

“Spatial” relationships to support knowledge transformation in business idea.

The network of POINT- Italian Technological Pole

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Localized relationships, scientific knowledge, resources, business idea, Science and Technology Park, spin off

Abstract

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In this perspective the main aim of this paper is to investigate how this process of knowledge transformation can be supported by a local network of actors that involves universities and research centres, local entrepreneurs, public institutions. These actors generate strict interrelationships characterized by mutual understanding based on spatial proximity. This one supports the process of technology transfer, and its development in spinning off new ventures from academic labs.

The relationships developed by firms in local context allow them to take benefits from firms' agglomeration (Marshall, 1920). In the latter a set of interrelated actors performs activities transforming interconnected and interdependent heterogeneous resources (Hakansson, Waluszewski, 2002).

In this context Science and Technology Park realizes knowledge transfer supporting relationships developed by hosted firms and by actors that belong to local area.

The empirical evidence of this paper investigates the activity of POINT, the Italian technological Pole, focusing attention on support provided to spin off.

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INTRODUCTION

Innovation is more and more considered as a result of continuous and non linear interaction among heterogeneous actors (Lundval, 1993, 1994). In this perspective the development of innovation is often characterized by a process that involves internal activities of firm and external ones (Rosenberg, 1982) in order to realize knowledge transformation into economic value.

Dissemination of innovation can be considered as a metamorphosis of technology transfer, referred to knowledge that passes from producers to users. The new organizational model of technology transfer is based on the shift from linear model to interconnected network. This one is characterized by a co-operative approach and by intensity of interactions, that is critical to innovation success (Allen, 1977).

This intensity is supported by spatial conditions that favour the transmission of ideas, information and knowledge; activating knowledge and technology spill over. The advantage of location has both static and dynamic feature, related to external economies. Static external economies from co-location arise due to reduced costs because of better proximity to suppliers or markets, while dynamic external economies from co-location are associated with learning, innovation, and increased specialization (Bergman, Feser, 1997).

In a local perspective the combination of resources is strictly related to the externalization of R&D activities, which support the relationship development among public, private and academic research. The latter three made up the key factor of Triple Helix Model (Etzkowitz, Leydesdorff, 2000), the spiral model of innovation that investigates the capitalisation of knowledge.

Firms, research institute and local public institution that belong to public, private and academic area, develop spatial relationships in order to support the competitiveness of each local actor and of the local area, through the process of resources sharing and resources combining.

Resources have been interpreted in different ways, particularly considering internal approach and external one. In the first one, Resource Based View, firms own resources that allow achieving competitive advantage (Grant 1991). Unlike this, in the network approach, resources can exploit their potentialities through interaction. The latter is the base of relationship, considered as one of the resources the firm can exploit and use in combination with other resources (other relationships) available to the firm. The relationships are connected among them, so what is produced in a relationship can have effects on other relationships and thus on other firms than those directly involved (Håkansson, Ostberg 1975). The ties of resources influence resources sharing and resources combining.

To create new ideas, acquiring new knowledge, identify new opportunities, firms interact within their boundaries. As knowledge is developed by the interaction among firms, these relationships contribute to the implementation of new ventures.

In this context takes place the activity of Science and Technology Park (STP) defined as an organization that supports relationships developed among local firms, universities, high education institutes, research centres, public institution, which encourages the growth of knowledge for local actors and for local area. STP is identified as “organization” considering the activity of the consortium, or the association, that realizes the management of its activities. STP promotes the economic development and competitiveness of regions and cities by creating new business opportunities and adding value to mature companies. In addition to this STP operates to fostering entrepreneurship and incubating new innovative companies. Furthermore the activity of STP is based on generating knowledge-based jobs, building attractive spaces for the emerging knowledge workers and enhancing the synergy between universities and companies.

The main aim of this paper is to investigate how a local network of actors, characterized by different nature (firms, institutions, research centre), can influence the process or technology transfer based on resource sharing and resource combining. The paper investigates how this process, particularly referred to academic spin off, can be influenced by spatial dimension, analysing the case of POINT, the Italian technological Pole.

The paper is articulated into two parts. The first one, based on a literature review and the second one is based on case study. The case study approach suits well to the examination of why and how contemporary, real-life phenomena occur (Yin, 1994, Halinen and Törnross 2004).

Single case study is particular adequate in this context, as the boundaries evolve during the analysis. The task of the analysis is often to progressively construct the context and boundaries of phenomenon, as theory interacts with empirical observation (Dubois, Araujo, 2004).

In a first stage of research semi-structured interviews have been conducted to different key informants of POINT (Science and Technology Park) and Petroceramics (academic spin off). The main objectives have been to investigate the network structure of STP and its influences on spin off development. Particularly, focusing on a project developed by Petroceramics, the objective has been to analyse, in a network approach, the resources generated by POINT and other actors involved, and their interconnection.

Considering the model of “4-Resources”, these one have been articulated in organizational/social, namely organizational units and business relationships, or technical/physical, namely products and facilities. The four resources can be considered as a part of different interaction processes, referred to organizational units engaged in cooperation activities (Håkansson, Waluszewski, 2002, Baraldi, 2002).

1. SYSTEMIC INNOVATION: THE INTERACTION IN TECHNOLOGY TRANSFER

The key role of R&D activities in the reaching of competitive advantage is more and more accentuated, strengthening the relation between the ability of firms to innovate and their competitiveness.

The innovation can be distinguished in introduction of new product, new method of production, new organizational model (Schumpeter, 1934). Particularly referred to this one it has been outlined the shift from

linear model to interconnected network. A relevant generator of innovation can be identified in the recombination of different elements in a new architecture (Henderson, Clark, 1990).

The process of innovation can be considered as a process of knowledge transformation into economic value. The invention comes to the creative generation of new ideas to solve technical-scientific requirements (Dosi, 1988). The innovation is the realization of invention's potential value to market. The spread of innovation is the adoption from users and the imitation from competitors (Grant, 1991).

Dissemination of innovation can be considered as a metamorphosis of technology transfer that depends on specific form of interaction between two or more social entities during which the technology is transferred (Coccia 2004). The technology transfer, referred to the passage of knowledge from producers to users, is characterized by the interaction (Autio and Laamanen, 1995).

In a traditional way, technological transfer is based on gearchical linear model in which a generator (university) adressed knowledge to a recipient. In a new perspective, the technology transfer can be considered as a interorganisational process of exchange, adaptation, learning of new technologies. The process that is co-managed and co-realized by different actors, required the combining of technological competences and managerial ones (Sancin, 1999, Piccaluga, 2001). Innovation and technology transfer, as follows, are developed through interaction among different actors (Emery, Trist, 1965).

The process of technology transfer can be analysed considering the great role of scientific research; in this context a key role is recognized to university and research center as generators of competences development. Through the activity of scientific production, actors support the knowledges frontier (exploration). A co-ordination is also required between production of new knowledge and commercial use (exploitation).

The process of enhancement of scientific research can be analysed through the value chain model elaborated by Porter (1985). The value chain of scientific research (Compagno, Pittino, 2006) is made up by different activities. Primary activities are processes that follow the chain from opportunities generartion to product commercialization. These are referred to identification of opportunities, formalization of idea, obtaining of patent. Support activity are realized by different actors as Incubators.

A key instrument to realize technology transfer is identified in spin off and acadmic sin off, through witch an innovative idea is transformed in a firm project. Spinning off new ventures from academic labs gained acceptance as a valid method of technology transfer (Degroof, Roberts, 2004). Spin-offs transfer technology from their parent organization to themselves and, they transfer the technology to customers.

Academic spin-off companies realize the main initiatives to transfer scientific and technological knowledge from universities to the market place (Chiesa, Piccaluga, 2000). Academic spin offs based on high technology develop continued relations with universities also after the initial phase of spinning off for different causes: universities can hold some equity shares in the spin-off (financial resources), spin offs can exploit patented technology owned by universities (intangible resources), and spin offs can have access to some university facilities (material resources). In the case of the last two, the relation may be bi-directional and the level of informality is higher (Berglund and Hellstrom, 2002).

A great deal of knowledge created at universities is tacit and no coded and that the dissemination of such knowledge relies on direct interpersonal contact. Professional mobility, therefore, is considered a critical element in transmitting knowledge, and an important channel for technology transfer.

A firm or an organization, can decide to launch a spin-off in order to create complementarities, to appropriate residual rents, and to focus on the core business. As, according to the resource-based view, a firm's resources are the critical factor in the design and implementation of the firm's strategy.

In spin-offs, the parent firm can exploit its resources and capabilities and generate rents by launching a new firm.

The first phase of a research spin off of is the definition of the business idea. This comes from an individually or collectively creative act to take an opportunity to create value. The business opportunities are generated by the dynamics in the existing social, technological and economic system. Starting from these opportunities, entrepreneur defines new solutions to meet emerging needs or consolidated ones

The importance of new scientific information to the development of a technologically intensive industry leads to geographic clustering in that industry (Audretsch and Feldman, 1996). Local resources and local networks support the development of existing firms and provide the catalyst for the start-up and spin off.

2. SPATIAL RELATIONSHIPS TO SUPPORT THE INNOVATION SPIRAL

In the proximity perspective (Bellet, 1993), spatial conditions support the process of approaching-separation of firms' resources and activities.

The density of firms' interaction is generated by external agglomeration economies that support the reduction of transaction costs and the improving efficiency in production, and also the development of innovative performance (Varaldo, 2003). External economies are structured in economies of localization and

urbanization. Localization economies (Marshall, 1920) recognize the centrality of the intra-industrial economies, which confer benefits to agglomerate space businesses. In the economies of urbanization, the process of agglomeration is the result of the presence of non-specific public goods, and the existence of inter-sector which act as catalysts of virtuous circles in the transmission of ideas, factors and service.

In this point of view, economies of location generate spill over. The creation of technology by a firm depends not only on what the each firm realizes, but also by what they do to each other (in terms of learning and R&D) (Antonelli, 2000). The technological spill over are very important in determining the growth of a local system, and the technological innovation of firm. Technological and knowledge spill over tend to be realized within local networks of firms (Breschi and Lissoni, 2001). The geographical concentration of industry, and therefore the regional specialization, encourages the spill over of knowledge between businesses, stimulating the growth of local industry (Glaeser et al., 1992).

The spatial concentration of firms tends to favour the transmission of ideas, information and knowledge; activating knowledge and technology spill over. These ones that are encouraged by geographical concentration of industry and regional specialization stimulate the growth of local firms (Glaeser et al., 1992). The context and specific knowledge, tacit or unexpressed, is embedded in the minds of individuals and in firm, and it is difficult to extract and transfer (Varaldo, 2003). The transfer of tacit knowledge is made difficult by spatial bonds (stickyness) and by routine (Nelson and Winter 1982).

The centrality of local systems outline the emerging of Regional capabilities (Maskell, Malmberg 1997), which identifies itself in tacit knowledge, the "... non-codified, disembodied know-how that is acquired via the informal take-up of learned behaviour and procedures" (Howells, 1995: 2).

Through processes of interactive learning "firms outline geographic area in which knowledge is embedded not only in individual skills and routines and procedures of organizations, but also in the relations that connect different firms to each other and with the institutional reference (Maskell, Malmberg 1997)".

In this context the company is required to develop an Absorptive Capacity that considers the dual role of R&D, which generate knowledge to innovate, and increase the stock of knowledge needed to reveal more cognitive needs (Cohen and Levinthal 1990).

In a local perspective the combination of resources is strictly related to the externalization of R&D activities, which support the relationship development among public, private and academic research. These latter three represent the key factor of Triple Helix model, the spiral model of innovation that captures multiple reciprocal relationships among institutional settings (public, private and academic) at different stages in the "capitalisation of knowledge" (Etzkowitz, Leydesdorff, 2000). These three institutional spheres are increasingly working together, with a spiral pattern of linkages emerging at various stages of the innovation process, to form a "Triple Helix".

In an evolutionary perspective the Triple Helix model assumes that within specific local contexts universities, government and industry are learning to encourage economic growth through the development of "generative relationships". The Triple Helix generates a knowledge infrastructure in terms of overlapping institutional spheres with each taking the role of the other and with hybrid organizations emerging at the interfaces.

The potential for knowledge-based development in "spatial area" reinforces the role of universities as a factor of socio-economic development within a spiral mode on trilateral interaction among academia, industry and government. The university can play an enhanced role in innovation in increasingly knowledge based societies (Etzkowitz, Leydesdorff, 2000).

The common objective of the actors is to realize an innovative environment consisting of university spin off firms, tri-lateral initiatives for knowledge based economic development, and strategic alliances among firms, government laboratories, and academic research groups.

2.1 RESOURCES COMBINING IN LOCAL NETWORK

The sum of skills, knowledge and resources generates the industrial atmosphere (Marshall, 1920), in which different actors are interconnected through relationships based on local resources. These relationships outline a local network.

In this perspective relationships are identified in inter-organizational platforms, through which different knowledge are combined and transferred to partners (Ferrando, 2001).

Any relationship is part of a broader context of interdependent relationships that define the network. The network, in IMP approach (Hakansson, 1982), is based on nodes (organizations and business units) linked together by interconnected relationships, through witch actors can share resources and develop activities.

Considering that relationship makes various resource elements accessible for the parties it also constitutes a resource that can be used and exploited. In the "interactive" approach through interaction actors can share resources and increase their value (Hakansson, Ostberg 1975) in a process of reciprocal adjustment and learning (Ferrero, 1992). In addition to this, the "industrial network" approach is focused on multipolar

relationships. All relationships are interconnected among them in a complex way. The role and position of actors outlines potentialities of resources.

Referred to the “4-Resources” model, resources can be considered as a part of different interaction processes, referred to organizational units engaged in cooperation activities; business relationships used in networking activities; products as parts of buying-selling activities; facilities that are involved in producing-using activities (Håkansson, Waluszewski, 2002, Baraldi, 2002). Resources are adapted to each other; the features of one resource become embedded into other resources (Håkansson, Waluszewski, 2002:18).

The resource ties among most of the interacting actors (considered as resource providers), generate an aggregated resource structure, the resource constellation (Håkansson, 1987).

Resources combinations become specifically oriented towards each other, as resources of the two firms will be tied together. The characteristics of systematic combining can be analysed through a distinction between three “levels” that outline how a specific resource becomes “patterned” through its interfaces with other resources in primary, secondary and tertiary combining (Gadde, Hakansson, 2008).

The “primary combining”, is focused on one specific resource. Considering that resources used in relation outline a “a relationship content”, products, facilities, and business units become patterned by their combining with specific business relationships. The systematic combining of resources improves the performance of the resources and increases their value in the specific setting.

Therefore, any resource is connected also to other resources on other analytical levels, since it is involved in various forms of “secondary combining”. The secondary level is related to resources from other primary combining sets that influence secondary relationships. In “Tertiary combining” systematic combining becomes a multifaceted issue since an increasing number of organizational and physical resources become involved and related. These characteristics influence the long-term development of both single resource elements and resource combinations. Physical resources and other organizational resources are successively provided with relationship content and thus given a specific relationship imprint. At the same time a business relationship is patterned through its combining with specific products, facilities, business units and other relationships (Gadde, Hakansson, 2008).

3. SCIENCE AND TECHNOLOGY PARK AS KNOWLEDGE FARM

The IASP (International Association of Science Parks) defines the Science and Technology Park (STP) as “an organisation managed by specialised professionals, whose main aim is to increase the wealth of its community by promoting the culture of innovation and the competitiveness of its associated businesses and knowledge-based institutions. To enable these goals to be met, a Science Park stimulates and manages the flow of knowledge and technology amongst universities, R&D institutions, companies and markets; it facilitates the creation and growth of innovation-based companies through incubation and spin-off processes; and provides other value-added services together with high quality space and facilities” (IASP International Board, 6 February 2002).

The STP is the centre of attraction and creation of innovative new businesses with the aim to support the growth of local enterprises. In addition to this STP enhances local potential growth, considering the creation of innovative firms that diversifies the structure of local production system.

STP is so identified as “catalysts” of innovation and technology transfer. The innovation of STP is generated by the presence within it of universities, research labs, financial intermediaries, efficient communications infrastructures that support the establishment of new businesses.

The STP can thus be considered as “Knowledge Farm”, which operate for the benefit of hosted enterprises and regions where they are located.

STP creates external economies, supporting the activation of relationships between firms, improving the technological level of enterprises in localized area, even if not directly involved in all projects. STP is therefore characterized by its ability to create opportunities for knowledge spillovers, through the development of relationships between different actors.

In the evolutionary trajectory, STP is considered as integrated local and regional development organization, based on the innovation diffusion. STP becomes Competitive Pole, a centre of competitiveness which includes all the strategic activities for the innovation process: training of highly qualified human capital, basic and applied research, incubating services, and other support services. In the same perspective Technological Poles, based on technology development, support the competitiveness of local area.

The main services offered by the STP can be identified in:

- Real estate services and support services: rental of offices, telephone network and transmitting data, voice, assistance to foreign companies for administrative problems, bars, restaurants, meeting rooms, hotel, conference centre and seminars;

- Support services: through advice technological research and higher education, STP offers services to enterprises and training of staff;
- Services to management: these services are referred to recruitment and selection of projects, training, assistance in preparing the business plan, legal advice, markets assistance, consulting in marketing, partnership with external consultants or professional bodies (Chamber of Commerce, Industry Union);
- Services to funding innovation: STP activity facilitates the access to public funds, assistance in the bureaucracy and the presentation of applications for aid, partnership with private banks or venture capital. This activity has a significant importance, especially in the economy characterized by a high number of SMEs, which thus may be aware of all funding opportunities on the market;
- Incubation services for new businesses. The creation of new businesses responds to the new role of STP for local development. Innovative initiatives can be facilitated by the presence of an innovative organization, the proximity to research facilities and the opportunity to share information with innovative companies in the same sector, the support of the park in the early stages of life;
- Services Partnership and networking: the STP facilitates a network structure of relations among all actors, national and international, involved in the process of innovation, competitive and reorganization of the territory, thus involving the research community, industry and local government.

STP strategy and organization is based on network. The players involved, often maintaining their separate existence (universities, businesses, local authorities and so on), create a new entity, which has its logistical facilities and its regulation system. This new entity allows STP to be considered as an organization.

The structure of STP is shaping up as a network organization consisting of a system of multiple connections. In these structures nodes with high level of self-regulation (or open systems vital) cooperate in order to design and implement processes, to share culture, to share technical- scientific knowledge, and support the development of the area.

4. POINT – Pole for Technological Innovation

The Italian Pole for Technological Innovation (POINT), localized at Dalmine (Bergamo), has been realized by Tecnodal Spa. This one was made up by Bergamo Province, Dalmine Chamber of Commerce and Dalmine Municipality.

POINT, founded in 1996, represents the Innovation Hub that hosts a Science and Technology Park, with R&D centres and hi-tech companies; an incubator for new hi-tech start-ups; the campus of the Faculty of Engineering of the University of Bergamo.

In the POINT, as a Science and Technology Park, hosted firms, universities, laboratories and research centres are localized.

POINT supports the development of relationships among private, public and academic firms that are located in the STP. At POINT are located public and private sector bodies as University of Bergamo, Faculty of Engineering, Materials Lab, Corrosion Lab, University of Milan, Nanotechnology Development Centre, Department of Earth Sciences, Department of Life Sciences, National Research Council, Georesources Lab, Lombard Regional Litoteca (geology museum), Italian Plastics Institute (technical certification),.

Management

The Pole is managed by Servitec that was born in 1996 on initiative of public institute, entrepreneurial organization, trade unions and some significant local business organization with the aim of encouraging the promotion of SMEs, and the diffusion of innovation and technology transfer.

The main shareholders in Servitec are: the Chamber of Commerce, the Province of Bergamo, Unione Industriali (employers' association), Banca Popolare di Bergamo- Credito Varesino (bank), Associazione Piccole e Medie Industrie (SME employers' association), Associazione Artigiani, CNA, Unione Artigiani (associations of employers and self employed craftsmen), Dalmine S.p.A., ASCOM and Confesercenti (commerce associations), CGIL-CISL-UIL (Trade Unions), University of Bergamo, Dalmine Town Council, Coldiretti and UPA (farmers' associations), Confcooperative (co-operatives' association), CESAP.

POINT supports the integration between the needs of growth of innovative enterprises, particularly SMEs, and knowledge delivered by the universities and research laboratories.

Servitec becomes a link between the market and the production of knowledge, as a tool that supports the connection between the need for innovation of Bergamo SMEs and possible solutions, according to increased dialogue between research and production of goods and services.

The relationships develop by Servitec with its institutional and business share holders enable it to assist companies in building supply chains, define innovation requirements and support technological development, promote access to financial incentives granted at EU, national or regional level, and facilitate relationships with local institutions.

The mission of Servitec is identified in the provision of services to industry in the technology transfer field to encourage the diffusion of product and process innovation; the management of the environment and rationalisation of energy demand; the assisting traditional firms to move into the world of e-business.

Spatial area

The Pole is a competitive interface, considering its functions, with urban infrastructure. POINT, as an Urban Pole, is finalized to support the development of spatial area.

POINT is localized in Lombardy Region. Together with Baden-Württemberg, Rhône-Alpes and Catalunya. Lombardy is considered one of the industrial motors of Europe, with employment rates among the highest on the continent. The performance of Lombardy is a result of the competitiveness of its companies, Milan, which is host to the largest concentration of services to industry in Italy. In addition to this Lombardy Region is characterized by numerous public and private sector universities and research centres.

POINT is localized in Bergamo province. The wealth of this province is created mainly by the ability of Bergamo industry to compete on world markets. The strong points of Bergamo industry are the international competitiveness of its machinery and chemical industries, in addition to the more traditional “made in Italy” sectors. The sound structure of its industry includes large multinationals, medium size internationally operating companies and small companies; a flexible and versatile mix (not narrowly specialised, which is common among traditional Italian industrial districts).

POINT provides services to satisfy infrastructure requirements for production, research and service provision activity that is small scale, environmentally conscious and in harmony with the surrounding area (e.g. small size non polluting hi-tech enterprises, design centres, computer laboratories, physical, chemical and mechanical testing laboratories, work shops, stores and warehouses).

POINT focuses its activity on information technology area, geology area, nanotechnology and environmental area. In addition to this POINT provides ecology and environment consulting, biomedical consulting, prototyping, TLC, engineering process. Priority is therefore to provide services both for incubating entirely new initiatives that are born as “spin offs” of research activity, as Petroceramics, and for companies operating elsewhere that decide to locate in Bergamo.

4.1 THE HOSTED SPIN OFF: PETROCERAMICS

Petroceramics S.p.A. was the first spin-off from Earth Science Department (Milan State University), with a view to making the most of the results of the University’s scientific research into materials engineering, in order to transform those results into industry-ready technologies and to develop state-of-the-art products.

Petroceramics was born by an idea of three geologists to borrow the specific expertise in geology, in industrial applications. The techniques and equipment of Laboratories have been very important for the medium-size companies as Pedrini and Bertini, which require high scientific level of competences and knowledge. The participation in society is referred to Pedrini and Bertini. The first produces machinery for ceramic materials developing relationships in Moscow and Singapore, while Bertini that has changed offer from accessories for textile machinery to the creation of ceramic products and metal surface treatment

The spin off consists of people involved in research and development materials studying ceramics on behalf of innovative companies in particular localized at Bergamo. For this reason, Brembo (leader in production of ceramic brakes, and Ferrari’s supplier) has entered into the firm.

The mission of Petroceramics is to develop advanced ceramic materials, as well as the processes and equipment associated with those materials. The company operates in a number of sectors, including: friction materials for brake systems (a field in which it works in partnership with Brembo S.p.A. and Brembo Ceramic Brake Systems S.p.A., as part of a joint venture with the Daimler Chrysler Mercedes Group); bullet proof materials for the armoured protection of persons and vehicles; and ceramic components for manufacturing industry and the aeronautical sector.

The fields in which it operates Petroceramics are identified in the industrial ceramics, traditional and advanced materials industry, synthetic or natural cement industry and the world Energy and Environment. Petroceramics exceeds the traditional structure of analysis or simple distributor laboratory equipment, but appears as a supplier of methods, innovation and technology.

The firms is at the interface between natural materials and synthetic materials, using methodologies and technologies for research and development of both areas, by finding and characterize raw materials for production, until reintegration into new cycles of waste processing. Petroceramics as a supplier of services and products for R & D introduces innovation at different levels of the production cycle.

Innovation

The business model deployed by Petroceramics is based on establishing strategic partnerships with customers and providing them with valuable support throughout the development of new materials and processes, right up until the start-up of manufacturing operations. The firm also provides materials analysis services and

consultancy services on ceramics and petrology. Petroceramics offers experience in analysis of complex systems thorough knowledge in material sciences, innovation in solving problems related to new materials, technology transfer.

In this perspective Petroceramics develops product innovation, referred to design, prototyping and characterization of materials aimed at specific uses (technical ceramics, ceramic composites, glass, metals ...) considering also design and development of new raw materials. In addition to this Petroceramics develops innovative processes for the traditional ceramic production.

Furthermore the management of Petroceramics is characterized by innovation as based on analysis of critical management processes, resolution of issues related the influence of seasonality on the processes, development and management of product quality control.

The quality of Petroceramics lies in the ability to introduce innovation into all levels of product innovation, process innovation and innovation in management and quality control of the material. The firm had also committed the University of Jerusalem, which required equipment for high pressure synthesis. Other orders came from the U.S

The goal is the reuse of industrial waste, working on materials containing heavy metals, an attempt to separate inert waste from used but toxic.

The project

Petroceramics has developed the project "Materials and innovative technological process" to realize high efficiency brake pad.

The main aim of the project has been the substitution of materials used in conventional brake pad (resin) with inorganic binder (ceramic and metallic material).

The project involved three Italian SMEs active in research and development of advanced ceramic materials, in the production of thermoplastic forming processes, as well the University of Milan and the Department of National Research National Centre (CNR - Italy). The high level of actors' scientific competences and technological knowledge made it possible to develop an innovative friction materials, which has great prospects of application in field of competition and then on-road cars

The main actors involved are:

- Petroceramics, that has realized applied research and prototype;
- Delta Moulds, that has provided tools and machinery;
- Elchi that has realized processing of raw material combination;
- CNR-IDPA Milano, that has realized software and database in order to monitor the processes;
- University of Milan, that has realized the study of processes.

The resources combination

The project has been started from preliminary studies developed on different lines of material. The project has been original in composition and in the process of implementation. In particular, the project has tested new formulations based on resins that, after specific treatments, are transformed in a ceramic binder. This one is completely characterized by excellent mechanical properties which are retained even under conditions of extremely high temperature (900 ° C), likely to be found in severe braking conditions. This property is crucial for security system.

This project required the involvement of different actors characterized by different activity, and generator of different resources, that have been interconnected by relationships (Figure 1)

Particularly *Petroceramics* develops different activities as:

- research and development of innovative technologies used in the production of traditional ceramics, advanced technical and, in the treatment of geomaterial and in characterization of rock masses;
- development of laboratory equipment and technologies fused in high temperature or high pressure, for the production of ceramic and treatment of geomaterial,
- research and development of solutions for recovery and reuse of industrial waste, the hazardous inert waste, with emphasis on waste containing heavy metals.

Firm's objective is to provide research, development and design of high level in the production of materials, processes and equipment. Target areas are primarily those of traditional and advanced ceramics, stone of, raw materials and synthetic minerals, cement, glass and Energy and Environment. Petroceramics developed relationships with all actors analysed.

Delta has provided tools and machinery. The Italian company Delta is specialised in design and production of permanent steel moulds and core boxes for gravity and low pressure die casting of aluminium alloys. With its machinery Delta is able to satisfy a wide range of requirements, moulds for the small and big castings, maintaining a high precision.

Elchi has provided processing of raw material combination. Elchi has created and produced a wide range of High Quality Moulding Materials, mainly based on Thermosets resins. Working closely with customers, they

have developed an extensive range of moulding compounds to meet the most demanding Industry requirements.

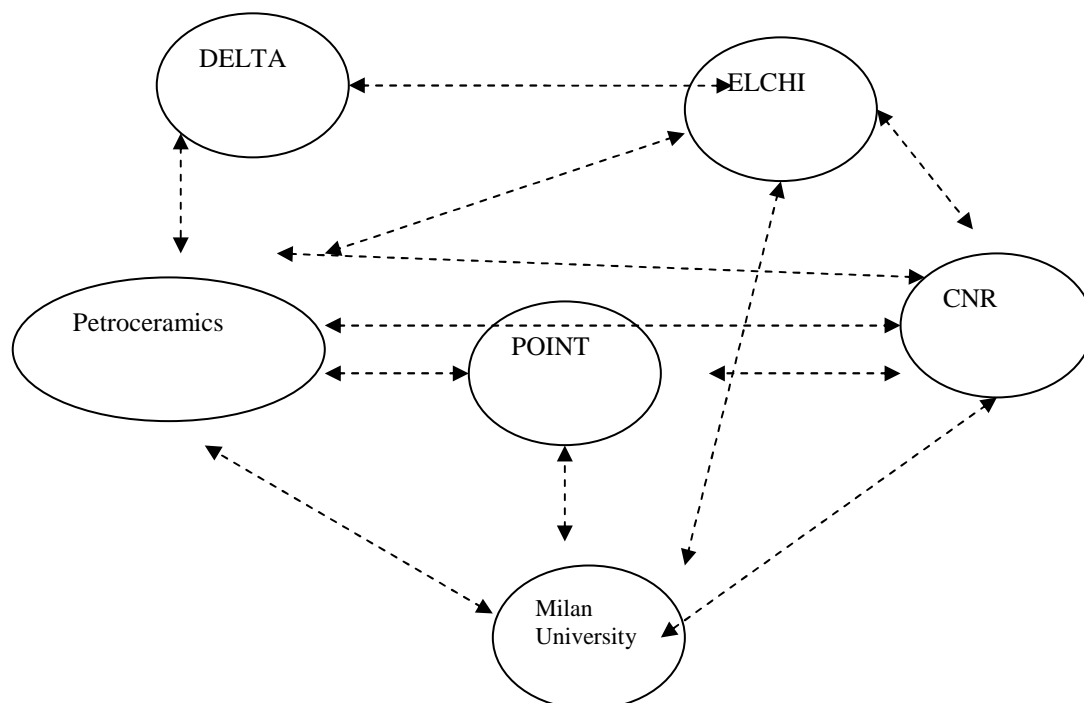
CNR- IDPA has provided software. The Institute for the Study of the Dynamics of Environmental Processes of the National Research Council adopts a multi-disciplinary approach in analysing environmental problems. The studies focus on chemical contamination at a planetary level, the mechanisms of transport and transfer of pollutants between various environmental compartments, the processes and cycles of transformation of chemical substances in the environment. Research focused also to the study of geological environment dynamics, to methodologies of study and representation of environment and landscape and to improve analytical, monitoring and prevention activities in geological and environmental field.

In addition to this *Milan University* has realized report and analysis. With its activities support the research in different branches

In this project *POINT* has supported the activities of Petroceramics through the structure or STP and services provided. Support services for technology transfer and innovation offered aim to support companies and public authorities throughout the process of innovative products and processes, from the preliminary stages of research and exploration of technological opportunities to its industrialization, and the protection of industrial property. Servitec is constantly engaged in direct advice to the single undertaking for the diffusion of innovations and technology transfer as well as the promotion and management of projects of technical and scientific interest in the area. The companies and other organizations located at *POINT* all benefit from communal services (reception, security surveillance, telephone switchboard, mail collection). Other services charged on a use basis include telephone lines, meeting rooms, class rooms, use of fax machines, photocopiers and filing systems, Internet connection and e-mail on the central server.

The actor have been interconnected in relationships in order to develop the project realizing activity through resources sharing and combining. Particularly Petroceramics, University of Milan, CNR have been strictly correlated to *POINT*, as they are hosted firm. Other actors have developed relationships with Petroceramics and other firm considering their specific role in the project.

Figure 1 the network of project



Petroceramics can so be involved in innovative projects with different partners and stakeholders, and also with others STP, Research Centres, Public Institutions. Firms that are localized in *POINT* find local spaces as offices and laboratories in a global organized area. Support activities as reception, secretariat, logistic service, informatics service are provided by Pole. Other research and development activities are developed (table 1)

The project has involved different actors that have generated different resources. As we can see in figure, the organizational resources generated are referred to co-ordination, education and intermediation competences

(POINT) together with geologist competences, industrial application competences, applied research and total quality competences, innovation capabilities (Petroceramics). Furthermore the project development has required design competences, production of permanent steel moulds competences (Delta), competences in processing of raw material combination (Elchi), research competences (CNR), applied research competences, materials engineering competences (University).

The product resources generated by actor have been referred to laboratory, conference room, secretary, office (POINT) and also by patent, prototype, laboratory equipment (Petroceramics). Furthermore the project has also involved tools and machinery (Delta), material combined (Elchi), Database Software (CNR), Report (University).

The development of the project has been based on facilities as planning and standard of (POINT), system of production (Petroceramics), procedure and methodology of research (University).

The process of sharing and combining resources has been based on relationships that different actor has developed.

In this perspective we find different actors with different resources combining in the relationship. This dyadic relationship is generated by previous relationships and influences new relationships. Petroceramics has localized activity in POINT as the University of Milan (parent organization of spin off) has developed relationship with the Pole. The development of relationship with Brembo supports the new choice of Petroceramics that will localize its activity in Kilometro Rosso, the Science and Technology Park where is localized Brembo. The transfer of the headquarters to the Kilometro Rosso Science Technology Park in Stezzano (Bergamo) is an important element in the company's expansion strategy.

Table 1 – Resources generated by actors

Actors Resources	POINT	PETROCERAMICS	DELTA	ELCHI	CNR	University of Milan
Org. Resources:	co-ordination competences, education competences, intermiation competences	geologist competences, industrial application competences, Applied research competences, Total quality competences, Innovation capabilities	design competences, production of permanent steel moulds competences	competences in processing of raw material combination	research competences	applied research competences, materials engineering competences
Products:	laboratory conference room secretary office	patent prototype laboratory equipment	tools and machinery	material combined	database software	Report
Facilities:	planning standards	system of production	system of production	system of material combination	procedure of reseach, methodology analysis	procedure and methodology of research
Reltationships:	to Petroceramics, CNR and uiversity	To POINT, Delta, Elchi, CNR,University	To Petroceramcs, Elchi	To Delta, Petroceramcs,	To Petroceramics	To Petroceramcs, CNR

Rielaboration 4R Model (Håkansson, Waluszewski, 2002, Baraldi, 2002)

In addition to this, relationships influence resource combining. Considering the dyadic relationship, Petroceramics can use the product of POINT and is influenced by its organizational criteria. The relationship is linked to other relationships with other firms and Science and Technology Park. In this perspective the relationships are linked to network horizon of POINT and horizon of firm investigated. Such efforts are thus concerned with current time and the current situation of the two organizations but are affected by a more extended time horizon (Gadde, Hakansson, 2007). Both parties link the current issues to their experiences of past interaction and the expectations concerning future interaction. Interaction is thus strongly connected to time. It is most likely that the two parties make different in simultaneous interaction concerning resource combining with other firms.

6. PRELIMINARY OBSERVATIONS

The generation and development of innovation is more and more based on co-operative approach. In this perspective different actors of “scientific chain”, identified in firms, research institutes, and public institutes, are linked among them by interconnected relationships through which they can share resources and combine these ones.

As evidenced in POINT case, different actors belong to private, public and academic area are strictly interconnected by relationship in order to increase the competitiveness of local economies. As investigated in Triple Helix model, private, public and academic actors develop relationship within each area but also with actor that belong to different area. The development of these long time relationships is influenced by the process of convergence of objectives that are identified in development of firms and other organizations that operate in the spatial area.

In this context a key role is taken by POINT. This one, as STP, develops relationships with firms, public structure, and academic institution. In this point of view the STP becomes a facilitator of relationships among different actors.

These relationships are also supported by contiguity. In the case analysed some actors of the project belong to STP; this allow firms to facilitate resource sharing and competences combining. These firms have the possibility to use the structure of POINT as laboratories, meeting rooms, research study and other services to realize experimentation.

The relationships analysed can influence other relationships also with actors that are not hosted in STP. In an effect of “spread”, that action realized by STP on hosted firms generates further indirect influence to firms that are linked through spatial relationships.

POINT is not sector specialized but supports activities and projects that are considered key project for the development of Bergamo Province and Lombardy Region. The STP is a centre of attraction and creation of innovative new businesses with the aim of achieving the formation and growth of local enterprises.

Considering the empirical case analysed, the offer of STP is based on tangible and intangible resources. POINT allows firms to develop relationships among them but also with other actors. The spin off success is based on know how, on the ability to finalize the excellence gained from research and academic technology transfer of materials and processes to industry.

Petroceramics has several projects in partnership with different firms in areas ranging from advanced sensors, the industrialization of processes for the use of toxic waste, the car components and avionics. These potential relationships are very important also for the spin off that, in time approach, based its activity and “strategic choices” on previous relationships.

In an evolutionary perspective, network horizon spin off will be influenced by network of STP. Petroceramics has decided to move from POINT to another STP considering the development of activities and the strategy chosen by its shareholder. “Time” and “space” can influence the network horizon and transforming it in a wide horizon. Systematic resource combining efforts in networks are therefore in continuous evolution. Thanks to the relationships developed by actor, the focal firms can improve the relationships that exist within the network, which become a means of coordination and knowledge and, under such conditions, the network horizon can be restrained, but it can also consist of extensive views (Holmen, Pedersen, 2003).

As outlining in IMP approach the great potentialities of resources can be exploiting through interaction of resources. A firm can be considered as constellations of resources that, through interaction, can interact with different resources constellations of different firms. Current interaction regarding resources is thus contingent on previous interactions (Gadde, Hakansson, 2008). As emerged in the case, the project of Petroceramics required the involvement of different actors characterized by different competences (organizational resources). The interaction is the base to realize resources sharing and resources combining, to support the activity of each firm and to support the development of spatial area.

Considering that POINT is one of the cases analysed in a research project, still in progress, focalized on the development of network in STP, the consideration of this case will be tested on other STP. In addition to this, in order to analyse other local implication, new semi-structured interviews will be realized with other “public” actors.

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