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Industrial district effects and innovation in the Tuscan shipbuilding industry

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Abstract: The aim of the present work is to investigate innovative processes within a geographical cluster, and thus contribute to the debate on the effects of industrial clusters on innovation capacity. In particular, we would like to ascertain whether the advantages of industrial districts in promoting innovation, as already revealed by literature (diffusion of knowledge, social capital and trust, efficient networking), are also keys to success in the Tuscan shipbuilding industry of pleasure and sporting boats. First, we verify the existence of clusters of shipbuilding in Tuscany, using a specific methodology. Next, in the identified clusters, we analyse three innovative networks financed in a policy to support innovation, and examine whether the typical features of a cluster for promoting innovation are at work, using a questionnaire administered to 71 actors. Finally, we develop a performance analysis of the cluster firms and ascertain whether their different behaviours also lead to different performances. The analysis results show that our case records effects of industrial clustering on innovation capacity, such as the important role given to trust and social capital, the significant worth put in interfirm relations and in each partner's specific competencies, or even the distinctive performance of firms belonging to a cluster.

1. INTRODUCTION: INDUSTRIAL DISTRICT EFFECTS AND INNOVATION

In the last decade, an increasing attention has been paid to the investigation of innovation activities inside districts and clusters, and to the way these industrial settings facilitate the introduction and diffusion of innovation.

Literature on industrial agglomeration shows that concentration fosters innovativeness of firms. This finding dates back to the original works of Marshall (1920) and to the subsequent literature on geographical agglomerations of firms, such as the studies on Italian industrial districts (Pyke *et. al.* 1990, Becattini 2004), and the researches on national (Lundvall 1992, Nelson 1993) and regional innovation systems (Cooke 2001), learning economies and regions (Lundvall 1992, Asheim and Isaksen 2002), US clusters (Porter 1998) and, finally, the innovative *milieux* (Aydalot 1986, Crevoisier 1993).

The intuition according to which similar or complementary economic activities tend to concentrate in space can be traced back, as already said, to the work of Marshall (1920), and his formulation of external economies of localisation. Literature commonly identifies three distinct sources for the so–called advantages of localisation: qualified labour force, specialised suppliers, and knowledge spillovers (Glaeser *et al.* 1992). The district theory has long ago proposed (Bellandi 1992) a classification of localisation economies in four different categories, which are respectively characterised by: a) higher specialisation, built on the division of labour, b) larger flows of information, c) more highly–trained labour force, and finally, d) greater innovation capacity. A more developed circulation of knowledge and spillovers do in fact promote the diffusion of innovations in thick territorial concentrations of firms (Pavitt 1987).

Empirical researches have also ascertained the positive effect of clustering on innovation and on knowledge diffusion (Glaeser *et al.* 1992, Audretsch and Feldman 1996, Ellison and Glaeser 1999), as they empirically prove that industries where knowledge tends to play an important role have higher propensity to cluster together.

Some authors (Noteboom 2006) have recently underlined that the reasons for the advancement of innovation capacity within concentrations of firms are but a combination of agglomeration effects and social and network relations. Firms in clusters benefit from network based effects, such as particularly enhanced social interaction (Harrison 1992, Bell 2005). In this context, the territory is recognised as the environment in which a network can grow and develop, and promote firm innovation (Boari and Lipparini 1999).

From this point of view, a special attention must be paid to the way an innovative process develops inside an industrial district or cluster. In particular, the transmission of knowledge that builds up in a district can be tacit or codified (Polanyi 1967, Nonaka and Takeuchi 1995). Codified

knowledge refers to the mass of scientific and technical knowledge which can be recognised by codes and transmitted by education or traditional form of communication (such as books, articles, and so on). Conversely, tacit knowledge is localised, it is territorially rooted in the geographically–bounded area of the district, and depends upon the concentration of a productive fabric over time and on the historical origins of the local system (Brusco 1989, Becattini 2004). Therefore, tacit knowledge fosters innovation because of the interaction among people and firms, which takes place through collaborative networks promoted by the local district cultural background (Belussi and Pilotti 2003). Consequently, if on the one hand globalisation accelerates the processes that make codified knowledge shared and widespread, on the other hand it also increases the value and makes the most of tacit and locally–rooted knowledge (Maskell 2001, Becattini and Rullani 2004). Pavitt (1987) also suggests that, because of its tacit nature, new technological know–how can more easily spread at a local level.

Agglomerations, and particularly clusters and industrial districts, are in fact recognised as places in which 'close inter–firm communication, socio–cultural structures and institutional environment may stimulate socially and territorially embedded collective learning and continuous innovations' (Asheim and Isaksen 2002: 83).

Hence, literature gives support to a series of effects which industrial districts have in the promotion of innovation within firms, and which can be summed up in the better diffusion of knowledge, the presence of social capital and trust, and the more efficient networking of firms (Swann *et al.* 1998, Noteboom 2006).

Agglomeration effects promote relationships and collaboration among networks (Boari and Lipparini 1999, Muscio 2006). In this respect, some authors stressed that innovative clusters of small and medium enterprises (SMEs) are characterised by higher levels of interfirm imitation, sharing of common knowledge, and mutual learning among organisations (Tallman *et al.* 2004). Also, as far as they develop an important social interaction in the territory, firms can better find their way in the acquisition of new knowledge and innovation (Harrison 1992).

The role of (given and received) knowledge is important, and accordingly encouraged, also for clusters (Belussi and Pilotti 2003, Noteboom 2004). Firms which are co–located in a geographical cluster have an enhanced ability to create new knowledge and exchange knowledge flows (Maskell 2001). Intentional or unintentional flows of scientific and technological knowledge can more easily spread in a restricted area, and in the specific case of tacit knowledge, its transmission is inversely proportional to geographical distance (spillovers) (Glaeser *et al.* 1992, Audretsch and Feldman 1996, Ellison and Glaeser 1999). Proximity matters in transmitting tacit and contextual knowledge to such an extent as to term it a 'sticky knowledge' (Von Hipple 1994).

Moreover, several authors focused on the role of trust in ensuring interfirm cooperation, and particularly in subcontracting among local firms (Lorenz 1988, 1999, Dei Ottati 1994a, 1994b). Trust is essential for coordination, cooperation and the development of support mechanisms that are vital for the competitiveness of small firms (Visser and Boschma 2004).

Finally, belonging to a district affects the performance of various dimensions, such the occupational dynamics, or the access to foreign markets and credit, as it also entails a higher profitability (Fabiani *et al.* 2000, Becchetti *et al.* 2007). The main contributions to this issue were developed following the works of Signorini (1994) and the Bank of Italy (Fabiani *et al.* 2000), and they generally compare profitability in district firms as opposed to 'isolated' firms.

Literature on management[1] also offers a series of contributions referring to the theory of resource–based view (De Carolis and Deeds 1999, Hervas–Olivery and Albors–Garrigos 2007), which demonstrate how firms located in thick clusters have access to knowledge flows which might be unavailable or difficult to attain by isolated firms. 'It is likely that firms located in geographic hot spots have more and frequent access to knowledge flows which will be accumulated internally and generate superior performance' (De Carolis and Deeds 1999: 957). De Carolis and Deeds (1999) provide evidence of a causal relationship between localisation and firm performance. Molina–Morales (2000) offers an interesting measurement of the performance of industrial district firms on a comparative basis by using the case of the Spanish ceramic tile industry.

The aim of the present contribution is to verify whether the advantages in terms of innovative advancement presented by industrial districts can also constitute a key to success in the Tuscan shipbuilding industry of pleasure and sporting boats. Specifically, we question whether a more widespread diffusion of knowledge, the presence of social capital and trust, and a more efficient ability to network can promote the innovation capacity of firms in regional clusters.

To this end, we analyse three project networks composed by economic, non economic and institutional actors, financed in the framework of a regional project of support to technological innovation and transfer, that is the Tuscan Policy (SDP) Action 1.7 ob. 2, 2000–2006 'Benchmarking and Foresight Networks for Technological Transfer and Innovation'. The three networks are composed of 71 relevant actors in the sector of Tuscan shipbuilding of pleasure and sporting boats.

The research develops through three stages. In a first stage, we enquire into the existence of geographical agglomerations or clusters in the Tuscan

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[1] In this context, the performance of a firm is affected not only by localisation, but also by its ability to access to the one and only know–how which can be hardly replicated outside the district, and thus allow local firms to attain better results.

shipbuilding industry, and to do so we recommend a suitable methodology for their identification, that is the local production systems mapping methodology for industrial activities, employed in Italy (Sforzi 1997), UK (De Propris 2005) and Spain (Boix and Galletto 2006). Using this methodology we can also verify whether the financed networks are localised in the clusters of the Tuscan shipbuilding industry of pleasure and sporting boats. In the second stage of the analysis, with the aid of a questionnaire administered to the 71 actors belonging to the networks, we verify whether the effects of industrial cluster on innovation capacity, discussed in the theoretical section of this work, are also effective for the Tuscan shipbuilding clusters.

Finally, we want to verify whether different behaviours in terms of innovation within the industrial clusters lead to different performances in their firms. To this end, we develop an analysis of financial statements in a formerly–set sample of firms localised in the clusters of shipbuilding. The source of data is provided by the database of 'Analisi Informatizzata Delle Aziende' (AIDA, Computerised Analysis of Firms), which contains the financial statements of a set of 700 000 multisectorial Italian firms.

The paper is divided into six sections. After the present introduction, in the next section the Tuscan shipbuilding clusters are identified and analysed by means of the local production systems mapping methodology drawn from the industrial district theory. In the third section the three networks of economic, non economic and institutional actors are described. In the fourth section the factors supporting innovation highlighted by literature on clusters are weighted up for the case of the networks under exam. In the fifth section, a comparison between performances of cluster firms and isolated firms is carried out. Finally, some conclusions are drawn.

2. THE SHIPBUILDING INDUSTRY: FOCUS ON CLUSTERS IN TUSCANY

2.1 The shipbuilding industry

The analysis is focused on the shipbuilding industry of pleasure and sporting boats, a sector which is doing well in Italy, as it has still experienced a rapid growth in recent years, and whose main geographical clusters are located in Italy (Cazzaniga Francesetti 2005) as well as in Norway (Asheim and Isaksen 2002, Karlsen 2005), England (Todd 1984, Schwerin 2004), the Netherlands (De Langen 2002), and generally all over Europe (Blundel and Thatcher 2005).

The shipbuilding of pleasure and sporting boats is an innovative industry which did not suffer cyclical crises so far; its brands are still symbols of quality and style for the made in Italy, in which technological innovation is a critical aspect (Cazzaniga Francesetti 2005, Bonaccorsi 2007).

According to the 'Unione Nazionale dei Cantieri e delle Industrie Nautiche e Affini' (National Union of shipyards and shipbuilding industries and the like, UCINA 2006), as regard the specific productive segment of super luxurious boats, 688 mega–yachts were under construction in 2006, of which 260 were launched by Italian shipyards. Italy holds around 38% share of the world market in terms of units produced.

The overall units employed in the building of pleasure boats are assessed at 18 000, of which 10 000 were polled in the sector of shipyards industry and about 8 000 in the sectors of accessories and engines[2] (UCINA 2006).

When taking into account the linked activities of this industry, the general economic and occupational figures present a significant increase. In fact, boats are at the origin of a series of allied activities in the fields of trade, location, harbour services of repair and maintenance, and the like.

The linked activities of the whole shipbuilding industry is estimated at 4 750 million euros for the year 2005, a figure coupled by approximately 18 000 people directly employed, something like 76 000 units occupied upstream and 6 800 occupied downstream. As regards both the numbers of employees and the GDP, the period ranging from 2001 to 2005 registered a growth of more than 160% (UCINA 2006), as shown in table 1.

Table 1. The contribution of the shipbuilding industry to national economy

	2001	2005	Growth 2001–2005	Percentage growth 2001–2005
Contribution to the national GDP (millions of euros)				
- Direct production	1,777	2,858.2	1,081	161%
- Indirect production	4,103	4,750	647	116%
- Total	5,880	7,608.2	1,728	129%
Employees				
- Direct employment	11,000	18,000	7,000	164%
- Upstream linked activities	6,000	6,800	800	113%
- Downstream linked activities (maritime tourism)	76,000	76,000	–	100%
- Total	93,000	100,800	7,800	108%

Source: our elaboration on UCINA (2006).

The sector of building of pleasure boats constitutes a strong point of Tuscan economy as a whole, since it showed a constant trend of growth starting from 2000, and thus counterbalanced the decline or stagnation of other sectors. It also proved to possess potentialities of development

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[2] These last data are probably underestimated, as they do not consider a consistent number of firms working as subcontractors.

notwithstanding the continually–changing setting (Cazzaniga Francesetti 2005).

The Tuscan shipbuilding industry finds a third position in the national place–list, a first placing in Italy and a top one in the world list as regards the value of production of mega–yachts and the steady level of growth of its productive capacity.

In fact, the calculated number of mega–yachts built in Tuscany is 90 out of 260 built in Italy and 688 in the world for the year 2006 (UCINA 2006).

The structure of the market of pleasure boat building is basically oligopolistic and characterised by the existence of:

– a few big shipyards that present the export characteristics of the made in Italy;

– a few niches of medium–sized shipyards that operate in high–quality segments (as for technology, raw materials, design, etc.);

– a system of small and micro firms, mainly handcraft–like, that complete the *filière* and prosper in the orbit of the business of big shipyards.

At the moment, subcontractors must face significant challenges coming from the international competitors (from the Far East, such as Korea, Japan, and China) since the big shipyards are more and more often addressing to a few medium–sized firms (often outside the national or the regional territory), while the small shipyards (which constitute the most part) are excluded from the design and planning phases and only involved in marginal workings, so that they gain a limited bargaining power.

In this context, innovation constitutes a critical aspect to be seriously considered in order not to lose competitiveness, both for small and medium, and big firms.

2.2. Identification of shipbuilding clusters

The national territory can be analysed into territorial units, which interpret the daily commuting flows due to work reasons, defined firstly in Italy by the ISTAT in the 1991 Census on Industries and Services. These territorial units are knowns as local labour systems (LLS) (Smart 1974, Combees and Openshaw 1982).

Therefore, we are able to analyse a 'thickening of socio–economic relations among the various members of the local society, to favour the formation, the spread and the maintenance of a system of values, productive acquaintances, typical behaviours and institutions through which the local society interacts with the productive organisation' (Becattini and Sforzi 2002: 21) that is typical of a local production system.

This methodology, recently applied to the 2001 Census, identified 686 LLSs in the Italian territory as the result of the aggregation of daily commuting flows of around 8 100 Italian municipalities.

In order to identify and map shipbuilding clusters, the economic activities that compose the shipbuilding industry have to be defined. The shipbuilding industry is substantially composed by three sub–sectors: first, a system of shipyards of pleasure boats; second, a set of subcontractors for furniture and interior furnishing, which is more and more integrated in the shipbuilding *filière* (Bacci 2006); and finally, high–technology producers.

Notwithstanding this situation, the shipbuilding industry of pleasure boats is commonly analysed in the NACE rev. 1.2 (ATECO, ISTAT 2002) classification as code 35.12 (CENSIS 2006, UCINA 2006). In this work, this approach is followed, and the above–said code, corresponding to 'Building and repair of pleasure and sporting boats', is taken into account. Next to the main economic activity, a few codes are added which refer to the production of boat accessories, such as ships' propellers (28.75), marine engines (29.11), navigational instruments (33.20), amphibious motor vehicles (34.10) (see table 2).

Although several headings may crisscross the code corresponding to the sector of shipbuilding, for instance furnishings (Bacci 2006) or plant engineering, this survey will focus on those activities that are specifically aimed at pleasure boat building, leaving out commercial ships and vessels, passenger ferries, cargo ships and tankers, which are included in code 35.11.[3]

Table 2. The shipbuilding industry of pleasure and sporting boats

35.1 Building and repair of ships and boats
35.12 Building and repair of pleasure and sporting boats[*]
28.75 Manufacture of ships' propellers
29.11 Manufacture of marine engines
33.20 Manufacture of navigational instruments
34.10 Manufacture of amphibious motor vehicles

[*] This class includes: building of inflatables; building of sailboats with or without auxiliary motor; building of motor boats; building of other pleasure and sporting boats: canoes, kayaks, skiffs. This class leaves out: manufacture of marine engines (see 29.11), and manufacture of sailboards (see 36.40).
Source: NACE rev. 1.1.

Following the approach of identification of industrial local production systems recognised at an international level and applied in various European

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[3] 35.11 Building and repair of ships. This class includes: building of commercial vessels, passenger vessels, ferry–boats, cargo ships, tankers, etc.; building of warships; building of fishing boats; this class also includes: construction of hovercraft, construction of drilling platforms, floating or submersible, construction of floating structures: floating docks, pontoons, coffer–dams, floating landing stages, buoys, floating tanks, barges, lighters, etc.; maintenance, repair or alteration of ships, shipbreaking.

countries,[4] we calculate an index of spatial concentration, which represents the index of regional concentration of employees as measured up against the national average. Where a local labour system presents a percentage of units above the national average, the index will be above 1; where it is below the national average, it will be less than 1.

Location quotient of concentration activities: $LQ_{i,s} = \dfrac{E_{i,s}}{E_s} \bigg/ \dfrac{E_i}{E} > 1$
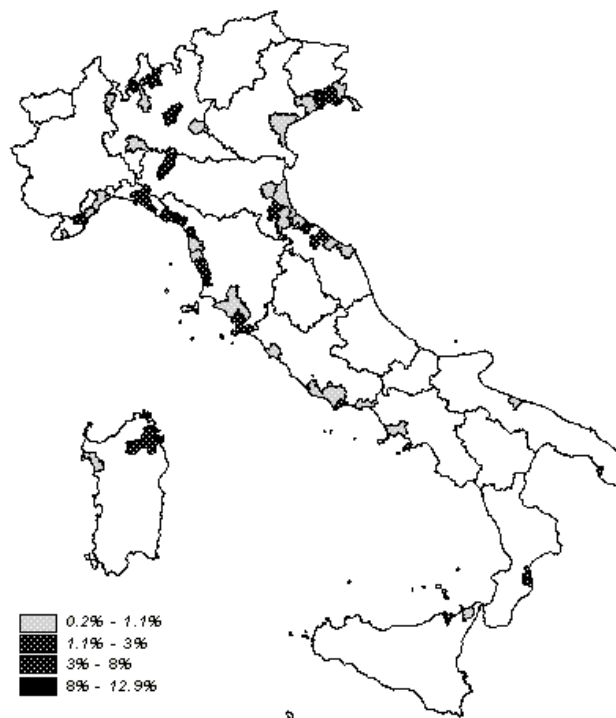
where $E_{i,s}$ is the number of employees in local units in the local labour system s specialised in the shipbuilding industry i as defined; E_s is the number of employees in local units in the local labour system s; E_i is the number of employees in Italy specialised in the shipbuilding industry; and E is the total employment in Italy. A Lq above 1 indicates that a LLS has a specialisation (concentration) in the shipbuilding industry above the national average.

The result is that, even from this point of view, Tuscany is among the Italian regions with a relevant sector of pleasure boat building, going after Liguria, Friuli–Venezia Giulia and, probably because of their small extension, Puglia and Marche.

Figure 1 offers a graphic representation of localisation coefficients of pleasure boat industry in Italy, so as to evince the main clusters of boat and ship building at an Italian level. The Tyrrenian coast, which includes the coasts of Liguria, Tuscany and Lazio, shows a high specialisation in the shipbuilding industry, with a few pre–eminent local systems, such the area of Genoa, Northern Tuscany (with Viareggio for the building of mega–yachts), the Argentario and the Latium coast. The eastern coast also presents a few local systems with high rates of specialisation, such as Venice, Trieste and the area corresponding to Emilia Romagna and Marche. However, this industry is quite dispersed along the Italian territory, presenting a few interesting clusters also in Sicily, Sardinia and Southern Italy.

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[4] Such as England (De Propris 2005), Spain (Boix and Galletto 2006) and Italy (Sforzi 1997, Capone and Boix 2007).

Figure 1. The shipbuilding cluster of pleasure and sporting boats in Italy (LLSs)

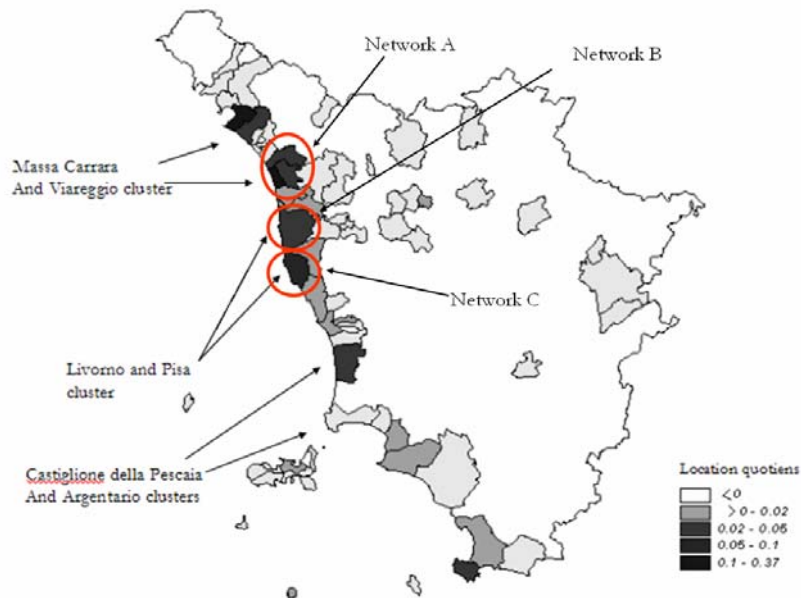Source: our elaboration on Industry and Trade Census, 2001.

Subsequently, the shipbuilding industry appears to be very concentrated: the 56 clusters identified in the Italian territory only represent 8% of the total. However, taken as a whole, these places gather about 8 000 employees and 394 firms, which respectively represent 77% of shipbuilding employees and 69% of shipbuilding firms.[5] Finally, next to the harbours, some places are identified, which are neither on the coast nor in its proximity, but close to waterways, with a long tradition in the production of boats or the presence of subcontractors.[6]

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[5] It is important to remind that this computation leaves out both subcontractors and linked industries.

[6] The local systems with a higher quotient of concentration are: *Viareggio*, La Spezia, Napoli, Fano, Forlì, Torino, Chiari, Venezia, Chiavari, Morbegno, Cattolica, Ancona, Fiorenzuola d'Arda, Latina, *Massa*, Genova, Olbia, Cervignano del Friuli, Ravenna, *Pisa*. The Tuscan provinces are in italics.

In order to analyse whether the three networks financed by the SDP funds are localised in the shipbuilding cluster of Tuscany, we widen the above analysis focusing on the region of Tuscany. In the figure below, we introduce the location quotient of concentration for the firms belonging to the Tuscan shipbuilding industry, in order to represent a first map of the clusters in this region (figure 2).

Figure 2. The shipbuilding clusters of pleasure and sporting boats in Tuscany (municipalities)

Source: our elaboration on Industry and Trade Census, 2001.

The Viareggio area represents one of the most prestigious mega–yacht building poles at a world–wide level and it is characterised by the important presence of big shipyards specialised in the production of yachts and mega–yachts (more than 24 meters of length) in steel and glass resin. This area is also crowded with miscellaneous activities from the subcontractors of products or services, so much that in the past it took the shape as a real neo–Marshallian industrial district (Cazzaniga Francesetti 2005). The Pisa area is characterised by several activities ranging from production to preparation, restructuring, ordinary and extraordinary maintenance of pleasure and sporting boats. In the Livorno area, the shipbuilding industry is closely connected to the activity of the big shipyard 'Fratelli Orlando' which – after

having produced commercial boats for the declining European market for a long time – was acquired by the Azimut–Benetti company, and is now becoming an important shipyard for the manufacture and repair of mega–yachts. In the same area, there is a great number of small shipyards for the production, repair, maintenance and laying up of small pleasure boats. Many other firms are also connected to the production of nautical accessories. The peculiar feature of the Grosseto coast is that its economy is strongly characterised by the tourism industry, and consequently the shipbuilding industry is also strongly dependent on the tourist system of the coast. In such a context, an important role is played not only by firms building small boats but also by those that provide repairing and laying up services. The localisation of many shipyards in the areas of Castiglione della Pescaia, Follonica and Porto S. Stefano, internationally–renowned tourist attractions, confirm the complexity of the shipbuilding system and the important relationships it entertains with the tourism industry and other activities related to the sea system (harbour, transport, etc.). In the Massa Carrara area, an important cluster of building firms of pleasure and sporting boats is progressively developing, with subcontractors, manufacturers of accessories, etc., that are mainly related to the mega–yacht production of the Viareggio area.

These activities mainly characterize the coast, with the above–described areas that surely have an important economic impact: in the thicker spots we find the Viareggio area, which forms with Pisa and the Livorno coast a closed–up system highly specialised in the production of mega–yachts. There are two other interesting clusters, Follonica and the Argentario, which register a high rate of specialisation, but seem to present a more spread–out configuration. This data seem to head to the conclusion that all three networks financed by SDP 1.7.1. are located in the main clusters of shipbuilding industry shaping the region of Tuscany (see figure 2);[7] the most interesting step to take now is to analyse the way innovation takes place in these networks.

3. THE THREE FINANCED NETWORKS IN THE SHIPBUILDING INDUSTRY

In this section, we present the three networks and their main characteristics, and question whether these networks are innovative and able to develop innovation and new knowledge.

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[7] The shipbuilding clusters presenting a bigger number of firms are Viareggio (with around 157 operative firms), Livorno (49), Monte Argentario (39), Massarosa (27), Pisa and Carrara (22), Massa (20), Camaiore and Cecina (16), Rosignano Marittimo (15), and finally, Orbetello (11).

According to Action 1.7.1, 'Networks for technological transfer', provided for by Measure 1.7 of 'Innovation transfer for SMEs' which is contained in the Tuscany Region SDP, Ob. 2 for the years 2000–2006, three networks were financed in the shipbuilding industry (networks A, B and C).

The common aim of the three projects was to organize a network in the sector of pleasure and sport shipbuilding and develop innovations and technological transfer, specifically of ICT technologies (for all three), domotic (network B) and telecommunication and computer applications (network A). The networks activities lasted one year. Table 3 presents a short outline of the characteristics of the three networks, that are described in the following pages.

Table 3. The main characteristics of the three networks

Characteristics	Network A	Network B	Network C
Innovation object	Virtual reality and simulations in shipbuilding	Domotic innovations in shipbuilding	Training and recruiting web–based services specific to the shipbuilding sector.
Networks composition	High presence of research centres and universities	Specialised networks on ICT and domotics	Leading actor
Innovation target	Mega–yacht manufacturer	Sport and pleasure boats manufacturer	Small pleasure and sport boats manufacturer
Location	Viareggio area (inside the cluster)	Pisa and Livorno area (through the cluster)	Livorno (close to the cluster)

Source: our elaboration.

These networks involved about 71 actors. Table 4 presents the miscellaneous composition of the partnership, which was also a mandatory requirement of the public call. They had to comprise (formalised networks of) public bodies (at least two, of which one a local, territorial or non territorial body), research centres and universities, consortia and SMEs (at least five), service centres, research and innovation companies, professional unions, for a total of no less than ten participants.

The greatest presence in this typology of actors resulted that of the SMEs, with 30 participants, while on a second position we find the professional unions (18), followed by the public bodies (7). The group of research centres and universities collected a total of six presences, and service and innovation centres (of diverse nature) five. Each network had an average of 27 actors.

Table 4. The typology of actors in the three networks

Network	Association	Chamber of Commerce	Research centre	Services centre	Public Institutions	SME	Total
A	6	2	4	2	2	11	27
B	6	2	1	2	3	10	24
C	4	2	0	2	2	9	19
Total	**18**	**6**	**5**	**6**	**7**	**30**	**71**

Source: our elaboration.

The three networks were all organised around an excellence research and services centre which was charged with the coordination of the technical partners for each network. Next to these, a few public institutional actors participated with a formal role of leading partner and were trusted with the task of drawing in the firms and research centres required to achieve the project goals[8].

Although all the networks were engaged in the innovation and technological transfer for the shipbuilding industry, the targeted final actors differed from mega–yacht to small pleasure and sporting boat manufacturers (table 3)[9].

The innovations regarding the three projects were mainly incremental innovations that had already been developed in other sectors (that is, citizen services for the case of network C, home–domotic solutions for network B, and the paper sector for network A). The innovations planned for the three projects were significantly different due to the diverse beneficiaries each networks applied to. Network A put forward practical and quite interesting prototypical innovations mainly intended for big shipyards (the manufacturers of mega–yachts); network B essentially offered innovations applied to domotic for shipbuilding firms; while network C was mainly given over to the firms situated along the southern Tuscan coast, to which it offered a prototype of web service designed for shipbuilding SMEs. The characteristics of the innovations applied by the networks are summarised in table 5.

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[8] Network B was promoted and coordinated by a local professional union, network A was checked on by the local entrepreneur association and the local Chamber of commerce, and network C by the local institutional actors of the territory.

[9] Network A was mostly concerned with the area of Viareggio and the production of mega–yachts; network B was mainly addressed to the provinces of Pisa, Massa Carrara and Livorno, thus including the building of both mega–yachts and smaller pleasure boats; network C was charged with the local institutional actors and addressed to firms of building and repair of pleasure boats, except mega–yachts.

Table 5. Characteristics of the network based innovations

Characteristics	Network A	Network B	Network C
Innovation object	Virtual reality and simulations in shipbuilding	Domotic innovations in shipbuilding	Training and recruiting web based services specific to the shipbuilding sector
Incremental or radical innovation	Incremental	Incremental	Incremental
Technology of the innovation	ICT and virtual reality	Domotic and ICT	ICT and web design
Evaluation of the innovations by the Tuscany Region	High technological content	Medium level of innovative content	Medium–low level of technological content

Source: our elaboration.

The project evaluation made by the Tuscany Region for the three network was positive, since they proved to have proposed interesting innovations and dissemination to all the actors in the partnership. The firms involved showed a significant interest in the innovations recommended and the relationships among the principal actors revealed to be excellent, thus providing evidence for the important role of trust and embedness in localised clusters.

In the following section, we will try and verify whether the innovativeness and the performance of these firms are affected by their localisation within the Tuscan clusters of shipbuilding of pleasure and sporting boats.

4. CLUSTERING AND INNOVATION OF THE NETWORKS IN THE TUSCAN SHIPBUILDING CLUSTERS

The aim of this section is to verify whether the effects of industrial districts on innovation capacity, as supported by literature, may take in the networks of the shipbuilding clusters. The section is based on a questionnaire administrated to the 71 participants to the three networks. The redemption rate is around 18.5% and in line with the redemption rate of the overall regional policy (around 26.2%).[10] In this section we consider three issues:

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[10] The Tuscany Region financed 36 multi–industries networks for a total of more than 830 actors.

a) *Relationships*. Agglomeration effects should promote relationships and collaboration among networks (Boari and Lipparini 1999, Tallman *et al.* 2004, Muscio 2006). Therefore we introduce the judgments expressed by partners as regards the contribution to the firm in terms of innovativeness, offered by the relationships among actors in the same network.

b) *Knowledge and trust*. The role of (given and received) knowledge is also important and promoted by the cluster (Belussi and Pilotti 2003, Noteboom 2004) together with the overall mechanism associated with social capital and trust (Lorenz 1988, 1999, Dei Ottati 1994a, 1994b). We then asked to evaluate the exchange of knowledge with the network and the role of trust in finding cooperation and agreement of interests.

c) *Innovation*. The innovation capacity of the network is influenced by industrial cluster effects (Swann *et al.* 1998, Bell 2005). We asked participants to evaluate the network capacity to reach the initial goals, to identify the firms' needs, to favour the economic exploitation of results, and also the analysis activities and the future developments. All these issues are presented in table 6.

Table 6. Evaluation of the contribution of the network to firm innovativeness

Rating	1 (insuff.)	2	3	4	5 (Excellent)	Total
Relationships						
a) Ability to activate relationships (also outside the networks)	8%	0%	**46%**	**31%**	15%	100%
b) Crucial technical and scientific competencies	8%	15%	15%	15%	**46%**	100%
c) Previous experiences of project management	15%	0%	**46%**	**31%**	8%	100%
d) Management of some phases of the project	8%	0%	**46%**	23%	23%	100%
Knowledge and trust						
a) Knowledge *received* from the partners	8%	0%	**54%**	15%	23%	100%
b) Knowledge *given* to the partners	15%	15%	**31%**	**31%**	8%	100%
c) Degree of trust and fairness towards the cooperating partner	8%	0%	**31%**	**31%**	**31%**	100%
d) Agreement of interests with the partners	8%	8%	23%	**31%**	**31%**	100%
Evaluation of the innovative network						

a) Ability to reach innovation goals	15%	0%	23%	**46%**	15%	100%
b) Identification of the firms' needs	29%	0%	14%	29%	29%	100%
c) Potential economic exploitation of results	29%	14%	14%	29%	14%	100%
d) Quality and implementation of 'analysis activities'	14%	71%	0%	14%	0%	100%
e) Identification of future actions	29%	0%	43%	14%	14%	100%
e) Other results	57%	14%	29%	0%	0%	100%

Source: our elaboration.

First of all, we analysed the evaluation of relationships made by partners in the same network. The actors in the network are well satisfied with the ability to start relationships. In about 82% of their answers their judgements scored at least three points or more. A very good evaluation is also given to scientific competencies, although in this case there is still 23% of partners who declare they are still unsatisfied with it. The past management practises also have a positive evaluation, but the percentage of satisfied subjects decreases (75%).

As regards transmission of knowledge and relationship mechanisms, the firms signal for these processes a slight predominance of the advantages acquired over the contributions given to the network. On the other hand, the relationship mechanisms (such as the role of trust and the agreement of interests) show that the network actually brought about a real cooperation among partners. The absence of trust and the existence of possible disagreement of interests concern respectively 8% and 16% of the interviewed.

Focusing the analysis on the overall judgement of the ability to reach the goals of network innovation, about 75% of the interviewed expresses the view that participation to the network is more than good. In particular, a good or excellent judgment of the work done by the network is given by more than 60% of the sample. However, a result which should not be undervalued is a 15% of the interviewed who found the ability of the network to reach its initial project goals insufficient.

Going into details in the analysis of the network's effectiveness to reach its (planned or unexpected) goals, we discover a conflicting overall evaluation. The views expressed on the recognition of the firms' needs (which scored at least three points or more in 75% of the answers), as well as on the identification of future undertakings, are substantially positive. Conversely, a generally negative opinion comes out with regards to the potentialities of economic exploitation of the network effects. In this case, more than one fourth of the interviewed hints at deficiencies in this field. The answers regarding the ways in which an activity of analysis should be implemented are much more troublesome. In this case, a relevant factor at

play seems the reduction of the budget raised by the Region measured up to the initial request made by the network. A reformulation of budget is likely to impair the achievement of the results from both a scientific and an economic viewpoint.

To conclude this section, we would like to look into the potential for collaborative relationships once the project is over. Given the technological nature of the public call, prospective collaboration should be basically established on the activities of technological innovation (positive judgements reach 85% of the valid answers). Positive views concerning productive and commercial collaborations are less than 69% of the total. From this point of view, the overall judgement of the work done by the network is basically positive, particularly with regard to technological support, as shown by 15% of the interviewed who do not intend to maintain the relationships developed in the course of the project.

In the next section, the analysis is completed with the exam of performances for the firms belonging to the identified clusters, in order to prove whether such behaviour inside the clusters lead to different performances in the firms as well.

5. THE ANALYSIS OF THE FIRM PERFORMANCES IN THE SHIPBUILDING CLUSTER

In this section, we put forward the analysis of performances for the firms belonging to the identified clusters in the shipbuilding industry. As already explained above, concentrations of firms encourage their innovation capacity because of a more widespread diffusion of knowledge, the presence of social capital and trust, and a more efficient ability to network.

In this section, we bring about a comparative analysis of firm performance in order to verify whether the localisation of firms in the cluster of shipbuilding industry and a higher innovation capacity produce different management outcomes. To this end, we employ AIDA database, which contains the financial statements of a sample of multi–sectorial Italian firms. AIDA of the Bureau Van Dijk contains company accounts, ratios, activities for 700 000 Italian companies; and the ownership and management for the top 20 000 companies.

From AIDA database, we extract the sample of all the firms (shipyards and subcontractors) operating in the sector of pleasure boat building and laying up (ATECO code 35.12).

Then, we separate the sample into two groups of firms using localisation as a variable. The first subset is composed of all the firms localised in the industrial district of shipbuilding situated in the Viareggio province, as already identified in a previous analysis, particularly in the municipalities of Camaiore, Pietrasanta, Viareggio, Massarosa and Forte dei Marmi. The

second subset contains all remaining firms of Tuscany. Considering how the analysis developed, we expect to find different performances in district firms, party due to the presence of external economies.

Then, we examine the financial statements of firms for the year in which interviews were collected (2006). The whole sample is composed of 183 firms out of the 520 operative firms existing in Tuscany, according to the last updated data from 2001 census (ISTAT 2001). In particular, the subset of Viareggio firms is constituted by 80 firms out of 157. In particular, we analyse their different performances as regards profitability (sale revenues, EBITDA, ROS, net income, ROA, ROE),[11] firm size (total assets and equity, while unfortunately not all the firms present the number of employees) and capital turnover.

In table 7 the above–said indexes and their relative results for the two subsets are listed. Using the Statistical Package for Social Science software (SPSS), we calculate the Leven test and the T di student test in order to analyse the significance of differences and compare the samples according to the selected variables (Stock and Watson 2005).

As regards the means of the variable under exam, the firms localised inside the cluster register higher values for all variables. ROS is 1.65 higher, ROA even 8.16 and ROE 9.5. Profitability is therefore much higher for these firms. If we look at the other variables, we find that sale revenues are more than 11 million euros higher, and the same happens with EBITDA, which is bigger of 2 million euros. Size variables bring to light a greater dimension of cluster firms as regard total assets and equity. Also, data associated with variance show that the Viareggio cluster presents not only higher profitability indicators, but also a lower variance, at least for some indexes (ROA, ROE). In other words, ROE for firms inside the cluster is not only bigger but it also varies less compared to that of firms outside the cluster.

However, as these values might constitute an accidental outcome instead of represent an actual difference of performance for the two subsets, we

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[11] EBITDA, Earnings Before Interest, Taxes, Depreciation and Amortization in English, or MOL (Margine Operativo Lordo, gross operating margin) in Italian, is a profitability index, which denotes the income of a firm deriving solely from its peculiar management, thus gross of interest (financial management), taxes (fiscal management), depreciation of goods and amortization. The Return On Equity (ROE) is a profitability index of the own capital; it represents the global index of the firm's economic outcomes, and is calculated as the ratio between the net income and the total equity of the firm. The Return on Sales (ROS) index represents the average operating income per unit of revenue. This ratio expresses the firm profitability in relation to the remuneration ability of a flow of revenue. The Return On Assets (ROA) is a balance sheet ratio measuring the profitability of the capital invested or the activity carried out (characteristic and patrimonial management), and is calculated as a ratio of net income on total assets.

resort to the two (T and Leven) tests and find whether or not the differences of means and variances in the two groups are significant.

Table 7. Performances of the shipbuilding firms in the Viareggio district and Tuscany[*]

Variables	Groups	N	Mean	Standard deviation	Leven Test	T Test	Mean gap
Sales revenue	Cluster	80	13.902.000	81.376,77	0.015*	0.149	11.665.180
	Tuscany	103	2.239.000	6.006,22			
EBITDA	Cluster	80	2.104.000	11.591,13	0.004**	0.087*	1.968.598
	Tuscany	103	135.000	586,74			
ROS (Operating income / sales revenue)	Cluster	71	6,75	10,58	0,177	0.453	1,16
	Tuscany	94	5,59	9,32			
Net income	Cluster	80	891.410	5.072	0,003**	0,099*	845.082
	Tuscany	103	46.330	901			
Total assets	Cluster	80	13.488.900	72.473	0,042*	0,186	9.679.502
	Tuscany	103	3.809.400	13.074			
Net assets	Cluster	80	4.014.510	25.425	0,020*	0,181	3.370.085
	Tuscany	103	646.43	1.887			
ROA (Net income / total assets)	Cluster	80	10,65	17,51	0,505	0,089[12]	8,16
	Tuscany	103	2,48	39,85			
ROE	Cluster	70	20,03	36,01	0,917	0,119	9,59

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[12] The non-parametric Mann-Whitney test, which does not tolerate any condition on data distribution, was also calculated. This test is significant for revenues, EBITDA and net income, thus confirming more precisely our results. Because of the presence of the world leader in the building of mega-yachts in Viareggio, we also tried and tested both subsets leaving the Azimut-Benetti company out of the sample, but the results were unchanged.

(Net income / equity)	Tuscany	91	10,43	40,39			
Capital turnover	Cluster	78	1,30	0,803	0,209	0,573	–0,76
	Tuscany	102	1,37	0,963			

Source: our elaboration on AIDA database (2006).

If the Leven test presents a significance higher than 0.10 we can assume that the two groups have the same variances and pass over the second test; otherwise, we must check data using the T test. If the T test has a significance smaller than 0.1, we can conclude that the difference of mean in the two groups for the experimental variable is not casual.[13] (Stock and Watson 2005).

In the Leven test, the significance is higher than 0.10 for ROS, ROA and ROE, so that we can say that the differences between the means of these indexes are not casual, but in fact depend upon a different performance of the two groups. In fact, the firms belonging to the Viareggio cluster register higher profitabilities. On the other hand, the T test presents significant values for EBITDA, net income, and – thus confirming the previous results – for ROA and ROS. The performances in the firms belonging to the two groups are significantly different and not merely due to the casuality of the sample. The localisation of firms inside the cluster of Viareggio affects their performance as regards both profitability and size, and operating variables.[14]

6. CONCLUSIONS

The outline of the sector of shipbuilding of pleasure boats in Tuscany is that of a territorially–widespread industry with geographical concentrations in a few internationally–renowned clusters. In this research, first the main concentrations of the shipbuilding industry in Tuscany were identified, and then the processes of networking in the regional clusters were analysed with regard to their ability to promote innovation and technological transfer by means of the three networks financed through a specific public measure.

The methodology employed for the identification of the shipbuilding clusters proved effective and bought to light the presence of territorial

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[13] Significance at 90%.

[14] Signorini (1994) compared textile firms located in the Biella and Prato districts with textile firms not belonging to an industrial district, and found significant differences in their performance. Profit rates, as indicated by return on investment (ROI), were, on average, five points higher for district firms than for 'isolated' firms. Banca d'Italia (Fabiani *et al.* 2000) reported that over the period 1982–1995, profitability, as measured by ROI and ROE, was always higher in industrial district firms.

concentrations of firms specialised in the building, laying up and repair of pleasure and sporting boats. The analysis results were encouraging, and interesting innovations and technological processes were evidenced within the networks.

Also, the survey reveals an overall positive evaluation of the innovative processes and the relational mechanisms started out by the network. In terms of transmission of knowledge among firms, what comes to light is a slight predominance of the advantages acquired over the contributions offered to the network. On the whole, the judgements expressed about the learning processes started by the network are good. Social capital is acknowledged to be a positive factor in the process of knowledge transfer, thus showing how the network really brought about cooperation mechanisms founded on mutual trust among partners.

The networks supported by the Tuscany Region proved to be innovative and effective because they managed to identify the technological needs of the firms and the future actions required in terms of innovation. In both cases, these are very good results as far as they draw near the two worlds of research and industry.[15]

However, the examination of the judgments expressed seems to call for future, more in–depth analysis, given that the limited number of answers might correspond to an undervaluation of negative opinions. In fact, it is possible to assume that the subjects who answered to the questionnaire were the more involved actors of the networks, or those partners who were more likely to express positive general views. Also, it might be interesting to investigate and underline the different answers coming from partners belonging to different networks, a feature we were not able to take into account, due to the low number of questionnaires that were actually filled up.

Finally, the research brings to light the important role of territorial clusters of firms in supporting and promoting innovation. In fact, a key role in the innovative process is played by a few aspects which are typical of concentrations of firms, such as trust, social capital and relationships among actors. Also, the localisation inside the Viareggio district affects the firms in a considerable way as regards their different performance in terms of profitability and size variables. In conclusion, the shipbuilding industry of Tuscany proves to be a geographically–concentrated sector in which an important role for their competitiveness is played by the localisation advantages achievable through the cluster.

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[15] In fact, the shipbuilding industry proved to be one among the sectors with a very good assessment out of the 36 networks financed by the Tuscany Region. This point is also dealt in Lazzeretti *et al.* (2007).

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