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A Conceptual Framework for Firm Cooperation and Clusters and Their Impact on Productivity and Competitiveness

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I Introduction

In this chapter we will attempt to develop a conceptual framework for clusters of SMEs, mainly based on the insights of Penrose and Richardson. Building on this framework, we will then move on to examine the effect of clusters on competitiveness, and we will “test” our ideas in the context of a country-wide project aimed to support the creation of clusters in Greece.

II Small firms and clusters in theory and practice

Small firms, including clusters of small firms, are being given an increasing share of attention in the economics literature lately. However, despite attempts to provide a theoretical backing of policies focussing on small and medium sized enterprises (SMEs) and clusters, there is still scope for attempting to provide an integrative conceptual framework to inform and/or improve policy on SMEs and SME clusters. In what follows we will attempt to sketch the basis for an integrative conceptual framework on clusters of SMEs (and importantly the inner workings of clusters), mainly based on Richardsonian and Penrosean insights.

We begin with a general discussion of SMEs and clusters. SMEs are usually defined according to the number of employees, although there are countries which also take into account some financial indicators, the sector of activity, and/or the percentage of shares held by other enterprises.[†] However defined, there are considerable differences

* We are grateful to Roger Sugden and Jamie Wilson for comments and discussion. We are also grateful to a large number of managing directors of the “clusters” we examined.

[†] For detailed SME definitions in many countries, see Asia-Europe SME Conference (1998). For an overview see Bianchi and Tomasso (1998: 11-12). Here we adopt the definitions set by the EU, which identifies three categories of SMEs: medium-sized (50-250 employees), small (10-49 employees) and micro-enterprises (1-9 employees). Small firms’ turnover should not exceed €10 million, and that of medium-sized ones should not exceed €40 million. Further, the firms should meet the independence criterion, i.e. no more than 25% of their equity should be held by non-SMEs (see, for definitions, data and more details, Capaldo et al. (1998) and <www.europa.int>).

among SMEs. There are differences in, among others, the market reach of SMEs (local vs national vs international); the “atmosphere” within which they operate (declining regions vs innovative and continuously improving regions); and the state of technology and product life-cycle (traditional sectors/saturated markets vs high-tech /fast changing sectors).

What accounts for SME size? You (1995) is one of very few providing a survey of small firms in economic theory as an attempt to pinpoint the basis of a theory of the determinants of (small) firm size. He suggests that available neoclassical, transaction costs, industrial organisation and evolutionary models each provide useful insights on the determinants of size and the size distributions of firms in an industry or an economy, and also on inter- and intra-country differences.

Based on insights from all these models, You (1995) proposes seven factors that would account for small size and, consequently, the growth of the small firm sector in an economy.

1. *A structural effect.* That is, deindustrialisation or expansion of the service sector may result in a large share of small firms in an economy.
2. *A macroeconomic effect.* That is, the small firm sector is more likely to expand during economic downturns.
3. *A change in technology.* A reduction of the necessary minimum efficient scale, or the reduction of asset specificities (dedicated assets), will tend to favour smaller firm size.
4. *A change in the market environment.* For example, an increase in uncertainty facing firms will increase returns to flexibility, thus (as small firms tend to be more flexible) will increase the share of small firms in an economy.
5. *A change in the factor markets.* The small firm sector will increase with an increase in available funding or finance for them.
6. *A change in tastes.* That is, a shift of demand towards more sophisticated products will increase the available “interstices” for small firms in the economy.
7. *A change in the strategies of large firms.* For example, high pricing strategies or restructuring of firms increase the available “interstices” in the economy for small firms.

You, however, fails to consider transaction costs and/or resource-competence related factors, which may also be of relevance, see below. Policy interest in SMEs can be more fully explained by considering the advantages associated with small firm size. To name but a few, small firm size is associated with increased flexibility within the economy.[‡] They are considered more suited to meet continuously changing demand conditions. SMEs have been associated with the potential for increased

[‡] In downturns, or during demand fluctuations, SMEs may serve as a cushion to larger firms that subcontract part of their production process to them. Therefore, it may be crucial for some SMEs to employ flexible labour practices in order to survive. See Lucas (1978) for a mainstream treatment supporting this, as well as Piore and Sabel (1984) for their emphasis on small firm flexibility as a survival determinant in the face of increased uncertainty. See also Richardson (2003) on inter-firm specialisation in the economy and the importance of general purpose intermediate products.

innovativeness. SMEs also account for a large amount of total employment in the economy. They may also provide a seedbed for the creation of larger firms in the future.[§] Further, small firm size allows a more democratic process of decision making by firms and avoids the problems of practices exercised by larger corporations (e.g. divide-and-rule practices, abuse of market power), see Pseiridis (2001) for an extensive account.^{**} Deindustrialisation processes, taking place especially in countries mainly dominated by large (multinational) corporations, such as Britain and the USA, and the emergence of “new competition” (Best, 1990), may question the long-term prospects of development based on a focus on large (multinational) firms.^{††}

The above help explain why policies with regard to SMEs, co-operation and clusters have recently become an essential part of an industrial development agenda, notably within the EU. However, arguments for support of SMEs, and especially clusters of SMEs, are still rather impressionistic, they do not derive from a coherent conceptual framework.

In what follows we will attempt to point out relevant difficulties in relying on traditional economic theory for the creation of a conceptual framework for clusters.^{‡‡}

First, mainstream neoclassical theory does not seem to accommodate positive insights/connotations on firm co-operation and clusters other than co-operation as collusion. Industrial Organisation (IO) literature is basically concerned with market power (and the associated monopoly profit associated), and strategies of incumbent firms in imperfectly competitive market structures to maintain that power. It is less concerned with the process of jointly setting and improving conditions for efficient production or for effective innovation-led profitability and growth.

[§] Penrose (1959) calls “interstices” the small segments of a market where the entrepreneurs see and are able to exploit productive opportunities, see also Penrose (1959, 1996) on limits to size. Best (1990: 207) suggests that the rate of creation of new firms, especially those which emerge in response to Penrosean interstices within an industrial district, is an index of the district’s dynamism and health. For an account on firm growth, on the process of concentration, and on the opportunities for smaller firms in the upswings of the business cycle, see Penrose (1959: 215-265).

^{**} For a number of case studies on firm practices, see Martin (1989) and Crystal and Lipsey (1997). Also, a lot has been written on “competitive bidding” of governments to attract TNCs, a game played among uneven participants, see Pitelis (1994) for an overview and also Cowling and Sugden (1994; 1999). See also the Chapter by Gilly and Perrat in this volume, where they discuss the intricate governance dynamics that occur between local and global territorial scales. See also Sugden (1996) and Cowling and Sugden (1999) on multinational webs (defined as webs of smaller firms which cross national borders), and also Bianchi and Tomasso (1998: 18-24) on the importance of “openness” and transnational networks.

^{††} On deindustrialisation and relative economic decline, see Singh (1977), Blackaby (1979), Bluestone and Harrison (1982), Martin and Rowthorn (1986), Rowthorn and Wells (1987), Pitelis (1993), and *The Economic Journal* (1996, 1997). It is argued that industrial development based on large firms may contain inherent strategic failures relating to the number asymmetry between people taking decisions and those affected by them (Cowling and Sugden 1994; Sugden, 1996; and Cowling and Tomlinson (2000), for the case of Japan). For a related discussion of strategic failure, in the context of ‘clusters’, see also the Chapter in this volume by Sugden *et al.*.

^{‡‡} Similarly to Sugden *et al.* in chapter XX, we take clusters as a broad category which includes industrial districts, inter-firm networks, Japanese industrial policy cartels, webs, or related institutions, such as industrial parks, etc..

Interestingly, there are some seeds for a conceptual framework on inter-firm co-operation in the transaction costs approach. In Williamson (1975), for example, there are four alternative ways (governance modes) of efficiently organising/co-ordinating transactions; the firm (unified governance), co-operation (contractual governance or “promise”), planning, or market. The nature of each transaction defines the appropriate (most efficient) governance mode. Thus when opportunism is absent, inter-firm co-operation emerges as the appropriate firm choice, and trust gains importance as a determinant of mutual firm success.^{§§}

Importantly, some SMEs seem to operate alone (i.e. carrying out the full set of activities needed for the production of their “final” product), while others may be linked, by one way of co-operation or another, with other, small or large, firms, effectively being a part of a co-ordinated chain of activities, in some cases also providing some or all of the co-ordination needed for the production of a “final” product. Researchers seem to acknowledge that horizontal or vertical linkages between firms and the existence of collocated “neighbouring” sectors are important contributing factors to firm and regional competitiveness, see e.g. Porter (1990; 1998a; 1998b), Pouder and St John (1996), Tallman et al (2004), Inkpen and Tsang (2005). This idea has spilled-off to the policy makers. Thus support for SMEs has been extended, especially during the 1990s, to encompass support for the creation of linkages and agglomerations of (mainly) SMEs, as a way to create and maintain competitive advantage for participating firms and regions.

Various terms and definitions have been used to describe this phenomenon of agglomerations of inter-linked firms (e.g. clusters, industrial districts, innovative milieux, etc.). Each of them seems to provide interesting insight on specific aspects of this phenomenon. Here we adopt the term “clusters”, defined as follows, which we believe embraces all the elements that are important for our description and analysis:

“Clusters are agglomerations of firms in a particular activity, usually with a geographical dimension, with horizontal and (preferably also) vertical intra- and (preferably) inter-sectoral linkages in the context of a facilitatory socio-institutional setting, which co-operate and compete (co-opete) in (inter)national markets.” (Pitelis, 2001).

The potential advantages of clusters vis-à-vis larger firms has been the object of inquiry of several researchers. This body of literature dates back to Marshall (1920) and especially his treatment of the industrial districts and the industrial “atmosphere”.

Marshall examined industrial districts as geographically defined (localised) socio-economic systems of production, mainly made up of (specialised) SMEs. It is not necessary that the district has a single specialisation, indeed the existence of multiple fields of specialisation can be essential in living through crises as well as an engine for progress. Most importantly, successful industrial districts have, by virtue of their openness and adaptability, the ability to renew their knowledge base, and thus maintain high growth rates.

Marshall viewed the industrial district as greater than the sum of its parts, and highlighted increased specialisation, external economies and collective efficiency as

^{§§} For a detailed analysis of trust, and in particular its relationship with proximity, see Dupuy and Torre in this volume.

factors that are conducive to the industrial district's growth. These factors provide to the district the ability to compete with other forms of (big business) industrial systems. Of central importance to the district's growth are tacit knowledge (which is aided by the type of organisation), interaction of humans, firm flexibility and also social factors, such as the "local spirit" (1920, Book I, ch. 2, pp. 20), industrial atmosphere, need for peer recognition, etc.. In sum, industrial districts, favoured by the existence of external economies and accommodating interactive and cumulative innovation processes, may constitute an efficient industrial structure. Marshall, however, did not fail to highlight the possible threats to the growth of an industrial district, especially the risk of institutional inertia, which may be inherent in a district, and behold the district from continuously adapting to new activities, innovating, outliving radical changes, and generally anticipating the future.

Following a long silence, the academic community rose to the challenge of clusters. Bagnasco (1977) was arguably the first of a series of researchers who attempted to cast light on industrial districts in north-central and north-east Italy as meritable industrial structures.*** Becattini (1979) highlighted a shift of emphasis from industrial sectors to industrial districts (often comprising more than one industrial sector) as units of analysis.

Many contributions thereafter centred on describing and explaining the Italian paradigm of industrial district. Industrial districts in Third Italy cover product areas as diverse as clothing and footwear, ceramic tiles and automated packaging machinery. Of the most extensively analysed regions is Emilia-Romagna, especially because it has the highest per capita income in the whole of Italy, and an extremely small firm size (average of about five workers per firm), see Brusco (1982), Brusco and Righi (1989), and Lazerson (1990) among others.

However, industrial districts of various types abound in much of the industrialised world as well. In almost every part of the world there is a history of rise (and sometimes decline) of industrial structures similar to the Italian industrial districts. The USA, the UK, Denmark, France, Germany, Portugal, Spain and also Brazil, India and elsewhere feature notable examples; see, among others, Piore and Sabel (1984), Sabel and Zeitlin (1985), Schmitz and Musyck (1994), and Pseiridis (2001).

All the above provided extensive descriptions, analyses, typologies, and/or classifications of various observed forms of clusters in various countries. This trend has been embraced by the neoclassical camp as well, with the most notable contributions those featuring a focus on location economics and economic geography (see, e.g., Krugman 1991b, 1998a, 1998b; Audretsch, 1998).

Many typologies of industrial districts have been suggested. One of the most influential has been Piore and Sabel (1984), who examine industrial districts of the 19th and early 20th centuries and argue that these districts shared three mutually dependent characteristics. First, they produced a highly differentiated range of products for regional and/or foreign markets, and they also engaged in constant alteration of their products, partly in response to changing market tastes, partly to

*** Bagnasco coined the term *Terza Italia* [Third Italy], to distinguish the area of north-central and north-east Italy from the south of the country and from the heavy industrial area in the north-west. Third Italy comprises the regions of Tuscany, Emilia-Romagna, Umbria, Marche, Veneto, Friuli-Venezia-Giulia and Trentino-Alto Adige.

shape market tastes and create new markets. Second, the technology employed by firms in these industrial districts could be used in various ways and for various products. Apart from the development and the efficient introduction of new technologies, these districts' vitality has also been reflected in the "...speed and sophistication with which they adapted power sources to their needs" (1984: 31). Third, in these districts, and in order to encourage permanent innovation, regional institutions were created aimed at balancing competition and co-operation between firms.^{†††}

Despite the mass adoption of mass production principles by governments after World War II, Piore and Sabel argue that "flexible specialisation" could re-emerge in our times (1984: 282), and suggest it as a way to deal with economic downturns, unemployment and slow growth. In summary, Piore and Sabel (1984) link the growing needs for specialised and customised products to the need for the adoption of more flexible production practices, highlighting industrial districts as a vital carrier of this flexibility.

Other researchers attempt to give an explanation of clusters emphasising knowledge and learning that takes place within clusters. Malberg and Maskell (1997), among others, suggest that clusters emerge as a response to increasing demand for rapid knowledge transfer between firms. Maskell and Lorenzen (2004) and Tallman et al (2004) argue that clusters are suitable for the creation, transfer and usage of knowledge. Rosenfeld (1997) emphasises a cluster's dynamic intangible characteristics, i.e. flows of information, knowledge and innovation, as well as the importance of its social capital in enabling it to remain competitive through adaptation and diversification. Porter (1998a) argues that (local) clusters provide unique knowledge, relationships and motivation in a globalised economy, and many more features that boost productivity and enhance competitiveness.

One of the basic themes running through the above literature has been that industrial districts seem to both contain and generate industrial dynamism that industrial districts are suggested as alternative ways to sustained growth (see among others, Sengenberger, Loveman and Piore, 1990; Best, 1990; Pyke and Sengenberger, 1992). Further, as many types of industrial districts appear to be viable examples of development hubs in less developed countries as well, the benefits of creating or maintaining industrial districts is thus emphasised as a major objective of industrial policy (Schmitz 1984; 1990; Schmitz and Musyck 1994).^{†††} As a result, policies for the promotion of industrial districts have been proposed, both for developing countries and other less favoured regions (Brusco 1989). An interesting issue is now in which ways the state can, through its policies or actions, support the creation or enhancement of SMEs and clusters.

Brusco and Righi (1989) highlight the role of local government, industrial policy and social consensus for the development of industrial districts. An array of possible roles and actions of the public sector are highlighted. A non-exhaustive list includes vocational training, the provision of real services, and business counselling, (e.g.

^{†††} These institutions were functioning as an industrial policy, see Best (1990: 38). For the case of Springfield Armory as an inadvertent industrial policy, and also Best and Forrant (1996).

^{†††} See also Parrilli, discussing the potential of so-called 'survival clusters' in less developed countries, in Chapter XX of this volume.

Brusco 1992, Brusco and Bigarelli 1997); consent and constructive partnership of state and private sector at local and national level (e.g. Hirst and Zeitlin 1989); the promotion of trust and inter-firm relations (e.g. Humphrey and Schmitz, 1998).

Best (1990) is a considerable contribution, setting this flourishing literature in the context of an emerging type of competition which calls for appropriate industrial policies.

He defines “new competition” as a novel form of competition, based on, and linked to, market-shaping activities as opposed to market-reacting responses. He suggests that the “new competition” can be distinguished from the “old competition” along four dimensions (Best 1990: 11).

- *The organisation of the firm.* The firm in “new competition” is a collective entrepreneur more like Schumpeter’s entrepreneurial firm than the hierarchically structured firm of Chandler and Williamson. Such a firm is characterised by a strategic orientation, Schumpeterian innovation (i.e. innovation in process, products or organisation), organisational flexibility, the promotion and use of collective knowledge, a more flexible organisation of production, an organisational culture of learning and thinking, and the incorporation of learning from doing into improved ways of doing.
- *The co-ordination across the production chain (“consultative co-ordination”).* The “new competition” could be best explained and described as an environment of consultative co-ordination between firms along the production chain. The firms are mutually interdependent in that, sharing problem-solving at a time of rapid technological change gives a competitive lead to all firms in the chain. Further, each of the firms, by specialising in a distinct phase of the same production chain, adds to the problem-solving potential of the whole system. However, this consultative (non-market) co-ordination does not rule out competition. Rather, competition is alive and encouraged between firms but by virtue of a long-term relationship of mutual trust and responsibility, which is ensured by specific social arrangements and norms.
- *The “Sector”: Competition and Co-operation.* “New competition” gives a different meaning to the industrial sector as well. The sector does not consist of identical firms producing homogeneous products and competing on price, as in neoclassical economics. Rather, the sector is compiled by a variety of interdependent firms (each one specialising in a distinct phase of the production chain) and inter-firm practices. Further, the sector comprises extra-firm agencies (such as trade associations, training programmes, joint facilities for R&D and marketing, etc.) and regulatory bodies, all of which aim at promoting and facilitating inter-firm co-operation. Seen in this light, firms in a sector not only compete, but they can also collectively act to shape “the rules of the game” for all the firms, i.e. shape a sector strategy. The challenge is in establishing “means of co-operation that generate common benefits to the firms involved and the *local economy*, without the stifling effects presupposed by the conventional view” (1990: 18).
- *The government and strategic industrial policy.* Finally, indispensable for the “new competition” is the task of industrial (including antitrust) policy. Given the co-operative and competitive nature of firms’ relationships under “new competition”, industrial policy has to administer a paradox. That is, to

promote (a) the (adequate) mix of co-operation and competition conducive to long-term infrastructural development of a sector, and (b) the ability of the firms for constant innovation and responsiveness to new challenges and opportunities (1990: 19).

Drawing on Japan's and Italy's industrial policies, Best (1990: 20) suggests that a successful industrial policy should

- i) use creatively and shape the market;
- ii) have a production as opposed to distributional focus; and
- iii) be *strategically* focused; i.e. target strategic sectors to maximise industrial growth.

A similar view is Humphrey and Schmitz's (1996) "triple-c approach" to industrial policy. In other words, (industrial) policies aiming at the promotion of industrial structures (mainly of SMEs) capable to compete in a "new competition" environment, should aim at the following: First, they should target *collective* benefits, that is, public resources should become available to clusters, not individual firms.^{§§§} Second, they should help firms and clusters to become more *customer-oriented*. Third, policies should aim at cumulative improvements in competitiveness (which may be stronger if the other two factors are already there). This suggests that policies should be carefully designed, long-term, consistent and coherent, and also that strength should be built on existing strength.

To conclude, Marshall has arguably provided a framework to understand and analyse clusters (including industrial districts). Many authors have investigated the phenomenon of clusters, paying particular emphasis to one or the other feature of the Marshallian industrial district, e.g. Brusco (1990). Humphrey and Schmitz (1995) acknowledge that the gains from clustering, especially due to external economies and joint action are already there in Marshall. Sabel and Zeitlin (1985) share with Marshall the role and importance of "industrial atmosphere". Becattini (1979) provides a detailed account of Marshall's ideas on the issue of industrial districts.

Lacking from such a wealthy literature, however, is a conceptual framework for clusters. Lawson's (1999) competence theory of the region is the most integrated attempt to bring together insights from various camps (e.g. Marshallian industrial districts literature; economic geography; competence-based perspective). As firms are defined as bundles of competences in the competence-based theory, social systems can also be defined and analysed as bundles of competences. Lawson attributed special emphasis to *linkages* within smaller units of the cluster (e.g. firms, or public agencies, etc.) and *interaction* taking place within a cluster. He argues that our understanding of clusters and regions, and their dynamics, can greatly benefit from resource-based insights.

We agree with that. On the other hand, however, the resource-based perspective does not seem to explain "why clusters, as a form of co-operation emerges" in the first place.^{****} Richardson (1972) is the only one who provided a resource-based

^{§§§} See also Bellandi in this volume for an analysis of the relationship between clusters and public goods.

^{****} As noted above, we may also trace an explanation for co-operation in the transaction costs perspective, namely in the "promise" contracting process. This perspective, though, takes the transaction as the unit of analysis. But the nature of transactions may change with the change in the

explanation for co-operation, although he did not elaborate on the benefits of, or the conditions for it. In his 1972 work Richardson focused on static efficiency, explaining under which circumstances co-operation within firms is the more efficient way to organise production. He then extended his argument (Richardson (2001, 2003) by explaining how the degree of intra firm specialisation within the economy reduces the costs of adjustment to change. In a way, an economy with small firms is more flexible, thus more efficient in re-allocating resources following a change. In either case, co-operation is viewed as an alternative to market or intra-firm co-ordination. Drawing on Richardson's ideas on co-operation and extending the Penrosean theory of the growth of the firm to (the growth of) clusters, we attempt to move from the (Penrosean) firm to the Richardsonian co-operation of (Penrosean) firms in the following section.

III Towards a Richardsonian and Penrosean conceptual framework for (the growth of) clusters

Penrose (1959) examines the growth (expansion) of the firm. Expansion depends on the *perceived productive opportunity* of the firm. The latter is defined with reference to "all of the productive possibilities that its entrepreneurs see and can (and are willing) to take advantage of" (1959: 31). The latter, in turn, depend on the *managerial services* that are available to the firm.

One of the basic determinants of the quantity and quality of entrepreneurial and managerial services available to the firm is knowledge. Knowledge is generated inside the firm and is used by the firm either for carrying out given activities or for planning and executing expansion, see e.g. Pseiridis (2001). This knowledge is thus essential both in shaping the "productive opportunity" of the firm and (subsequently) planning and implementing its expansion.

At this point we need to examine in more depth the Penrosean notion of knowledge: its generation and its carriers (people working inside a firm). We also need to examine in more detail the Penrosean firm's "productive opportunity" and its inducements to grow. In so doing, we will attempt to show the following. First, that clusters of firms may be seen as an expanded (or quasi) Penrosean firm. Second, and drawing on the previous point, that in cases of activities requiring co-operation à la Richardson, there can be Penrose-type effects within co-operating firms which might be working simultaneously and complementarily with Penrose-type effects within single firms. Third, while Richardson's ideas contribute towards our understanding of the circumstances under which co-operation will be the most efficient option, Penrose's ideas are needed to identify how and why the entrepreneurs are able to understand when the nature of some activities necessitates intra-firm co-operation.

Richardson (1972, 2003) has pointed to co-operation as a third mode of carrying out economic activities – the other two being the "market" and consolidation (hierarchy). He provided a rationale for firm co-operation based on the nature of the economic activities that have to be carried out and on the nature of the distinct capabilities by economic agents. He defined "similar activities" as those requiring the same

perceptions or actions of entrepreneurs who see co-operation (i.e. the co-ordination of dissimilar but complementary activities) as a profitable productive opportunity. Hence this perspective with its instability trap cannot be of much help towards understanding (the choice/emergence of) clusters.

capabilities, while “complementary activities” as those that need to be combined with complementary ones for the production of a specific product. Richardson suggests that when two firms possess dissimilar capabilities that need to be “closely” matched for the production of a given product, then these firms would find co-operation to be their best option (the alternatives being either market co-ordination or intra-firm co-ordination). This given product would be produced more efficiently if co-ordination took place within a co-operative arrangement than if each firm independently produced their part of the product and used the market to do the co-ordination. That is, to let co-ordination take place through the market would probably entail problems with specifications, quality etc.. If one of the two firms decided to carry out the whole of production itself, this would require too much effort for the acquisition of the necessary matching capability. Thus co-operation is best in the case of complementary activities requiring dissimilar capabilities. That is, intra-firm co-operation is the most efficient way to organise production when it is important that activities be “closely” co-ordinated, while the capabilities needed for each activity are different.

Accordingly, integration is best when activities are both similar and complementary. Markets are best when activities are in no need of close co-ordination. This includes both cases of similar and dissimilar activities. Both cases are very interesting, because they it is difficult to predict what the most efficient arrangement would be.

Let us start with the case of similar and non-complementary activities. When two activities require the same capability but no close co-ordination along a single production chain (similar but non-complementary activities) this could probably be reason for all three types of economic organization. The “market” co-ordination is the most obvious outcome. Each firm would specialize in its activity while another firm having the same capability would specialize in another activity, both leaving the co-ordination of the production of their respective given products to the market. But, both firms could seek other activities (carried out by other firms) which could be combined for the production of a third or fourth product. Here each firm can be seen to belong to a different co-ordination chain, and co-ordination may take place either in the market, or through co-operation. There is also a case that these firms will find a way to exploit more fully their respective similar capability by increasing their scale (“firm”) or by conceiving and introducing a combination of their capability with complementary ones. If the latter are owned by other firms, co-operation will ensue. If the latter are owned by the same firm, there will be intra-firm co-ordination. If the complementary activities do not necessitate “close” co-ordination, co-ordination will be left to the market.

The above hold if we consider that capabilities and activities remain constant through time and that two firms may possess almost identical capabilities. If we relax these, then there is the potential for specialization of capabilities, so that the activities are no longer “similar”.

This potential for specialisation of capabilities could eventually alter the nature of the activities themselves. The initial similar capabilities owned by two firms, could be replaced by dissimilar ones (let’s say capability A, variant 1 owned by the one firm and capability A, variant 2 by the other firm). These dissimilar activities could then point to “market”, if they are in no need for co-ordination for the production of a specific product. Further, at a later stage (and according to each firm’s productive opportunity) there is also the possibility of either of these two specialised

activities/capabilities to be used, along with other, different ones, possessed by other firms, in the production of other products (“co-operation”). Finally there is the possibility that either firm could use its own capability variant to produce other complementary variants (i.e. “similar capabilities”) which could then be internally combined for the autonomous production of new products. Similar reasoning could apply to the case of dissimilar and non-complementary activities.

To summarise, it is more efficient for activities which do not need close co-ordination to be left to the “market”. That is, it is inefficient for a single firm to carry out (diversify into) unrelated activities which demand the use of different capabilities. In the case of unrelated activities which rely on a single capability, then a firm has a stimulus for diversification into different activities. Crafting the Penrosean rationale for firm growth into the above stories would provide the following account: similar and non-complementary activities could be seen as an inducement for a firm to explore further its existing capability into new product lines or markets, which hints to expansion into “neighbouring” areas.^{††††} Further, dis-similar and non-complementary activities could lead, if specialization of capabilities takes place through time, to the same kinds of inducement for internal growth or co-operation. Table 1 summarises the above.

	Complementary activities (co-ordination needed)	Non-complementary activities (co-ordination not needed at product level)
Similar activities (requiring same capability)	Co-ordination through consolidation (firm)	no co-ordination needed between the two specific activities (“market”) <p>However, co-ordination with other firms/activities may be of all three types</p> <p>In the long run: all three types.</p>
Dissimilar activities (requiring different capabilities)	Co-ordination through co-operation	As above

Table 1. Richardson: markets, consolidation, and co-operation

Therefore, we have a production-based explanation of co-operation. That is, co-operation occurs, according to Richardson, because in some cases it is the most efficient of the three modes available. Thus, just as “co-operation” between people within a firm (and related specialisation and division of labour) results in increased productivity, co-operation between firms, bringing with it a combination of

^{††††} Penrose defines as “neighbouring areas” those that have two of the following three elements in common with the previous activity of the firm: these elements are: market, technology, and product.

specialisation and division of labour properties, may result in increased productivity (through its positive effects on human resources, infrastructure, knowledge, etc.) in the economy.

Richardson's ideas are useful in providing us with an explanation of *observed* forms and/or predict co-operation between firms. For example, one can observe a joint research agreement between two firms and explain it in Richardsonian terms. One might say that the activities that have been "jointly" undertaken *must* have required the combination of distinct capabilities (and each firm within the agreement should, by definition, have at least one unique capability, hence the activities must be "dissimilar"). In saying so here we ignore the possibility that two activities, no matter how complementary and/or similar they are) do not merge into *one* activity once some form of co-operation has been introduced. This might tend to ignore that, post co-operation, the initial activities may be transformed, altered, or fused with each other to a degree that it might be difficult to describe, *ex post*, the initial activities. Further, that the firms that engaged in some form of co-operation must have done so because both activities are, in some way, crucially linked ("complementary" activities).

It is interesting to note here that many firms are seen to "internalise" dissimilar activities, either complementary (as is the case with vertical integration), or even non-complementary (as is the case with diversification). Why do they do so? Maybe they do so because the benefits from consolidation exceed the costs of carrying out and co-ordinating dissimilar activities. For example, a large firm may acquire more power in the market (thus enjoy monopoly profit) by undertaking dissimilar activities on its own. Were it to leave these to the market (and/or other firms), other firms might take better advantage of them and, at one time or another, they would probably "internalise" (take over) the firm themselves.

In the case that activities are similar and complementary, that can be so either because the output of one activity is used as a specialised input for the output of the other activity, or because both activities provide outputs which have to be used in parallel to produce a given output. The first point has been extensively explained in Richardson (1972, 2003). The second, however, has remained rather vague. If the output of two activities has to be used in parallel, this implies the existence of a third, distinct activity of *combining the two*. The capability of combination hints to the existence of "excess" managerial services that will be used to implement any type of expansion (co-operation included), see below.

The above shows that Richardson provides a good explanation for firm co-operation, focussing on the efficiency attributes of different types of organisation of production within an economy. This explanation is useful in that it departs from the view of co-operation of (neoclassical) firms as collusion and highlights positive benefits (at the production side), which include but also extend beyond the avoidance of the negatives (such as transaction costs), see also Pseiridis (2001). Further, it is also useful in that it helps understand various observed types of inter-firm co-operation, pointing to a base for a conceptual framework for clusters of firms. However, while Richardson may be useful in explaining why clusters or any other form of firm co-operation have ensued, there are still many issues to be addressed. For example, is it obvious to any firm that some activities require some form of co-operation? Penrose's ideas are useful in filling these gaps, as will be explained below.

At this point, it is helpful to be reminded of the Penrosean “productive opportunity”. As Penrose writes,

“The productive activities of such a firm are governed by what we shall call its “productive opportunity”, which comprises all of the productive possibilities that its “entrepreneurs” see and can take advantage of. ... It is clear that this opportunity will be restricted to the extent to which a firm *does not see* opportunities for expansion, is *unwilling to act* upon them, or is *unable to respond* to them.” (1959: 31-32, emphasis added).

Most probably, *the ability of a firm to choose* a Richardsonian mode of co-ordination (co-operation, consolidation or market) *must be already there in the productive opportunity of the firm*. Its entrepreneurs may choose just because they are able to see and to make an economic judgement about alternative options. Therefore, the action of choosing and instituting a type of intra-firm, inter-firm or market co-ordination does not seem to be one which may be left to be done by random forces. Whether a firm’s choice will be successful is another matter, pertaining to some kind of “planning”, “decision”, “managing expansion” or “executing” capability that a firm may possess (or, perceives that it possesses); the issue here is that a firm *purposefully chooses* between several options (including to leave co-ordination of activities to the market) that it is able to discern.

Therefore, we cannot exclude the possibility that observed modes of co-ordination might not (prove to) be the best choice for a firm. As much as we are able to say that the jointly run research programme mentioned above might be a successful combination of unique, dissimilar skills needed for complementary activities, we could equally find out that such a co-ordination mode may have proved unsuccessful. This may be due to inadequate judgement of entrepreneurs, both regarding the existence of co-operation as a profitable productive opportunity (presupposing a good perception of internal capabilities of the firm, see below) and regarding the excess managerial resources available to effect (expansion in the form of) co-operation. On the other hand, firms that enter into co-operative arrangements that are consistently successfully and prove profitable to the participants signals that both firms have made a purposeful and educated choice than of their luck.

But, what does a *purposeful* and educated choice consist of? Each firm is guided, in its operations and activities, by the need to fulfil an *objective*. To delve into the determinants of specific objectives is not attempted here; we just find it plausible to adopt Penrose’s assumption that

“financial and investment decisions of firms are controlled by a desire to *increase total long-run profits*. Total profits will increase with every increment of investment that yields a positive return, regardless of what happens to the *marginal rate* (original emphasis) of return on investment, and firms will want to expand as fast as they can take advantage of opportunities for expansion *that they consider profitable*. ... In other words, *profits* would be desired for the sake of the firm itself and *in order to make more profit through expansion*.” (1959: 29, emphasis added)

Therefore, the Penrosean firm purposefully adopts either a type of Richardsonian co-ordination or no “co-ordination” at all (i.e. the market). There emerges a most interesting issue now. *How is a firm’s productive opportunity shaped?* Do the entrepreneurs see all of the productive possibilities that are open to them? Further,

what does their judgement about productive possibilities and their implementation possibilities depend upon?

To address this, we follow Penrose and assume that the *relationship between the firm and its productive opportunity is a dynamic one*. The availability and quality of entrepreneurial services shape, to a great extent, the productive possibilities available. Therefore, if a firm is seen to choose between the three Richardsonian modes of co-ordination, it chooses one to the other because its entrepreneurs are, first, able to see this mode as an opportunity; they then judge it as potentially more profitable vis-à-vis the other ones which they see as available.

This is how Penrose puts it:

“[A]lthough the ‘objective’ productive opportunity of a firm is limited by what the firm is able to accomplish, the ‘subjective’ productive opportunity is a question of what it thinks it can accomplish. ... ‘Expectations’ and not ‘objective facts’ – indeed there must be if action is to be successful, for the success of a firm’s plans depends only partly on the execution of them and partly on whether they are based on sound judgment about the possibilities for successful action. In the last analysis the ‘environment’ rejects or confirms the soundness of the judgments about it, but the relevant environment is not an objective fact discoverable before the event. ... Firms do not only alter the environmental conditions necessary for the success of their actions, but, even more important, they know that they can alter them and that the environment is not independent of their own activities. ... We shall be interested in the environment as an ‘image’ in the entrepreneur’s mind, for we want, among other things, to discover what economic considerations, as contrasted with ‘temperamental’ considerations, determine entrepreneurial judgments about the environment.” (1959: 41-42)

A choice by the entrepreneurs, and implementation, of a Richardsonian co-ordination mode (e.g. inter-firm co-operation) may prove to be successful or disastrous to the firm. What determines the possibilities for success, both in the choice of mode and further implementation of the chosen mode? To address this issue, we should go back to the inner workings of the Penrosean firm.

According to Penrose, a firm’s resources (human and physical) render *services* to the firm. Just as each firm consists of a bundle of resources, each resource consists of a bundle of *potential services*. The services that any given resource, in its interaction with other firm resources, gives to the firm are firm dependent. That is, the same resource will not yield the same services to a firm as it would if it was employed in another firm. Each firm’s uniqueness lies exactly in the fact that resources can be defined independently of their use, while services cannot.

Apart from physical products or services to be sold, one important output of the everyday workings of the firm is the creation of “excess” productive services within the firm, and knowledge. The former is an input in the expansion process and the latter is an input into all productive resources and, consequently, the firm’s productive opportunity. Further, the expansion process creates more, and more specialised, services (especially managerial ones) which are freed once the expansion process is finished.

Hence, more and more unused productive services are becoming available to a firm, either through the everyday working or after an expansion process: productive services of a similar type as the existing ones, freed because existing resources are not entirely exploited, while they get more and more efficient with given tasks; and also new productive services, generated through the expansion process and freed once expansion has taken place. In parallel, unused productive services are further increased and improved owing to experience and knowledge acquired by human resources working in a firm. That is, the potential of existing resources to yield services (of any type) increases while these resources gain experience.

It is in this process of acquiring knowledge through experience that a firm's capability to actually *see* a Richardsonian mode of co-ordination, *judge* it as profitable and *take action* to adopt it may lie. Further, once (expansion through) co-operation has taken place, human resources from both firms end up with a stock of similar and/or "new" productive services (importantly, some of them unique to the co-operative entity) to be redeployed in further expansion (in much the same way as a single firm is left with some new and unique productive services, after expansion has taken place). The direction of expansion will be dependent upon the existence of new profitable productive opportunities, either in individual productive opportunities or in the productive opportunity owned by the co-operative "entity".

In Penrose's words,

"[T]he experience gained is not only of the kind just discussed which enables a collection of individuals to become a working unit, but also of a kind which *develops an increasing knowledge of the possibilities for action and the ways* in which action can be taken by the group itself, that is, by the firm. This increase in knowledge not only *causes the productive opportunity of a firm to change* in ways unrelated to changes in the environment, but also contributes to the 'uniqueness' of the opportunity of each individual firm" (1959: 52-53, emphasis added)

Therefore, on the one hand, the services yielded by any one resource cannot be taken to exhaust total resource potential. On the other hand, experience endows individuals with even more increased potential.

"[E]xperience produces increased knowledge about things ... experience itself can never be transmitted; it produces a change – frequently a subtle change – in individuals and cannot be separated from them. Increasing experience shows itself in two ways – changes in knowledge *and changes in the ability to use knowledge*. There is no sharp distinction between these two forms because to a considerable extent the ability to use old knowledge is dependent on the acquisition of new knowledge." (1959: 53, emphasis added)

Further,

"[O]nce it is recognised that the very process of operation and of expansion are intimately associated with a process by which knowledge is increased, then it becomes immediately clear that the productive opportunity of a firm will change even in the absence of any change in external circumstances or in fundamental technological knowledge." (Penrose 1959: 56).

That is, the Penrosean firm, having accumulated knowledge over time, through its everyday workings (for normal operation or expansion), is able to identify productive

possibilities that may not have existed for the firm before. Based on the same knowledge, the Penrosean firm is further able to assess whether these productive possibilities would be profitable. It is also able to draw a plan towards embracing this perceivably profitable productive possibility, as well as use its resources (and also acquire and absorb new resources) to implement this plan.

Along similar lines, it could be argued that a co-operative arrangement provides conditions for interaction and “working together”, and thus acquiring experience, increasing knowledge, and producing “excess” services as is the case within a Penrosean firm. Individuals from both firms may be seen as individuals working within *one* firm; with the latter exhibiting somewhat lower levels of “administrative co-ordination and authoritative communication” (which for Penrose define the boundaries of the firm). Thus, to the extent that sufficient interaction within people of the two co-operating entities exists, it is reasonable to expect that a joint productive opportunity will be formed in the minds of the entrepreneurs, one which will include (joint) knowledge generated from joint activities, and excess services generated from working together that will be unique to the co-operative entity. Importantly, such knowledge and excess services would be valuable features of the joint productive opportunity, in that they will point to further co-operation and further combinations of the excess resources of participating firms. ****

What emerges from the above is a Penrosean rationale and explanation for Richardsonian co-operation (and clusters of firms). Before the realisation of co-operation with other firms, firms should be able to see in (a type of) co-operation a profitable productive possibility. Firms choose a type of co-operation to other Richardsonian forms of co-ordination, and they choose the most profitable type of co-operation, judging on two grounds: the future increases in the productive opportunity they face, and the means they own (free services) to carry out expansion. If co-operation proves “successful” and profitable over a long time, one can reasonably assume that the judgement of the firms involved has been quite accurate, and also that these firms had had the ability, apart from identifying a profitable productive possibility in co-operation, to plan and execute its implementation.

To conclude, Penrosean firms, through the process of acquiring experience (and through this, knowledge) within their operation and expansion, gain and thus possess the necessary capabilities to identify, plan and execute expansion in any form (e.g. through acquisition of resources, co-operation etc.). One such form may be some type of Richardsonian inter-firm co-operation, for example alliances, joint ventures, clusters, etc.. In some cases, participating firms hold their separate identity by

**** In this light, co-operation can be seen to be superior to integration in terms of potential strategies (“productive opportunities”) available to the members of the cluster. Namely, a cluster, due to its large number of “participants”, offers more opportunities for promptly re-organising production and re-dividing labour within it in the presence of environmental changes (see also Andriani, 2001). Co-operation (à la Richardson) between two firms by definition does not offer the opportunity to re-organise production (since co-operation ensues when the two firms possess different capabilities needed simultaneously for the production of a specific product). What is crucial is the number of firms and potential linkages that are there in a specific cluster. Along similar lines, another argument would be that firms involved in clusters may have enhanced prospects of increasing their knowledge base (hence their respective productive opportunities) compared to “single-value-chain” integrated firms, due to the possibility of interaction with firms working in the same and other value chains (see Collins et al., 2002).

maintaining sufficient administrative co-ordination within them, as is the case with formal or informal contractual agreements. In other cases the boundaries of participating firms might get a little intertwined, as is the case with deliverable-oriented alliances or some kinds of clustering. In other cases still, a separate entity that may be identified as a firm may come as a result, see below.

It is reasonable to suggest that in all cases, albeit to a greater degree when boundaries of participating firms get somewhat fused, (individuals in) participating firms, through their everyday workings and interaction, acquire experience, in almost the same way that human resources within a firm acquire experience by working together. In other words, people working together within a firm gain experience, and, through experience they gain knowledge, which affects their service yielding potential and the firm's productive opportunity. In much the same way, firms working together, by virtue of their human resources working together within some type of inter-firm co-operation, also gain knowledge through experience which affects, apart from the separate firms' productive opportunities, a *joint* productive opportunity. That is, a joint venture, cluster, or other form of inter-firm co-operation might possess a unique productive opportunity of its own which would not exist had the participating firms not entered into co-operation. Importantly, this productive opportunity cannot be exploited (at least in the short run) by individual firms alone.

It is in this joint productive opportunity that profitable productive possibilities might be jointly available to participating firms. But, this productive opportunity will be there, and will be continuously augmented, only to the degree that sufficient communication exists between (resources of) participating firms. The existence of profitable productive possibilities within this joint productive opportunity might be a reason why co-operating firms are seen to continue co-operating, e.g. be embarking on new co-operative ventures. The lack of profitable productive possibilities in firms' respective productive opportunities might be the reason for not initiating co-operation in the first place. Once co-operation has been instituted and working, a lack of joint profitable productive opportunities might signal that individual firms have not allowed sufficient communication either between them and other firms, or within themselves, or that individual productive opportunities present more valuable options than the joint one (it could also be bad perception of the productive opportunities available).^{§§§§} In any event, it seems reasonable to assume that the Penrosean limit to the rate of growth applies both to individual firms and to their joint co-operation activity (to the extent that sufficient interaction exists between the resources of participating firms). The crucial issue here is that co-operating firms, apart from being able to benefit from a joint productive opportunity, might also be able to enjoy in parallel an expanded individual productive opportunity, due to interaction of their resources with those of other firms. The latter constitutes an opportunity that would not have been available in the first place, that is, had they not seen a profitable productive possibility in co-operation and had they not entered into it.

To summarise, in this section we highlighted the interest that firm co-operation, including clusters, has received in the literature and policy from the 80s onwards.

^{§§§§} Similarly, co-operation might not always be the best choice of (Richardsonian) mode. A fuller investigation into the division of labour between market, consolidation and co-operation (and their respective productivity benefits) is an exciting research topic to be pursued. Here we only focus on the productivity benefits of co-operation explicable in terms of Richardsonian and Penrosean insights.

However, there is still scope for a conceptual framework for clusters and their growth. We attempted to address this by suggesting a conceptual framework for clusters, building on Richardson's insights on co-operation and Penrosean insights on knowledge and firm growth. We suggest that Penrosean effects of knowledge and experience may apply to co-operating firms and clusters as well. Interestingly, co-operation (and clusters) may create a *joint* productive opportunity that would not be there if firms did not choose co-operation (clustering). At the same time, co-operation may enhance individual firms' productive opportunities, thus enhancing the whole economy's productive opportunity. A prerequisite for the exploitation of these productive opportunities is the existence of sufficient and efficient (entrepreneurial and managerial) services within firms. The existence of such services is important in *seeing* co-operation as a profitable opportunity, and successfully acting towards it.

Following from the above, there are three points worth highlighting towards a conceptual framework for co-operation and clusters. First, co-operative arrangements (including clusters) of firms may be seen as an expanded (or quasi) Penrosean firm. Second, drawing on the previous point, in the cases of activities requiring co-operation à la Richardson, there can be Penrose-type effects within co-operating firms which might be working simultaneously and complementarily with Penrose-type effects within single firms, all of them leading to increases in productivity. Third, while Richardson's ideas contribute towards our understanding of the circumstances under which co-operation will ensue, Penrose's ideas are needed to identify how and why the entrepreneurs are able to understand when (and when not) the nature of some activities necessitates intra-firm co-operation. Having discussed "when co-operation" and "how this choice comes about and works", in the following section we will attempt to discuss the issue of "why support co-operation and clusters?", by linking our discussion to recent concerns about productivity and competitiveness.

IV Clusters and the determinants of productivity

Having examined the advantages stemming from co-operation, we pursue further the effects of co-operation and clusters on firm (but also regional and national) productivity and competitiveness. To do this, we expand on the "productivity-competitiveness wheel" model (Pitelis 1998). In this model, competitiveness is linked with productivity, which is shaped by four elements: human resources; infrastructure; unit cost economies; technology and innovativeness. All these work within the broader sectoral, regional, macro-economic, and social and institutional environment. Horizontal measures, optimal firm size, clusters of SMEs, and firm strategies for sectoral restructuring are all linked to the "competitiveness wheel", through their effects on the determinants of productivity. But, how exactly do clusters affect the productivity wheel? We will attempt to throw some light to this issue, based on our previous analysis.

1. *Human resources.* Human resources within a cluster, by virtue of the continuous interaction that takes place, are more likely to specialise in the cluster's needs. ****
Human resources within a Penrosean firm expand their potential services by working together within a firm; human resources within a cluster may enrich further this

**** On this point see also, among others, Reuber and Fischer (2001). See also the chapter by Quintana and Pulignano in this volume for a discussion of the interface between industrial relations and clustering processes.

potential by having the opportunity to work together with other people within their cluster. Hence, a cluster expands and enriches the opportunities for fruitful interaction between human resources, which may increase their quality and availability (in the Penrosean sense of “excess” productive services). Since the quality and availability of human resources is a determinant of productivity, clusters offer opportunities for increased productivity through the enhanced (potential of) human resources.

2. *Infra-structure.*

A cluster may offer improved material resources to the firms located within it relative to those located outside. That is so because all the workings that take place within a cluster are more oriented to the cluster’s needs. Therefore, roads, telecommunication networks, computer networks, etc. are more fully used within a cluster (Humphrey and Schmitz, 1995), and also their enhancement is oriented to serve the logic of the cluster’s needs.^{††††} This also comprises infrastructure generated through common action by the cluster’s members.^{††††} Machinery for common use, bought through understanding of mutual needs and common action and funding, is a case in point.

Apart from this commonly mentioned type of infrastructure, there is another type of “hard” infrastructure that is available to a cluster’s participants and may enhance their productivity and competitiveness. Within a cluster, specialised hard infrastructure owned by a member of the cluster becomes, in some way, property of all the other firms within a cluster. That is, firms may make use of this type of infrastructure by embedding its output in their own production process, thereby indirectly making use of others’ infrastructure. Since a cluster strengthens the motive for innovation in the firms within it, and the allocation of labour within it becomes more and more intricate, it could be said that this type of infrastructure within the cluster, which becomes all the more intricate and specialised to (a firm’s thus the) the cluster’s needs, is available, in some way, for use by other firms within it as well. Further, the benefits of investment in training staff made by one firm may easily spread to other firms, through the mobility of workers. Although this is an indirect way for a firm to “own” and make use of infrastructure actually owned by other firms, it is arguably a most important feature of a cluster that increases the productivity potential of the firms within it. Hence, clusters, by improving infrastructure content and quality in two ways, may actually lead to improved productivity relative to geographically dispersed firms of comparable size.

3. *Unit cost economies.*

Clusters are usually associated with small firm size. The benefits from clustering may outweigh losses from the absence of large size and the benefits traditionally associated with large volumes of production (e.g. economies of scale or economies of learning, the latter associated with *cumulative* volume); see Marshall, 1920; Piore & Sabel, 1984; Best, 1990 among others. A cluster as a whole may or may not achieve economies of scale as such (i.e. in terms of volume of a single product), but it may replicate them. The likelihood of the existence of economies of learning (e.g. by an

^{††††} See also Porter (1998a), who suggests that information generated within a cluster is more relevant to the cluster’s needs.

^{††††} The common ownership of infrastructure, as well as the provision of “real services” by institutions within a cluster, is a common theme throughout the literature on clusters, see Pseiridis (2001) for a discussion.

increased cumulative volume of highly specialised parts), economies of experience, and also economies in transaction costs (facilitated by the the reduction in opportunism and the existence of trust), may be larger within a cluster's firms than within a single big firm unrelated to a cluster. Firms within a cluster may be in a privileged position to "shop" for knowledge and other inputs in other, heavily specialised (small) firms.^{§§§§§} Since specialisation and flexibility are more relevant to/associated with small size and changing demand conditions, the quality of inputs (intermediate products) within a cluster will tend to be better than outside. While, therefore, a large firm may reap high economies of scale or economies of learning for a given product, a cluster might have proceeded to produce the next generation of this product, thus establishing early positions in the markets and hence enjoying the benefits associated with first-mover advantages and the introduction of new technologies, products, processes, etc.. This might be especially true in sectors or products with high technological/knowledge content, but not only there. Almost all sectors or products can be seen as having a high-technological/knowledge content, see e.g. Porter (1998a). Further, the existence of positive external economies as analysed in traditional economic theory is by definition more likely to occur within a cluster than without it (see, for example, Marshall, 1920; Humphrey and Schmitz, 1996).

In addition, management of firms within clusters may have more, and cheaper, opportunities for fruitful, face-to-face, everyday interaction (overall, opportunities for increased experience by working together, as has been put by Penrose for people working within a firm). Managerial staff are, therefore, more likely to face an augmented productive opportunity, which, moreover, will tend to include more, and more *profitable*, opportunities for internalisation of transactions.

The competence of managers and entrepreneurs within a cluster's firms may lead to an augmented productive opportunity for each firm that may also include profitable opportunities for Richardsonian co-operation, as illustrated in the previous section. That is, competent management is more likely to demonstrate a higher degree of self-knowledge. Knowing a firm's capabilities (plus an appropriate degree of interaction) produces opportunities for profitable capability matches, that is, co-operation.^{*****}

This may also be the missing link between transactions and choosing to carry out appropriate transactions for efficient production. Whether it will be most profitable to internalise these transactions (integration) or to carry them out via the "market" (co-operation or Coasean "market") depends on the nature of the transactions, i.e. on the complementarity and similarity of "Richardsonian activities", as presented above.

Further, there are instances within clusters where the costs of purchase and maintenance of machinery and infrastructure (e.g. common buildings, warehouses, exposition areas, etc.) are shared by many firms. As a result, the capacity of these resources might be used more fully and, consequently, at lower cost per unit produced than if they were owned by a single firm.

^{§§§§§} Apart from this, co-operation of firms may produce some assets (such as ad-hoc services) which may be available to collocated firms, see Nicolini (2001).

^{*****} This is especially aided by the use of internet and communication technologies, which make interaction and communication less costly and, taken to the extreme, may induce the development of clusters with firms which are not really geographically close, i.e. the development of "virtual" clusters.

Last, but not least, close interaction of firms within a cluster can result in economies of time. That is, feedback on a firm's products that are used as inputs for the other firm's production process may be faster than where the firms were geographically dispersed. Face-to-face interaction in the locality may also enhance this effect.

To summarise, collocation of firms within a geographical area may reduce unit costs in at least five ways. First, production costs may be lower owing to continuous innovations (and new technologies used) that may take place within a cluster. Second, and related, firms within a cluster may enjoy economies related to first mover advantages, i.e. introduction of new products. Third, transactions within a cluster may be fewer or less costly (as trust may be stronger), and internalisation of transactions is more likely to lead to real, tangible, transaction cost economies. Fourth, a cluster will benefit from external economies. For example, interaction may bring economies of learning, albeit not for a *given* product, but rather in processes, innovation etc., see also Richardson 2003 (for example, economies of learning to innovate, economies of learning to learn, economies of learning to change, etc.). Further, the cost of purchase and maintenance of shared machinery and infrastructure is more likely to be lower when these are (more fully) used by many firms within a cluster. Fifth, firms within a cluster may also realise reasonable time economies.

The above suggest the existence of some beneficial effects of clustering on unit costs. It can thus be suggested that the collocation of small firms or a large size firm (that already enjoys advantages of size) within a cluster of mainly small firms could increase benefits for all firms in terms of unit cost economies.

4. Technology and innovation.

There is a large literature on innovation and incentives to innovate. Among this, there is growing recognition and evidence that (clusters of) small firms can be more innovative than large firms. There are a number of ways that clusters can have beneficial effects on technology and innovativeness, some of which are explored in detail in the chapters in this volume by Henry and Pinch and Di Tomasso *et al.*

First, collocation improves communication and *interaction* between firms with different skills and capabilities. Mutual interdependence leads to continuous efforts to improve (see Cowling and Sugden, 1999, on localities, and Porter, 1998a, on peer pressure). Firms within a cluster recognise their mutual interdependence and also strive for excellence to distinguish themselves from peers. Thus a problematic input may turn out to bring about a technological breakthrough as well as increased status within the local community.

Second, to the extent collocation favours the division of tasks among firms, the everyday workings of firms are more oriented to the cluster's (or to specific firms') needs. That is, specialised skills increase and become available for use in new, but related, areas; along with increased skills, innovative ideas are more likely to abound.

Third, geographical proximity of firms enhances favourable conditions for profitable Richardsonian co-operation and transaction internalisation. Co-operation of firms may by itself constitute an innovative idea regarding business practices; internalisation of transactions could be seen under the same light.

Fourth, technology available to some firms within a cluster may be improved by common actions (and also at a smaller cost than were it purchased and maintained by one single firm). For example, many firms that have also shared relevant expenses

may share high technology tools or machinery, or specialised (e.g. CAD/CAM) computer applications.

5. Sectoral, regional, and Institutional atmosphere.

Clusters can be seen as a more participatory and open industrial structure, vis-à-vis large firms (see Cowling and Sugden, 1999). It is thus likely that clusters enjoy wider support from the communities within which they operate. Therefore, requests of firms within clusters regarding infrastructure, legislation, education programmes, publicly funded research, etc., may enjoy a wider base of support from local or state authorities, as they encapsulate needs from a wider base within the locality, and as benefits will be widely dispersed within it. In this context, working interaction between firms and the authorities is more likely to be fruitful at a local (cluster locality) level, than elsewhere. Further to this, and subsequently, peer pressure within a cluster may cross the boundaries of the cluster and “infect” public officers as well. It is thus most likely that, through working, everyday interaction, public officers will have increased motivation to serve the clusters’ and the locality’s needs.

We attempted to address in detail the way clusters are linked to the “productivity-competitiveness wheel” introduced by Pitelis (1998). In a similar vein, Porter’s (1998) “diamond” of national competitiveness links some important attributes of a state (or region) to the competitiveness of its industries. He also suggests that clusters are crucial to competitiveness in that they positively affect all attributes of the “diamond” (Porter, 1990). The relationship, however, between clusters and competitiveness is not straightforward. It should start, we believe, with a discussion of the effects of clusters on productivity.

We therefore tried to show in which ways clusters are important in enhancing the productivity potential of a state or region. To do this, we were assisted by the theoretical framework of clusters suggested in the previous section. That is, clusters may be seen as a Penrosean quasi-firm and may thus own some characteristics inherent to Penrosean firms. In this framework, it is interesting to note that cluster dynamics may lead to the incorporation, within this quasi-firm, of public officers as well. That is, locality and clustering may strengthen inter-organisational interaction, teamwork, co-operation and associated benefits. This is linked, for example, both to the ‘community’ framework in which Sugden *et al.* root their analysis of cluster governance in Chapter XX, and to the detailed discussion of territorial governance provided by Gilly and Perrat in Chapter XX.

V Some comments on implementation

In this section we aim to apply aspects of the framework developed thus far in a brief analysis of a specific “cluster” policy, where comparisons might be drawn, for example, with the analysis of cluster policy in the Basque region of Spain provided by Aranguren *et al.* in Chapter XX. We focus on a notable example of a policy to support clusters in Greece; the “Future of Greek Industry” project (henceforth FGIP), run from 1994 until 1997, see Pitelis *et al.* (1997). The FGIP used local, national and international expertise to produce a consensus-based industrial strategy for Greece. The organisation of the FGIP is illustrated in Figure 1. As a result, potential clusters were diagnosed, and among them “pilot” clusters were chosen, i.e. clusters that were considered to be good candidates for subsequent upgrading. Support would not accrue to individual participating firms, but to a distinct new legal entity (the “cluster

carrier”) which should be jointly owned by participating firms. To exploit market signals and dispersed knowledge on top of the results of the FGIP, funding was allocated through “open bids”, where firms in pilot but also in other clusters could apply. In what follows we provide some comments on implementation of the two first bids which led to the funding of 54 “cluster carriers”. ††††††

FIGURE 1 here

Average number of firms in cluster carriers

The average number of firms participating in each cluster carrier was 10 in the 1st bid, and subsequently fell to 8 in the 2nd bid.

Both, are rather small numbers, not allowing for the existence of sufficient interaction between firms nor large scale projects. †††††† In the light of the preceding analysis, these small number of actively participating firms would not easily yield the advantages associated with interaction between the resources of various firms. Therefore, the individual productive opportunities and the joint one would not provide a full set of profitable productive opportunities to the firms involved.

It is interesting to note that co-operation (in the form of the action towards creating a cluster carrier) has apparently been easier to establish when there were previous formal or informal linkages (acquaintances or pre-existing co-operation) with other firms/individuals. §§§§§§ Importantly, many of these linkages had already been developed while potential clusters were being analysed within the FGIP. Many workgroup members were the first to motivate firms to co-operate and jointly apply for funding. This partly explains the fact that almost half of the supported clusters were empowered/organised by local people who were involved, one way or another, in carrying out the analyses of the potential clusters. Hence another “product” of the FGIT has been the development of knowledge regarding the potential benefits of co-operation and clustering *within* the analysed areas, which was subsequently used to spur the development of clusters.

Table 2 provides a list of the potential (some of them “pilot”) clusters that were identified by the FGIP, and the corresponding number of successful proposals for the creation of cluster carriers. These proposals, however, were not the only ones that were eventually funded. Funding was also allocated to proposals for cluster carriers that had not been identified by the FGIP.

†††††† In what follows we were assisted by interviews with managing directors of clusters.

†††††† It has to be noted that the (“formal”) cluster carriers referred to here are smaller than the (“informal”) cluster which comprises all the (informally) linked firms as well, see also footnote **Error! Bookmark not defined.**

§§§§§§ This might be explained with reference to the framework for analysing trust discussed by Dupuy and Torre in Chapter XX of this volume.

Table 2 · Potential and funded clusters

Potential and Pilot (*) Clusters	Potential cluster area	Funded, 1st bid	Funded, 2nd bid
Software applications and software for technical construction firms (*)	Attica	0	0
Laser applications in industry	Attica	-	-
Automation in production	Northern Greece	2 (informatics)	2 (informatics)
Juice producers (*)	all of Greece	-	-
Industrial area of Elaionas (*)	Attica	-	-
Perama shipbuilding and repair area and Piraeus Shipping Centre (*)	Attica	0	1
Metal products (*)	Kozani & Volos	2	0
Postgraduate studies and further training	Attica	1	0
Consultancy services	Attica	-	-
Wine (*)	Macedonia & Epirus	1	0
Meat and dairy products (*)	Thrace & Epirus	2	0
Development of a biomass cluster (*)	Thrace	0	0
Garments	Xanthi, Drama & Kavala	4	2
Marble (*)	Macedonia & Epirus	1	3
Canned fruit (*)	Northern Greece	0	2
Wood and office furniture	Northern Greece	1	1
Quality products, primary manufacturing, tourist services (*)	Crete	2	0
Furs (*)	Kastoria	1	0
Agricultural technology	Central Macedonia & Central Greece	1	0
Total		16	9
Total funded (grand total = 54)		28	26

Source: Pseiridis (2001)

Activities of funded cluster carriers

Supported cluster carriers have mainly built on/boosted already existing activities, especially in “traditional” sectors (clothing, agricultural products and foods, marble). There were few notable exceptions to this rule (such as the cluster carriers in

informatics) especially in combinations with “traditional” activities (such as publishing), which point to the potential existence of more high-value-added/high technological content opportunities for future clusterings.

Geographical dispersion of supported clusters and inter-cluster linkages

Map 1 shows the geographical dispersion of the supported cluster carriers. It is obvious that the two largest cities of Greece (Athens and Salonica) are heavily concentrated with firms that are involved in cluster carriers. The less developed regions have been “represented” with relatively few proposals. For example, Thrace in NE Greece is the home region of only two cluster carriers (dairy products and food packaging) and another firm participating in the cluster carrier for the production of CD-ROMs.

While the dairy products (which interestingly received the largest funding among “traditional” activities) and the packaging cluster in Thrace can be seen as complementary, we believe that funding of a third one (production of energy from biomass, which is a by-product of dairy firms) would strengthen the local clusters by providing more productive possibilities to the firms and cluster carriers involved.

Amount of funding

We believe that more funds should have been allocated to each proposal. Investment in such clusters would also be facilitated if the private (firm) cost of investment were spread across a larger number of quite large firms. For example, despite potential benefits (including linkages with other clusters in the region) the biomass cluster has been hard to empower. One reason could be that it represented a new activity with large capital requirements and within a less developed area in which there was no relevant knowledge from existing activities (and, importantly, also little knowledge about co-operation).

Further, there have been other cases where initial and fixed funding was very small for subsequent development of the clusters, with no provision for (re-negotiation of) further funding to cluster carriers. A case in point is the SolarNet cluster (boiler production). While the initial business plan was modest, the participating firms subsequently realised that if their cluster carrier were to be successful, they ought to go for a larger investment or nothing. They opted for the former and created one of the most state-of-the art factories in Europe, with exports since its testing phase.

A related issue pertains to the selection and support of multiple cluster carriers of the same activity, such as food (ten cluster carriers), clothing (six), marble (four), and aluminium products (three). In spite of allocating funds to similar clusters, the Ministry could have supported more diverse (and more open) ones in *core* areas. These could subsequently have attracted more participants into a path of further development. Most importantly, and to save funds that could support larger clustering ventures, the Ministry could have based its selection on an additional criterion: the existence of linkages between different clusters. Successful examples of complementary clusters are the dairy foods (1st bid) and food packaging (2nd bid) cluster carriers in Thrace.

Bureaucracy

Another shortcoming of the implementation process faced by all clusters has been the large bureaucratic burden imposed on them by the Ministry. First of all, participating firms had to found a separate legal entity (i.e. the “cluster carrier”) to actually receive the funding, and then the cluster carrier ought to submit a letter of guarantee to the Ministry. Obtaining letters of guarantee from banks, however, proved a challenge for the cluster carriers, since the former are usually reluctant to guarantee newly-borns. Dealing with it resulted to a loss of valuable time and resources.

The creation of a new legal entity and also tedious progress reports complete supporting paperwork were set to ensure that individual firms would not use funding received to support their own interests, but they would actually use it to promote collective interests.

Interestingly, however, there have been instances that participating firms complained that their products were not given a fair share of the (joint) effort (mainly joint promotion in exhibitions or joint sales efforts). Usually cluster carriers were staffed by people from participating firms,; hence staff’s actions were biased towards the benefit of their “mother” firm. Since generally these were people of high skill and it would be unfortunate if they were precluded from taking positions in the cluster carrier, we believe there is no safer way of dealing with this inherent inequality, other than allowing a larger number of participating firms in a cluster carrier, to increase intra-carrier competition.

Horizontal & vertical linkages

We believe that some of the most interesting developments that were brought about have been within clustering proposals that aimed to improve the (quality of) the participants’ final products by improving backward stages in the production chain. The most notable examples include the establishment of a common quality assurance lab (aluminium products); the production by the cluster carrier of a basic input of top quality (e.g. boilers for solar heaters) which is then bought and used by participating firms in the production of their own products; and the provision of a common variety of wine for subsequent use (blending with other varieties) by each participant. Importantly, the wine cluster carrier has also become a competitor of its participants as well, by proceeding to the creation and trading of a new wine label.

Knowledge creation and productive opportunity

As mentioned above, the FGIP gathered existing knowledge and also created new. Then firms and individuals used it to develop cluster carriers. One of the most interesting developments, in our view, is that cluster carriers have also created new knowledge that has been used in many instances for further expansion in activities other than those originally conceived. That is, individuals and firms have produced, through working together and interacting, new knowledge and new capabilities, and at the same time have seen the opportunity that both could be used profitably to explore new joint production opportunities. The most notable examples are CosmoMarble and PressNet, see Pseiridis (2001). The initial objective of the former, for which funding was granted, was the expansion of the existing distribution network in foreign markets, and especially in China. Then CosmoMarble proceeded to establish a joint venture in Shanghai, China (a marble-processing factory),). PressNet is a cluster

carrier made up of 6 similar firms (publishers of regional newspapers), and it aimed to upgrade newspaper quality and distribution. PressNet developed and provided electronic archiving services for newspapers, and is expanding to corporate archiving.

These few examples point to the inconclusiveness of judging the relative prospects of each clustering venture based alone on whether horizontal and/or vertical linkages exist. The co-existence of vertical linkages may be facilitatory in some cases (e.g. promotion) because the cluster carrier can build on existing strengths of individual firms and also induce further specialisation and division of labour. However, the lack of vertical linkages might not preclude the possibility of a new division of labour based on the relative strengths of each participant. The examination of whether, and to what extent, the formation of cluster carriers led to further specialisation and division of labour within the cluster carrier's participants, and whether vertical linkages have facilitated specialisation within cluster carriers, could be interesting topics for future research.

The latter observation brings up the issue of cluster "openness". As funding was given to a new firm, the "cluster carrier" remained, mainly owing to its legal shell, relatively "closed" to new linkages and additions. We believe that the provision for openness should be taken into account in similar initiatives. Further, the creation of clusters apparently (to a certain degree) builds on and exploits existing linkages between firms; therefore the potential for creation and profitable use of new linkages should be added, we suggest, to the selection criteria in subsequent rounds of funding.

In sum, the FGIP has arguably succeeded in increasing awareness of businesspeople, and public sector officials alike on the benefits of clusters. In fact, numerous applications for funding came by firms from within the "potential" clusters that were identified during the "project", see Table 2. These firms were eager to initiate a clustering venture and thus co-operated to apply for funding. Further, and most importantly, the FGIP has arguably been successful in institutionalising clusters as a productive possibility for Greek firms, thereby enhancing their productive opportunity.

To summarise, the above suggest that the FGIP, and the subsequent implementation of its results regarding support for clusters, can be seen as an example of a reasonably successful national policy experiment for the enhancement of productivity and competitiveness through clusters, despite limitations. First, the number of participating firms has been rather small. Second, more regions should be involved in clusters and more inter-cluster linkages sought. Third, there does not seem to be a full representation of the potential clusters that were diagnosed by the FGIP, which could mean that its results have not been fully exploited. Fourth, numerous cluster carriers of the same activity were supported instead of multiple clusters in different activities, or instead of a larger one in each activity. Fifth, the cluster carriers in their current legal form are quite rigid and cannot easily accommodate inclusion of future member firms and/or other linked cluster carriers. Sixth, the size of funds allocated to each cluster carrier was quite small, therefore not inviting/facilitating co-operation for large-scale investments. Lastly, the administrative requirements imposed on the cluster carrier by the Ministry required the dedication of large amounts of resources which would be more profitably used in seeking or effectuating (further) co-operation.

Despite the above limitations, the private sector seems to have welcomed the possibility of co-operation and clustering. The concept of clusters is now an integral

part of Greek reality and it seems to be a fruitful one. Further, the example of Greece currently forms the basis of other projects for the development of clusters. The Netwin project (NETWorking for INnovation), which was funded by the EU and was run by 6 Business and Innovation Centers (BICs) in Italy, Portugal, Ireland, Northern Ireland, France and Greece, is a notable example. Its objective was to diagnose and support the development of innovative clusters. Its diagnosis tools have been developed on the basis of the Greek experience by the co-ordinator of the FGIP.

As mentioned above, the adoption of clusters as a policy for competitiveness was based on the understanding that clusters may positively affect the determinants of productivity and (thus) competitiveness.

For the case of marble, for example, as shown in Table 3, the volume of Greek marble exports to China increased by almost 17,000% in the years 1995-2000. This development co-incides with the activities and promotion efforts that were spurred with support to the 4 existing clusters.

Table 4 • Marble exports (volume and value) to China

	Volume (in tons)			
	Exports to China	% change	Exports to 3 rd countries	% change
1995	235,000		40,330,013	
1996	206,600	-12.09	38,136,959	-5.44
1997	1,799,000	770.76	50,113,299	31.40
1998	2,017,101	12.12	69,042,925	37.77
1999	8,856,327	339.06	83,101,094	20.36
2000	40,056,242	352.29	160,726,971	93.41
1995-2000		16,945.21		3,885.28

Source: Calculated from data from National Statistical Service of Greece (SITC 27312)

To conclude, while it is too early to be decisive, and notwithstanding the problems of transferability, clusters as a policy for competitiveness seem to have worked reasonably satisfactorily for Greece so far. Therefore, the Greek experience/experiment could be used as a model for the development of competitive clusters in other countries or regions, in particular less favoured ones.

MAP HERE

Map 1 • Regions involved in cluster activities in Greece

The Map is Courtesy of the Perry-Castaneda Library Map Collection, The Central Libraries at the University of Texas at Austin.

VI Concluding remarks

In this chapter we provided a conceptual framework for co-operation and clusters based on the insights of Penrose and Richardson. We suggested that co-operation (e.g. in the form of clusters) of firms may be seen as an expanded Penrosean firm and

hence there can be Penrose-type effects within co-operating firms. More specifically, co-operation, apart from enhancing individual firms' productive opportunities, may also create an additional productive opportunity which may be jointly enjoyed by participating firms. We also suggested that a crucial element in the selection of co-operation (à la Richardson) as a profitable productive opportunity is the process of acquiring knowledge through experience, which takes place within Penrosean firms and Penrose-type entrepreneurs. That is, while Richardson's insights are useful to understand the conditions under which co-operation will be a profitable option, Penrose's theory is crucial in identifying why and how entrepreneurs are able to understand when the nature of activities calls for co-operation.

Further, based on our analysis we attempted to examine how co-operation and clusters may affect productivity. Using the "productivity-competitiveness wheel" model as a starting point, we examined in more detail the ways that clusters can affect each determinant of productivity, identifying some ways that co-operation and clustering may positively enhance each one of them. Finally, we used our suggested framework to assess the effectiveness of a policy aimed at the promotion and/or creation of clusters in Greece. Our discussion tends to suggest that the implementation of this policy could be improved if more emphasis was given to:

1. Promoting the "openness" of clusters. The formal and informal "entry" of other new firms within the shell of a cluster should be facilitated because it would offer more opportunities for interaction and competition between firms thus would enhance even more the productive opportunity of participating firms and the joint productive opportunity.
2. Involving larger numbers of firms. The average number of firms in existing cluster carriers is quite low to create bring about considerable increases in productive possibilities that participating firms see as profitable, can, and are willing to take action upon.
3. Giving larger amounts of funding in fewer but larger cluster carriers instead of funding numerous small ones in the same or in different activities. The support of multiple cluster carriers has been very usual in activities such as food, clothing and aluminum products. Support for fewer but larger cluster carriers would lead to increased competition within participants, hence would provide a stimulus for intra-cluster firm specialisation. This, combined with more opportunities for interaction between firms, would, in turn, create more productive possibilities for participating firms to see and act upon.
4. Promoting inter-cluster linkages. For example, the biomass cluster in Thrace along with the dairy products one. This would provide more opportunities for profitable co-operation across clusters and would thus further enhance both the individual and joint productive opportunities.

However, notwithstanding limitations in implementation, the Greek example can be seen as a reasonably successful case of national policy towards the promotion of co-operation and clusters. We conclude that while it is difficult to replicate (a policy for) clusters, an industrial policy for the promotion of clusters looks promising, because clusters seem to provide an alternative way to increased productivity and competitiveness to that obtained through the promotion of large scale.

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Figure 1. The FGI Project's Organisation Chart

Source: Pitelis et al 1997

