

PILOT

Policy and Innovation in Low-Tech

The role of company and social networks in low-tech industries

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Contribution to the conference

Low-Tech as Misnomer: The Role of Non-Research-Intensive Industries in the Knowledge Economy

Brussels
29 + 30 June, 2005

The PILOT project and the conference are financed within FP5 Key Action
Improving the Socio-economic Knowledge Base (HPSE-CT-2002-00112)

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Drawing on empirical data from PILOT field research as well as current theoretical literature on globalisation the authors examine firm embeddedness and the importance of the social context for innovation and competitiveness in LMT industries. They highlight some challenges brought about by globalisation, namely the new international division of labour led by cost competition and a devaluation, in the global value chain, of the manufacturing activities that are typically the main feature of LMT firms. Facing these threats means adopting new company strategies and upgrading managerial capacities. But beyond firm-level changes, the authors stress the importance of the social context in which the firm operates for innovative capacity and international competitiveness. In other words, besides the technical context for innovation, equally important is the social environment. Environments that favour innovation are characterised by high levels of social cohesion, based on collective decision-making processes, or governance, involving all relevant stakeholders from government, the business community and labour. The paper concludes that, given the role of LMT industries in driving employment and growth, policy must focus on building the innovative capacity of low- and medium-tech firms, in particular by strengthening firms' social environments through the creation of strong intermediate institutions and institutional infrastructure for the provision of local, collective goods. Such institutions should be created through the combined effort of public institutions and local stakeholders in order to create social contexts that favour a process of continuous innovation and evolution. More generally, policy should be aimed at creating a sound industrial environment by guaranteeing a sophisticated organisational setup, a highly skilled work force, and encouraging cooperation among different actors at all levels.

1 Foreword

This paper is based on research carried out for the European Commission-financed project on policy and innovation in low and medium tech industries (LMT), known also by the acronym PILOT. Here we examine the importance of the value chain and local embeddedness to competitiveness in LMT firms. The empirical information was provided by members of the PILOT consortium in nine EU countries. The report is divided according to the two main sets of questions the PILOT team has selected: the analysis of the value chain and of the regional networks, or degree of local embeddedness. The analytical distinction between these two sets, however abstractly clear, is difficult in practical terms; a lot of overlapping issues are dealt with. Because of this situation of overlapping issues, the two parts of the report will comment on the outcomes of the value chain and the regional networks analysis, formally distinct, as a whole; it will be done through two different “focal lenses”.

2 The value chain analysis

For our purposes “value chain” refers to a particular firm’s transactional relationships, both up and downstream. This includes not only the supply chain, but clients as well.

Expanding the analysis to include the value chain, the quantitative and qualitative importance of outsourcing emerges. The companies analyzed establish relations with a very wide variety of different kinds of suppliers. For this reason different kinds of supply chain architecture emerge, even in the same companies.

The value chain reports provided by the participants in PILOT also make clear the strategic role LMT companies play in terms of innovation in high tech companies. In different cases we see how LMT companies actually boost high tech companies’ innovative capacity. Often it is the low tech company, the

user of the technology, that pushes a high tech supplier to innovate through requests to improve an already existing product, or develop a new one. For example, in the German paper industry, the main impulse for innovation for chemical dye suppliers comes typically from the paper manufacturers. In other cases, formally LMT companies (as measured by expenditures on R&D) are actually high tech companies in disguise, either through their capacity to modify high tech equipment, or their involvement in product design and process innovation, frequently in cooperation with clients and suppliers. A metal die producer in Italy provides an example of this type of innovation through cooperation.

Conflicting tendencies regarding physical proximity and the supply chain emerge, depending largely on the type of product produced. On one hand, there are cases where the trend is toward greater globalisation of the supply chain. This is the case of global procurement, mainly when dealing with producers of standardised components. This dynamic implies an extension of the supply chain. On the other hand, where the relationship between clients and suppliers is based on JIT (with both high product complexity and a high degree of outsourcing), logistics is crucial, and when personalised, non-standardised solutions are required (as in the case of customised products) then proximity between the company and its suppliers is important, if not essential. Where delivery time to client is important, geographical proximity is required. Finally, where companies deliver custom solutions, and not just a commodity, physical proximity between clients and suppliers may be of importance.

But there is another type of proximity that is fundamental for some of the PILOT cases: cultural (i.e. language, managerial culture) and/or organisational proximity (harmonisation of the level of technology, homogenisation of the procedure, a similar approach to quality control). In fact, this type of proximity may now be more important in some cases than spatial proximity. An example of this is a swivel chair manufacturer in Germany.

A focus on lead time reduction and cost control in the management of the supply chain does not necessarily imply high levels of integration between the focal company and its suppliers. Often, though, suppliers are important—sometimes key—contributors to innovation, with innovation occurring as a result of cooperation between supplier and client. In this case, early involvement of the suppliers is crucial and a high degree of cooperation is a factor for strategic success.

In the case of customised manufacturing, cooperation needs to go yet a step further. Companies need to develop inter-functional project teams. Based on our research, project teams are typically established with the core competence of each company on a sequential basis. In successful cases, team members include all functions including purchasers, sales representatives, product designers, production managers and personnel at the shop floor. This is exemplified by one of the cases studied by PILOT's Norwegian research team.

Tacit knowledge flows are of clear importance in LMT. When tacit knowledge is crucial for competitiveness, proximity (both cultural and physical) becomes important. This is because practical knowledge is sometimes difficult to codify, requiring for example an exchange of personnel and temporary assignment of employees at the partner company.

Even when geographically far from the focal company, equipment suppliers are often important for both productivity and innovativeness in terms of knowledge-transfer. The relationship with the equipment

supplier is important even without physical proximity. This is the case where, for example, established collaborative connections are close and investment volumes are high. Here, temporary assignment of workers in another company is not dependent on distance.

Another dynamic that emerges is the importance, in some cases, of “co-opetition” (cooperation and competition, or horizontal networking) as a useful way of doing business. For example a firm that is unable to meet a particular order, rather than losing the client, may contract out that order to a competitor. This was the case with a precision-components manufacturer in Ireland, for example.

Increased integration is a challenge for many of the companies we studied. In particular, the importance of the greater use of both managerial and ICT tools emerge in cases where the value chain has been internationalized to a relevant degree. Nonetheless, the use of ICT tools and portals for managing relationships through the value chain is quite rare.

While stable and long-standing relations are the main means of selecting the right suppliers, building trust and co-operating efficiently, the use of methods and instruments for evaluating the performance of suppliers also emerges. This practice emerged in one of the Polish companies examined. Where such evaluation is important, it is best used in ways that enhance the ability of companies to build relationships of trust and cooperation. Unless evaluation systems are designed to help suppliers improve their performance, companies run the risk of ending up with a high rate of supplier turnover.

The trends toward greater concentration and the increasing role of multinational companies in local economies reduce the role of SMEs. In some cases this leads to a situation in which, though clusters and agglomeration economies still exist, they are more and more a ‘traditional holdover’ of the past, when the structuring of the industry was still characterised by a multitude of small and medium-sized companies.

On the other hand, in some cases foreign investors (e.g. pension funds) define their acquisition strategy based on the level and nature of existing regional resources, like the existence of a network of locally embedded, small and medium companies specialized in a particular phase of the productive process.

The social context is of critical importance for technological evolution and innovative capacity. Clusters and fragmented economies need strong intermediate institutions and institutional infrastructure to provide local collective goods. Such institutions can be created through the combined effort of public institutions and local stakeholders in order to create social contexts that strengthen the innovation process. Agglomeration economies, and in particular regional clusters, are places where close inter-firm communication, socio-cultural structures and institutional environments stimulate socially and territorially embedded collective learning and continuous innovation. In this context, intermediate institutions can become important bases of economic coordination at the meso-level.

Almost all of the SMEs in our cases are embedded in the local context through financial and structural constraints. Many SMEs are facing crises because of both the globalization of the economy and the stagnation of GDP growth in Europe¹. In this context, horizontal, virtual networks among suppliers

¹ Though even in fast growth EU economies like Ireland, SMEs, particularly in LMTs, face serious difficulties

emerge in certain clusters as competitive strategies. This new form of organization seems to boost the competitiveness of SMEs.

Regarding specifically SMEs, the analysis of the value chain reports indicates that institutional infrastructure and public goods are essential for their competitiveness. Often SMEs require supplements to their informal, tacit knowledge base in the form of R&D-competences and more systematic basic research and development. In addition, external institutes, universities and associations are important for boosting innovation, quality insurance and vocational training.

3 The regional network analysis

On first reading, the national reports on the regional networks of the PILOT case companies suggests very different situations, with little basis, if any, for comparison; in short, a very disappointing exercise in description adding no value to the general inquiry. This impression changes dramatically if we switch the conceptual frame of reference from a static to a dynamic perspective. Through this switch, a story emerges of processes in train – for example that LMT firms are increasingly international - in some, and probably all the European countries. Strategic alternatives available to policy makers and the main social and economic actors are suggested. To make this “switch” possible, a set of concepts must be introduced basically affording the interplay between globalization dynamics and forces of localisation and embeddedness.

3.1 The role of geographical proximity

The importance of economies of scale is well known but it is not the only factor shaping the way firms operate. Marshall (1890), rather than underrating the importance of economies of scale, highlighted the role of economies of scale not dependent on the size of the individual business:

*Meanwhile an increase in the aggregate scale of production of course increases those economies, which do not directly depend on the size of individual houses of business. The most important of these results from the growth of correlated branches of industry which mutually assist one another, **perhaps** being concentrated in the same localities, but anyhow availing themselves of the modern facilities for communication offered by steam transport, by the telegraph and by the printing-press. The economies arising from such sources as this, which are accessible to any branch of production, do not depend exclusively upon its own growth: but yet they are sure to grow rapidly and steadily with that growth; and they are sure to dwindle in some, though not in all respects, if it decays.*

The use of “perhaps” should be noted; accordingly, proximity is not a *conditio sine qua non* for exploiting this special kind of economies of scale, it was simply a more frequent empirical situation at that time; Marshall (1890) was aware of this and, therefore, also described a different possibility:

*We have seen how the economies which result from a high industrial organization often depend only to a small extent on the resources of individual firms. Those internal economies which each establishment has to arrange for itself are frequently very small as compared with those **external economies** which result from the general progress of the industrial environment; the situation of a business nearly always plays a great part in determining the extent to which it*

can avail itself of external economies; and the situation value which a site derives from the growth of a rich and active population close to it, or from the opening up of railways and other good means of communication with existing markets, is the most striking of all the influences which changes in the industrial environment exert on the cost of production.

The concept of “external economies” introduced the idea that some interdependencies exist between the participants in an economic system, which do not operate through the market mechanism or that are not completely mediated by the market process. These externalities can be negative, as with pollution or positive, as with knowledge spillovers. Typically, the positive externalities are external to the market and are related to co-operation and co-ordination. Special examples of externalities are transaction costs. This relates to the concept of network in terms of the explanation of growth and economic change. The more integrated the network, the more the positive externalities arising from reduction in transaction costs. Information and knowledge have become valuable in providing a strategic advantage, from both distributive and production organisation perspectives. Where shared, they become an important part of the ‘productive basis’ of wealth.

Contemporary research still stresses the importance of agglomeration; Cainelli (2003) underlines this point, at least for Italy:

Only recently have these two strands of research – the one regarding the study of innovative activities and the one focusing on the analysis of agglomeration economies – been integrated (..) In conclusion, ...one can say that there seems to be a positive relationship between agglomeration and technological innovation.

So there are at play two different drivers, the one exploiting economies of scale based on local agglomeration, the latter exploiting external economies due to “the general progress of the industrial environment”. In the first case the focus is more on social, embedded and mostly non-physical features – what is also called “contextual environment”; in the latter the focus is mostly on non-spatially constrained and on physical and non-physical features – partly coinciding with the “transactional environment”. What the net effect of the two drivers is, depends on the specific situation of each locality.

The “transactional environment” (Trist, 1976, Van Beinum in Naschold, 1993) of an organisation is the one with which it interacts in carrying out its primary task; however, there is also a broader ambient, beyond that relating to the primary task, which can be called “contextual environment.” Now, whereas there is greater consensus as to the relationship between business organisation and transactional ambient, the relationship with the broader ambient is seen indiscriminately as background and, at most, the place of possible constraints on the business activity. In the past decades, there have been contributions from the most diverse disciplinary fields – ecology, economics and sociology with an Institutionalist orientation, the Italian tradition of analysis of districts, etc. – offering a reassessment of the salience of the contextual ambient which appears to be anything but undifferentiated and with a much more strategic role than that of setting constraints.

A broader view can be introduced, taking into consideration the effect of the globalization processes.

3.2 Deconstructing and taking roots: globalisation 1

There are very simplistic narratives of globalisation on both sides. On one side globalisation can be said to be a process of overwhelming quantitative and qualitative homogenisation of the world. It means for

instance that every kind of idiosyncratic feature – such as food, clothes and entertainment – will be more and more disregarded and lose any real market relevance; the manufacturing process will become more and more mobile, as cultural and social differences at the national and sub-national level among different nations or regional areas diminish. On the other side it can be argued that “places” matter and, in the long run, only some activities will actually be globalised. A conciliatory view was introduced with the word “glocal” to stress the very positive and optimistic view that the two drivers can support each other in some kind of virtuous circle. “Glocal” is an omnibus concept with very little, if any, analytical power.

A realistic account of globalisation is different.

The starting point is Storper’s contribution (Storper, 1997) on the relationship between “economy of flows and substitution” on one side and “economy of interdependencies and specificities” on the other side. The first case occurs “when resources would flow between parts of a firm, between places, without having any particular dependence on any particular place.” In a pure flow-substitution economy “locations offer factors of production that could potentially be substituted by a large number of other locations.” This is exactly the reverse of the concept of a territorialized, as Storper puts it, or embedded economy. According to Storper (Storper, 1997), an embedded economy consists “in economic activity which is dependent on resources that are territorially specific.” It should be noted that a pure flow-substitution economy can be developed both via hierarchies and via networks/markets. Hierarchies imply certain sectors, for instance: those characterised by “low wages, low skill, low sunk-cost manufacturing processes, but also highly standardized consumer durable manufacturing (where sunk costs are higher, but modular and widely available equipment is used); and certain consumer services where centralized production can be combined with local delivery”. In the case of markets a possibility comes from broad marketing networks, flexible enough and organised in such a way as to exploit local economies, because of their local features, but on a global scale.

The second case is the ideal-type of a pure territorial economy of interdependencies and specificities, that is: “activities dependent on resources with specificities that are strongly territorialized and where the supply of these resources is subject to important inelasticities.” It is of course the case of the existence of relations of proximity, of agglomeration, etc.; it should be noted that the concept of embeddedness is broader than geographical proximity and agglomeration; it implies a specific contextual environment – made up of social institutions, conventions, trust, etc. – allowing people to exploit both economies of scale and external economies in a very idiosyncratic way. This is the case for example of very high quality goods, those that involve technological innovation or ongoing rapid differentiation, or highly specialized services. What is relevant is that, as will be argued later, this condition is not necessarily in total contrast with the process of globalization. Actually some firms in our sample have been very smart in taking advantage of this possibility.

The actual existence of these two ideal-types in a pure form is very rare; in the real world there are many different hybrids, but it is analytically possible to trace them back to one of the two models.

If these are the basic concepts useful for our inquiry, what kind of dynamics can be highlighted in the process of globalisation? It is not a single and homogeneous process of substitution of the second ideal-type by the first. There are at least four different possibilities as the following figure shows:

Figure 1 - Territorialization and internazionalization

		Territorialization of Production System	
		High	Low
		(type 1)	(Type 2)
International Flows in Production System	High	Intrafirm trade with asset specificities Intermediate outputs of FDI Intermediate markets served from territorial cores Industrial districts	International divisions of labor (e.g. in routinized manufacturing) International markets (e.g. in consumer services) Interfirm and interindustry trade without territorial core
	Low	(Type 4) Locally serving production to specialized tastes with low international competition	(type 3) Local commerce in basic services not delivered via big-firm hierarchies

Therefore, there are many different dynamics and strategies for each firm and sometimes more than one option, at the same time, for each firm, as in the case of the multi-utilities.

The standard account of globalization stresses the importance of the movement from type 3 to type 2 and from type 4 to type 2, that are of course actual trends. The “true” process of globalisation – as different from the old process of internationalization – is, of course, the dynamic from type 1 to type 2.

But is there a principal trend?

Storper (1997) argues that there is and that it is:

a simultaneous and ongoing development of the characteristics of both type 1 and type 2 systems: the latter as ongoing standardization of tastes and techniques occurs, the former as technological learning, product differentiation, and the separating off of new branches of production, materials, and processes occurs all of which are causes of location specificity, but also precisely outcomes of the interactive processes permitted by the locationally specific relational assets that underline territorialization. This form of territorialization is qualitatively quite different from that of type 4 systems, in that it is not developed as the result of “tradition via isolation” but via what might be called the ongoing reinvention of relational assets in the context of high levels of geographical openness in trade and communications.

As argued in greater depth later in this paper, this is one of the most relevant consequences of globalization: a reinvention and re-functionalization of the uniqueness of some places; in these cases, the concepts of economies of scale and external economies, of transactional context, etc., will come again to the fore.

To summarize, from a more realistic perspective globalization is a process of dynamic connections mostly of previously embedded economies; the setting up of these new and broad connections leads to a new positioning of these economies – national or sub-national – that can produce both a destructuring of their territorial features or a different kind of embeddedness. There is a formation of a new global context whose features will be analysed in a specific chapter; the very existence of a division of labour on an international scale is not brand new in itself – this was the starting point of both Smith and Marx. In

the XIX century there were very good examples of the international division of labor, for instance the cotton industry that related distant places in a single division of labour.

What is now unique to this new global context can be better understood through the difference between multinational and transnational firms (Group of Lisbon, 1993, Gordon, 1995, Poma, 2003):

*Multinationalization involves the organised direction and control of cross-national economic activities by corporations that remain fundamentally anchored in national economic systems(..)it is demarcated by the centrally coordinated activities of specific corporate organizations extended to multiple countries(..) **Transnationalization** manifest itself, that is, in the consolidation of a **world-wide intra-firm division of labor**. As such, it constitutes the ultimate terminus of the multinational project: in the final analysis, transnational networks are coordinate essentially as self-contained intra-firm projects of enterprises that, however extensive their global reach, are still singularly corporate, if not still national-corporate, in character.*

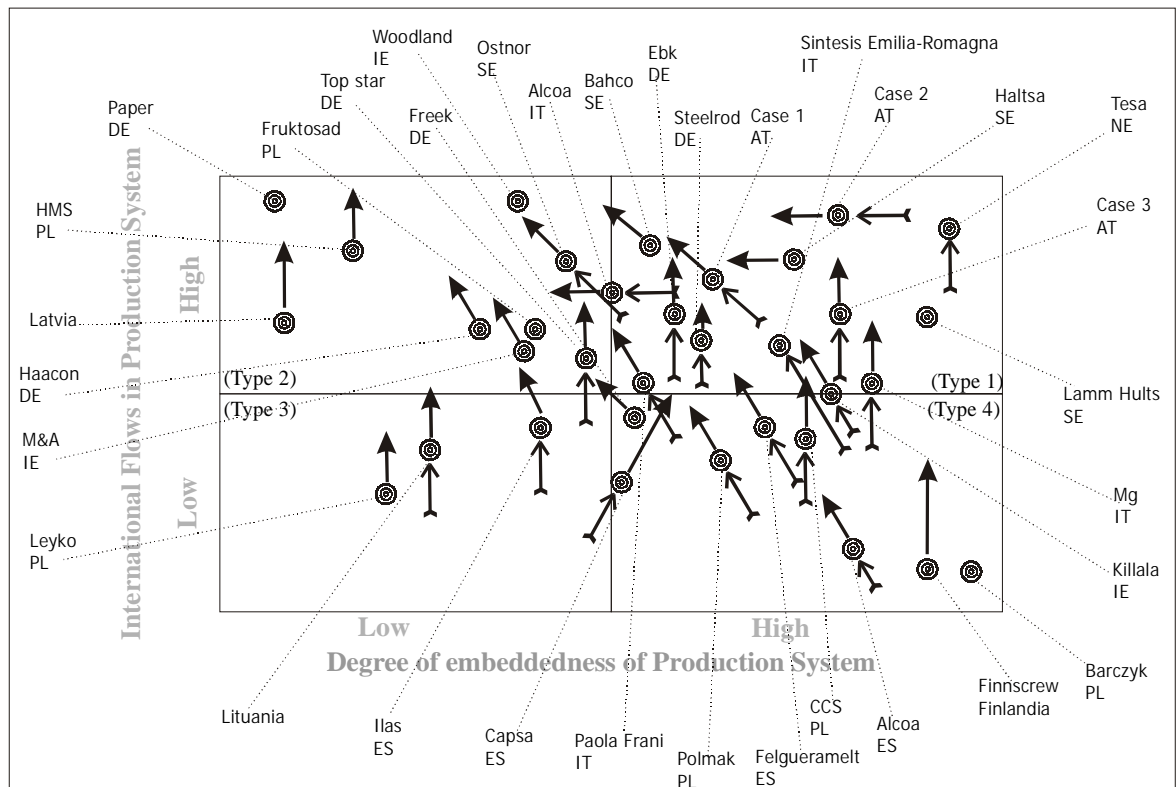
3.3 Our sample - 1

It is time to go back to our sample of firms and to read each case according to figure 1 It must be added that the word “sample” can lead to a misunderstanding of the nature of the case studies. Our cases are not a statistical sample so what we will quote from each case is intended as an illustration of some actually existing tendencies in LMT firms; any attempt to draw conclusions as to what constitutes representative behaviour is beyond the scope of this methodology.

Below is the matrix we have constructed based on Storper’s model. Our matrix is a modified version of his original. We have left the vertical axis the same, while making a few modifications to the horizontal axis. Instead of “territorialization” we have used “degree of embeddedness.” We have moved the label of the horizontal axis to the bottom of the graph and reversed the “high” and “low” quadrants so that the matrix reads like a regular graph. The origin is at zero, with international flows and degree of embeddedness increasing as you move up and over along the two axes. These slight changes render Storper’s model easier to read.

Our regional reports show cases distributed in all the four quadrants. The dynamic trajectories from the past and towards the future show clearly that the main trend is towards both type 1 and type 2. A first conclusion therefore is that the equation “low medium tech industry = local embedded processes” is not tenable; while some of our cases are on a highly embedded, self-contained trajectory, others are not. Another conclusion is that the equation “low medium tech = structural weakness to globalize” is wrong; some of our cases provide evidence of strongly embedded processes nonetheless able to gain a global market position.

The concepts of economies of scale, external economies, transactional and contextual environments can be taken now into consideration in relation to our sample.

Figure 2 – Regional dynamics

At first glance in all our cases external economies play a role, more or less relevant depending on each national/regional situation. Firms in a poor or restructuring environment have particular problems; where there is potential for growth policy makers should intervene with a comprehensive policy acting on all the levels of our analysis – contextual, transactional environments and external economies to set up a virtuous circle. In an economy dominated by high levels of international flows and low levels of embeddedness, globalisation can become a driver of a process of institutional restructuring and repositioning in order to make a given territory more open and favourable to the process of globalisation itself. In this case both the solidity and variety of the local institutional set up is of importance. This is something that we will explore in greater depth below. Factors such as specific national, sub-national or EU policies play a very important role both in supporting the development of economic activities and/or repositioning and adapting previous activities. Other important factors are institutions related to the labour market, such as vocational schools, intermediate institutions in the field of organisational, technological and scientific innovation and highly informal factors such as networking based on trust.

3.4 Concentration and dispersal: globalization 2

In her seminal analysis dating back to 1984, Sassen (2001), on the basis of empirical evidence, says that “the globalization of economic activity entails a new type of organizational structure.” Global cities and global city regions are elements of this new architecture. Global cities are the place of the new financial activities and of the new services in support of the process of globalization. Global city regions are the places of the headquarters of transnational firms:

For instance, in the case of large manufacturing complexes, the identification with the national is stronger and the often stronger orientation to consumer markets brings to the fore the question of quality, prices, and the possibility of substitution. Hence competition and competitiveness are likely to be far more prominent. Further, even when there is significant offshoring of production—as in the auto industry, for instance this type of internationalization tends to be within the chain of production of a given firm. Insofar as most firms still have their central headquarters associated with a specific region and country, the competition question is likely to be prominent and, very importantly, sited—i.e. it is the United States versus the Japanese auto manufacturers.

In the new global organizational structure centrality still matters:

Several of the organizing hypotheses in the global-city model concern the conditions for the continuity of centrality in advanced economic systems in the face of major new organizational forms and technologies that maximize the possibility for geographic dispersal.(...) It can be the CBD [Central Business District], as it still is largely in New York City, or it can extend into a metropolitan area in the form of a grid of nodes of intense business activity, as we see in Frankfurt and Zurich (Hitz et al. 1995). The center has been profoundly altered by telecommunications and the growth of a global economy, both inextricably linked; they have contributed to a new geography of centrality (and marginality).

Therefore the destructuring and reinvention of organizational structures due to globalization does not imply the disappearance of regional spaces but a redefinition of them:

This is a partly deterritorialized space of centrality. Indeed much of the actual geographic territory within which these nodes exist is part of an older social geography—the suburb or the metropolitan region—which is not part of the new grid of digital networks, and is in that sense partly peripheralized. This regional grid of nodes represents, in my analysis, a reconstitution of the concept of region. Far from neutralizing geography, the regional grid is likely to be embedded in conventional forms of communication infrastructure, notably rapid rail and highways connecting to airports. Ironically perhaps, conventional infrastructure is likely to maximize the economic benefits derived from telematics. I think this is an important issue that has been lost somewhat in discussions about the neutralization of geography through telematics.

This new region is still a geographic entity and it cannot exist without the old sub-territorial entities and infrastructures that are “encapsulated” in the new structure, or, the other way round, the new grid is embedded in the old structure. Then there is a different kind and level of centrality, “the formation of a transterritorial ‘center’ constituted, partly in digital space, via intense economic transactions in the network of global cities. These networks of major international business centers constitute new geographies of centrality.” In the case of Europe this is a complex situation because there are:

in fact several geographies of centrality, one global, others continental and regional. A central urban hierarchy connects major cities, London, Frankfurt, Amsterdam, Zurich of which in turn play central roles in the wider global system of cities. These cities are also part of a wider network of European financial/cultural/service capitals, some with only one, others with several, of these functions, which articulate the European region and are somewhat less oriented to the global economy than Paris, Frankfurt, or London. And then there are several geographies of marginality: the East–West divide and the North–South divide across Europe, as well as newer divisions. In Eastern Europe, certain cities and regions, notably Budapest, are rather attractive for purposes of investment, both European and non-European, while others will increasingly fall behind, notably in Rumania, Yugoslavia, and Albania. We see a similar differentiation in the south of Europe: Madrid, Barcelona, and Milan are gaining in the new European hierarchy; Naples, Rome, and Marseilles are not.

A new hierarchy of overlapping circles, based on the nature of the globalization process is growing. There is a world-wide transterritorial network, linked to “continental” networks, such as the European one, each of which connected to “regional” networks. Some of these centers belong to more than one circle or network, at the same time. These centers deploy a thick matrix structure, that is partly transterritorial, partly virtual, partly territorialized and partly highly territorialized. There is therefore a concentration of decision making power in few centres, even if there is a highly indented situation that seems to be a dispersal of the power structure.

According to Sassen (2001) there are processes still highly rooted in national or local contexts but belonging to globalization dynamics, not because standardized or “swallowed up” by it, but because in their daily functioning:

They involve transboundary networks and formations connecting multiple local or ‘national’ processes and actors, or involve the recurrence of particular issues or dynamics in a growing number of countries... as is the case with many human rights and environmental organisations... And... particular aspects of the work of states...

3.5 Trans- and multi- scales

The novelty is not the very fact that the world is interlinked, as Smith and Marx have already pointed out. The novelty, instead, is the shift from a system of nested scales to a transcalar one, that is, a system connecting scale-based, independent or partially overlapping systems, therefore linking different levels of different scale-based systems, independently from their own internal hierarchy. New social and economic dynamics are at the fore; for instance as Sassen (2001) points out “A focus on places allows us to unbundle globalization in terms of the multiple specialized cross-border circuits on which different types of places are located.”

So, while it is clear that globalisation is important, to understand the particular relationship between a place, including its production system and related social context, the specificities of the place must be examined, in terms of the various ways in which it interacts with the global. The nation-state will have to renounce its exclusive right to power over its territory, but it will not disappear.

It might be argued that there is a contradiction between the importance of place and the “digital revolution”. If any kind of data / information is at the immediate disposal of everyone, everywhere why is it still so necessary to physically agglomerate?

The speed and diffusion of ICT development have been so important that they have been treated in a wide range of literatures, including political studies, economic, sociological and cultural. Among the conclusions are those ranging from the view that it will solve all ills, to pessimism about the social side effects.

A realistic narrative is different; Garcia (2002) offers a critical assessment of the main hypothesis.

As she says, for instance:

By aggregating supply and demand horizontally, networking technologies can overcome many of the market failures associated with rural economies and generate new economic synergies based on economies of agglomeration.

On the other side:

In the new economy, local places will continue to matter. However, these places will not remain untouched by the global expansion of markets; on the contrary, in order to survive, local communities will have to redefine themselves in relationship to them.

Coming back to our topic, the territory, there are many different possibilities: on the one hand economic activities can take root and become more embedded; on the other they may dis-embed from the local dimension. The first possibility may induce levelling, the latter create new hierarchies. But the main trend, based on market forces, is toward the loosening of the local dimension and setting up new hierarchies of places. Besides, ICT based networks, when installed, will follow path dependant trajectories so they will lock the degree of freedom of the actor into play.

3.6 Our sample – 2

Our sample is not geographically distributed in or around global cities but partly in global city regions and in new regional or sub-regional centres. In this case “regional” is a subdivision of global and not the administrative unit of a country. In some cases the dynamic is very interesting: a process of redefinition of the global hierarchies of different places is quite evident.

Our sample is a very good illustration of the dynamic of centralisation and dispersal, of the redefinition of centrality and hierarchies among different places, etc. It is also evident in many cases that there are transcalar processes at play.

Are there policy implications?

The first really critical policy indication is of the overwhelming importance, for a balanced dynamic between global and local, of **local policies** operating on the entire set of “environments” to which a firm belongs. This is relevant not only for the reason already illustrated in point 3.3, that is the virtuous circle, but to create the possibility for low and medium tech SMEs to act at the different scales without losing a distinct asset, that is a transition from whatever quadrant of figure 1 to type 1. For SMEs this is a very difficult task and some specific policies can support it. For instance the setting up of what in the international literature is defined as *virtual firm*, that is a network configuration of independent SMEs able to cooperate in delivering to the market complex products and services, can be helpful. These kinds of processes need a leader taking the initiative, so they cannot be simply planned from above, but they need policies, at least, to ease the start-up process and increase the chance of long run sustainability.

A second policy problem is the **circulation of knowledge**. As we have already argued low and medium tech firms are actually utilising high tech knowledge in original and often informal ways.

It has been noted (Mattsson, 2003) that the already classic distinction between tacit (Polanyi, 1967) and formalised knowledge defines a dynamic that transforms tacit knowledge into formalised or codified knowledge (Soete, 1997):

Codified knowledge is contrasted with tacit knowledge, which cannot easily be transferred because it has not been set out in an explicit form. As argued above, skills are one important kind of tacit knowledge. [The skilled person follows rules he or she is not aware of, linked to activities acquired through learning but often of a non-routine kind.] The most important impact of new ICTs is that they shift the border between tacit and codified knowledge; it becomes technically possible and economically attractive to codify various types of knowledge which so far have remained in a tacit form.

However, as Schienstock argues (1999):

At the same time, modern IT has and will further increase the possibilities to codify large parts of human skills. This does not mean, of course, that tacit knowledge becomes less important. Often, the codification of knowledge creates the need for new tacit knowledge, for example, for a worker to be able to sort out relevant information and to use it effectively. The more knowledge becomes codifiable, the more the remaining non-codifiable part is likely to become even more crucial.

As has already been demonstrated by others (Ennals, 2000), tacit knowledge is a close, not exclusive relationship, with agglomeration economies via mechanisms such as “learning by doing” and “learning by using:”

Agglomeration economics allows us to understand important basic conditions and stimulus to incremental innovations through informal "learning by doing" and "learning by using", primarily based on tacit knowledge (Asheim, 1994) (...) A territorially embedded, regional innovation system builds on different types of knowledge and views of innovative activities compared to the traditional system perspective (...) This form of knowledge can bring about "learning by interacting" such as with relationships between the user and the producer of a product. In relation to modern innovation theory, interactive learning can bring about radical innovations in addition to incremental ones. There is also an important issue concerning the different types of innovation as they require different kinds of knowledge. Generally, product innovations represent a more "disembodied" form of technological development than process innovations, and organisational innovations will be conditioned by "disembodied" knowledge, as they are normally a product of intra- or inter-organisational learning processes (Nelson & Rosenberg, 1993).

Actually, it can be said that the dynamic between tacit and codified knowledge is a key factor today in international competition and that the possibility, for an organization, and the capability, for individuals, to fine tune this back and forth dynamic is critical.

LMT firms are in a very special position; they cross the two domains – tacit and codified – using codified knowledge to produce a new kind of tacit knowledge and vice versa. In the best of cases, they not only utilize the codified knowledge produced by high tech firms, to innovate their business. At the same time they produce a feedback process of innovation that can be codified as well as incremental, non-codified knowledge to add value to their own business. Learning by doing and learning by using are the methods allowing these processes to develop.

To facilitate these processes of knowledge exploitation the presence of a dense network of institutions favouring knowledge circulation is critical. This does not imply that the only scale for circulating knowledge among low and medium tech SMEs is the local or national. There are also examples of international circulation. The point is that there is a big difference as to whether the transfer comes from within a corporate scheme, from within a sub-supplier relationship, through taking advantage of institutional aid, or because of a cooperative scheme. In the last two cases the capacity of low and medium

tech SMEs to exploit knowledge resources on their own will develop with time and it is probable that some of this knowledge will spill over to other firms. The policy problem is, therefore, to support **capacity building** for low and medium tech SMEs to access knowledge resources in a critical and selective way. The development of policies to support the circulation of knowledge and capacity building for low and medium tech SMEs can also be implemented through networking techniques; in this case the network is not a functional operative scheme among firms with which to deliver products and services, but a way to cooperate between firms and agencies in order to reach specific objectives.

4 A quantitative analysis of our sample

Comments on the Storper Graph

Figure 2, Regional dynamics is, as we have explained, based on the model created by Storper for gauging the degree of internationalization and territorialization of a production system. While in Storper's original model companies with high levels of international flows and embeddedness were in the top left corner of the graph, they are now at the top right. Companies with a low level of international flows and embeddedness are now in the bottom left.

Based on a review of networks of the PILOT case study firms, we have positioned each company on the matrix according to the firm's degree of territorial embeddedness and levels of international flows. The bullseye indicates the firm's current position. The arrows show the firm's past and future trajectory.

As explained above, there is a move toward Type 1 and 2, as firms tend to internationalize. This move towards increasing international flows does not necessarily imply a decrease in firms' degree of embeddedness. A number of firms have maintained a high degree of embeddedness while increasing their international flows.

Many other firms have seen (or will see), alongside an increase in international flows, an accompanying decrease in embeddedness. In fact, looking at the matrix, it is as if Type 2 exerts a gravitational pull on the firms in the other three quadrants, with many of the arrows pointing in the direction of decreased embeddedness and increased international flows. Some companies are de-territorializing without increasing international flows.

It is interesting to note that there is no evidence of the opposite: none of the firms in our sample are moving from *low* levels of embeddedness and *high* levels of international flows towards *higher* levels of embeddedness. Nor do we see, except for one case, an increase in international flows accompanied by an *increase* in embeddedness.

Our cases are coherent with overall business trends towards increasing internationalization. They clearly demonstrate, though, that globalization does *not* necessarily imply a decrease in embeddedness. In reality, a number of scenarios are possible, all of which are dynamic.

For many firms, an increase in internationalization has meant a decrease in territorial embeddedness. What is significant, though, is that a number of the PILOT firms have successfully increased their level of globalization, while maintaining a high degree of local embeddedness.

4.1 Value chain analysis

Matrices-Methodology

Based on the results of the “Value Chain Checklist” that PILOT researchers filled out for each of the case study companies, we constructed the matrices that follow.

For each company studied, researchers filled out two checklists, one focusing on relations with clients, the other with suppliers. Both checklists were made up of six questions, more or less the same six for each checklist. The first two questions have to do with the “content” and “purpose” of the relationship. Questions three and four relate to the level of involvement and integration of clients/suppliers, while the last two questions are on whether Business to Business (B2B) portals and ICT are employed in the management of the supply chain.

The matrices (figures 3 and 4) are graphs, each with an X and Y axis. Each case study has its own X and Y values, determined by the responses on the checklists. The X values were calculated by taking the average of the responses to the first two questions (those questions about the “content” and “purpose” of the relationship). The Y values were calculated by taking the average of the responses to questions three, four, five and six, the questions regarding the level of integration among the companies, including the use of B2B portals and ICT in supply chain management.

Once those values were calculated for both checklists (relations with suppliers and clients) the coordinates were plotted on the appropriate graph. The graphs provide a clear, visual expression of the distribution of firms in our sample according to the type of relations they have with their clients and suppliers.

Each of the points on the matrices represents one company, and is identified by country abbreviation. Cases indicated with a blue dot all belong to the same sector (NACE Code DJ.28, “manufacture of fabricated metal products, except machinery and equipment”).

Each graph is divided into four quadrants. The first quadrant represents the most basic kind of relationship between companies in the supply chain: a **traditional market driven** relationship. Companies in this quadrant have a low degree of integration and inter-firm collaboration. At the extreme, these are black box relationships: suppliers produce based on the client’s specifications. Neither company is interested in what happens inside the other. Here, the pressure is overwhelmingly to reduce cost and time, not on adding value.

The second quadrant represents **collaborative relationships**. These are companies that engage in co-makership, co-design, even cooperation on product and process innovation. Companies in this quadrant exhibit a low level of inter-firm integration. Companies in this quadrant will, for example, collaborate in

the design phase, but have implemented limited B2B and ICT platforms. Companies in quadrant two, though highly collaborative, have not reached high levels of integration with their partners through the use of ICT tools.

Companies in quadrant three (the top left hand corner of the graph) on the other hand are highly integrated, but do very little in terms of collaborating on product design and innovation. Companies in this quadrant are highly integrated logistically speaking in order to reduce costs, buffers and lead-times. This is the quadrant of **Supply Chain Management**.

Finally, we have the companies in the upper-right hand corner of the graph. Companies in quadrant four exhibit high degrees of both collaboration and integration. These are companies that are integrated with their suppliers and/or clients in a **strategic partnership**, combining effective supply chain management and a high degree of collaboration at the design and product innovation phase.

The figures highlight the distribution of the companies in relation to both relationship with suppliers and clients.

Figure 3 - Suppliers

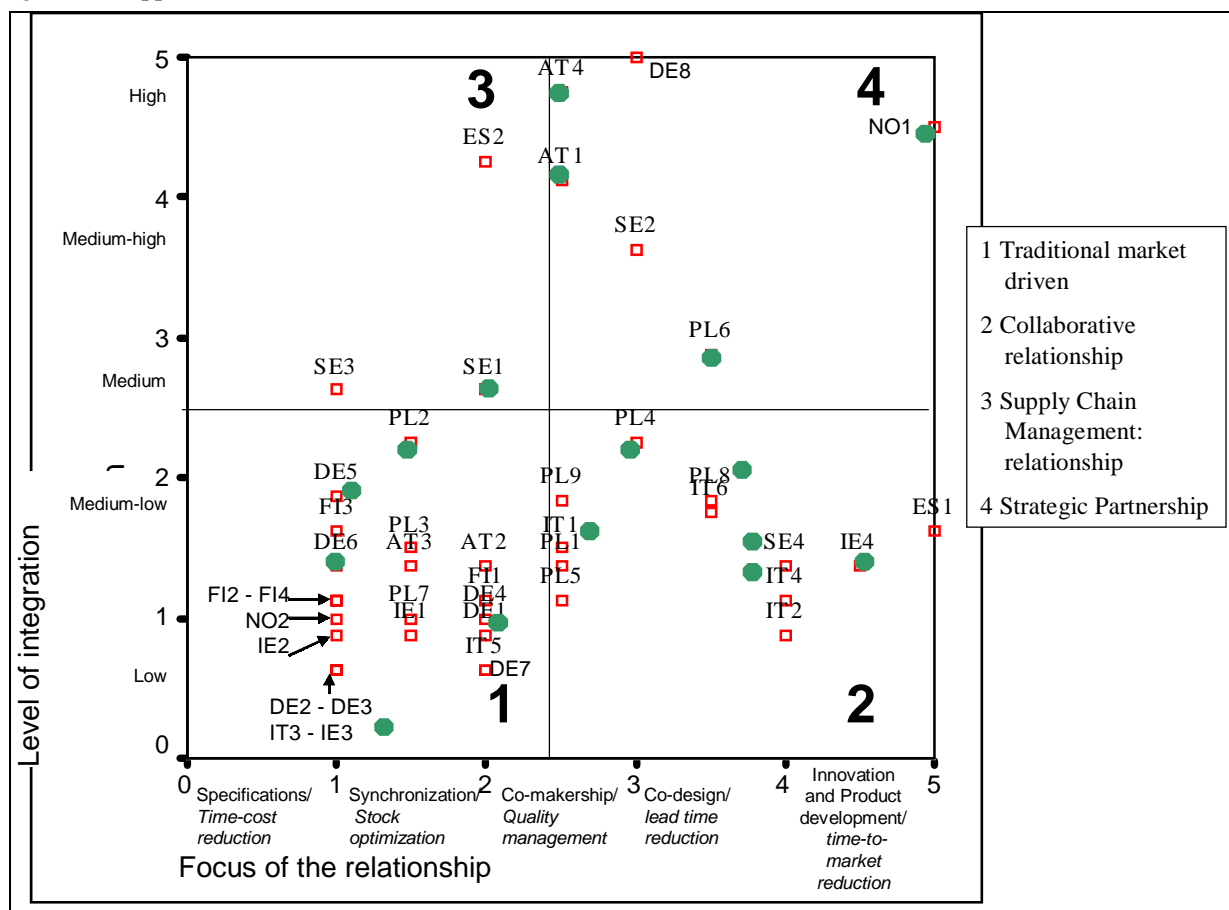
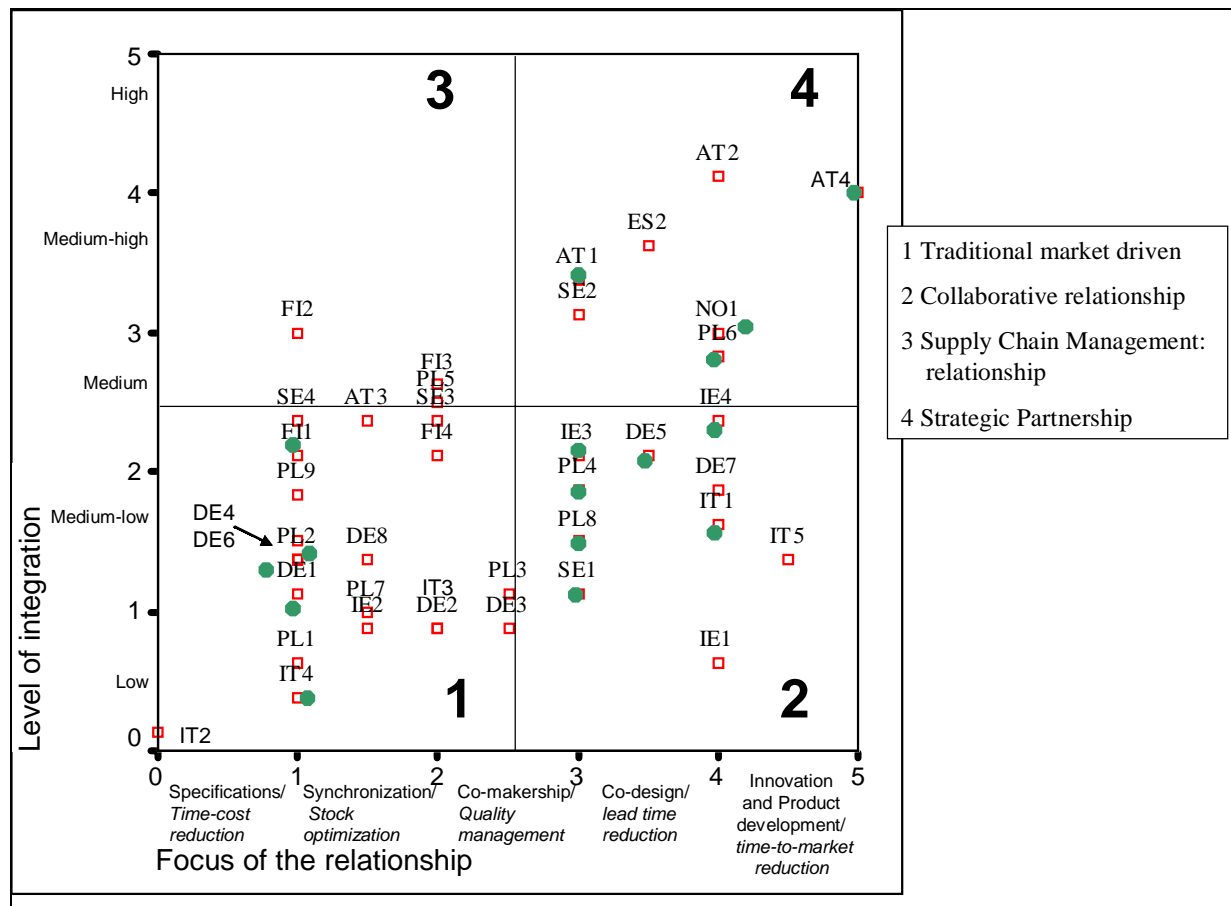


Figure 4 - Clients



Legend

Companies	Code	Companies	Code
Wifo Case 3	AT1	Bcd Engineering	IE4
Wifo Case 2	AT2	Alcoa	IT1
Wifo Case 1	AT3	Paola Frani	IT2
Wifo Case 4	AT4	Mg	IT3
Kraemer	DE1	Sinteris	IT4
Freek	DE2	Pontillo	IT5
Steelrod	DE3	Ducati	IT6
Topstar	DE4	Bms	NO1
Haacon	DE5	Domstein	NO2
Erhard	DE6	Barczyk	PL1
Gmund	DE7	Hms	PL2
MD Lang	DE8	Leyko	PL3
CAPSA	ES1	Wietpol	PL4
ILAS	ES2	Huta	PL5
VTT CASE 1	FI1	Cooling And Climatization Systems	PL6
VTT CASE 2	FI2	Fructosad	PL7
VTT CASE 3	FI3	Metal	PL8
VTT CASE 4	FI4	Polmak	PL9
Woodland Product Ltd	IE1	Ostnor Ab	SE1
M&A Moran	IE2	Lammhults	SE2
Killala Precision Components	IE3	Hallsta Paper Mill	SE3
		Bahco Tools	SE4

4.2 Results

Companies in open and globalised markets that want to increase competitiveness, like the PILOT case studies, must do so by “moving up” the value chain. That is they must produce a greater share of total value added, rather than focusing primarily on time and cost reduction. Because of the fact that companies normally co-operate with partners (like clients, suppliers of components, suppliers of raw materials, suppliers of equipment, etc.), the nature of established relationships with actors shapes company capabilities to both acquire and contribute to creating value. In that sense the nature of the relationships contributes to competitiveness.

Companies that do not make this shift find themselves subject to increasing downward pressure on their prices and margins. The consequences for many are increasingly low margins, eventual plant closure and/or delocalization. On the other hand, figures 2, 3 and 4 suggest that companies that move up the value chain are generally more competitive and enjoy a higher degree of autonomy. They are often able to compete with low-wage countries, by providing just-in-time solutions, customized products, services including design, and participating with their clients and suppliers as partners in product and process innovation. Companies that move up the value chain can free themselves from dependency on one or a few clients, increase product lines and services provided and open up new markets. By moving up the value chain, suppliers who were previously interchangeable (for lower-cost competitors) can make themselves indispensable.

Moving up the value chain implies two processes. On the one hand, companies tend towards greater integration with their clients and suppliers. For example, more information is shared, there is continuous consultation among members of the supply chain, companies even co-invest in their suppliers. Procedures are streamlined as companies in the supply chain adopt the same systems, and ICT and B2B portals are employed to greater and greater degrees. On the other hand, companies build stronger, more collaborative relationships with their clients and suppliers. From an arms-length, market relationship (where clients see their suppliers as black boxes, simply filling orders based on the client’s specifications), clients and suppliers move towards co-operating on product design, innovation and development.

There are of course exceptions. Not all companies need to increase levels of integration and collaboration with their clients and suppliers in order to be successful. However for many companies it is a question of survival.

The growth of internationalisation and outsourcing processes in open economies requires that companies increase their capability to act through extended and globalised organisational forms like the virtual enterprise. For this reason the capacity to manage ICT tools for the support of relationships between companies and partners is needed. While firms have lagged in terms of introducing supply chain management platforms (like ICT and B2B portals) there is a tendency towards more inter-firm collaboration.

One of the themes that emerged from the study of the relationships with suppliers and clients is the importance of the relationships between firms for knowledge generation and innovation. In many firms innovation is non-linear, has a highly tacit dimension and does not occur within the confines of one company’s R&D department. This is confirmed to a great extent by the results of the analysis of the check-

lists, with about half of the firms engaging in some degree of collaboration on design and/or innovation with their clients and suppliers.

Thus the relationships between clients and suppliers often represent important nodes of knowledge formation and innovation. It follows that companies' ability to be innovative depends on their ability to develop ways of managing their relationships that take advantage of the innovative capacity of these relationships. This means, in general, building more highly collaborative relationships, and integrating more fully with clients and suppliers. In other words, this means moving up and to the right on our graphs. Companies that effectively manage the supply chain and build cooperative relationships with clients and suppliers (companies that move up the value chain towards greater value added) will not only see wider margins, but greater autonomy, new markets etc.

In general, movement out of quadrant one is desirable. To this end, public policy should be aimed toward increasing levels of integration and building collaborative relationships among companies in the value chain. New supply chain management strategies, ICT, B2B, and B2C platforms are a particular area of concern for public policy.

5 Conclusion

The main conclusion of our research is that a typical LMT firm characterized by standard behaviour does not exist. LMT firms can be classified, using any set of indicators, as highly dispersed. Our research shows us the overwhelming importance of the strategies and the specific set of managerial capabilities firms need to cope with the main threats to low and medium tech competitiveness: a) a new international division of labour, based on the globalization process, lead by cost competition; b) a devaluation, in the global value chain, of the manufacturing activities that are the main feature of LMT firms.

Successful LMT firms are going global though different paths either by strongly reducing their own degree of embeddedness in a specific territory or utilising it as a competitive asset. Whether adopting the latter strategy has to do with being an SME should be investigated. The first strategy is sometimes very complex because it seems that successful firms following this path are aiming for a mix of embedded and non-embedded elements. The rationale is very clear: to utilize the embedded factor to shape a specific product/service asset in the global scene while at the same time to dis-embed the standardized products/services. Designing the proper mix is quite difficult.

The second strategy stems from the simple fact that in a global world there are broad sets of products and services whose value depends on being associated with some kind of uniqueness. A clear example can be a specific sector, such as food, but also a traditional pairing of some product quality – for instance quality or delivery reliability – with a country or a region. In this case, too, the strategy is not simple because it cannot be the mere continuation of the tradition; the same “content” should be made available according to new standards.

The devaluation of the global value chain is a very difficult strategic issue that must be confronted. Generally speaking the overall process of concentration in most of business activities leads to a restructuring of the value chain with a trend towards a devaluation of the manufacturing activities in favour of the final producers or distributors. In this case the position along the value chain is of critical importance. LMT firms are distributed at different levels so no single recipe exists for all. Basically the ones in the upper part of the value chain, are not so keen on designing new strategies for moving up the value chain. For the others moving up is a matter of survival; moving up means acquiring the capability (managerial capability, organisational renewal and workforce skills) to handle customised product/service innovation. This presents the problem of a new degree of integration with clients and suppliers. What is really new is the fact that generally clients and in many cases also suppliers are no longer bound by geographical proximity, so again the problem is to cope with the globalisation trend. The conclusion of our research is that, taking into consideration the different interests of LMT firms depending on their actual positioning along the value chain, our cases show a low level of integration. By this we mean that, in comparison with the main trend in the industrial sector depending partly on globalisation and partly on concentration patterns, our cases present a low level of integration. OEMs, and more generally, firms at the top of specific production chains, are looking at some kind of closer integration with specialists and first tier suppliers, the so called integrators; to decide how close, if at all, an LMT firm should be to other firms is of course a difficult choice but this is today one of the critical strategic choices to be made. The evidence suggests that most of these firms will have difficulty making this choice because it implies a general restructuring of their businesses and therefore new managerial capabilities, a different and more sophisticated organisational structure and in many cases new skills for the workforce. Recent Fraunhofer research demonstrates that some firms going East to de-locate are coming back disappointed. It is possible to show that they decided to de-localise to cut costs and improving productivity, without having implemented at home a truly updated organisational system.

The importance of making the right strategic choice depends of course on each firm's capabilities. Based on the results of our research, for a balanced dynamic between global and local, **local policies** operating on all sets of "environments" to which a firm belongs, aiming at the creation of public goods supporting the innovation process must be stressed. Clusters and fragmented economies need strong intermediate institutions and institutional infrastructure to provide local collective goods. To set up such institutions the positive combination of the vision of the public bodies and the interests of the stakeholders (collective actors) are important factors. The crux of the argument is that technological evolution and innovative capacity evolve among other things due to the social context. Generally firms, and particularly small and medium LMT firms, are very sensitive to the solidity of the institutional set up both of the national and of the sub-national specific dimension. "Solidity" here means a mix of physical available infrastructures and of educational, vocational, knowledge creation, diffusion and brokerage facilities and institutions.

Another policy problem is the **circulation of knowledge**. Low and medium tech firms are actually utilising high tech knowledge in original and often informal ways. To facilitate these processes of knowledge exploitation the presence of a dense network of institutions favouring knowledge circulation is critical. The policy problem is, therefore, to support **capacity building** for low and medium tech SMEs

to access knowledge resources in a critical and selective way. Policies for the support of knowledge circulation and capacity building for low and medium tech SMEs can also be implemented through networking techniques. In this case, the network is not a functional-operative scheme for the delivery of products and services, but a way to cooperate on specific goals. Shared facilities for product innovation or a policy coalition lobbying for particular policies, for instance specific vocational policies to strengthen the labour market, are examples of this kind of network.

Lastly, our research reveals the importance of the positive coupling of the presence of LMT firms with the long standing economic and social sustainability of an industrial sector in a specific country/region. There are two main reasons for this positive association. First, the employment factor: until now and for a long period to come, the employment multiplier of the manufacturing sector in general, and namely of the LMT firms, is one of the highest among many different industrial activities; a decline of these firms in a specific territory will lead to a high level of unemployment. The second reason depends on the very peculiar role of LMT firms in the knowledge dynamic; they channel, intermediate and fuse two different flows of knowledge; the one based on social capital, the unique or the idiosyncratic feature of a specific industrial culture, which is mainly tacit; the other coming from the scientific and technological development on a broader societal scale and mostly global, which is due to *the general progress of the industrial environment*, and is mainly codified. The fusion of these two knowledge flows produces new tacit and new codified knowledge; it is not a spontaneous, linear and automatic process; it depends on the societal environment, on the soundness of the industrial environment, on the sophistication of the organizational setup, on the nature and the scope of the workers' skills, on the nature and the effectiveness of the co-operation among the different actors at the micro, meso and macro level, on the soundness of the firms' strategies and ultimately on public policies.

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