Industrial Districts' Evolution and Technological Regimes: Italy and Taiwan *

Carlo Pietrobelli

Full Professor of Economics

Università di Roma Tre, and
CEIS, Università di Roma Tor Vergata
c.pietrobelli@uniroma3.it

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I. Introduction

For several decades, in many countries and industries, enterprise clustering has offered a competitive alternative to the advantages achieved through a larger production scale, and through the ensuing economies of scale.[1]

The typical uniformity in the growth process of SMEs systems, experienced during the 1970s and the 1980s in Italian local systems, has come to an end (Carminucci and Casucci, 1997). New diversified and 'idiosyncratic' patterns of growth have been observed, and the range of options chosen expands when attempting to draw international comparisons. No common and unidirectional development pattern has proved valid anymore, and different avenues have been followed to face the new competitive challenges posed by the globalisation of markets and technology. It appears especially useful to remember the insightful remark of the main scholar of the industrial districts (IDs):

' … particularly in the Italian experience, the industrial district has often proved to be rather a 'stage' in one of the possible different paths of industrialization' (Becattini, 1987).[2]

The aim of this paper is to investigate some plausible models of evolution of enterprise clusters and industrial districts and provide an explanation in light of the peculiar features of technology and technological change. This task is made even harder by the variety of visions on the notion of ID in the literature, and by the very vast array of experiences of enterprise clusters and agglomerations that have been recorded world-wide. In fact some "concrete instances of industrial districts are closer to a set of stylised facts than a model" (Humphrey, 1995:152), and none of the IDs is strictly equal to another, as also demonstrated by the variety of product specializations, degree of complexity of organizational and network systems and cultural and social backgrounds. Moreover, the scope and variety of inter-firm organizations are continuously expanding in relation to the globalization of technology and the increasing internationalization of economic activities.

To this aim, we shall first briefly review the literature on the typology of IDs, and in general on the variety of visions on the phenomenon of enterprise clustering. We shall notice how little attention has been paid to the transformation of IDs, and to models geared to explaining the different responses in terms of organisation of inter-firm linkages, within and outside the cluster.[3]

Among the crucial factors explaining the evolution of the clusters' industrial organisation are the external inducements derived from market competition and changes in demand, and from technology and technological change. The latter appears especially important in the current world. The changes in technological paradigms and trajectories, that crucially affect the foundations of competitiveness, are increasingly shaped by the internationalisation process,[4] and contribute to determine the prevailing form of company strategy, especially inter-firm attitudes and the industrial organisation within an enterprise cluster. Interestingly, this dimension has often been underplayed in the studies of industrial agglomeration.

In order to explain the pattern of success, the similarities and the differences, and the possible evolution of enterprise clusters,[5] we shall explore and compare selected experiences in Italy and Taiwan.

Importantly, it is the whole enterprise group that achieves this transformation, not necessarily the individual firm. Through such an evolution, a cluster would be renewing its sources of competitiveness, initially based on lower input costs, some (limited) horizontal linkages with a blend of competition and collaboration and mainly local external economies and "collective efficiency".

The following gives an outline of how this chapter is structured. In section 2 some of the main categorisations of clusters and IDs proposed in the literature are presented and discussed. They seldom focus on the possible evolutionary paths of each model of industrial organisation, as explained in section 3. Changes in such regime

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[1] On this evidence, see the studies in Becattini, Pyke and Sengerberger, 1991, and Guerrieri, Iammarino, Pietrobelli, 1998.

[2] According to Becattini, Marshall properly distinguishes between different geographical levels of analysis, the industrial district showing a lower degree both in the density of territorial agglomeration and in the weight of services with respect to the urban system, and a mono-sectoral character along with a lesser degree of complexity with respect to the industrial region. The significance of different territorial units clearly depends on the aim of the investigation, although the choice of the district is probably the most appropriate to help understand the "endogenous sources of industrial dynamism" (Becattini, 1987: 32).

[3] An interesting exception is Castellano, 1999.

[4] See Ernst and Guerrieri, 1998, for evidence on the electronics sector, and Guerrieri *et al.* (2001).

[5] See Bagella (ed.), 1996, for cases in Latin America.

are in fact inducing different responses in different parts of the world, as explored in sections 4 and 5, that report the results of a recent field-research conducted in Italy and Taiwan. Section 6 concludes and draws some comparisons from the cases analysed.

II. Categorisations of Clusters and Industrial Districts and the Dynamics of Industrial Organisation

The literature on enterprise clusters and industrial districts is sizeable, and was started by the classical contribution of Alfred Marshall (1896) on the importance of external economies for industrial districts. Then, following the increasing complexity and variety of real world inter-firm organisation, several categorisations of industrial clusters and districts have been proposed, often grouping widely different realities under the same label.

In a study of the Italian evidence on how production is spatially organised, Garofoli (1991) proposed a typology of models of local development that has been rather influential on later work. This classification introduced concepts such as Local production systems and System areas, and described the rise in the complexity of the local system that may occur, with inter-firm and inter-institution synergies growing widespread and effective.

Another interesting categorisation explicitly introduces asymmetries among the clustered enterprises and it is centred on the concept of 'leader-firms' and of the constellation surrounding them (Lorenzoni, 1990). Interestingly, in all cases there is no perfect symmetry among the various agents operating in the cluster but each agent may play a distinct role and one (or more of them) leads the cluster in terms of organisation, innovation, and/or finance. The extent of the leadership is more marked the more the system moves towards a 'network' or a 'group'.

Markusen (1996) broadens the picture to include several different forms of industrial organisation within the definition of an industrial district. She argues that the emergence of 'sticky places' in a 'slippery space' - characterised by dramatically improved communications, and increasingly mobile production factors and enterprises - may be related to numerous variants of industrial districts. Thus she opts for an expansive connotation of industrial district which does not confine it to the most common usage (for example the Marshallian – 'Italian' variant – district). Therefore the definition of ID utilised is the following:

'…an ID is a sizeable and spatially delimited area of trade-oriented economic activity which has a distinctive economic specialisation, be it resource-related, manufacturing, or services' (Park and Markusen, 1994).[6]

It is clear that adopting such definition implies considering a cluster or an industrial district essentially as synonyms to describe a reality of a location that provides "… the glue that makes it difficult for smaller firms to leave, encouraging them to stay and expand, and attracting newcomers into the region." (Markusen, 1996: 294)

The conceptualisation proposed, focuses on the following essential classificatory principles: firm-size, inter-firm relations and internal *versus* external orientations (Figure 1).

The concept of the **Industrial District**, and its **Italian Variant**, owes its popularity to Alfred Marshall, who first noted the external economies due to the co-location of small firms, and to several scholars that resuscitated his insights to explain the superior economic performance of regions such as the Third Italy, or Silicon Valley in the US, in the eighties and nineties. They emphasised concepts such as the 'industrial atmosphere',[7] the local long-term socio-economic relationships among local firms, involving trust and a blend of competition and collaboration, and the role of local institutions, the latter especially in the Italian version.[8]

>>>>> **INSERT Figure 1**

The second category of ID proposed by Markusen and empirically detected in the US and elsewhere is the **Hub-and-spoke district** (Markusen, 1996). It occurs where one or more firms/facilities act as anchors or hubs to the regional economy, with suppliers and related activities spread around them like the spokes of a wheel. A single large – often vertically integrated - firm (for example Boeing in Seattle and Toyota in Toyota City) or several

[6] Her definition of ID is clearly different from the definition proposed and utilized by the Italian (mainly Florentine) school (Becattini, Bellandi, Dei Ottati, Sforzi and others) as she acknowledges several different institutional set-ups as having the essential features of a 'district'. In fact, her typology gathers together several different forms of organization of production where a common geographical localization plays a central role. As a consequence of this very broad approach the "Italian" version of ID ends up being only one possible form of inter-firm organization, very close to the original Marshallian idea.

[7] See Pietrobelli, 1998, for an empirical test of the concept of 'industrial atmosphere' in a sample of Italian IDs.

[8] See Guerrieri *et al*. 1998 for a survey.

large firms in one or more sectors (such as Ford, Chrysler and GM in Detroit, or the biopharmaceutical industry in New Jersey) may act as hubs, surrounded by smaller and dominated suppliers. The spokes may represent strong ties, as in the previous example, or loose ties, such as the externalities enjoyed as agglomeration economies derived from proximity.[9] The large hub-firms often have substantial links to suppliers, competitors and customers outside the district. This may represent an interesting dynamic feature of this model, insofar as these 'long arms' act as 'sensors' for innovation and creativity in other locations and thereby enable the transfer of new ideas and technology to the home region. However such long arms may also inform the hub company of the potential benefits and opportunities elsewhere and drive the major firm out of the region. Co-operation among competitors within this form of ID is remarkably lacking, and inter-firm relationships occur between the hub firm and their (often long-term) suppliers. However, the terms of cooperation are always set by the hub-firm. Thus, in principle the hub might even be interested in deliberately playing off one supplier against another as a way of getting more favourable conditions.

In Northern Italy, this sort of agglomeration has developed in Piedmont around the automotive producer FIAT and its intermediate goods and service suppliers, and around Olivetti in Ivrea.

In principle, within this type of cluster, an interesting development process may be envisaged. The spark could be represented by the agglomeration of skilled labour and business services around the hub, with the spoke firms setting up alternative and independent links and benefiting from the agglomeration economies generated by the district. In this hypothesis, the presence of a large hub-firm with several activities and multiple linkages with other firms and providers would foster (or even *lead*) the ID to venture into new sectors, diversifying away from the traditional specialisation. This is likely to occur more frequently when hubs are active in more than one industry, and may explain the evolution of clustering and IDs and the reorganisation of their network of linkages.

The **Satellite platform** is the third type of ID described by Markusen: it consists of a congregation of branch facilities of externally based multi-plant firms. It is often induced by the policies of national/local governments to stimulate regional development. Key investment decisions are made out of the ID, and tenants of the satellite platform must be able to more or less 'stand alone', that is to be spatially independent from upstream or downstream operations as well as from the agglomeration of other competitors and suppliers in the same area. There tends to be minimal collaboration among platform firms, often engaged in different activities and industries. Differently from what happens in the hub-and-spoke version, the large, often multinational, corporation is not locally based. Constraints to the development of this type of ID derive from the lack of local sources of finance, technical expertise, business services, 'patient capital' and of the industry-specific business associations that may provide shared resources and services.[10]

When industrial activities are 'anchored' to a region by a public or non-profit entity, such as a military base, a university or a concentration of public laboratories or government offices, then a **State-anchored District** may emerge. The local business structure is dominated by the presence of such facilities, which follow a logic that is different from private-sector firms' view. Politics may play a central role in the development of such a form of ID. Indigenous firms will play a smaller role here than in the previous forms of ID. However some new SMEs may emerge out of specialised technology transfer (for example via universities) or business services provided by (or spilling over) the anchor institution. As for the Satellite platform, this type of ID occurs less frequently in Italy than in larger countries such as the US but may represent a useful way to portray an ID emerging from a government-planned initiative. Thus the many examples of 'business parks', 'science parks' or the like, being set up in developed and developing countries through a government initiative to finance and promote a local institution such as a training centre, a quality control agency, a technology diffusion centre, a laboratory or a testing and R&D facility, may fall within this category.

In this class of ID, the growth of local SMEs, and their diversification into various industries is likely to depend on several specific features of the ID, such as the specificities of the prevailing industry, the technology in use and its transferability from the 'anchor' to local firms, and the existence of local additional competitive factors (for example local demand or distribution channels, pools of skilled labour and the presence of 'patient capital').

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[9] An example may be provided by the local skilled labour pool (or cadre of business services) built up by a large firm that facilitates the start up and growth of SMEs in the shadow of the major firm (Markusen, 1996b).

[10] This type of ID appears more adequate to portray the situation in the US than in Italy or other smaller industrialising countries. Moreover, its prospects of endogenous development appear remarkably conditioned by externally made decisions.

Of course a real-world cluster may be an amalgam of one or more types.[11] In order to simplify these categories even further, by singling out one key characteristic, we may explore whether a form of leadership is present. At the cost of lacking precision, firms may tend to share a geographical agglomeration along three broad modalities:

1. (Casual) geographical clustering of firms, with occasional inter-firm linkages, no (little) experience of co-operation, non-existent or little developed local institutions;
2. Marshallian (Italian) ID, with smoother inter-firm transactions, much better developed practices of co-operation, more developed and effective local institutions, economies of scale at the district level made possible by substantial enterprise specialisation, deep integration between economic activities and the local socio-cultural fabric;
3. Enterprise network with some form of leadership prevailing, be it a hub-and-spoke, leader-followers, or satellite-platform, with the leader providing the strategic services and impetus for diversification into different products and sectors, with reorganisation of production and new relationships with firms, local institutions, and factor and product markets.

It is important to note that these are not necessarily sequential stages, as clusters may remain persistently different, depending on industry or country characteristics or historical circumstances and 'lock-ins'.

However, over time enterprise clusters may mutate from one type to another. In search for a dynamic theory of enterprise clusters, could we interpret these types as different stages of a possibly continuous evolution? This would be especially interesting insofar as the latter forms of clusters may exhibit greater propensities for diversification into new production lines through more complex networks and inter-firm linkages, rather than for upgrading along the present sectoral specialisation.

Some possible transitions through different types of clusters are illustrated in Figure 2. Thus instances of a transition from a Marshallian ID to a Hub-and-spoke, with the emergence of larger oligopolistic companies (1), are provided by Detroit (automotive industry) and Pittsburgh (steel industry) respectively in the first decades of the 20th Century and at the end of the 19th Century (Markusen, 1996:301). In principle, the same process might occur through the incubation of a hub within the ID, or in the event a State-anchored ID turned into a Hub-and-spoke, with a private company replacing the public firm/institution (like for example in Colorado Springs, Markusen, 1996:308).

Similarly, Satellite platforms may transform into a Marshallian ID by strengthening and intensifying backward and forward linkages among SMEs, both suppliers of intermediate goods and competitors for the same final markets (3). In the event larger firms prevailed, or SMEs as a result of increased competition or economies of scale (and of organisation) grew bigger and established leader-follower or hub-and-spoke links, then a Hub-and-spoke district might prevail (4). In principle, also a Hub-and-spoke might convert into a Marshallian type of district (or an infant variant of it) (2), following the failure or the loss of influence and power of the anchor-firm (institution). However the latter appears a rather abstract hypothesis as it requires a true 're-democratisation' of inter-firm relations and a fragmentation of the power of managing business relationships among several different actors. An oligopolistic outcome looks more likely indeed.

>>>> **INSERT Figure 2**

Among the three modes of clustering, the network is the one (CIOE'???) that requires, as well as offers, the largest opportunities to reach out much further away, breaking the geographical borders without losing its identity and preserving its specificity and uniqueness. This feature may prove remarkably useful when technological paradigms change, like in recent years, with the co-evolution of technology, industrial structures and the internationalisation of economic activities. This is explored in the following section.

III. The Link between Clusters Evolution and Technological Regimes

Two new major features of the social and economic systems are emerging and have characterised the last two decades. On the one hand, technology increasingly plays a central role in all economic activities and the pace of technological change is becoming more and more rapid. On the other hand, the scope of all economic and enterprise activities has become global (Pietrobelli and Samper, 1997). These two dominant features are intrinsically inter-related and mutually reinforcing. Thus the rapid pace of technological change brought about

[11] For instance, Silicon Valley hosts an industrial district in electronics (Saxenian,1994), some important hubs (Lockheed, Hewlett Packard, Stanford University), and platforms branches of large corporations (IBM, Oki, Hyunday, Samsung, NTK Ceramics), but it is also the fourth largest recipient of military spending in the US.

by improvements in communication and information technologies (ICTs) is facilitating the international expansion of economic activities, whilst this process of internationalisation is enhancing and further accelerating the pace of technological changes.

It has been widely shown that technology has become a crucial input, with the knowledge intensity of production growing remarkably. Consistently, since the late 1970s, intangible investments including R&D, training, software development, design and engineering, have been growing at three times the rate of tangible investments (OECD, 1992). New technologies such as ICTs, biotechnology and new materials are creating new products (United Nations, 1995) while at the same time changing the characteristics and performance of many traditional products (UNCTAD, 1995).

The second dominant feature of the prevailing techno-economic model is the widespread internationalisation of all economic and technological activities. International trade and investments now account for larger proportions of national income in all countries. With the expansion of international trade and investments, technology is becoming more global as well. The nature of technology makes it more convenient for a company to extend its technological activities by sourcing technology abroad and striking R&D and technology partnerships with other companies and institutions (Pietrobelli, 1996, Cantwell and Iammarino, 2001). This knowledge needs to be sourced from different origins, as firms become less capable of supplying all the technological knowledge required, and inter-firm and inter-institution linkages acquire more importance for science & technology (S&T) and R&D.

The literature in this area has often studied the relationships between the technology in use and the pattern of technological change. An interesting approach to the analysis of the different patterns of innovation is centred on the notion of technological regimes. This concept was first introduced by Nelson and Winter (1982), and later developed by others (Malerba and Orsenigo, 1995, 1996a). Within this framework a firm's rate of innovation is influenced by the technological (and industrial) environment facing the firm, that is by:

- Opportunity conditions: the firm's likelihood to innovate, given the investment in research;
- Appropriability conditions: the possibility of protecting innovations, and the profits thereby derived from imitation;
- Degree of cumulativeness: the extent to which the amount of innovations produced in previous periods raises the probability of innovating in the present period;
- Knowledge base: the type of knowledge upon which the firm's activities are based.

In this framework two polar models of innovative activities have been developed following Schumpeter (1934, 1942). The first pattern of innovative activities has been called the Schumpeter Mark I model. It is characterised by conditions of medium-low opportunity, low appropriability and low cumulativeness. Typical features of this pattern are technological ease of entry in an industry, a relatively large number of innovators, a major role played by new firms in innovative activities which are continuously breaking through the current way of production, organisation and distribution. The second pattern of innovative activities, known as the Schumpeter Mark II model, is characterised by conditions of high opportunity, appropriability and cumulativeness which are more likely to lead to a low number of innovators and the dominance of a few firms that are continuously innovating through the accumulation over time of technological and innovative capabilities. They employ their accumulated stock of knowledge, thereby creating barriers to entry in an industry for new entrepreneurs and small firms. Importantly, it has been shown that technological regimes are technology-specific (Malerba, Orsenigo, 1996b), that is to say that the pattern of innovations in one sector is very similar throughout every country.[12]

Does the technological regime within which firms operate have consequences upon enterprise clusters, and especially on their internal organisation, geographical location and innovative behaviour?

It is reasonable to expect that innovators will emerge from the location where technological opportunity is available and accessible (Baptista and Swann, 1998).[13] When there are conditions of high opportunity, high appropriability and high cumulativeness, as in the Mark II Model, innovators are geographically concentrated. This is also related to the firm's knowledge base, since the more technological knowledge is tacit, complex and systemic, the more constant inter-firm interaction will be needed; so one can expect a greater concentration of

[12] However systematic differences in patterns of technological change across countries in all sectors have also been observed (Guerrieri and Tylecote, 1997).

[13] Baptista and Swann (1998) study the link between firms clustering and their probability to innovate, and find evidence of a positive relationship for the electronics sector.

innovators, as this type of knowledge can only be learned through daily use, and requires informal personal contacts and exchanges (Nelson and Winter, 1982, Lundvall, 1988). This is what typically happens in a localized cluster and brings about greater industrial and geographical concentration. Conversely, geographical concentration should be less important when the industry's knowledge base is simple and well codified and conditions of low opportunity, low appropriability and low firm cumulativeness prevail. Here a high degree of geographical dispersion of innovators is likely to emerge (Schumpeter Mark I). Are these hypotheses expected to hold in the present context?

The prevailing techno-economic model, with the diffusion of the ICTs and the rapid internationalisation of all economic and technological activities, would seem to lead toward an increasing relevance of Schumpeterian dynamics of the first type. Resources, capital and other inputs can be efficiently sourced in global markets. Furthermore information and technologies become generic, increasingly codifiable, and are readily available via globalisation.

Thus, changes in technology and global competition have therefore diminished some of the traditional roles of geographical location. Firms find it increasingly necessary to create knowledge through linkages with distant firms and organizations. The analysis needs to move beyond the boundaries of a region or nation state, and international knowledge linkages acquire increasing importance (Ernst, 2001).

But all this is only one side of the coin. In fact location remains fundamental to competition, albeit in different ways, in the new techno-economic model dominated by ICTs (Cox, 1997 and Storper and Salais, 1997). The relevant knowledge base involves tacit as well as increasingly codifiable and codified aspects. The former are related to a firm's specialised capabilities, while the latter refer to technological knowledge which is new, widely applicable and generic. So if technology can be licensed or sourced from other locations, and components and equipment can be out-sourced, other more complex dimensions of competitiveness remain geographically bounded and related to the Schumpeter Mark II model. The enduring technological and competitive advantages in a global economy are often still significantly local.

In this perspective the spread of global production networks (GPN) may be understood as an organisational innovation which may enable a firm to gain quick access to higher quality and/or lower-cost foreign capabilities and knowledge, without losing the complementary locally clustered capabilities (Ernst, 2001).

To our present aims, these recent patterns impose drastic reorganisation demands on all enterprises. Such changes are sweeping and imply comprehensive industrial restructuring, new skills and intermediate inputs. In their absence, competitive advantage may shift to another enterprise, group of firms or location.

From the above analysis, two working hypotheses may be singled out:

1. A shift in the technological paradigm that applies across sectors and that requires a substantial industrial reorganisation is being observed world-wide. Again, firms traditionally operating within a cluster or a district would need to learn to source their technological knowledge from the most advanced locations outside it, and to reorganise their knowledge linkages from a cluster-based approach to a wider and global approach such as the GPN model.
2. The prevailing form of the 'Marshallian' ID may not be the most adequate for the new technological areas promising faster and more sustained demand in world markets. In other words, the internal organisation of the Italian IDs, and their strength based on local interactions within the cluster, used to be essential in explaining their past performance in traditional sectors. Yet this kind of organisation may prove less capable of tackling the challenges posed by a new technological regime and an environment that demands the internationalisation of production and commercialization, and most notably of knowledge creation.

The comparative evidence on Italy and Taiwan presented in the following sections sheds some light on this issue.

IV. Some Evidence from Italian IDs in the Textile and Clothing Industry

The textiles and clothing industry has traditionally played a central role in the Italian pattern of specialization since the Second World War. In addition, this sector is the most representative of local systems in Italy.[14] Looking at the country's export pattern, the textiles sector reveals the highest degree of geographical concentration, with only seven systems (ten

[14] Italy has almost 200 local systems of SMEs, of which nearly half can be strictly defined as IDs, while the others are either IDs in the birth phase, or remains of declined IDs, or polarized industrial areas. However, in the sector here analysed, the majority of local systems correspond to real IDs (Becattini, 1987).

provinces) accounting for the whole of the industry's exports. Knitwear and clothing exports are slightly more geographically dispersed, with 15 systems and 23 provinces contributing to 83 per cent of Italian exports in 1995 (Conti and Menghinello, 1996). Moreover, this industry shows also a remarkable degree of internationalization, with an average export propensity rising from 24.4 per cent during 1987-89 to over 33 per cent during 1995-97 (above that of total manufacturing, 31 per cent). Similar remarks hold for inward and outward foreign direct investment flows, confirming the trend towards de-localization of stages of production particularly towards Central and Eastern Europe and China.

Table 1

Contribution of Italian local systems to national exports of textiles and clothing, 1986 - 1995

Sector	No. of local systems	No. of Provinces	1986 % Share of Italian Exports	1995 % Share of Italian Exports
Textiles	7	10	77.0	84.5
Knitwear	10	15	73.5	79.8
Clothing	15	23	68.1	83.1

Source: adapted from Viesti (1997), Tab.3.

During their first stage of restructuring, which started during the 1980s, the Italian textiles and clothing IDs have shown a greater capacity of reaction and adaptation to the new market conditions than the average of SMEs (Guerrieri and Iammarino, 2001: 39-42). This has had the following main characteristics:

- personalisation of products, that is increasing and faster horizontal and vertical product differentiation, leading from price competition to quality competition;
- greater flexibility in the management of differences, both internal and external to the firm, with shifting attention towards formal and informal networks;
- acquisition of technological advantages, stemming from the diffusion of micro-electronics and from industrial machinery and equipment, which have allowed a higher degree of automation of production processes (Santarelli, Sterlacchini and Quaglia, 1991);
- some diversification processes mainly occurring through the specialization, within the ID, in complementary sectors, such as machinery and equipment for textiles and clothing. Thus, the technological level of the latter products strikingly increased during the 1980s mainly because of the exploitation of embodied technology;
- the rise of groups of firms referring to a leader (occasionally a multinational) particularly in mature IDs – such as Prato, Como, Carpi – leading to more formal and long-term subcontracting linkages, once essentially founded on occasional and short-term contractual relationships;
- a much less pronounced hierarchization of inter-firm relationships in 'younger' districts specialized in textiles and clothing (e.g. in Teramo, Pesaro and Isernia), with many small firms repositioning their sales in small market niches thanks to some degree of protection.

In sum, since the eighties most IDs have undergone changes in the production structure to face international markets. This has occurred mainly by losing many upstream phases through relocation outside, very often abroad, and increasing their specialization in downstream stages of production, characterized by higher value added (Carminucci and Casucci, 1997). On average, Italian IDs have shown a stronger propensity to upgrade their production rather than to diversify their sectoral specialisation.

However, in light of the newly prevailing conditions of international competition, whose main features have been described in the previous section (i.e. internationalisation of markets, multinationalisation of production, globalisation of technological innovation, and changing technological regimes) are such strategies proving sufficient to stay ahead?

To this aim, it is essential to understand whether the balance between collaboration and competition within the district, along with the structure and the degree of openness of local networks, can generate reactions to external major changes, thus securing successful transformations.

In order to assess whether a renewal of competitiveness has occurred in Italian IDs, a fieldwork analysis was carried out in selected districts (Guerrieri *et al*., 2001). In particular, this study aimed at providing preliminary answers to the questions outlined above, and sketch the possible paths followed by IDs to cope with the increasing global competition and its new characteristics.

As it is well known, the geographical identification of industrial districts is not straightforward, as the levels of the province and the commune usually overlap and none of them turns out to be the most appropriate to describe a specific local system. In fact, the Italian ID is often an intermediate area between the commune and the province. Therefore the identification of industrial districts to carry out the direct survey had to hinge on several secondary sources (recent literature, surveys and empirical analyses on IDs).

Notwithstanding the limits, the choice of the province as unit of analysis seems to represent a good approximation of geographical agglomerations such as IDs. Thus, the structural characters of production and export specialization of Italian provinces and, more importantly, their dynamics in terms of performance during the 1980s and the 1990s allowed to single out some possible geographical differences in the restructuring of competitiveness of local systems of textiles and clothing productions.[15] Among them, three case-studies were selected to be studied more in depth, taking into account criteria such as: the identification of the 'dominant' industry in the specialization pattern of the district, the variety of historical backgrounds, the search for older and younger districts, the variety of structural features and performance, and the features of the export performance also of the related sectors of machinery and equipment for textiles and clothing.

In spite of the *caveat* implied by this exercise, Prato and Carpi were chosen as representative of 'older' districts, whilst Teramo was selected as an example of a 'younger' ID. The field work was carried out in the summer and autumn of 1998 on the basis of EU-harmonized questionnaires administered to a random sample of textiles and clothing SMEs, with interviews to 48 SMEs overall.

Firms on average turned out to be older in Prato and Carpi, and younger (late 1970s) in the newer district of Teramo. Surveyed firms are also larger in the latter district, with seven firms between 21 and 40 employees and four employing more than 40. The recent performance, as measured in terms of sales, has been better in Prato, with an improving trend over time, relative to an almost stable pattern in Teramo and a sudden decline in Carpi in 1997, after years of increasing sales. Enterprises in Prato and Carpi appear more export-oriented, with respectively 54 and 33 per cent of total sales going to foreign markets, than in Teramo, where exports account for only 17 per cent of sales. Most of these exports go to EU markets (54.2 per cent).

Furthermore, data on the share of output sold to the top three customers in 1997 show that Prato and Carpi exhibit rather low percentages, 31 and 22 per cent respectively, while Teramo's firms seem to rely much more on top customers, with an average share of output sold to the main three clients equal to 63 per cent. This may suggest a stronger concentration of subcontracting relationships in Teramo than in the other two more mature districts, and is confirmed by qualitative evidence.[16]

One central target of the survey was to assess and measure the "cluster effect" - that is the extent to which the location in the ID is perceived as important (strategic) by the firm – its relative openness, and its impact on enterprise performance. The main results may be described as follows:

- the background of the entrepreneur/founder, is often a family business (46 per cent of all firms) or another SMEs (33 per cent), both located in the same cluster. This confirms the traditional result on the importance of family ties, traditions, and a sort of 'path-dependence' in Italian districts.
- Product innovation, both as *new to the firm* or *new to the sector*, has been scarce (limited). However, exactly 50 per cent of all surveyed firms undertook improvements in existing production processes, mainly consisting of the use of new specialized machinery, equipment and computer-assisted technologies. This confirms once more the central role played by a related sector, such as machinery and equipment, for innovation in SMEs in traditional productions.[17]
- Turning to the external sources of technology, customers and equipment suppliers were judged as crucial by our respondents: indeed, in both cases, 25 respondents attributed a high score. Considering the main external

[15] The analysis of textiles and clothing exports was carried out at a detailed level of sectoral breakdown (i.e. 27 groups of products for textiles and 15 for clothing, numbered from 99 to 140 according to the Istat classification, which includes 236 product groups, with reference to the province unit. In spite of the presence of more than one local system in the same province, by considering detailed classes of products it was possible to obtain a rather accurate picture of the contribution of the 'dominant industry' given by geographical systems to national exports.

[16] The results of this survey can by no means be generalized. However, this result is confirmed by the recent survey on Italian IDs carried out by the Bank of Italy (Pizzi, 1998).

[17] As expected, R&D is not at all the principal source of innovation for SMEs operating in traditional sectors. Indeed, the expenditure on design, development and engineering amounted to very small values in all districts. Overall 13 firms out of 48 declared to perform 'some' R&D.

source of technology by its geographical origin, in Prato local together with national and international customers were ranked as the leading channel of technological sourcing. Only in the case of Teramo no international linkages turned out to be important.

- Local and national equipment suppliers emerge as the main external source of technology in all cases, strengthening the hypothesis on the interplay between the collective creative capacity and more formal R&D activities Bellandi (1996).
- The geographical features of relevant linkages are especially noteworthy in our sample. In Prato, local technological linkages are rather strong (with ten firms indicating the local environment as the origin of the main source of technology), as well as for Teramo (with nine firms), but while in Prato and Carpi firms also show a relatively international openness, the respondents in Teramo do not have any major technological channel with sources outside the country. This would support the idea of a relative closeness of Teramo with respect to the 'older' districts.
- Overall, our data would suggest that the intensity of local linkages, and therefore the strength of an 'ID atmosphere', is far more perceived in the two 'older' districts of Prato and Carpi than by respondent firms located in the 'younger' ID of Teramo, which attached a lower rating to local connections as a whole. Moreover, linkages with service providers were deemed important in Prato, linkages with private financial institutions in Carpi.

The well established system of networking detected in Carpi and Prato by this and many other studies, may not only encourage interdependence and collective learning but also facilitate the future integration in global networks and the response to the challenge of the ICT revolution.[18] On the other hand, the relative lack of internationalization and perception as being part of a local system detected in Teramo may turn out to be a critical drawback in the complex path to stay ahead in global markets.

How can we summarise the evidence gathered from this survey on three prominent Italian IDs, in light of the theoretical hypotheses on the evolution of technology regimes, and the implications for cluster organisation?

- The evidence presented confirms the importance of the *industrial atmosphere* and the strength of the Marshallian model in traditional IDs like Prato and Carpi. This appears to occur to a lesser extent in younger IDs, such as Teramo.
- Proximity matters and will continue to matter. However, this needs to go together with an attitude of industrial districts to open and reach out distant markets and partners, and become part of international integrated system.
- However, the limited knowledge of new global technological languages, as well as the lack of substantial organizational changes required by the new technologies to be effective, may progressively cut out geographical clusters and, as a result, 'industrial atmosphere' might not be sufficient any more to stay ahead in the global economy.

Sectoral trends are showing univocal signs towards radical organizational changes, with the clothing industry facing even bigger risks than textiles, related to the rising dominance of much retail trade by large firms and multinationals, and the ensuing substantial change in marketing and distribution activities.

Indeed, the global challenge implies not only relocation of production in search of low labour costs, but even more a variety of industrial organization. Most firms, both small and large firms, are learning to acknowledge the crucial importance of participating in global innovation networks which entail relationships with suppliers, distributors, financial systems and customers, each of them contributing differently to the innovation of products and processes, and boosting the productivity and creativity of everyone in the network. So far, in the Italian IDs specialized in traditional sectors, the exploitation of the potential offered by global networks to strengthen communication and information has been rather weak. This remarkably differs from what is occurring in other emerging parts of the world, as the evidence on Taiwan, presented in the next section, suggests.

[18] It has been pointed out, with reference to the Italian cotton industry, that the adoption of ICTs may display its economic effects in terms of overall productivity levels "… only when associated with systematic changes in the organization based upon systemic networking among different firms and different units within the firms". Furthermore, the efficiency brought about by the adoption of ICTs can be effective only with the introduction of "… parallel changes in [firms'] organization in terms of closer interaction among internal functions such as production, marketing, finance and strategic decision-making, higher levels of vertical integration and product diversification, closer interaction with customers and providers of intermediate goods and services" (Antonelli and Marchionatti, 1998, p. 13).

V. Clusters and Networks in Taiwan's Electronics Industry

The comparison between selected cases of industrial clusters in Italy and Taiwan may appear hazardous, but this is only apparent at first sight.[19] In reality, in both economies SMEs represent the bulk of industrial structures. Furthermore, both countries are fully integrated into the current processes of internationalization and globalization. Taiwan has been one of the earliest developing countries to open to international economic flows, first targeting export markets, and then relying on the direct investments of foreign multinationals. More recently, Taiwanese companies have also started to invest overseas and to strike strategic linkages with transnational corporations.

What makes the comparison especially instructive as well, is the countries' different patterns of industrial specialization. Italy has been, and still is, mainly specialized in 'traditional' productions such as furniture, textiles and clothing, ceramics, and industrial machines, sometimes the heritage of craftsmen's skills and capabilities, and often localised in industrial districts. The pattern of Italian foreign trade has hardly changed over time. In contrast, Taiwan, after an early phase of specialization in labour-intensive clothing, has experienced a remarkable structural transformation and rapid diversification towards electronics and electrical machinery since the 1980s.

During the 1990s Taiwan achieved great success in the electronics industry, and especially in the information technology (IT) area. In 1998 the value of domestic and foreign production of the Taiwanese IT industry was over US$30 billion and ranked third in the world for the production of computers, following the US and Japan. In terms of export value, Taiwan's electronics industry has overcome textiles and clothing – traditionally the core industry of the Taiwanese specialization model – to become the leading exporting sector since 1994.[20] This outstanding success is all the more surprising for an economy with scarce resource endowments and dominated by small and medium-sized enterprises (SMEs).

Such remarkable restructuring has occurred during the last two decades in reaction to an increasing competitive pressure. The sharp appreciation of the New Taiwan dollar, the severe shortage of labor and the consequent escalation of wages, the loss of the GSP (Generalized System of Preference) status, the rise of real estate prices and the aggressive competition from the Korean *Chaebol* in the late 1980s, were all factors that have tremendously affected SMEs operating in traditional labour-intensive industries. Many of them were thus compelled to shift production abroad (mainly to South-east Asia and mainland China) to maintain competitiveness. The remaining enterprises had to redirect their business towards more skill-intensive, R&D-oriented products, searching for new product niches and new market areas to survive.

Indeed, the textile and clothing sector has undergone a strong process of upgrading from a few traditional spinning and weaving products to capital and technology intensive man-made fibres and fashionable clothing. Currently, garment firms which continue to produce in Taiwan are all specialized in high-end products with strong design content. At the same time, the overall industrial structure has remarkably diversified towards higher-technology products and sectors.

The electronics industry in Taiwan has followed a totally different path of development. While the textile and clothing industry received few foreign direct investment, the electrical and electronics industry depended heavily on international markets and access to foreign technology from the international sector. It was firstly propelled by Japanese joint-venture investment and by the investment of semiconductor multinational firms like General Instrument, Texas Instrument and Philips, or TV producers like RCA, Zenith and Philips. The Japanese joint ventures targeted Taiwan's domestic market, while US foreign direct investments focused on export-oriented semiconductor assembly activities. It was only when US firms began exporting TVs that Taiwan's SMEs had the chance of massive production in various kinds of TV components. Trying to take advantage of the huge demand for such products, many good Japanese component companies invested in Taiwan as well. Such a FDI inflow generated huge spill over effects and created a lot of domestic input suppliers (most of them SMEs) in the area of wires, sockets, resistors, capacitors, transformers and many other passive components. In the early 1970s, following the footsteps of several large foreign companies, local TV producers began to engage in original equipment manufacturing (OEM) TV export activities, as the production capabilities of local input suppliers began to receive international recognition. Some SMEs started exporting their components directly to

[19] This section relies on the results of an international research project. For further details, see Guerrieri *et al.*, 2001, and the chapters by the editors, Kuo and Wang, and Ernst therein.

[20] Machinery, electrical and electronic equipment accounted for 22 per cent of Taiwan's total exports in 1981, and 50 per cent in 1998 (with information and communication products – the highest technology sub-set – growing from 0.7 to 12.4 per cent of total exports during the same period).

foreign markets, others sold them to local producers, leading to an outstanding growth of Taiwanese SMEs specialised in electronics.

In order to face the Korean threat of large *chaebol* like Samsung and Goldstar taking TV orders away from Taiwan during the 1980s, Taiwanese input suppliers had to find new products and new markets. Many of them had already accumulated relevant capabilities about computers, and the IBM's open PC framework lowered barriers to entry into the computer industry during the 1980s. This created opportunities for Taiwanese SMEs to participate in the decentralized global production chain of the PC industry.

Initially Taiwanese firms reverse-engineered existing technologies to produce low-cost personal computers, peripherals and components. Subsequently they developed their own design and process engineering capabilities to move into more complex, higher value-added products.

The rapid expansion of the information industry provided a lot of new opportunities for both existing and new SMEs. Cable and wire producers could upgrade themselves from TV cables to computer wires, socket producers became connector makers and resistor firms started to produce chip resistors for notebook computers. Moreover many new SMEs entered various kinds of components and parts, such as integrated circuits (ICs) designs, chip-sets, scanners, add-on cards, multimedia products. A significant structural change occurred in the product mix of both electronics production and exports, with a continuous shift towards exports of more complex information and electronic components and products.[21]

At the end of the 1990s further structural adjustments occurred in the electronics industry, particularly in the computer sector, spurred by structural imbalances, high volatility of Original Equipment Manufacturing (OEM) orders and an increasingly competitive environment. The price of computers and peripherals declined sharply, and Taiwanese firms were forced to increasingly rely on offshore production in the region. Without such a price pressure, it would have been very difficult for Taiwanese firms with relatively poor product image to win over sizeable orders. At the same time the Japanese economy was further hurt by the financial crisis, and some Japanese companies became more willing to transfer technologies or release key components to Taiwanese firms (e.g. liquid crystal display technology).

There has been an intense debate on how Taiwanese firms, most of them SMEs, have been able to compete successfully in the international market. Abundant human capital, strong information networks among local and overseas Chinese engineers, flexible and specialized production systems and broadly based supporting industries are all commonly mentioned as distinctive characteristics of Taiwanese SMEs (Kuo, 1998). An important distinctive feature of the Taiwanese supporting network is that it never implied a stable relationship between input suppliers and users, which instead characterizes the Japanese case. Probably due to the dominance of small sizes and to the unstable competitive environment, the "centre" firms exerted a constant pressure to squeeze input suppliers and bargain hard to reduce costs. This has propelled the improvement of SMEs, although clearly not all of them could succeed (for examples, see Kuo and Wang, 2001:71).

The same methodology and survey questionnaire employed in Italy was also utilised for the Taiwanese field study to gather microeconomic evidence on the restructuring efforts and the sources of competitiveness of selected electronics SMEs. Enterprises were interviewed in the Summer-Fall of 1999, in the textile and clothing and in the electronics sectors. All 23 surveyed SMEs in electronics were located in northern Taiwan, reflecting cluster effects in Hsinchu County and in Taoyuan County.

The evidence collected is presented in greater details by Kuo and Wang (2001), and reveals remarkable differences from the Italian cases. Thus, for example, many company founders (12 out of 23) had previously worked in large domestic or multinational companies, already suggesting an intense interaction between these groups of actors.

Moreover, the interviews carried out support the view that OEM/ODM orders have helped manufacturers to acquire technological and product design capability from foreign companies, at the same time absorbing relevant experience in product management and shipping procedures. This valuable feedback effect has greatly enhanced the learning and innovative capacity of SMEs in Taiwan (Ernst, 2001). At the same time a high percentage of the equipment used by SMEs is purchased abroad, with crucial elements of technical know-how embodied into this equipment.

Most of these firms were also substantially helped by the numerous government policies to support SMEs in the electronics sector, whose role cannot be understated. These policies range from joint private and government R&D (e.g the 'Alliance for the Joint Development of Notebook Computers'), to subsidies for the development of leading new products (with 50 per cent of the development costs covered by government subsidies), active

[21] Three out of the top five notebook computer manufacturers in Taiwan today were very small firms in the early 1990s.

venture capital Funds, S&T Parks modelled on foreign succesful experiences such as Silicon Valley (e.g. the notable example of Hsinchu Science-based Industrial Park (Saxenian and Hsu, 2001), to several Government-sponsored Research Institutes for the generation and transfer of advanced technology (Kuo and Wang, 2001, Kuo, 1998, San Gee, 1995, for details). Moreover, a central area has been in the domain of building a remarkable array of inter-firm and inter-institutional linkages, often promoted by government policies.

A key explanation of the success of SMEs competing in globalized high-tech industries, supported by our survey evidence, is the **co-evolution of domestic and international knowledge linkages**. In other words, inter-firm and inter-institution linkages have been built to provide local SMEs with the necessary externalities to cope with the dual challenge of knowledge creation and internationalisation. Let us see how these linkages have developed for Taiwanese SMEs.

When Taiwan began to enter the computer industry during the late 1970s, domestic linkages did not exist. International linkages thus were of primary importance from the outset, together with the gradual development of domestic linkages. Two main types of international linkages prevailed: inward FDI, that played an important catalytic role for knowledge creation during the early phase, and the participation of Taiwanese firms in global production networks (GPN) established by foreign electronics companies. The latter has represented a remarkable organizational innovation, and its main features have been aptly described by Ernst (2001) and summarised in Table 2.

Taiwanese SMEs, as well as the government, have pursued a *plurality* of approaches in parallel to build a variety of *domestic linkages.* Among these forms of linkage creation, the following have been considered especially important (Ernst, 2001:101-7):

- Informal 'Peer Group' networks, whose focus has shifted from labour, capital and basic market information to technological knowledge and brand name recognition. Originally these networks were restricted to family and kinship relations. Now they have evolved to professional 'peer group' networks, that are especially required in electronics and high-tech industries.
- Hierarchical Centre-Satellite systems to encourage closer, interdependent and long-term ties between larger 'centre' firms (upstream suppliers, final assemblers, large trading companies) and their 'satellites' (especially component suppliers). These links have often been favoured and subsidised through government policies.
- Linkages with large domestic firms, often in the form of Cross-sectoral Business Groups. The shift to business groups has been most pronounced in the electronics industry, due to the critical importance of economies of scale and scope, the necessary linkages with foreign customers through international subcontracting and OEM arrangements, and with international supply sources, especially for key components.
- Business Groups centred around a holding company, and creating a federation of loosely connected companies united by four factors: access to common core technologies; access to the holding company's financial resources; access to its knowledge base, market intelligence and technology scanning capabilities; and a common brand name.[22]

Thus, contrary to conventional wisdom, *large firms* have played a central role in the co-ordination and development of the Taiwanese computer industry; and have also acted as *important sources for knowledge creation in SMEs*.

Moving to international linkages, these do not only encompass critical imports of key components and capital equipment, but also crucially facilitate local capability formation. A GPN may be taken as a paradigmatic example to describe the strategic complementarity of linkages with foreign networks of firms and institutions and localised external economies. The logistic complexity of a GPN is not simply a result of its geographic spread, but also a function of an increasingly complex division of labour. In fact, each GPN combines different hierarchically structured and closely interacting sub-networks.

Taiwanese firms in the electronics industry are deeply embedded in complex global production networks that involve transactions between a large number of different national production systems. What factors have induced large computer companies to increase their reliance on outsourcing and hence to establish GPNs, and local SMEs to participate in them?

[22] This has been named the 'client-server' model.

From the point of view of a large global competitor, concentrating on product development, while at the same time remaining a low-cost producer to stay competitive in international markets is vital.[23] Thus, large multinational firms tend to focus on R&D and on the production of some key components, and outsource most of the other activities, forcing potential suppliers to compete and reduce production costs.

From the point of view of small suppliers from a small country like Taiwan, participating in a GPN can provide various advantages, such as:

- Manufacturing on an OEM basis is a significant source of knowledge creation for affiliated firms. Knowledge is transmitted through the supply of blueprints, the interaction of personnel and the transfer of tacit dimensions of technology.
- A supplier may then use the relevant technology and technical expertise acquired in manufacturing on an OEM basis for other multinationals. Thus, Taiwanese firms often participate in more than one GPN.
- This process allows local SMEs to achieve economies of scale, and in turn justifies the installation of capital equipment otherwise too large and costly.
- Letters of credit by the foreign purchaser allow local suppliers to borrow additional capital.
- Participation in a production network saves the expense of building distribution, sales and service networks. This reduces the costs of acquiring knowledge about foreign consumer preferences, and of setting up the distribution and service networks, a formidable challenge even to large multinationals.

Although in principle marketing products under the firm's own brand name (OBM) may allow higher profit margins, many Taiwanese companies have found that the costs incurred in setting up distribution, sales and service networks can outweigh their benefits. In several instances, OEM relationships and GPNs have rapidly moved beyond production to encompass an increasing variety of knowledge-intensive, high-end support services (Ernst, 2000).

In sum, inter-organizational knowledge creation is critical for small firms that compete in high-tech industries such the computer industry, in years of changing technological regimes. If well organized and managed, such external knowledge linkages can effectively compensate for some of the original size-related disadvantages of small firms. Such a model of industrial organization has produced the *co-evolution of domestic and international knowledge linkages*, remarkably favouring the competitiveness of Taiwanese SMEs.

VI. Conclusions

The selected evidence discussed in the paper suggests three inter-related propositions. First, there is no one best model for organizing an industrial district or an industrial cluster, since a diversity of institutional arrangements is possible and each has proved successful in different circumstances. Second, clusters are not cast in iron, but they evolve over time. Thirdly, globalization reshapes the upgrading options for SME-based clusters, by providing a variety of international knowledge linkages. In a nutshell, globalization changes both the concept of proximity and the scope of competition: a necessary prerequisite for competitive survival is the capacity to foster the co-evolution of local and global linkages and networks, and to develop new interactive modes of knowledge creation.

The first two propositions are fully confirmed by the reorganization of both the Italian industrial districts and Taiwanese SME-based clusters, particularly over the past decade, as analysed in the paper. Industry and firm-specific differences provide one possible explanation for the diversity of cluster development trajectories. However, the industry-level explanation is not sufficient by itself, and some new features of the technological regimes challenge all industries, though in different ways. The consequences of globalization on industrial restructuring and reorganization are going to be felt more and more across sectors in the future, and so the industry level could not be the relevant unit of analysis of such changes.

Geographical dispersion is occurring on a massive scale. However, geographic dispersion does not lead to the wonderland of a 'borderless world' (Ohmae, 1991), and the *gravitational forces of geography are not rescinded by globalization*. A breathtaking speed of geographical dispersion has been combined with spatial concentration, and much of the recent cross-border extension of manufacturing and services has been concentrated on a handful of specialized local clusters. Thus, rapid cross-border dispersion coexists with agglomeration, and

[23] The cost of components, software and services purchased from outside has increased to more than 80 per cent of total (ex factory) production costs (Ernst and O'Connor, 1992), thereby raising co-ordination costs substantially. As a result, the *reduction of the cost of external sourcing* through rationalization and internationalization represents a central strategic concern.

agglomeration economies continue to matter, as well as the path-dependent nature of the cluster evolution. Moreover, dispersion is no longer restricted to lower-end activities, and notably applies also to more traditional sectors such as textiles and clothing (Ernst *et al.*, 2001).

Systemic forms of integration are emerging to combine geographic dispersion with localised concentration. Global production networks represent a remarkable example of such evolution, and their concept may have some important implications also for the future evolution of the Italian industrial districts. Systemic integration implies that international linkages are no longer secondary, quasi-optional to domestic linkages. Instead, existing clusters in any two countries supplement each other and may experience mutual inter-penetration. Under such conditions international linkages are essential for the continuous growth of an industrial cluster.

This is self-evident for network suppliers, especially lower tier ones, whose growth and strategic direction is heavily determined by the network or cluster leaders. But it has important implications also for the experience of the Marshallian industrial districts and the high locally concentrated innovation capability that has been characterizing their evolution up to now. In fact, such international linkages can recharge local linkages. They provide important opportunities for international knowledge sourcing (a possible explanation for Silicon Valley's apparently inexhaustible upgrading capacity).[24]

A GPN can create a virtuous circle of international knowledge diffusion for several reasons (Ernst *et al.*, 2001). First, it increases the length of a firm's value chain, creating new gaps and interstices that can be addressed by small, specialized suppliers. Second, once a network supplier successfully upgrades its capabilities, this creates further pressure for a continuous migration of knowledge-intensive, higher value-added support activities to individual network nodes. Third, network participation may provide new opportunities for *reverse knowledge outsourcing* by SMEs and industrial districts that may help them to overcome some of their knowledge-related disadvantages. This process has worked for Taiwanese computer firms.

In this perspective we argue that the prevailing form of the 'Marshallian' ID may not be the most adequate for exploiting the new technological opportunities promising faster and more sustained demand in world markets. The preliminary evidence presented suggests that, into the 2000s, the organization of economic activities in IDs will necessarily be post-Marshallian, that is, less locally confined and less vertically disintegrated.

The integration into the global economy, through international networks and markets, corporate hierarchies, global production and technological organization, is boosting the importance of functional integration vis-à-vis geographical integration. The latter was one of the fundamental conditions for the emergence of IDs, and will continue to be an essential factor, provided that the necessary organizational changes connected with complex technologies are introduced.

The current shift in the technological regime that applies to all sectors and requires a substantial industrial reorganisation, poses formidable challenges to the industrial organization of SME clusters. New technologies, and particularly the ICT paradigm, have permitted the intimacy that used to be possible only within a cluster to take place over long distances. Firms traditionally operating within the ID mould need to learn to source their technological knowledge from the most convenient locations outside the ID, and to reorganise their knowledge linkages from a cluster-based approach to a global GPN's approach.

However, reaping the benefits from participation in GPN cannot be left to market forces alone; much depends on the nature of supporting institutions and policies (Ernst et al., 2001). Experiences from the small Nordic countries and the Netherlands demonstrate that the scope for proactive technology and industrial policies in a liberal ownership regime is far greater than commonly assumed. Taiwan, Singapore and recent developments in Korea also illustrate that a variety of approaches are possible to such policies.

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[24] The critical importance of international linkages is also reflected in the dense links between the Valley and Taiwan, India, and China, through trans-national technical communities, especially circuit designers and computer engineers, recently studied by Saxenian, 1999.

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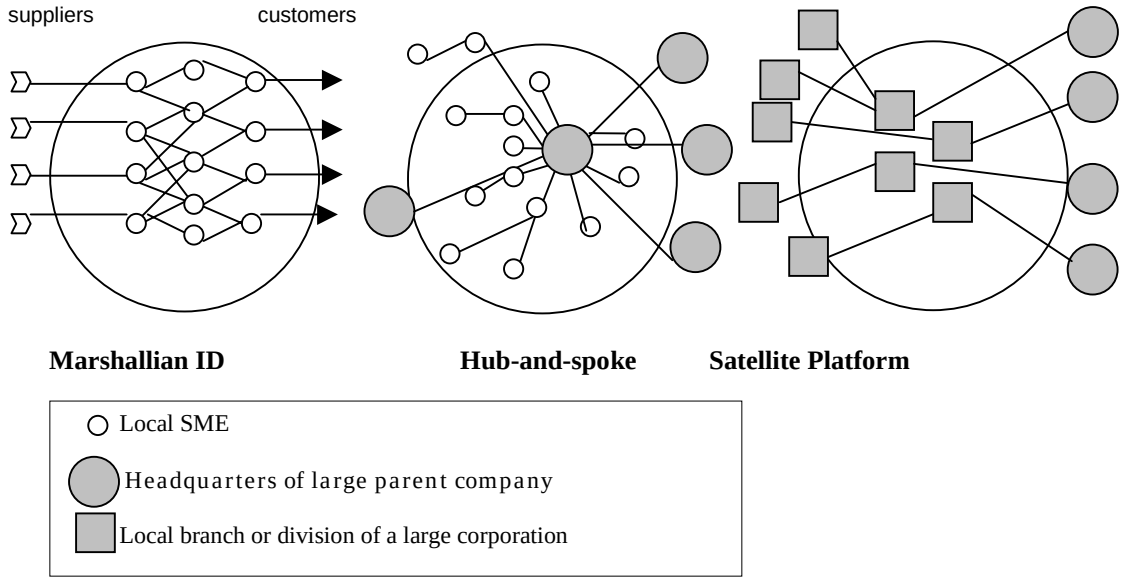
Figure 1
Typology of Industrial Districts



Source: adapted from Markusen (1996) and Castellano, 1999.

Figure 2 'Possible transitions through types of enterprise clusters'

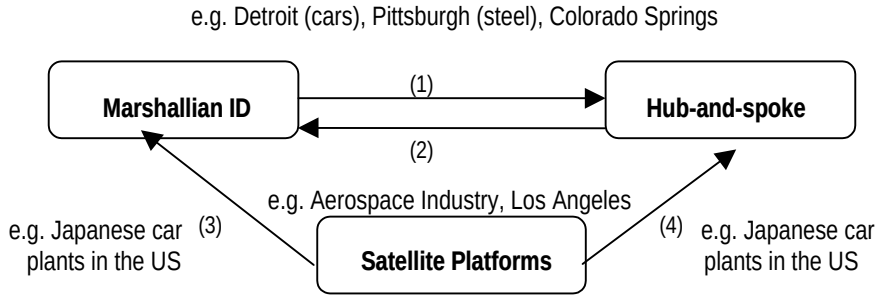


Table 2 Features of Different Forms of Clusters and Models of Industrial Organization

Features	Marshallian ID (ITA = Italian variant)	Hub-and-spoke district	Satellite industrial platform	State-anchored industrial district	Global Production Network (GPN)
Prevailing market structure	Local SMEs	One/several large firms and suppliers	Large firms external to the district	One/several government institutions providing infrastructures	Global oligopolies with networks of local SMEs
Extent of geographical agglomeration	High	Fair	Limited, extended beyond local cluster	High	Limited, extended beyond local cluster
Economies of scale	Low	High	High	High	Highest (also for SMEs, often part of several GPNs)
Intra-district trade	Highly developed	Between large enterprise and suppliers	Minimal	High between institution and suppliers	Limited
Key investment decisions	Local decision	Local decision, but globally dispersed	External decision	In local government or external to the ID	Foreign contractor
Regulation of relationships	Long-term contracts	Long-term contracts	Short-term contracts	Short-term contracts	Contracts subject to instability
Co-operation with firms outside the ID	Low	High	High with parent company	High with parent-company (institution)	High with foreign contractor company
Labour market	Internal to the district, Highly flexible	Internal to the district, Flexible	External to the district, internal to the large enterprise	Internal (government), national from other institutions	Global (for high skills)/ local
Main Workers' commitment	with the ID	with large firm	with large firm	with Gov. Institution, then with ID	With local SMEs
Local cultural identity	Developed	Developed	Virtually absent	Developed	Developed locally, not across the GPN
Sources of knowledge and innovation	Internal to the ID	Mainly in the hub	Mainly in parent company	Local Institution	Global
Sources of financing and technical assistance	Internal to the ID	Large firm	External	External (national/local government, military base, State University or research Centre)	Foreign contractor improves local firms' access to finance
Patient capital *	Exists	Scarce out of the large firm	Non-existent	Non-existent	???
Local trade associations	Strong presence (ITA)	Virtually absent	Absent	Weak	yes
Role of local government	Important (ITA)	Important	Important	Weak in regulation and industry promotion / Important in infrastructure	Useful in promoting local participation to global networks

Source: own elaboration inspired by Markusen, 1996, Castellano, 1999, Ernst, 2001.

* Presence of financial institutions willing to take long-term risks, for the confidence and information they possess.