Inter-firm Relationships in Industrial Agglomerations - the Case of the Portuguese Industry of Moulds

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Abstract

Some authors questioned the continued relevance of industrial districts, now that communications infrastructures and possibilities develop ever faster. It has been stressed that learning, in particular the diffusion of tacit knowledge, may be a major benefit for each of the firms located in industrial districts. Industrial districts can also be seen as “a localised network” where one can more easily research the operation of some mechanisms, which are nevertheless not exclusive to them (Loasby, 1998c). The combination of Loasbian notion of firm, as a set of direct and indirect capabilities, with the industrial network approach may be useful to gain an enriched view of the dynamics of industrial agglomerations. This paper seeks to give an interpretation of how the spatial agglomeration of firms operating in the industry of moulds at Marinha Grande may facilitate certain local practices. Our study of moulds industry, suggests that the potential to generate and access diversity seems to be increased by both spatial proximity of firms and the emergence of relationships between them and with external actors. This last mechanism suggests a focus on interactions in the context of both connected and partially counterpart-specific relationships.

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1. Introduction

TEC, the largest Portuguese firm in engineering and commercialisation of moulds for the injection of plastics (also simply referred to as "moulds"), is located in the district of Marinha Grande, roughly 100 Km north of Lisbon. According to its M. D. "*we are placed within both a 'circle' of clients and a 'circle' of producers. I learn from my clients and I transmit [my knowledge] to the producers of moulds. Likewise, there is feedback from the producer. Diversification [of producers and suppliers], what we bet on, allows both TEC and the producers to obtain diversified know-how, which we can use for the moulds we make for different industries*".

TEC's *circle* of clients includes major companies such as General Motors, IBM, Nokia, and Tupperware, among others. Its *circle* of suppliers (manufacturers) is all made out of small firms located in the district of Marinha Grande (MG). Several authors stressed the theoretical importance of firms' location. For example, Maskell and Malmberg (1999) argue that: "[the] knowledge creation of even the most globally oriented firms or sector is, at least to some extent, influenced by differences in the economic properties of their place of location". By emphasising, respectively, the need to access and articulate knowledge, and the existence of local characteristics which are relevant for learning, both quotes above are useful to frame the theme for this paper: the relevance of the spatial agglomeration of an industry for the practices and the relationships between the firms located there, and for the dynamics of both of these[3].

This paper is structured as follows: Section 2 refers several authors who analysed the benefits arising from spatial proximity and emphasised the emergence of relationships and their role for the generation and diffusion of knowledge among local firms. It is suggested, in section 3, that the relevance of spatial agglomeration for the practices of local firms can be contemplated by considering their need to build a structure of indirect capabilities involving relationships which tend to be counterpart specific. These create potential for future developments, which depends on counterparts, and thus goes beyond that which would result from firm's ´own´ direct

[3] It should be emphasised that our interest is not to evaluate whether MG can be classified as yet another industrial district. Initially our research sought to analyse the processes for the positioning of local firms (Johansson and Mattsson, 1992). Gradually we became confronted with the need to accommodate the relevance for these processes of aspects related to the generation, diffusion and co-ordination of knowledge in industry. Our focus became the analysis of the dynamics of the mechanisms for the co-ordination of activities, by combining the industrial network approach and a view of firms as nexus of capabilities (Penrose, 1959; Richardson, 1972; Langlois and Robertson, 1995; Loasby, 1998a, 1998b).

capabilities. Section 4 gives a general perspective of the moulds industry as well as information about the trajectory of two major local firms emphasising their practices involving access to other actors' knowledge. Finally, in section 5, we discuss the relevance of spatial proximity for the practices and dynamics in relationships observed in MG.

2. Spatial proximity and the emergence of relationships in "Industrial Districts"

Of recently, there has been renewed interest in the study of the consequences of spatial proximity among firms operating in the same industry, partly due to the persistence of such agglomerations now that the transfer of information keeps on becoming ever easier and cheaper in global terms. Some researchers emphasised the generation and diffusion of knowledge in order to study the relevant factors underlying the dynamics of such agglomerations (Lawson, 1999; Maskell e Malmberg, 1999; Nooteboom, 1999; Schmitz, 1999). According to Lawson (1999), some literature about industrial agglomerations – 'industrial districts' (Becattini, 1990), 'innovative millieux' (Camagni, 1991), and the 'Californian school of economic geography' (Storper, 1995) – converges in associating the benefits of agglomeration, in terms of firms' learning, to the emergence of connections between local actors.

Nooteboom (1999) resorts to the notion of 'cross-firm economies of learning' in order to stress the role of the links among local actors for the generation of benefits[4]. The development of a common language, i.e. shared norms, rules of conduct, routines, expectations about future business, etc., is essential for the growth of mutual understanding and generation of trust among parts. The resulting links between firms will be varied as they can be complementary (clients with suppliers) and/or similar (competitors), and they can involve weak bonds (Grannovetter, 1973) and/or strong bonds, the latter especially useful for access to and transfer of tacit knowledge.

Schmitz (1999) also stresses the relevance of inter-firm links, through the notion of collective efficiency. Non-planed collective efficiency or "incidental external economies" of agglomeration are usually mentioned in the literature on industrial districts. It includes, for example, the availability of a specialised work force, the emergence of specialised local suppliers, made viable by the concentration of client firms, and easier diffusion of know-how

[4] "While economies of scale, scope and experience can only be achieved by a combination of different activities in one context (firm), this economy of learning can only be achieved in linkages between different contexts (firms), i.e. firms which are sufficiently independent to have their own categories of perception and interpretation, associated with different paths of experience" (op. cit., p. 292).

and ideas. Schmitz argues that the benefits generated and spread in agglomerations also involve the operation of 'deliberate forces' or joint actions. These involve cooperation between two or more firms, and they deserve particular attention as they may help to explain differences in performance between agglomerations. Joint actions can be bilateral or multilateral and, in either case, horizontal or vertical. Knowledge generated in these contexts" seeps out through multiple sources: workers who socialise with workers of other enterprises, workers who change employers, and suppliers or repairs who have multiple clients". (op. cit. p. 474)

Bell and Albu (1999), to some extent, share Schmitz's perspective about the importance of joint actions, as a manifestation of a more active or deliberate posture to explore new opportunities. These authors emphasise knowledge systems, in particular the role of local institutions and organisations for the acquisition, generation and diffusion of knowledge. They explicitly stress the connections between the local knowledge system and external knowledge systems[5], in particular the potential for large firms and technological institutes to operate as 'gatekeepers'. 'Deliberate forces', presented in the form of "joint-action", "gatekeepers" or "pollinators"(Lazerson and Lorenzoni, 1999), may be relevant for local diversity, by affecting the acquisition and dissemination of knowledge in the industry.

Loasby (1998c) also emphasises local dynamics and connections to the "outside" in terms of knowledge but, differently to those authors, proximity is seen as relevant for the division of knowledge and consequent need for its integration. Spatial proximity may facilitate both processes[6]

The Industrial Network Approach shares this emphasis on connections, and sees the important role of relationships for the co-ordination of activities and learning. Both perspectives, to our view, can be combined. Then the generation and appropriation of benefits in an agglomeration (Schmitz, 1999), is intimately associated to how proximity may affect the dynamics of relationships and interactions in which each actors gets involved. When Foss (1999), for example, looks for common ground among what he calls Marshalian approaches (where he

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[5] "...key features of the knowledge systems of clusters include not just their internal mechanisms for circulating the knowledge already available and for acquiring the new knowledge from experience of various kinds of 'doing'. Possibly more important is their openness to knowledge flows from outside" (op. cit. p. 1726).

[6] "An industrial district is a localized network in which Marshall's general rule has been applied with exceptional thoroughness. Firms located in very close proximity are able to develop especially intimate connections, and consequently the division of labour can be taken to extreme lengths" (Loasby, 1998c).

includes the industrial network approach), he says that benefits for other (local) firms are a natural consequence from the need felt by each firm to build an ‘external organisation’.

3. Indirect Capabilities and Relationships

As we suggested before, co-operation between firms, or ´deliberate forces´, can be seen in the context of the ´external organisation´ built by each firm, which may involve connections to actors external to the agglomeration. Loasby (1998a, 1998b), resorting to the contributions made by Penrose (1959) and especially Richardson (1972), exploited the notion of external organisation initially advanced by Marshall. The seminal paper by Richardson (1972), discussed the mechanisms for the co-ordination of economic activities, considering that the activities to be co-ordinated are underlined by capabilities – experience, skills and knowledge, which are partially tacit. Closely complementary capabilities (those requiring quantitative and qualitative matching) demand directed coordination, either ´within´ the firm or through relationships between firms. The second mechanism tends to be favoured when the capabilities underlying sequential activities are dissimilar. Loasby refines the notion of ‘capabilities’, by resorting to the notions proposed by Nelson and Winter (1982) of knowing *how to do something* and *knowing how to have something done*. He suggests that firms can be seen as sets of direct and indirect capabilities. The indirect capabilities structure that each firm needs to build may include relationships with other firms, whose benefits in terms of the development of new products and processes may result precisely from the connection of very dissimilar and closely complementary capabilities.

On the one hand, geographic and psychological proximity between firms facilitates firms´ learning, including learning by rival firms (Loasby, 1998b, p. 175) but, on the other hand, it may also increase potential learning for the industry as a whole. If it is easier to gain a detailed perception of both clients and suppliers´ needs in industrial districts, then “[v]ertical integration is therefore not necessary to ensure the alignment of closely complementary activities”.

It can be expected that the relevance of spatial proximity and the propagation of effects in the network, be intimately related to firms’ paths as actors embedded on a network of relationships (Best, 1999). This corresponds, roughly, to the role attributed to certain firms or institutions as gatekeepers in the context of knowledge systems. As Loasby (1998c) notes, some firms in industrial districts simply respond to the directions of other firms who introduce new products and new forms of production. The former firms start out based only on operational capabilities but, as they get better acquainted with business, they may begin to develop deliberative capabilities.

The notion of position in industrial networks accommodates Loasby's notion of firms as structures of direct and indirect capabilities, but it stresses both that these are counterpart specific and that relationships can be connected. The notions of 'joint-learning' (Håkånsson, 1993), and 'interactive learning' (Lundvall, 1993) also point at the specificity of indirect capabilities. They involve, respectively, mutual learning about how to use the resources kept by the counterpart, and interaction processes through which technical knowledge and communication codes are developed and, no less important, an understanding of the economic and social expectations of the parts. Nooteboom (1999, p. 141-142) also notes with relation to industrial districts that reputation, trust and bonding are best achieved at small spatial, cognitive and cultural distance, but he adds up: "To build up knowledge exchange one must develop common understanding, which to a greater or lesser extent constitutes a relationship-specific investment".

Moreover, each relationship exists in the context of other relationships with which it may be connected, and firms may differ among themselves on how they deal with diversity at that level (Håkånsson and Snehota, 1995). This means that aspects related with the trajectory (or path) of firms, like vertical integration, subcontracting, promotion of joint actions, and access to other institutions (e.g. technological centres) are set in the context of a network of relationships. However, the "dense network of co-operation and affiliation by which firms are inter-related" (Richardson, 1972, p. 883) does not have to be restricted to the existence of economic exchanges or formal cooperation. Industrial networks studies show a diversity of substance in relationships (Håkånsson and Snehota, 1995) and of modes of formal and informal co-operation (Easton and Araújo, 1992), the latter involving the transfer of people, information and social norms.

To sum up, the combination of both perspectives in our study of the moulds industry allowed us to recognise the interdependence between knowledge systems and production systems, albeit without a clear or definite border between them (cf. Bell and Albu, 1999). Our perspective also lets us look at the relevance of the tending counterpart-specificity of firms´ indirect capabilities and its possible contribution to counter some perceived trend for the decline of the agglomeration or its lock-in. In parallel with Araújo (1998, p. 330) – *i.e.* replacing the word agglomeration for the word firm – the notion of agglomeration as a community of communities is abandoned in favour of the notion of agglomeration as a set of connected relationships, differentiated and in change towards becoming communities of knowledge. In this context, the relevance of geographical proximity for the dynamics of the relationships between actors is seen in connection with its relevance for the generation of and access to knowledge.

4. The Moulds Industry in MG

This section gives a short description of the local moulds industry. Some events are referred which seem to have contributed to the emergence and maintenance of a network of economic and non-economic relationships in the local industry, including creation new firms by technical staff spin-offs and promotion of industry related events. Consideration is given to the operational complexity faced by firms due to the "uniqueness" of moulds. Sub-contracting and consults to other actors are two local practices for dealing with such difficulties. The special role of the technological centre (as a formal arrangement) and two cases of local firms are used to evaluate the relevance of spatial proximity to relationships between local actors.

4.1 A short historical note about the MG industry

The Portuguese industry of moulds for the injection of plastics (moulds industry, for short) includes some 250 SMEs, averaging 50 workers each, which together employ about 7,500 people. These firms are mostly located in Marinha Grande (MG) (53%) and Oliveira de Azeméis (OA) (26%). The Portuguese moulds industry as a whole has frequently ranked among the top 10 largest world exporters: 90% of its total sales (Euros 225 million in 1997) are exported to 50 countries across the world, mostly to the EU (60%) and USA / Canada (20%). The relative weight of its client industries has changed throughout time. Aggregate export data reflect the success of local industry, and witness its capabilities to establish and maintain relationships with such diverse and notorious clients as Alcatel, BMW, Compaq, Electrolux, Ericsson, Ford, Fisher-Price, General-Motors, Hoover, IBM, Mattel, Nokia, Opel, Peugeot, Philips, Renault, Saab, Samsonite, and Volvo. Geographical distance to clients and the uniqueness of each mould, both place particular demands on local firms. One of our informants said: *"We have to make sure that moulds are exported with one way ticket only, that is, we do not want the moulds returned with quality problems. […] The business of selling moulds is fundamentally a business of trust where I receive the drawings for the product and the mould takes months to make. In a way the client is dependent on our performance, on our* *being credible from the point of view of quality and delivery date, so that he can some how carry on with his business".*

The Portuguese industry of moulds started first at MG and, soon afterwards, at Oliveira de Azemeis, both districts with traditions in the production of glass. Moulds for glass have little in common with those for injecting plastics, but both require steel ´carving´ capabilities. The growth of the moulds industry in Portugal can be traced to the firm Aníbal H. Abrantes (AHA), from MG. Back in 1935, AHA started producing moulds for shaping Bakelite. From 1946, the material to mould, thermoplastic is injected into the mould, in a semi-liquid state, and hardens there. AHA's fundamental role in several areas is often mentioned in MG. It was the first local firm to export moulds for plastics. Also, its M.D., confronted with the local scarcity of an experienced workforce, and with the time it would take to train versatile workers like those found in other countries, chose instead to train and co-ordinate specialised workers for the various tasks required to produce moulds[7]. Specialisation eased the recruiting and training of inexperienced individuals but it posed serious co-ordination and control problems.

AHA was 'the mother-firm' from which a large number of other local firms "hatched". These were generally formed by groups of 4-6 individuals, specialised in complementary activities in mould fabrication. They would get their first orders from clients who visited MG, some of whom where AHA's clients. This *spin-off* process replicated with the firms meanwhile created. The growing demand for moulds stimulated the creation of yet more fabricating firms and their number grew from about 20 in the early 60's, to more than 100 in the 80's and 250 by mid 90's. Foreign clients and engineering and / or commercialisation firms located in MG had important roles in this. Availability of local sub-contractors (producers) able to fabricate moulds was essential for the development of intermediary firms and these encouraged their creation and development. However, the issue for intermediaries was not just to help any other firm to be created but rather to know *who* and *which firms* had adequate capabilities and potential for development in given directions and so were worth being stimulated. The M.D. of TEC, the largest local engineering and commercialisation firm, created in 1968, stresses: "*...every year there were another two or three new firms ... We were more than a client for most those firms, we were like a tutor, although there wasn't any financial interest*

[7] "*Mr. Abrantes ... came to Lisbon for a miller. He got a turner from the cement factory. He had some men who knew how to carve steel, bench men, and he divided knowledge... among four or five people where each person knew a bit of the whole. All together they managed to do what he wanted: a mould for plastics. For the first few moulds they did not even have a drawing. They made it among themselves, discussing, chatting. Then he hired a draftsman. I was one of the first few, may be the third one."*

[participation] *involved. The first client for most fabricators* [in the area] *must have been TEC. When you have four or five people working in a garage, no foreign client will order a mould from them. They do not know what* [who] *is there, but I do…*[Our underlining]".

The network of relationships, created throughout the years by spin-offs and people exchanging firms, led to the diffusion of practices and enable cooperation between firms, something also found in other agglomerations (e.g. Pinch and Henry, 1999). It also facilitated the mobilisation of firms for several purposes[8]. Such mobilisation by and of some local firms supported the realization, since the 80's, of congresses, conferences and regular weekend meetings. These events encouraged associates to present experiences and concerns about several areas, e.g. CAD-CAM systems and techniques for cutting steel. Some of them witnessed the first public contentions about the need for joint multilateral actions. For example, a recurrent topic on the interventions by several industrialists has been the problem of communication between local firms, due to lacking common norms, procedures and nomenclature for a wide range of products. The first Hand Book of Procedures for the Moulds Industry, finished in 1996 resulted from a process which involved several teams and included people from the fabricators of moulds, intermediates, suppliers of steel and components, etc. The Training Centre and the Technological Centre were also created out of mobilisation involving several local firms and public institutions. Technicians from some firms taught the first training classes in the Training Centre, and used their own firms´ equipment.

4.2 Activity Flows

A mould is the result of a set of closely complementary activities and a unique combination of both specific components (shaping areas, injection points, etc.) and standard components (refrigeration systems, heating systems, injectors, hydraulic systems, etc.). Moulds differ widely in their sizes, tolerances, rates of output, and interchange ability of components, etc. The relevance of any such characteristic depends on how and where the mould will operate, and on the size, shape, tolerances, and usage context of the plastic pieces it will deliver.

The sequence of activities for the production of a mould usually starts with a request by a client for a price quote and time for delivery, given a draft or project he submits of the plastic piece to be delivered by the mould, and a set of specifications for it (he seldom gives in a prototype of the piece). The supplier will answer back with a budget (price quote) and a technical solution

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[8] This is less of a generalisation than might be thought: one of the current Directors of AHA recently tried to call a meeting of ex workers from AHA, soon to find that most firms in the district were represented in the event.

(preliminary plans for the mould) and, often, with suggestions of alternatives for the type of materials to use for carving and building the mould and/or for changes in the final plastic product. Choices made at this time often have consequences for subsequent steps, e.g. the type of equipment that will be used, the nature and sequence of activities, etc. The client's approval of the preliminary plans triggers the drawing of the final design/plans, and the purchase of steels with the sizes and physical properties required for the mould. Fabrication will start next, and it involves a series of operations like machining, thermal treatments and rectifications. Finishing of moulding surfaces, including polishing and ´texturisation´, will follow. Then the mould will be assembled, the preceding activities will be evaluated for quality and the mould will be tested. Only at the final testing of the mould can a better evaluation be made of the adequacy of the solutions adopted at the project (design) and fabrication stages. Testing the mould is an important leaning event. It may allow a better understanding of the behaviour of the plastic inside the mould, through tentative partial fillings. This is very critical for fabricators. In extreme situations the impossibility of obtaining a certain piece will not be detectable beforehand, with very serious financial consequences. This stresses the importance of possessing the knowledge for correct preliminary evaluations of the requests made by clients and of the existing (or potential) capabilities of producers to fulfil them.

The parlance of the industry distinguishes *corrections* from *changes*, despite both involving problems and additional operations on moulds. Suppliers are responsible for *corrections* and accountable for the additional operations and costs involved. C*hanges* are modifications requested by the client who will pay for them. Despite the development, of recently, of simulation software, it is still difficult to predict exactly how melted plastic injected into the mould will behave against its internal surfaces, flow inside its moulding cavities, contract on cooling, etc. The number and location of injection points, and the standard components built onto and into the mould may have to be revised and corrected. Uncertainties may go as far as the clients'. Besides aesthetics, the client my request changes after testing the plastic pieces in real life operating conditions, whence their mechanical or chemical characteristics my show inadequate. Some clients develop their pieces by successive approximations, especially components for the automobile and appliance industries. Therefore, the portfolio of clients of each local producer reflects its capabilities and availability to deal with such time consuming and uncertainty generating processes, which vastly complicate the programming and management of production operations.

In general, each mould is a unique tool, but *having done something similar* or being able *to talk with someone who did something similar* may help reduce the consequences of changes and corrections for the parties involved. Equally important is knowing who has already worked for some client, and being able to find out about a client's behaviour in interactions with other suppliers. Such local practices are intimately associated to the emergence of relationships between local actors, and are but some of the ways local firms seek to deal with such problems. It may be also important to be able to access or participate on the development of knowledge about project technologies, machining, prototyping, simulation of materials behaviour, and even the usage and behaviour of new types of materials and solutions for the design and fabrication of moulds.

Finally, it may be necessary or advisable to sub-contract to someone else part or all the activities, because of the possibility for changes or corrections together with the firm's perceived (in) ability to deal with often unanticipated requests by (multiple) clients, who differ in terms of patterns for investment in new products, and number and size of moulds ordered. It is frequent for a producer to subcontract to other local producers or some specialised firms, and he may also find himself called on by a client to participate in a pool of producers. In such circumstances, in order to reach the required levels of quality and timeliness, it may be crucial *to know who may be available and capable* to do what, be it directly or in subcontract.

The relevance of such indirect capabilities for an actor can be better understood by looking at some aspects of the trajectory of two local leading firms who together sold about 25% of the turnover of the whole local industry in 1997. More important, they are notorious for their roles as 'gatekeepers', which contribute for a better understanding of the dynamics of local industry.

4.3 Diversity of Solutions by Local Actors: IB, the Technological Centre and TEC

IB and TEC are two of the largest local firms. Staff that left other local firms founded them in 1975 and 1968, respectively. Both started their activity as engineering and commercialisation firms. From start both IB and TEC were confronted, not so much with the problem of accessing existing capabilities, but rather with the need to promote the development of capabilities at their subcontractors. Subsequently, IB faced important restrictions with its subcontractors who progressively became less than available to accept its requests for further developments, whilst IB itself met compounded difficulties in co-ordinating activities assigned to various producers. Consequently, from 1976 onwards IB opted for vertical integration and growth. They began establishing specialised firms to serve both themselves and other local firms. IB owned specialised firms faced increased competition from other specialist firms at MG, but they benefited from growing orders from IB´s own clients. They gradually evolved into full cycle firms, specialised by size of moulds, having IB itself as almost their only (direct) client. Detailed norms and procedures were developed for the group's firms. As the group grew, the need for training increased. Thus, IB created its own training centre both to provide for that need and to make up for the exit of technicians of theirs hired into other firms.

Later on, IB adopted and used concurrent engineering and rapid prototyping with some of its clients, in order to reduce both the time required for developing the products and the need for changes and corrections. IB has presently insufficient internal capacity partly due to the deepening of its relationships with some clients and despite being already one of the largest European groups in the moulds industry (hiring about 600 people). Subcontracting is not seen as viable due to the small receptivity of the local fabricators who are seen to have the adequate capabilities and potential. The variety of demands from IB´s diverse clients has been mostly accommodated internally, and its economic relationships with local firms seem not have worked as a mechanism for the dissemination of knowledge in the local network.

Still, IB was confronted with the need to develop its "external organisation". In contrast with its relative 'closure' to local producers via subcontracting, it increased its involvement with the Technological Centre. The usefulness of the centre (and the perception its associates have of it) is intimately dependent on its ability to mobilise and connect diverse capabilities held by a variety of actors (firms, universities, other technological centres, training centres, etc.). Its creation, back in 1991, resulted from the involvement of several local firms together with the industrial association and some governmental institutions. It provides services like training (technicians from some firms act as trainers), design of moulds, flow analyses, rapid prototyping and reverse engineering. It also carries out various activities related to the exploration and use of new technologies in the context of projects led by the member firms. These projects include themes like 'Advanced Techniques for the Finishing of Moulds and Tools', 'The Applicability of Copper Alloys for the Production of Moulds', and the creation of a 'National Network of Rapid Prototyping' (RNPR).

Among those development areas rapid prototyping technologies should be stressed, where IB has had a relevant role. The RNPR project allows directly exploring a technology IB has been tracking since 1986: Selective Sinterisation by Laser (SSL). SSL allows the production of plastic pieces by melting materials by laser beams and it is potentially complementary, and may even replace, some of the existing rapid prototyping processes. In the meantime, high unit costs, along problems with materials resistance and surfaces finishing, have restrained the applicability of SSL to a small number of pieces. Still, the impact on IB and the industry can be still more significant, since it is expected that SSL will probably allow, in the future, the production of plastic pieces, without using moulds. If that is the case, then the industry may be facing “major changes”, requiring the development of new connections between capabilities (Loasby, 1999c). Thus, IB benefits indirectly from its participation in the Technological Centre and its notoriety in the context of the agglomeration of smaller local firms (I can only be speculated whether its ´clout´ would be the same, were it the same size but not geographically close to other actors like it happens in MG).

TEC, unlike IB, kept on being an engineering and commercialisation firm. They see each other as competitors, especially regarding large clients. This is a source of some tension but they still acknowledge each other in the sense that both recognise that the industry gained from the co-existence of their distinct “solutions” to operate the business. The MD from TEC sits on the Board of the Technological Centre, like does IB´s, but TEC’s link with the centre seems “weaker”.

The fact that TEC remained as an engineering and commercialisation firm is intimately associated to its performance in the context of a vast network of relationships with 70 local producers. Proximity and systematic interactions seemed relevant for TEC to develop knowledge about its counterparts´ capabilities and interests. Vertical integration was never considered necessary. The relationships with local producers have been a mechanism both for access to existing capabilities and for transfer of knowledge and, sometimes, for influencing the development of producers’ capabilities. The co-ordination and knowledge about the interests and capabilities of each producer are essential aspects to ensure the production of orders for a diversity of clients, with consistent levels of quality of moulds destined to fulfil the same order, often technically connected between themselves. Spatial proximity and the establishment of lasting relationships are important aspects to deal with the co-ordination of diverse capabilities among local producers. In some cases subcontracting does not seem to be a problem. In other cases the firm will help by demonstrating to a producer the solutions adopted by another local fabricator and even displaying the artefacts this one produced. Still in other situations, the setting and keeping of relationships with clients involves the need to train, sometimes with the help of the client, the supplier’s technicians.

Knowledge flows also work in the opposite direction. The possibility to access the producers' experiences (both by their involvement in the Technological Centre and especially that acquired in the context of direct relationships between producers and other clients) is seen as very important for learning solutions and technical developments in the design and fabrication of moulds. Nevertheless, the (selective) connectivity of relationships between clients and fabricators ***via*** TEC and, indirectly, with the relationships of fabricators with still other clients is a source of concern for some of TEC's clients. They worry that their competitors may access solutions disseminated by TEC with various local producers

Since the early 90's some firms, specialised in moulds design, were created. TEC´s growing emphasis on the conception of solutions and reduction of delivery times, led it to actively promote the creation of those firms who design the details for moulds. These design "cabinets" are, in turn recommended by the focal actor to the fabricators he subcontracts, so that they themselves benefit from the existing knowledge about each of the specific projects, as they facilitate the integration of the contribution from various fabricators.

5. Concluding Remarks

Our study about MG supports what other authors have referred to be practices facilitated by spatial proximity between firms in industrial districts, associated to the emergence therein of economic and non economic relationships. A 'common language' has been developed and shared throughout the historical process at MG: creation of firms by spin-offs, frequent subcontracting, rotation of technicians among firms, activities of the technological centre and more or less systematic realisation of events. The emergence of this network of relationships supports and is fed by processes of mobilisation for bilateral and multilateral actions. However, looking at industrial agglomerations with an emphasis on the dynamics of knowledge and interactions between actors, highlights other aspects:

First, the relatedness between the benefits of agglomeration and the emergence of connections between local actors should not underrate the importance of the interdependencies (connectedness) between the relationships internal to the district and those external to it. If small local producers only worked as mere subcontractors for the intermediating firms (or to provide for the needs of larger firms), without direct access to final clients, then their horizons would be much shorter and the relationships among firms *within* the district would probably be of a very different nature. In fact, part of the variety in local capabilities and learning can be traced to the existence of direct relationships between producers of moulds and final clients.

Second, even in an industry where ‘everyone knows everyone’, firms diverge in the ways they combine their direct and indirect capabilities and, in these, on their links of similarity and dissimilarity. This is an additional dimension for local diversity that the IB and TEC cases illustrate, as they very existence represent alternative solutions to deal with access to, diffusion of, and co-ordination of capabilities in the industry. Both firms seem to have important roles as “gatekeepers”, but they act differently and they differ in the nature of their relationships with other local firms. Despite competing for clients, at least for some clients and, in a limited extent, for access to/as other local firms, people in both seem to share the perspective that they need each other for joint actions and may need each other again sometime, for whatever reasons, in a future they cannot foresee. Besides, looking at both firms. Especially at their historical and current practices and modes of relating with others, spatial proximity can hardly be seen as irrelevant for their trajectory with respect to capabilities and internal and external organisations. Relationships with other local firms run deep in the case of TEC, because its dynamics is intimately associated to relationships with external clients, and these involve permanent adjustments on the ways its local counterparts capabilities are connected. Diversity of interests and capabilities at this level generates room both for the entry of new firms and for existing firms to explore new lines of development (Best, 1999). In IB’s case, in contrast, any developments in its portfolio of clients do not easily impact upon other local firms, at least directly. Such effects may be felt mostly via the Technological Centre, as it was illustrated with reference to the techniques for rapid prototyping, inasmuch as other firms are called in to participate actively on the issue or services or training are provided.

In short, it may be said that the understanding of what is apparently a healthy dynamics in the local industry between homogeneity and heterogeneity, seems to be closely associated to the existence of diversity on the ways the various firms are embedded in connected relationships which tend to be counterpart specific. The case of MG seems to support the perspective that the relevance of spatial proximity for learning in the industry depend partly on systematic interaction and dynamics on forms of interaction among the specific parties involved, and on the connectivity between relationships at the level of each local firm.

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