that diverge and as such do not result in a negative lock-in for the region as a whole – rather than a threat towards the system in the future.

Conclusion

Hence, important non-local linkages exist in the form of a) linkages to sources of knowledge, and b) linkages to sources of incentives and constraints concerning strategy and collective action that both originate outside the cluster (again in particular related to foreign corporate governance systems and their implications for corporate strategy), while still having to interact with and complement incentives and constraints within it. When understood in the context of our theoretical framework, what can the experiences of TESA as a regional innovation system tell us about the importance and limitations of such linkages?

The first question concerns the relationship between on the one hand local learning, and thus endogenous development and the place-specificity of competitive advantage, and on the other potential forces of fragmentation acting upon this structure, notably the development towards internationally distributed knowledge bases not contained within the RIS, raising the question of where resulting knowledge is accumulated and appropriated, and how and where the formation of international strategic alliances and international user-producer relationships takes place. Hence, are such development tendencies a necessary prerequisite for local learning, or do they contribute to disembeddedness or ubiquitification of the specialised knowledge of firms in the region?

Our data clearly indicate that specialised knowledge and related learning processes remain locally embedded, while representing a change in the embeddedness from local system embeddedness to local organisational embeddedness (i.e. from collectively contained within the TESA structure to individual firms). This in turn results in information asymmetries with temporary organisations. Another outcome is that actors attempt to link organisational knowledge bases to outside sources of knowledge even though they would rather wish to favour the region instead of contributing to the ubiquitification of that knowledge which is localised. According to ABB, and as highlighted theoretically by Wenger (1998), the

organisation may very well learn from individual 'visitors', at least in their case the scope for communicating knowledge outwards is extremely limited as a result of the properties of their knowledge base itself, thus in turn limiting the scope for interactive learning involving external parties. This is not to belittle the role of linkages to outside sources of knowledge, but simply to highlight that the relative importance of local versus non-local learning is a question of core learning processes versus complementary or corrective learning interfaces, not a question of non-local learning substituting local learning and definitely not a question of non-local accumulation of knowledge - and thus control of core competencies - substituting local accumulation. Core competencies remain embedded in the experiences and competencies of the dedicated workforces of these firms, enabling competitive advantages to the extent that involved systems of corporate governance realise that they cannot hierarchically control what must first be constructed cooperatively.

This brings us to the next issue, namely linkages or interfaces between different 'business systems' created in particular by the presence of foreign ownership in the region. The evidence from Jæren clearly indicates how foreign ownership per se is less problematic than foreign strategic control, as the latter imply both a large information gap and a potential tension between host and home institutional incentives and constraints concerning strategy and the definition of legitimate participation and legitimate interests. To sustain local learning processes a certain degree of local strategic control is critical, as the information gap between decision makers and their subsidiaries otherwise easily translate into local learning processes becoming subordinate to corporate demands for transparency and - depending on the external governance system of the parent company - short-term profitability. Thus, as market coordinated external systems of corporate governance easily create internal systems of monitoring and capital allocation heavily influenced by it, FDIs carrying such system characteristics represent potentially strong destructive forces with respect to sustained local learning compared to FDIs originating in systems of corporate governance with less focus on transparent resources and values. The contrast between ABB Flexible Automation and our anonymous case clearly illustrate this dynamic. Hence, there are two dimensions to this as local strategic control emerges as a prerequisite for sustained endogenous learning, not least because the willingness and ability of foreign owners to allow for local strategic control is restricted and permitted by their own business system's national embeddedness. [10]

[10]/. I.e. this is not to say that local strategic control, or the lack of such control, necessarily emerge as a result of incentives and constraints pulling in either one direction, put simply to highlight the structural constraints actors, in this case parent companies, face in defining strategy and structure.

Thus, on both of our two main issues we need to think in terms of complementarities, 'synergies' or interplays rather than oppositions, and based on this identify ever-evolving processes. We need also to avoid thinking in terms of linear 'transfers', be it of capital or knowledge. Local learning processes can be complemented by foreign ownership to the extent that this ownership allow for investments that by their interplay with the local institutional context and industrial structure emerge as 'value creating' – i.e. supporting or correcting *the basic logic* of knowledge exploration and exploitation in which they initially invested. Similarly, non-local learning interfaces are essential as firms increasingly find themselves in need of specialised high-end knowledge, but these learning interfaces complement rather than substitute whatever goes on locally - such as inter-firm learning or in-house organisational learning embedded in the labour force. Temporary organisations - both local and transcending geographical space - are part of this picture, but in attempting to understand their role it is important to remember how they - by their temporary character - are unable to accumulate knowledge, and also how they primarily link individual knowledge for a certain amount of time, rather than link collective knowledge and thus create organisational idiosyncrasies. Whereas both these barriers may be overcome when temporary organisations are locally embedded and linked to an occupational community labour market that serves as an unit of accumulation, as Lam (1998b) argues, temporary organisations that span social spaces will easily take the form of superficial interfaces between individual specialists removed from those home communities in which their knowledge is developed. ABB Flexible Automation might perhaps be a good illustration of this, as there is a perfect 'formal' logic for their establishment of learning interfaces towards a broad range of scientific and industrial communities. However, related to their use of external specialists, they still maintain that "...people have to be here for a long time, they have to sit on top of each other in order to contribute". When they contribute, they do so but at high transaction costs and only as individual experts, not as carriers of organisational knowledge, and this contribution is highly asymmetrical as the organisation in which they are visitors – or to varying degrees "legitimate peripheral participants" in the terminology of Brown and Duguid (1996) - clearly gains more in terms of knowledge than does the home community of the experts.

Leaving firm level implications aside, there is however no doubt that there are negative implications for the regional cluster. Established local inter-firm networks are broken as firms substitute them with non-local ones, reducing the ability of the region to accumulate externalities related to transactions within the network, and the general process of specialisation and deepening cognitive focuses within the individual firms that necessarily result from international competition, further reduces the ability of the local network itself to accumulate knowledge externalities from these companies and use them as inputs in a

continuing process of industrial renewal and innovation. Thus, as regional cognitive focuses increasingly diverge, as a consequence of firm specialisation and thus as an inevitable result of the natural development paths of firms exposed to international competition, the scope for local inter-firm interactive learning is reduced dramatically. This in turn reduces the general level of system integration at the regional level and thus the ability of the system to contribute to new firm formation. To conclude, the question may be raised as to whether successful regional innovation systems inherently carry the seed of their own demise.

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