The Role of Relationships in the Development of Firms' Capabilities:

Evaluating and Acting on a Portfolio of Customers

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Abstract

The concept of connectivity between inter-firm relationships underlies the network view of markets. Dyadic relationships are partly counterpart specific and affect each other. It is usually stressed, within the industrial networks approach, that the heterogeneity of relationships and their specificity are a source problems and opportunities for management (Håkansson and Snehota, 1995). In this context, we can expect that setting priorities between relationships should be one of the central issues for managers to influence their firms' trajectories. In this paper, we discuss this issue considering two inter-related dimensions of firms' trajectories: the counterpart/relationship dimension and the production system (activity & resource) dimension. Changes in both dimensions and development of capabilities make sense in a temporal context. Therefore, we conducted longitudinal case studies of producers of moulds for the injection of plastics, analysing how their contrasting trajectories in terms of product specialization can be related to how variety was used and learned in both dimensions. Our study suggests that the relevance of the interdependencies and variety found within a set of relationships should be seen in the context of firm's idiosyncratic capabilities, which include their interpretations and experiences in using and influencing variety. Awareness of this could be important when managers evaluate the composition of their firms' portfolio of relationships with customers and act to influence its evolution. This is also important because its may propagate and impact on the firm' relationships with other direct and indirect counterparts.

1. Introduction

The rejection of the perspective of firms as atomistic entities operating in a faceless environment, may be traced to Richardson (1972), published thirty years ago. Richardson argued that firms are not islands of planned co-ordination in a sea of market relations. Rather, they interrelate in a dense network of relationships. It is interesting to note that inter-firm relationships as a coordinating mechanism for economic activity acquired theoretical visibility when focus moved from products to activities and capabilities. Hence, the organization of the industry deals with the coordination and development of firms' capabilities (Loasby, 1998a, 1998b).

The concept of network of (inter-firm) relationships, in the IMP tradition, is based on the

notion that relationships are connected. No business is an island (Håkansson and Snehota, 1989). Firms are viewed as embedded in a network of connected relationships inasmuch as each relationship, or dyad, exists in the context of other relationships. The development of a relationship may affect and be affected by other directly or indirectly connected relationships. Thus, connectivity is a central feature of the industrial networks view of markets (Axelsson and Easton, 1992; Håkansson and Snehota, 1995; Ford et al, 2002).

As each relationship is partly specific to each counterpart, it is usually stressed within the industrial networks approach that the heterogeneity of relationships and their specificity are both a source of problems and opportunities for management (Håkansson and Snehota, 1995). Managers have to deal with each relationship and also to consider the existing set or portfolio of relationships. This portfolio is a complex system where evolving interdependences or specific connections may matter. One implication of this perspective is that the industrial networks approach to business-to-business marketing excludes the conceptualisation of a portfolio of customers as independent firms and/or dyads (Gadde e Snehota, 2000).

Some efforts were made to open the 'black box of connectivity', for example by representing interdependencies between relationships as neutral, positive or negative (Ritter, 2000). But, as Ritter put it, "most companies operate in a changing environment and there is [the] need to manage change within and through relationships" (Ritter, 2000, p. 326). Also, connections among firms cannot simply be seen as positive or negative (Anderson et al, 1994) and often these signs are entirely a matter of interpretation (Anderson and Narus, 1998). "Creative visions" of networks may matter for a firm's strategy (Axelsson, 1992). The analytical distinction between, on the one hand, relationships as governance mechanisms, on the other hand, and activities and resources at the level of production system (Johanson and Mattson, 1992) is partly based on the notion that "actors have intentions, they make interpretations of conditions in the industrial system and they act" (p. op. cit. 205). Thus, it is argued that interdependencies between firms' network positions are also of a subjective nature (Johanson e Mattson, 1992).

In this paper it is suggested that one way to address the issue of connectivity in the context of the portfolio of relationships of a firm is to relate variety at that level with the use and

development of particular capabilities. In particular, we will focus on how variety within sets or portfolios of relationships of a firm may be related with its specialisation in terms of products. This is done in the next section by combining the view of firms as embedded in networks of relationships with the notion that products and activities are manifestations of capabilities (Richardson, 1972; Loasby, 1998a).

Sections three and four present the contrasting cases of two firms, both of which operate in the industry of moulds for the injection of plastics, and on the same location. This is an interesting industrial context because moulds are made to order and the activities involved in designing and producing them are often customer and order specific. Both cases are discussed in section five in order to illustrate how the variety found in the firms' portfolios of relationships can affect and be affected by their capabilities. The differences between both firms, concerning their specialisation at product level, cannot be understood unless one takes in consideration the evolution through time of their respective portfolios of relationships and, in particular, how each one "managed" to use and affect variety at that level. This study supports the notion that the relevance of the variety (or heterogeneity) found in the particular set of relationships of a focal firm should be seen in the context of its idiosyncratic capabilities, which include its interpretations and experiences in using and influencing that variety.

2. Connectedness and capabilities: relating relationships and production system

The notions of connectedness and capabilities are interrelated and make sense within a temporal context. Connectivity is an emergent property of industrial networks, which manifests itself through a dynamic (rather than static) structure involving firms and relationships. When the time dimension is given consideration, learning matters because actors are assumed to strive with limited and incomplete knowledge about activities, resources and relationships (Håkansson, 1987). As Dubois (1998, p.121) puts it, "neither firms, activities or resources can be regard as 'givens' when firms interact".

Considering the time dimension does have some implications for the analysis of the dynamics in the portfolio of relationships of a firm. Firstly, since actors' knowledge and interpretations change over time, so can change the very dimensions deemed relevant to evaluate the

connections between the relationships that make up the relationships portfolio. Secondly, the consequences of actions addressed to that portfolio or to the production system (Johanson and Mattson, 1992) may lag and be difficult to anticipate. Uncertainty may be irreducible both in the specification of the desired outcomes and in the adequate processes to achieve specified outcomes. Awareness of this can be particularly important when firms consider the adoption of some technologies, as some innovations may impact in unexpected ways their activities and resources and on their other relationships. For example, the adoption, or rather adaptation, of ECR (Efficient Consumer Response) technologies by some firms started with pilot projects at dyad level, which expanded gradually to include other connected relationships (Tsoukas e Araujo, 2000).

When introducing time, history also matters. It can be difficult to change a path-dependent pattern of development because the establishment and development of relationships with other firms may involve various kinds of investments (Araujo and Easton, 1996). The network of relationships in which each firm is embedded is a major force, locking-in the firm in specific trajectories. However, trajectories are not deterministic and firms may use the experience gained in some relationships to change other relationships (Araujo and Easton, 1996). The extent to which knowledge acquired in some relationships may be re-used also seems relevant to portfolio analysis, as some counterparts may have been treated in a rather unique way, involving specific investments in adaptations (Ford, 1982, Anderson and Narus, 1998). In extreme cases, the relationship between two firms can be so central to one of them that its trajectory to a great extent reflects the story and the dynamics of that relationship (Håkansson e Snehota, 1995).

At dyadic level, stability on some dimensions of the relationship may enable or create room for change in other dimensions (Mattson, 1984). Likewise, at the portfolio level, firms need to combine homogeneity with variety. As Dubois put it "if the whole operation of a firm is seen as encompassing an activity and a counterpart/relationship dimension, specialization can also be carried out in the relationship dimension" (Dubois, 1994, p. 136). Thus, the view of firms as having two inter-related dimensions, one concerned with their activities and resources and another with their counterparts or relationships (Johansson and Mattson, 1992; Dubois, 1994, 1998), accommodates the possibility that focal actors may also appreciate the relevance of

connectivity, or combining of homogeneity and variety, in terms of its impact at the production level (activities & resources). In particular, specialization within the relationship dimension "implies that concentration to a few counterparts, with a high degree of similarity in their requirements, which may entail possibilities to obtain a high degree of resource sharing, may enhance the firm's efficiency both in terms of cost reductions and of values that can be created for its customers" (Dubois, 1994, p. 137)

This perspective is consistent with a view of firms and inter-firm relationships as mechanisms to coordinate closely complementary activities or capabilities[1]. Also it allows focusing, not only on the activities and resources dimension as 'givens', but also on the issue of how the knowledge, experience and skills of the firm are developed and confronted with problems and/or opportunities perceived as relevant. As Loasby (1998a) suggests, it would be expected that the involvement of the firm in new activities be associated with a real or perceived similarity of such activities to those it already carries out, similarity being defined with relation to the evolution of the firm itself and the variety of its experience over time (op. cit., p. 153). This, however, does not exclude surprises. For example, the firm's involvement in new activities may result from these being wrongly perceived to require capabilities similar to those the firm already holds, to later disillusionment.

Firms may differ in terms of their postures and capabilities to deal with diversity in their portfolios of relationships given the variety each one has experienced in that respect over time, *i.e.* firms' previous experience in terms of relationship variety may influence their interpretations about which interdependencies among relationships are relevant at any one point in time. This includes, for instance, the possibility to mobilise suppliers to deal with diversity in their relationships with clients, thus affecting the very micro dynamics of the network (Easton and Araujo, 1997)[2]. Thus, the degree of similarity in the requirements of their clients may matter in the context of existing capabilities, including those related with the

[1] Products and activities are manifestations of capabilities, developed through time and whose nature is partly tacit (Richardson, 1972; Langlois and Robertson, 1995; Loasby, 1998a).

[2] In fact the issue of the degree on heterogeneity or standardisation may be raised not only in respect of the products but also relative to the ways in which clients try to access and combine their own resources with those from their suppliers (Araujo et al, 1999).

recognition and use of variety, related to the existence of connected relationships and their likely relevance for the activity and resource dimension.

This approach is applied to two contrasting cases of co-located firms operating within the industry of moulds for the injection of plastics. It is an interesting empirical context, as both the moulds and the activities related with their design and production, are unique and customer-specific. This means that at the dyadic level there is at the least the need to coordinate production activities in terms of what and how should moulds be produced and to integrate these decisions with connected relationships.

3. Two Cases from the Industry of Moulds

This section will first look at some aspects of the production of moulds deemed relevant for a better understanding of some of the interdependences between the firm's production system and the set of relationships it holds. In particular, corrections and alterations, which often have to be made on the moulds being built are, in part, a consequence of the knowledge, by nature incomplete, held about the characteristics of the final product and/or the adequate processes to get a specified outcome. Then two cases will help to illustrate on the ground that the notorious difference between the products of both firms can be seen to involve the development of specific capabilities, intimately related with variety at the level of relationships.

Data about these firms and the industry were collected from various sources, including documents about the industry, participations in industry congresses and meetings, and informal meetings. Interviews were conducted in each firm between 1996 and 1998, which were subsequently taped and transcribed. Interviews were not very structured, following just a general outline, an approached that is considered particularly useful when "... highly sensitive and subtle matters need to be covered, and where long and detailed responses are required to understand the matters the respondent is reporting on" (Ackroyd e Hughes, 1992, p. 104).

3.1. The Mould as a Unique Product Specific for a Client

Moulds for the injection of plastics, hence simply referred as 'moulds', are made to order for specific clients. Each mould is generally unique or, rather, a unique combination of standard components like injectors and heating and cooling systems, and non-standard components like moulding surfaces. The production of moulds involves complex interdependencies among several sequential activities for their design and manufacture. Given its uniqueness, the design and building of a mould is often considered in the industry as a challenge. The relationship between a supplier and a client may depend critically from the evaluations made of the supplier's capability both to conceive and produce the mould, and to control costs and fulfil delivery deadlines. One of our interviewees put it his way:

> *Problems may always arise when building a mould and any one activity, which is expected to take 20 hours, can take up to 40 hours. Timely control of the evolution of all steps in production is fundamental to ensure credibility [with the client], to fulfil the delivery times, in the end to guarantee the trust the client gives us when he buys from us.*

Moulds as a product category, vary widely in several aspects such dimensions, tolerances, components interchange ability, production cycle, etc. Likewise, the final plastic pieces obtained from the injection of plastic material into moulds also vary widely in terms of quantities to produce (from some hundreds to millions of units), utilisation context (including light and heat exposure, thermal variations, physical and chemical resistance required), and functional and technical characteristics, including design and dimensions. These plastic pieces are usually moulded by injection by specialist firms, or by the final client but, sometimes, they are injected in the premises of the mould producer. Later they can be combined with other pieces and components to make up some apparatus. Some of the characteristics of the pieces that will be moulded are taken as givens but others can be discussed. Therefore, to the heterogeneity of moulds as a class of products, one may add, as a source of complexity, the need for capabilities to evaluate possible sources of problems and to explore alternative solutions for mould design and production and, sometimes, to consider at the same time adjustments in the specifications of the pieces and the moulds that will make them. A brief outline of the production processes will help to detect some of the areas for contribution.

3.2. Processes for the Design and Manufacture of Moulds

In simple terms, the production process can be said to be triggered by a first enquire by a client to the producer, asking for a quote for a mould, specifying the characteristics and final material composition of the pieces that the mould will produce, the kinds of steels to be used for the mould, the characteristics of the injection equipment to which the mould will be coupled and the desired delivery date. To this the supplier will answer with a technical solution in terms of a sketch, a delivery time and a price. These aspects can be and normally are discussed by representatives from both parts in a search for alternative technical solutions. These interactions often involve direct contact between technical staff from both firms and a variable amount of exchange of technical information.

In the project phase, i.e. final the conception of the mould and its components, consideration is given simultaneously to technical processes and to machining options which, in turn, depend on the characteristics of the steels to be used, the client's preferences in this respect, the functions that the various components will perform in the mould, etc. After the steels with adequate dimensions for the mould have been acquired, several machining operations are started, followed by thermal treatments, which depend on the equipment used for machining. Machining operations of component parts often cause dimensional distortions, which then require rectifications. Next, follow the finishing of the moulding surfaces. These may be demand more or less intensive usage of qualified labour force, depending on the geometrical complexity of the pieces and characteristics of their surfaces. The following operation is the assembly of the mould, which follows a previously established sequence and includes some standard elements, like injection and cooling systems, as appropriate to the characteristics of the mould and the circumstances for its usage. After this first integrated evaluation of the quality of the preceding activities, the mould coupled to injection equipment and tested, be this in the premises of the producer or elsewhere in another firm, taken in consideration the characteristics of the client's injection equipment and production circumstances. The testing of the mould allows the fine-tuning of several of its parameters and of the injection equipment's, the collection of data about the behaviour of the plastics during injection, the evaluation of finishing and other specifications of the pieces, etc.

3.3 Corrections and changes: the Testing of the Mould and the Pieces as a Test of the Capabilities of the Parts

The results of testing a mould are somewhat uncertain. Existing knowledge may be insufficient to anticipate the behaviour of the mould and the plastic inside. Hence, the test may be a point of departure for a re-design of the mould and further machining on it. If a mould does not produce pieces with the specifications or at the rate desired by the client, then this starts a process of successive approximations. Non-conformity with specifications will result in additional operations for ***corrections***, whose costs are at the expense of the producer, and possibly in an extension of the delivery date and postponement of the payment by the client. In this situation, capabilities developed in previous projects, which may show some similarities with the current one, may help to reduce the chance of unexpected results, i.e. the need for corrections. In extreme cases, a deficient evaluation of existing capabilities relative to the specifications of a desired piece may lead to the late conclusion that the pieces **cannot** be obtained by moulding, with dire consequences for the firms involved, especially the producer.

Otherwise, the results of the tests may induce the client to make ***changes*** in the pieces. This means that there is some uncertainty on the part of the client regarding the final characteristics that the pieces should have and/or how should they operate in articulation with other parts. Be it for aesthetic or functionality reasons this may happen either right after the client receives the test pieces produced by the mould or after a variable period of time during which the test pieces, made in the premises of the mould producer, are tested in real life operating conditions. In these cases the additional costs from changing the moulds will be charged to the client but, same as before some components will have to be re-designed and the mould returns to the production lines. In extreme cases the mould producer will do the moulding of all the pieces the client will use. That's what happens if the client firm carries on ordering further changes in the moulds, between batches of "test" pieces that it mounts, uses and tests on the systems for which they are intended.

Corrections and ***changes,*** besides having important financial consequences, can significantly affect the flows of production activities. Thus, they can increase or create additional difficulties in fulfilling the delivery dates for moulds ordered by other clients. In this respect,

both producers and clients see relevance in efforts aimed at reducing the uncertainties from which corrections and changes seem to derive.

Corrections and changes are but one of the motives for the co-ordination of closely complementary activities (Richardson, 1972). An order from a client can include several moulds, which may be technically interdependent in various ways and in different degrees, provided that the resulting plastic pieces are also interdependent. Besides, all or nearly all production activities may involve various Manufacturers, be it due to the client's so demands or to the initiative of the main producer itself, confronted with the need to fulfil strict deadlines and/or to access specific capabilities, e.g. the polishing of moulding surfaces. Thus an order can involve various firms, specialised or not, beside the producer and the final client, for example, other producers, engineering or machining firms, trading firms or even the local Technological Centre. Thus, the consequences of corrections and changes can propagate well beyond the dyad.

4. The Famolde (FAM) and Somoltec (SOM) Cases

FAM e SOM were created as moulds manufacturers in 1982 and 1979, respectively, both of them in the district of Marinha Grande (hence referred to as MG) in Portugal. Both of them, like most local firms, started out designing and producing moulds with very diverse characteristics for a variety of final clients (clients from various industries, geographical locations, sizes, etc.), mostly intermediated by engineering and/or commercialisation firms. In 1997, FAM and SOM, employed 60 to 70 workers each, both had nearly the same volume of sales about € 3 million each, and both exported more than 90% of their productions.

Still, FAM and SOM differ in several aspects, most obviously in their degree of specialisation in terms of product. FAM can be seen as one of a small group of "specialised" manufacturers with specific capabilities for the design and production of very small technical moulds. In contrast, SOM, like most local firms, is seen as a generalist firm, able to produce an ample

range of moulds, mostly of average size but diverse in terms of technical complexity [3]. As one might expect, both firms show important differences in terms of their internal tangible resources, the most visible being the sizes and precision of some of their equipments. At another level, both these resources and the different technical tolerances acceptable for their products, affect their mould design and production activities.

Finally, both firms differ substantially regarding the number of clients in their respective portfolios, 6 for FAM and about 30 for SOM, and their level of subcontracting from other local firms, be them mould manufacturers or firms specialised in specific tasks in the production processes. However, a clearer view of both firms trajectories and the differences between them can be obtained if we take in consideration aspects such as the evolution of their portfolios of relationships and the interdependencies between that evolution and the dimension of their resources and internal activities.

FAM: to keep specialised with and for clients who "know" well what they want

FAM's trajectory and in particular its specialisation in the production of highly technical small sized moulds comes intimately associated to a very reduced number of clients and relationships. In 1997 FAM had just 6 clients with whom it established relationships from its early years of activity. The firm started its activity working with a few final clients and some engineering and trading firms, as most in the industry did. However, one of its initial (and current) clients presented, from start, some very specific product requirements. This client needed pieces intended for cosmetics casings. The design and manufacture of the moulds for these pieces were subject to very specific demands, especially regarding the finishing of the pieces (and their moulding) surfaces and the strict tolerances for the articulation of the very small components of the pieces.

The capabilities that FAM developed in the design and production of those moulds were determinant for it to gain a first trial order of moulds from the manager of a German firm (DL)

[3] Technical complexity is generally seen in the industry to depend on the number and types of components in the mould, articulations among components and their interchange ability, dimensional tolerances and geometrical shapes.

who in 1987 was visiting mould producers in the district of MG. DL needed moulds to produce very small pieces for the electronics industry, much smaller than those FAM was used to. The client demanded, among other aspects, interchange ability of the pieces and even moulds components, with very strict tolerances in the specifications. The relationship with the DL client developed and deepened trough time, reflecting a mutually high degree of priority. FAM became DL's only mould supplier and pledged not to sell moulds to any of DL's competitors. One of the most notorious aspects in this mutual commitment concerned the acquisition of equipment from an early phase of the relationship:

> *"(...) We had made those [first] moulds with much difficulty because the right equipment was not exactly that [which we had]. But we had to opt... so [we acquired] Swiss machinery, small and very accurate, all like watch makers' to do things with much precision, and we grew used... the pieces [required by customers] always evolved and we kept accompanying".*

One of the consequences of such developments in this relationship was that some of the then clients, especially intermediation firms ceased to be "attractive":

> *"We no longer had the methods or means to do the work they asked. Also, they did not look for these [precision moulds] markets because there was no tradition for these in Portugal. Later they came up with this kind of pieces but we no longer had [spare] capability of response, because I have a client [DL] who takes up all our work.*

FAM's growth has been associated to DL's growth. DL has set up new factories and it currently has facilities in Germany, Switzerland, India and China, in order to supply electronic modules to several firms, like Siemens, Philips and Gründig.

There are such tight links between the activities of these two firms that any quality or delivery time problems, concerning either moulds or pieces, can have significant consequences on the relationships between DL and its own clients. Normally, FAM designs and manufactures three identical moulds for each order, two of which will operate inserted in two lines of production and assembly, while the third mould is kept in reserve in case problems arise. The relevance of these interdependencies is also patent on FAM's high availability to do all necessary changes to deal with unexpected requirements from its client. Sometimes it is necessary to deliver new pieces at very short notice to DL's clients or to some industry fair. In these cases, before it produces the triplicate moulds, FAM designs and manufactures prototypes moulds in order to produce a small number of pieces, which it does itself on injection equipment it purchased following indications from its client DL.

Beside this client that fills up 60% of its installed capacity, FAM as lasting relationships with five other clients, seen as sharing several of DL's characteristics. The relevance of these relationships for FAM shows on its extreme care when evaluating any potential client. In general it seeks to maintain the degree of diversity in its portfolio of relationships at a level considered adequate to the maintenance and development of its existing relationships and the capabilities that support them. The question is not only in terms of the characteristics of the products, i.e. only to accept orders for moulds with levels of sophistication and exigency comparable to those that it produces for its current clients, although this is seen as clearly relevant not to jeopardise its practices and internal routines, hence its capabilities. Another, equally important, aspect is the perceived need to keep a portfolio of relationships, which is relatively homogeneous in terms of practices involved.

Two particularly stressed aspects are the informality of existing relationships and the processes for the design and development of the pieces. The first one has to do with the unavailability of the firm to provide formal guarantees, to sign very elaborate contracts or to "waste" time in frequent interactions concerning price negotiations. The second aspect has mostly to do with the demand that potential clients be able to provide clear specifications for the pieces they require. Processes of successive approximations for the design of the pieces and definition of specifications, i.e. ***changes*** – see above, are seen as sources for instability on the flows of manufacturing activities that may impinge on the relationships with current clients. This unavailability for unexpected changes did show on the appreciation made about a recent experience with a client from the automotive industry:

> *"The moulds [for this client] are made fast. But then they start to ask for pieces for this and that. Small changes keep on arising and they keep the producer busy… [Relationships with these firms] are deleterious. I am not interested [in them]. You see, for these moulds to Spain I went four times to Barcelona and had to send a technician there twice.*

Most demands from FAM's six major clients are provided for internally, sometimes through adaptations in its internal activities and resources. It very seldom and punctually resorts to subcontracting, mostly for a first hewing the steels and/or to fulfil delivery times. Preference is nevertheless given to firms created by former FAM's workers, perceived as having capabilities similar to those of FAM itself and acceptable levels of precision.

SOM: pursuing specialisation – seeking to "manage" variety in its relationships portfolio

SOM is a "full cycle" manufacturer, such as FAM. Except for Hasbro, one of the largest toy producers in the World, its other three initial clients were mould engineering and trading firms located at MG. Currently, SOM produces an ample range of moulds for some 30 clients most of them from a variety industries in the EU. Up to 1985 a great deal of its moulds were destined to clients in the USA, but since then an increasingly larger number of its clients is located in European countries, which had important consequences for SOM's operating practices:

> *"The proximity of the European client brings in the habit and obligation to work as if the customer were always present. The American client, despite being demanding in delivery times, accepted longer terms. We began working with very short terms, the client started showing up with many more demands than the American client used to. [American clients] were very much [moulds] for toys. Although toys were almost a technical piece, still they were [technically] less demanding.*

In the meantime two of the initial three local engineering and trading customer ceased to be regarded as interesting both for the kinds of moulds they wanted and for their excessive emphasis on price. Still, SOM's trajectory since 1985 can be characterised as seeking to deal with, and more recently to counter, the "excessive" diversity found on its portfolio of relationships with clients. Its clients differ significantly among themselves in many respects: delivery times, moulds sizes and complexity, processes for the design and development of the plastic pieces, availability to involve SOM technicians in those processes, price sensitivity, and regularity and variability in their order sizes. Corrections are frequently needed, with disruptive consequences in production sequences and delivery times, which is seen as caused by the excessive variety in the orders taken, regarding the technical specifications of the moulds.

> *"If a technician who is trained to do smaller moulds requiring more precision has to alternate with larger moulds, of less precision he ends up loosing his sensitiveness for precision."*

The processes of design and development of pieces adopted by some clients demand high availability from the firm to deal with frequent ***changes*** both on the pieces and the moulds, as a requisite for the continuation of those specific relationships.

Especially between 1990 and 1995, when the industry faced a critical period of general reduction of demand and some more price sensitive clients changed suppliers, SOM's

managers agreed to deliberately counter the diversity found in their client portfolio. They sought to reduce product heterogeneity and especially to reduce the variety in the sizes, tolerances and technical complexity of the moulds. A restraint on the consequences of frequent ***corrections*** and ***changes*** to moulds is seen to require deepening relationships with some clients and discontinuing others, while increasing the firm's capabilities in designing and manufacturing a narrower range of moulds. However, pursuing this policy has been neither simple nor easy. Some experiences with new clients were not successful, both at the level of the relationship itself and due to possible negative effects beyond the dyad:

> *"**…** During all the process that takes place along the way, we will see what does work and what does not… We have to see how the client talks with us, what we can expect in technical terms about the way he can contribute to the development of the mould, whether he answers our questions, whether he understands the process, whether there are chances for more work or is was just a couple of moulds awarded to us just for the price (…) we give a suggestion and [some clients], for lack of knowledge – it does not mean we are always right – do not take it. But then we will have to introduce changes on to the mould and we go back to square one. We find out that they are not competent for technical discussions and that does not give us any guarantee for continuity…and we are still blamed for delaying their mould!"*

The volume and rate of orders can vary substantially either because the relationships between the parts are not sufficiently developed or because some of SOM's customers' clients vary substantially their investments in moulds. The client may order 40 moulds on any given year and only 5 on the next year, or even not to put any orders for a period of time. This situation has forced SOM to keep relationships with clients whose orders include the design and manufacture of moulds that counter the firm's intentions to restrain the heterogeneity of its produce:

> *"Sometimes we recognise that a piece is not adequate for our firm but possibly there are no other works to do, we have to grab it."*

Any way, the firm has sought to develop its relationships with client firms seen as having the potential to order several moulds on a regular basis. The efforts have included the pursuit of a better acceptance, especially from current clients to a more active involvement of SOM's technicians in the design of the pieces. Besides other potential benefits, it is expected that this will reduce the need for later changes to the moulds.

In order to reduce mould ***corrections***, besides the expected beneficial consequences from a reducing the heterogeneity of the types of moulds taken as orders, SOM started in 1996 a

project with a technological centre aiming at interchanging and creating knowledge about the behaviours of plastics and steels. A better understanding about the behaviour of injected materials may result in less need for corrections in the moulds. Benefits are also expected from a better understanding of the steels. There is an enormous diversity in the characteristics of steels, but some of the expected benefits will result from changes in the practices usual in the firm, concerning over dimensioning of some components to allow for later corrections, as well as "over-quality" to reduce the chances of failure on the moulds testing and operation phases.

Despite its growing concentration on a portfolio of 15 clients who operate mostly in the automotive and appliances industries, requests can be very diverse even within the same industry. In some cases the pieces projects come in completely defined and in others SOM participates in the process, for example by building three-dimensional models of the pieces. The moulds are frequently used to produce pieces and they are kept in SOM's facilities for relatively long periods until the specifications of the pieces are definitely fixed. ***Changes*** are highly demanding of interactions between the parts but this is seen as intrinsic to the possible approach for the design of certain pieces and for specific clients.

In this context, SOM has used relationships established and maintained over time with a small number of other manufacturers. These relationships have been an important mechanism to deal, at least in part, with the diversity in its portfolio of clients, namely to deal with ***changes*** and ***corrections***. It has been subcontracting out some 15% to 20% of its volume of sales, mostly concerning some manufacturing activities such as polishing or milling, and even the fabrication of whole moulds, following the acceptance or even imposition of the client. Also, the similarity of capabilities between SOM and the other manufacturers, seen as being "of our level" has facilitated access to and exchange of varied experiences in the design of moulds.

5. Comments to the Cases

Both cases support the perspective that the trajectory of each firm could hardly be understood without considering the dynamics at the level of the portfolios of relationships with clients in which each one has been embedded. The cases illustrate how the degree of specialisation of each firm at the product level evolves intimately associated to its capabilities and the ways it

strives to articulate over time the diversity at the level of its portfolio of relationships with the development of specific capabilities.

In the case of FAM, its specialisation at product level reflects a learning process, which occurred in a context where homogeneity and variety are intimately associated to a priority relationship. To some extent, the development of the relationship resulted in the setting of the dimensions for stability, which helped to define the range and the nature of the diversity that the focal firm could accept. It was seen that this level of priority translated in an increased mutual commitment, patent not only on the progressive mutual internal adaptations but also on the relationship becoming a term of reference for the evaluation of other existing or potential relationships, given the firm's interest in preserving or developing its capabilities in specific areas. The extent of diversity on its portfolio of relationships deemed acceptable by the focal firm can be analysed along two interrelated dimensions: the nature of its product specifications and the nature of its relationship practices. The first one points towards a relative homogeneity in terms of sizes and tolerances, inductive of the specialisation of the firm in terms of product. The second one, besides aspects such as regularity and size of orders, as to do with the capabilities of clients to define the types of pieces they need done, avoiding that the frequency and nature of interactions be determined by (more or less unexpected) ***changes*** on the pieces. In this respect, and in contrast with SOM, it is not expected nor is it available to deal with significant consequences on the design and manufacture of moulds ensuing from an insufficient knowledge of the specifications of the desired pieces. The benefits for FAM and its client firms, which result from its specialisation at product level, arise therefore associated to a complex combination of developments at two levels: its portfolio of relationships and its production system.

In short, the FAM case seems to be a particularly good illustration of how specialisation at product level can take place simultaneously and in articulation with specialisation at relationship level. This process was accompanied by the formation, over time, of a framework of reference for the evaluation of its portfolio of clients. Existing relationships seem to have generated the required stability in certain dimensions that allowed variations in other dimensions, *i.e*. they allowed the firm to deepen its capabilities in specific areas while benefiting from the similarity of the requirements from its clients.

The SOM case is particularly interesting in this respect, by reinforcing that perspective, if we have in mind its efforts aimed at promoting changes in two inter-related levels: its portfolio of relationships and its production system. The very dimensions of variety, which were considered relevant, changed over time. The firm has been conducted towards the need to seek reducing the variety found in its portfolio of clients. SOM tried to restrain the need for frequent ***changes*** in the moulds by emphasising a reduction on the heterogeneity of the specifications of moulds, seen as affecting the consolidation of some routines and internal productions practices. This process occurred simultaneously with efforts aimed at a greater participation on the design of the very pieces to be moulded and, provided some of its clients let themselves be persuaded, it is expected that the need for ***changes*** in the moulds be contained, especially those that may result from not having incorporated in an early design phase the firm's available knowledge about the behaviour of components and materials to be injected. In away the issue is to move the ***interaction*** between both parts up to the earlier design phases, and its capabilities to produce three-dimensional prototypes seem to support that movement.

Curiously and contrary to FAM, a greater participation on the design of the pieces to be injected is for SOM an essential development to promote on its relationships with specific clients. This case adds in two interesting aspects. One of these has to do with its relationship with the local Technological Centre. The nature of the requirements from some of its clients seems to have contributed to widening the perceived relevance of actions seeking to develop knowledge about plastics and other materials. This knowledge will not exclude the possibility of ***changes***, but it is means to generate more stability in other dimensions of the relationships, namely the regularity and volume of orders.

The other aspect concerns the possibility of connecting some existent resources that have been created over time, namely its relationships with other local firms. But such relationships are now seen as supportive of the new developments intended for the firm's portfolio of clients. It is recalled that for some of the current SOM's clients and at least for the time being, pieces can only be tested in real life situations and there may always be the need for ***changes***. Some of these changes can be subcontracted to those local related firms. Besides, the volume of orders from some clients can punctually exceed the capacity available. In this context the propagation

of possible negative effects on the relationships with other clients has been avoided by accessing, through local relationships, the capabilities of other producers.

6. Conclusions

This paper starts from the perspective that, given the connectivity between some relationships, the results of the efforts aimed at whichever relationship should be seen as possibly affecting other relationships in the portfolio of the firm and being affected by them. The relevance of such processes for firms was seen by seeking to associate the diversity on the portfolio of relationships with the specialisation of the firms at product level. Differences at this level were seen to reflect both learning and the usage of capabilities specific to each firm, which integrate the relationships dimension with the production system dimension. The cases presented illustrated how differences on the degree of specialisation at product level can be seen to result from different strategies regarding the portfolios of relationships in which the firms are involved, which in turn also reflect their interpretations and capabilities to use and seek to influence, over time, diversity at that level.

It was previously stressed that the context in which agents operate involves complex interdependencies among relationships. The effects of connectivity in relationships can show throughout time and it may be very difficult to anticipate those effects and their nature. Therefore no unique and simple answers can be expected to the question of what should be the diversity of relationships, let alone any prescriptions about the "optimisation" of the portfolio of relationships. This does not mean that firms should be passive or reactive in this respect. The cases illustrate the importance of interpretations, experience and learning to deal with the effects of diversity in the portfolio of relationships. Unfortunately they do not support a mapping of connexions and corresponding measures of predictability. But, as Loasby (1991, p. 49) stresses "...controllability in management is rather easily interpreted in the same way as in standard microeconomics - as requiring complete predictability of every element and individual within the system. What is not controllable is therefore liable to be excluded from the model by which the organisation is managed. But it is not thereby excluded from the behaviour of that organisation, still less from its environment".

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