Daniela Corsaro
SEGESTA - Catholic University of Milan, Italy
daniela.corsaro@unicatt.it

Chiara Cantù
SEGESTA - Catholic University of Milan, Italy
chiara.cantu@unicatt.it

Abstract

It is becoming increasingly difficult to ignore the shift from innovation as a firm level phenomenon to a networked one. Innovation is more and more considered a collective process that involves a multitude of business actors, sometimes very different among them, such as companies, universities, private research centers, governmental institutions, and many others. This has lead to the emergence of the concept of innovation network, and the related concern of how innovation networks are composed by. In this paper we study the roles of actors' heterogeneity in the development of collaborative innovation, a research area recently highlighted as relevant in marketing studies, but with scarce empirical evidence to support it. We developed the case of two projects –ESASIM and NeWTech– where the innovative outcome (simulation software) developed in the first has been applied in the second to develop a further innovation (wireless sensors). By using the six sources of heterogeneity by Corsaro et al. (2012) –*goals, competences and skills, knowledge bases, power and position, perceptions and cultures*– we find out the processes which describe the role of actors' heterogeneity both in the development of collaborative innovation (de-contextualizing of the joint innovative outcome with respect to the different actors' specific features) and in its application (re-contextualizing of the innovative outcome into the specific context of each actor). Even if our findings are preliminary, important marketing implications arise from our study.

Keywords: inter-organizational relationships, innovation, network, stakeholder, heterogeneity

Actors' Heterogeneity in Innovation Networks: The ESASIM and NeWTeCH projects

1. Introduction

This paper explores the role of actors' heterogeneity in the development of collaborative innovation in business to business networks. An increasing number of studies suggest that innovation is created by the interplay of different and committed stakeholders (Bourne, 2009; Håkansson, 1987), where the innovation activities of the firm must take account the complementary innovation activities of others in the network (Perks & Jeffery, 2006). Innovation performance is related to inter-firm cooperation (Diez, 2000), aimed at ''*systematically performing knowledge exploration, retention, and exploitation inside and outside the organization's boundaries*'' (Lichtenthaler, 2011; Freytag and Clarke, 2002).

Innovation networks include all institutions involved in the generation, commercialization, and diffusion of new and improved products, processes and services. Different actors can share knowledge resources in order to generate new ideas and bring them to the market (Chesbrough, 2003; Hagedoorn, 2002).

Since innovation is not considered anymore as a firm-level phenomenon, but rather as a process which involves business actors collectively, then the issue of how such innovation networks are composed by emerges as relevant. The types of actors taking part to the innovation network, in fact, can impact the innovative outcome generated in interaction (Corsaro, Cantù, Tunisini, 2012), and more in general the effectiveness of the innovation itself (Varamäki and Vesalainen 2003).

However, even if actors' heterogeneity has been studied in strategy and organization studies, in marketing the debate still remained in a preliminary phase, with empirical evidences almost absent. Only recently Corsaro et al. (2012: 2) identified the six attributes of actors heterogeneity -*actors' goals, actors' knowledge bases, actors' capabilities* and *competences, actors' perceptions, actors' power* and *position,* and *actors' cultures*- which seem to be particularly relevant for the effectiveness of innovation networks. Related to this, Cantù et al. (2012) observed that in the development of complex innovative solutions each actor acts simultaneously as a provider, who brings resources to the combination, and as a user, who makes use of the resulting combination to solve its specific problems. From the interaction between these two roles the resource interfaces emerge and thus the innovative solution develops.

Our paper positions in this debate and attempts to provide empirical evidence for the role of actors' heterogeneity in innovation networks. In particular, we are interested at answering the following research question: *How does actors' heterogeneity affect innovation networks?*
To answer this question we will adopt two levels of analysis: on the one side a collective-network level that considers the set of business actors, on the other side the single actor as part of the wider network. With the term 'actor' we refer both to organizations taking part to the innovation networks, and the key referents that represent them.
Empirically, we will describe the case of two projects developed in the context of Intellimech, an innovation network located at Kilometro Rosso Science Park, one of the most-ambitious Italian district of knowledge, an aggregation node of relationships and connections around innovation purposes. More specifically we analyzed two critical and subsequent projects in the context of Intellimech case with the first project, ESASIM, diverse actors collaborated to develop a simulation software potentially of use for all the organizations involved; with the second project, NeWTeC, we observed how some actors taking part to the first phase applied the simulation software to develop a further solutions, wireless sensors.
The reasons we have chosen this case are different: the actors' strong innovation orientation, the diversity of the actors taking part to the project and, not least, the fact that mechatronic itself is the result of the convergence of existing industries. Data collection is at the moment still in progress. Until now, we carried out 10 interviews with the key referents of the project. Further interviews will be carried out in the next months. For reasons of privacy, we will use invented names to indicate the actors taking part to the two projects.
In this study we will find out the processes through which actors' heterogeneity can influence the development of innovation (collective-network level), and the micro processes that involve each single actor in playing its provider and user role (single-actor level). The paper is composed as follows. First we will review literature on innovation networks, with a particular attention to the role of business actors. In section 2 we will describe the methodology applied and in section 3 we will present the case. Discussion of findings, conclusions and managerial implications end the paper.

2. Exploring Innovation in Networks

Firms' long-term competitiveness crucially depends on their ability to innovate and learn continuously (Florida, 1995; Cooke, 2001; Malmberg and Maskell, 2002). Almost all disciplines, including economy, management psychology, sociology, etc. have been interested at innovation

(Brown and Ulijn, 2004). Innovation is about creating something new and implementing it successfully at a market (Brown and Ulijn, 2004).

Innovation, embodied in artefacts such as patents and new products, can involve the novel recombination of known elements of knowledge, problems, or solutions (Fleming 2001; Nelson and Winter, 1982) or the reconfiguration of the ways in which knowledge elements are linked (Henderson and Clark, 1990). Several studies have pointed out that these processes do not result from a single economic agent but from a complex process in which several agents interact (Powell, Koput & Smith-Doerr, 1996; Porter & Stern, 2001). Chesbrough (2003) defines the traditional innovation process as a closed innovation model where innovation activities are located inside the firm. But the closed innovation model cannot satisfy the fast changing demands of global customers in a changing society. Exploiting external relationships firms realize the co-development of innovative products and services (Gulati and Gargiulo, 1999). The locus of innovation thus moves from individual firms to networks of inter-organizational knowledge exchange relationships, outlining innovation as an evolutionary, non-linear, and interactive process between a company and its context, which involves contacts with several actors inside and outside the firm (Kaufmann and Todtling, 2001). In other words, the innovation development has to be seen and understood in a wider context than that of a single company, called a 'company's technological interweavement' or 'innovation network' (Gemunden and Heydebreck, 1994).

Innovation networks can be defined as "*...the linkages between organizations...in order to create, capture and integrate the many different skills and knowledge needed to develop complex technologies and bring them into the market*" (Calia et al., 2007: 427). Innovation networks are all organizational forms between market and hierarchy which allow the information, knowledge and resources exchange supporting the implementation of innovations by mutual learning between the network partners. Lundvall (1995) is among the first promoting a more holistic perspective which highlights the role of interaction between different actors and how this interaction is influenced by social, institutional and political factors (Fagerberg and Verspagen, 2009).

Interaction becomes an important mean of gaining and transferring new knowledge, gathering relevant information about new business, finding external support and services (Birley, 1985), especially when the degree of complexity or novelty of the innovation increases the market for the innovation poorly defined. The development of external relationships allows firms to access resources in order to innovate, to respond to market requirements and to better overcome competitive, hierarchical or market-based arrangements (Alter and Hage, 1993; Hardy et al., 2003). Pittaway et al. (2004) identified six innovation benefits that firms received from their networks: risk sharing; access to new markets and technologies; commercialization speed; accumulation of complementary assets; protection of property rights; and the role networks play as avenues to external knowledge (Pittaway et al., 2004, p. 145). But Bruce et al. (1995) also found that collaboration for innovation is not always beneficial for the participating companies, emphasizing the risk of "*...strategic information leaking to collaborators*" (Perks and Jeffrey, 2006, p. 68). Among the main problems of cooperation we can find conflicts, disputes, lack of coordination as well as the presence of free riders, companies that do not share their knowledge or skills but still enjoy the benefits from the flow of knowledge being distributed through the innovation network (Teece, 2000).

Summing up, innovation network is well established phenomenon that has been studied under different perspectives, with a common agreement on the relevance of business actors composing it. Some literature on network cooperation has analyzed the effect of different types of partners on the innovation process (Tether, 2002; Nieto and Santamaria, 2007). According to Whitley (2002), for instance there were significant differences among the types of partners that could determine how the cooperation is managed and what kind of innovation could be achieved. Nieto and Santamaria (2007) indicated that the specific characteristics and objectives of different partners would bring different results. Partner types (e.g. customers, universities) and their characteristics condition the nature of the innovation activities (e.g. exploratory, radical or incremental innovation) (Baum et al., 2000; Biemens, 1991; Kash& Rycroft, 2002; Phelps, 2010). The heterogeneity of business actors in business to business markets matters as it makes each relationship, and what occurs in it, highly specific and dependent on the context in which it develops: "*…starting from a micro-perspective of observation, which includes the features of actors and their interaction, can be helpful to understand the effectiveness of innovation networks and their evolution*" (Corsaro et al. 2012: 2).

However, compared to strategy and organization studies, marketing scholars have dedicated much less efforts at understanding how the interaction between heterogeneous actors affects the innovation processes and the innovative outcome it generates. In the following section we will try to deepen empirically the issue through the Intellimech case, and in particular the ESASIM and NeWTeC projects.

3. Intellimech: the consortium of mechatronics at KilometroRosso Science Park

Intellimech is a consortium of high-tech firms dedicated to interdisciplinary research in mechatronics. Intellimech is located in Lombardy Region, one of the most important economic and industrial areas in Europe, together with the Baden-Württemberg, the Rhône-Alpes and Catalonia.

Intellimech is promoted by Confindustria Bergamo, Servitec and Kilometro Rosso Science Park (the main founder). Kilometro Rosso is the first private Italian Science and Technology Park that creates strong links between science, industrial research, technological development and innovation. The Park is in fact oriented toward implementing a virtuous circle of innovation development by promoting partnerships, interaction and synergies with firms located within the Park and outside.
Kilometro Rosso is the result of a joint venture between Daimler Chrysler and Brembo. The management activity of Kilometro Rosso is carried out by Kilometro Rosso s.r.l. while River S.p.A. is the holding company, which delivers investments through the urbanization of the site.
The Park promotes radical innovation and product innovation with the scope of attracting increasing numbers of hi-tech businesses. The philosophy of the STP is that *innovation is a state of mind*. It thus becomes critical to create those conditions that allow innovation to flourish, not just within firms but also in the wider economic and social context.

3.1The main features of the Consortium

Mechatronics includes different industries: electronics, IT, ICT and mechanics and, as a consequence, firms belonging to Intellimech operate into different fields**.** They are instrumental mechanics, mechanical and electrical appliances, precision instruments, metallurgy, multi utilities, instrumental electronics and industrial services. Following how the Consortium is composed by:
- *Instrumental mechanics*: Balance Systems, Bianchi, CMS, Cosberg, IMS Deltamatic, N&W, Persico Engineering, Same DeutzFahr, Tesmec.
- *Mechanical and Electrical Appliances*: Brembo, Ceccato, Claber, Fassi, Indeva, SIAD.
- *Precision instruments - automation and measurement*: Balluff, G&G, Vimercati.
- *Metallurgy*: Tenaris Dalmine
- *Multi utilities*: a2a
- *Instrumental electronics*: ABB, Lovato
- *Industrial Service*: FIAT Research Centre, Confindustria Bergamo, EnginSoft

The Consortium develops institutional activities such as “Intellimech Afternoons”, technical seminars to support the development of projects, and other training courses. It manages R&D activities, the testing of interdisciplinary pre-competitive technology platforms, and the construction of prototypes. From these results several proprietary applications can be subsequently developed by specific members of the consortium.
Intellimech develops two types of projects: the general projects and the research on order projects, where these last ones generally come after the first.

General projects are characterized by a common objective shared by all the consortium's members. Often R&D investments are too high to be faced by individual firms; therefore they cooperate to overcome their spending capacity and increase the value of their offering system. Participants to these general project could be even competitors, working in the same industry but cooperating in pre-competitive research.

Differently from the previous ones, **Research on order** projects are built around the specific goals of the consortium's members, or external firms, that cooperate to develop a competitive research. These projects may involve suppliers and customers that invest in the same product because they have a specific interest in particular applications (i.e. new technology).

Both the two types of projects involve a qualified international network of academic, industrial researchers and organizations. The technical, administrative and management activities of Intellimech are conducted in collaboration with Confindustria Bergamo, Servitec and Kilometro Rosso. The philosophy adopted by Intellimech is that "*diversity creates value*".

Among recent general projects developed in Intellimech, and which is emblematic of the role of actors' heterogeneity in the development of collaborative innovation is the case of a simulation software, ESASIM.

The main actors involved in ESASIM, precompetitive research (first phase), have then started a competitive research (second phase), the NeWTecH project. In the following sections we will describe both the two phases/projects.

3.2 First phase: ESASIM, the general project

ESASIM project (Simulating the operation of actuators / electromagnetic sensors) aims to deepen knowledge on the design and use of components/actuators and sensors, electromagnetic, with special attention to simulation techniques that allow innovative design and an optimized use. The main aim of the project is to increase the knowledge and ease of use of electromagnetic simulation software. In particular ESASIM aims to reach the characterization of materials and to develop the analysis of the electronic control circuit and of the system electromechanical behavior.

In this project Intellimech deals with firm's opportunities generated in automation, robotics and mechatronics. Intellimech manages R&D and testing interdisciplinary pre-competitive technology platforms, and the prototyping of mechatronic devices for innovative applications. The project is carried out in Intellimech's laboratory that is located at Kilometro Rosso.

The interactions of electromagnetic fields with the mechanical quantities are the basis of many applications that apply mechatronic actuators and sensors based on electromagnetic technologies.

Among these ones, electric motors and actuators use ferromagnetic cores inserted in coils. The applications are magnetic locks, switches, locking pins, speakers, pneumatic and hydraulic solenoid valves.
The ESASIM project has been developed over a period of 18 months, 4 months of which dedicated to results dissemination.

The project involved several members of Intellimech Consortium, both large firms and SMEs. In particular the main actors involved are:

- Large firms operating in the electromechanical field that carry on products to test technologies. Among them, we find *Alpha*, which operates in power and automation technology industry to enable industrial customers to reduce environmental impact; *Beta* which provides skills related to design and machinery manufacturing for the industrial automatic distribution, and *Eta*, an European firm specialized in sensors production.
- Systems suppliers for product design. Among these suppliers, *Epsilon* is specialized in design, production and sales of braking systems for cars, motorbikes, and commercial vehicles, while *Omega* provides skills related to the design and manufacturing of irrigation systems.
- *Delta* brings expertise in the area of virtual prototyping, process simulation and scientific computing oriented to production processes.
- *Tau,* that belongs to mechanical machinery industry, is specialized in the construction of hydraulic machines.
- *Kappa*, University, provides technological support about simulation analysis and sensors research.
- Local associations, such as *Gamma* (Industrial service field), which with 1,300 members is the third Italian association.
- The local Chamber of commerce (*Ypsilon*)

Actors taking part to the project are quite different each other and this heterogeneity has influenced the development of the four main phases of the innovation project: the *analysis of different software simulation and selection,* the *software training,* the *experimental activity* and the *validation.*
Among the different sources of heterogeneity considered, we notice for instance the actors' goals. While the main aim of Alpha was to create a new market, Beta was aimed at enhancing the relationships among the several organizations that made up the consortium. Rather, the University was interested at applying the theoretical knowledge developed internally.

This heterogeneity in goals mainly influenced the actors in the choice of the software: *Alpha and Eta* looked for a solution in order to increase their productivity, *Beta* and *Tau* selected a software characterized by an average quality so as to collect a larger agreement among the other firms. The university, given its background in simulation, tried to find a particular software to experiment the theoretical insights developed and thus increase the value of its research. Several technical meetings have been organized by Intellimech in order to allow the comparison between the main actors and their goals. Even if these goals were quite heterogeneous actors find some agreement and decided to move on in the project planning the other phases: the *analysis of different software simulation and selection,* the *software training,* the *experimental activity* and the *validation*. These organizations also agreed in temporary sub-goals related to the specific project phases; firms preferred not to remain too obliged with respect to the evolution of each specific phase.

In the second stage of the project, *the software training*, the actors' different time perceptions required firms to revise their activity scheduling. The University was interested to develop the project in 5 years, while firms scheduled it to be concluded only in 1 year. After several meetings, the organizations found out a solution that worked for all participants, they finally agreed with 18 months.

Actors have been also characterized by different competences and knowledge bases and this element influenced in particular the third step of the project, the *experimental activity and validation.* In this phase actors cooperated in order to make the experimental analysis of electronic circuits for electromagnetic device. A key role was undertaken in this step by Delta firm (industrial service) that provided expertise in the areas of virtual prototyping and process simulation. These specialized competences have been very important in this phase also increasing the power of Delta in the project.

During this phase of the project, many training sessions took place, the so called "Intellimech Afternoon". At these special courses several firms shared knowledge and competences. After the first phase, organizational meetings become more frequent. The interaction between different firms generated a cross-fertilization process with positive outcomes by the Consortium and by each firm involved in the project. ESASIM project generated new design skills drawn from interdisciplinary synergies to be applied in the field of electromechanical design. Also, the project developed the refining capacity to model and properly use electromechanical components. Through the project actors reached the ability to apply expertise and theoretical knowledge to real cases. Moreover, the "Intellimech Afternoons" allowed knowledge sharing concerning the design and the use of electromagnetic components.

The different firms' cultures also influenced the development of this step as large firms were more available to make investment in research, training and application. Differently SMEs had some difficulties in making investment in innovative project. SMEs were also reluctant in cooperating with competitors that made up the consortium, their perceptions of risk were higher than for big firms.

Thanks to ESASIM project, firms could use the innovative outcome, which consisted in a passive sensing element of a magnetically resonant energized (micro) structure interrogated in contactless way, to develop an on order project (NeWTeC).

3.3 Second phase: NeWTeC, research on order project

The main actors involved in ESASIM decided to enhance their cooperation through a second innovative project aimed at developing innovative sensors, and for which the simulation software has been critical to reach this goal. This project involved two firms of the Consortium, *Eta* and *Tau,* together with the *University, local associations and Intellimech*.

In NeWTeC project the two main firms are characterized as follows. The provider, *Eta*, is a European firm with 600 million of turnover. It has electronic competences that use to produce sensors (characterized by different application, i.e. residential and automotive sensors). *Tau*, the customer, belongs to the mechanical machinery industry and is specialized in the construction of hydraulic machines (hydraulic cranes). Also, researchers from the University from a long time have been working on sensors analyses and their implementations. There was also the industrial local association which supported firms' activity in local context.

The project lasted 24 months and was articulated in the following main phases: *technology assessment*, *verification*, *technology validation*, and *engineering*.

The first phase of the project has been the *technology assessment* and lasted 18 months. The two firms (*Eta* and *Tau)* and the University attended several meetings, with the involvement of key referents from the company board and financial offices. During this stage firms and Intellimech signed the initial agreement. This step involved the combining of technical competences and financial ones. On the one side there has been the need to evaluate the financial investment, on the other side to share technical information with Intellimech and the University.

During the *second phase - verification*, Intellimech made testing laboratory in cooperation with the University. In this step researchers from Intellimech and the key technical referents interacted intensively. Through the interaction the organizations outlined the details of the testing activity.

Among the companies that took part to this phase, *Eta* was a world leading manufacturer of sensor solutions. The hallmarks of the firm consisted in sophisticated technology and customized solutions. The firm stands for technology, continuous innovation, experienced application support, highest quality, reliability, customer orientation. *Tau* was characterized by skills and professionalism based on a manufacturing scheme that is dedicated to achieving high standard quality: performance, working capacity, safety, research, innovation, and products range. Recently the customer research has been aimed at reducing the weight of cranes. The firm aims at producing savings in engine fuel consumption to increase the truck working efficiency. Attention to eco-friendly paints forms is part of the wider company commitment to sustainable growth.

In the third phase, *technology validation*, Intellimech and the University cooperated in order to analyse the project results. Intellimech brought in the project the expertise related to mechatronics and previous projects such as ESASIM, together with PROPHET PROgnostic Platform for Experimentation and Testing, MAXUV methodologies for the control of vibration and noise for applications in industrial, and COMETHA methods for the control of electrohydraulic actuators of new generation. At the end of this step, Intellimech developed the prototype. The Intellimech consortium produced the prototype with wireless devices, supported by its technology provider and Kilometro Rosso (in particular by its technical laboratory).

The last phase is the *engineering,* which started in September 2012. This phase was conducted by individual enterprises with the support of the consortium. In this step firms interacted with the consortium and with the provider in order to investigate the opportunity to commercialize the prototype. Also, firms have been strongly influenced by their own providers and stakeholders.

Going more in depth in the analysis of the actors' features previously highlighted, if we take into consideration the actors' culture we notice in particular divers 'working approach'. *Eta*, for instance, is an European firm characterized by a significant attention to internationalization and cooperation. This firm made relevant investments in the management of external and internal relationships with several stakeholders. During the different interactions, the firm has shown an open culture with high investments in innovation, staff training and territorial development purposes. *Tau*, instead, an Italian firm located in Val Seriana, has always paid attention to the local context and territory, as well as to the staff training. The firm presented connected to internationalization processes and recognized the importance of collaboration with several stakeholders. Its skills regard primarily products related aspects, not only to technology itself. In addition to these two actors, the University had a culture very open toward the external surrounding and high competences in sensors technology. It presented a significant attention to the relationships developed in the territory, national and international. Further, we have Intellimech which operated

according to the principles of open innovation. Even if the Consortium was very close to the needs of the local territory, in recent years it faced an increasing expansion in the international context. In this phase the open perspective of *Eta* (large firm) pushed the small firm (*Tau*) to increase the R&D investment, while the local perspective of *Tau* supported Eta to well know the Italian area.
With respect to the competences offered by the different actors, *Eta* (the provider of sensors) used the software simulation based on its main technological competences and it "customized" the use of software in order to improve its productivity.
Eta brought the assessing technology to understand the market potentiality. The technology could be extended in several industries. In addition to this, Intellimech promoted, coordinated, and developed the project (two people from the consortium work on the project). University granted the availability of skilled people in sensors technology. Each firm tried to enhance its own competences on the basis of the shared complementary competences provided by the well-known business partners.
But actors taking part to NeWTeCH also presented different goals. The objectives were mutually different, scientific on the one hand, research and product development on the other. These actors adjusted their objectives on the basis of the first project; *Tau* looked for product innovation following the analysis developed in the first phase. Thanks to information collected and on the basis of software simulation potentialities, the firm could optimize the creation of new products. *Eta* looked for technical problem solving, creating new markets while the University supported firms in technology development.
Finally, firms belonging to different industries worked together influencing each other in a process of cross-fertilization. For instance the cooperation between *Eta, Tau, Kappa and Gamma* allowed *Eta* and *Tau* to improve their knowledge about the features of the SMEs located in Bergamo area. *Eta and Tau* also used the previous research results to develop new products. *Gamma* increased the knowledge about the Large Enterprises and SMEs operating in Intellimech.

4. Discussion and preliminary considerations

Data available on innovations confirms that most innovations involve several organizations (Rycroft and Kash, 2004; Doloreux, 2004), which makes them complex, chaotic, non-linear, characterized by both diverging and converging directions (Van de Ven et al., 1999).
In the Intellimech case we have explored the role of actors' heterogeneity in innovation networks, taking into in particular consideration two different levels of analysis. On a collective-macro level, we have looked at the set of actors in the network, while on a micro level we have concentrated at

the role each single business actor as part of the wider network.

Even if evidences from our study are preliminary, there seems to some interesting findings to be developed in further research. A first consideration is that actors' heterogeneity appears to matter differently with respect to the different phases of the innovative process. The first moment is when heterogeneous actors collaborate to develop an innovative solution which is potentially of value for all the actors involved; the second is when the collective outcome reached is applied the specific context of each single actors. To stress the relevance of these two phases with respect to the actors' specificities, we have re-labelled them as 'de contextualizing' (de-contextualizing of the innovative outcome with respect to the different actors' specific features) and 're-contextualizing' (re-contextualizing of the innovative outcome into the specific context of each actor).

In particular, for each of the two moments we have identified some processes which seem to emerge with respect to the actors' features previously identified in the literature (see Corsaro et al., 2012). Following a table summing up these processes:

Table 1: Actors' heterogeneity features and their effects in innovation networks

Actors' characteristics – Source of heterogeneity (Corsaro et al. 2012)	**Processes that characterize the de-contextualizing phase**	**Processes that characterize the re-contextualizing phase**
Actors' goals	*Overlapping*	*Adjustment*
Actors' competences and skills	*Coordination*	*Leveraging*
Actors' knowledge bases	*Cross-fertilization*	*Consolidation*
Actors' power and position	*Understanding*	*Concentration*
Actors' perceptions	*Temporal Alignment – Space Awareness*	*Reconfiguring*
Actors' cultures	*Mediation*	*Contamination*

With respect to the *actors' goals*, from our study shows that for the effectiveness of collaborative innovation actors do not always share the same long terms goals, but rather it is quite common for these goals to diverge. We in particular observed that, to make the collaboration working, actors realized an *overlapping* among their different goals, which is however situational. In other words, the area of overlapping changes according to the specificity of each situation. This overlapping allows for business actors to coordinate their behavior. When then the innovative outcome is re-applied in the context of the single actor, we have observed a phenomenon that we labeled as *adjustment*: actors modify and adjust their initial goals as a consequence of the outcome they got from the first phase. Back to our case, for instance, *Tau* decided to increase the investment in innovative product even if, at the beginning, it was interested only into process innovation. This again underlines the changing nature goals, which vary according to the interactions and the evolution of the innovative outcome itself.

As for the second element, competence and skills, a *coordination* is required among the different actors so as to avoid duplication of competences and inefficiencies that could lead to an excess in resources consuming. Several meetings have been required in order to support firms to know and share their different competences; among these moments the first annual workshop promoted by Intellimech supported the organizations at understanding reciprocal competences. At the end of the workshop Intellimech elaborated a document, the "Competences framework", that has been used by the project's participants to better organize the different activities, given their competences. *Leveraging* is then the process that seems to characterize the 're-contextualizing' of innovation': once the innovative collective outcome has been reached (in our case the simulation software), then each actor pushes its specific core competences to develop the potentiality of the solution and thus to appropriate the higher value from it.

Diversity in the knowledge bases of the companies seems then to generate *cross-fertilization,* where actors with different knowledge bases give rise to a learning process that promote the development of new knowledge. For instance, thanks to the cooperation with *Tau, Eta* improved its knowledge related to the Italian context and its potential customers. This kind of knowledge allowed Eta to customize the offering system for Italian market. This new knowledge has been later applied in the particular context of each actor and *consolidated,* becoming part of the company knowledge base, and thus in such a way stabilized. In order to avoid this new knowledge to remain embedded in single individuals, many companies implemented processes of codification, such us through best practices, the sharing of experiences or, in the case of technical knowledge, through manuals.

In our project we have also noticed certain diversity in actors' perceptions. For instance we realized that actors had different perceptions of time, they see differently the *timing* of the project. University was interested in developing the project in a long time perspective, while firms had a short term temporal horizon. But heterogeneity does not relate only to time, but also to a *space* dimension. Since actors present different pictures of the business surrounding we have observed they tend to put efforts at understanding reciprocal actors' pictures and, for instance, see a threat they were not able to realize alone. The process of interaction then allowed for a *reconfiguration* of the time and space perceptions of the single managers. On that we can consider that *Eta* and *Tau* knew the University *(Kappa)* only through the direct link between Intellimech and the University. The development of the projects allowed the firm to involve the University in a further innovative project.

One more element is then the heterogeneity in actors' cultures. The Italian local firm, *Tau*, presented some limits in R&D investments, as well as showed some resistance in cooperating with competitors, differently than large and medium firms. During ESASIM, this heterogeneity has led at introducing the role of Intellimech as a mediator to facilitate communication and interaction practices. This role has been particular evident during the various meetings. In the second phase, then, the interaction among the different cultures has caused a process of *contamination* of the internal culture of each single company: due to the cooperation with a small Italian firm (*Tau*), the international large firm (*Eta*) improved its knowledge about the Italian economic context, identifying the key business partners to develop a production for a new geographic area, and thus develop more its 'local' dimension.

Finally, we have power. In the Intellimech case the differences in power and position have been evident from the beginning, and in such a way actors have not tried to mediate these divergences, rather they realized more this was an unavoidable issue, 'part of the game'. During the NeWTeC project, we instead find out a process of *concentration,* or in other words each actor becomes the focal actor of his net and acquired a higher power in deciding the application of the innovative outcome deriving from the previous phase.

Moving from a macro to a micro-single actor level of analysis, the second consideration from our study regards the role of the single actor in the innovation networks. Cantù et al. (2012), in fact, have not discussed in depth how the two actors' faces –provider and user– co-exist, or in other words what Mason (2012) defined as the duality of business actors.

Intuitively, one can think that while actors work together and collaborate to develop a joint innovative outcome they behave as providers, which provide their resources in order to interface them with the other actors' resources. Coherently with that, it could be argued that in the second phase, when actors apply the joint innovative outcome to their specific contexts, they behave as users, as they use the resulting innovative outcome as a solution to their own problems. In the Intellimech case, we however noticed that two actors' roles, provider and user, coexist and interact in both the two phases, which is quite interesting given that Cantù et al. (2012) only studied this phenomenon in the development of innovation (what we called de-contextualizing) but gave no insights on what happens in its application (re-contextualizing of the innovative outcome). On that, *Eta,* for instance, cooperated in the first phase to develop the software simulation, it provided its competences about technology and design and it used the software to improve the product development. In the second phase it used the results of the first project to better outline the new market but at the same time it also provided its international 'working approach' that supported the evolution of the small local firms, such as *Tau*.

Further research on this topic could thus be addressed at better understanding, if in certain specific phases one of the role ‘provider vs user’ prevails over the other and which effects it generates. More in general, it would be interesting to explore not only the six single actors’ features individually, or in other words in isolation, but rather patterns of them. We do not exclude that different profiles of actors - characterized by specific goals, competences, power, knowledge, perceptions and culture - could emerge in innovation networks.

The study has also important marketing implications. The first is that by better understanding the role of actors in innovation networks, companies can improve their networking strategies and thus increase the likely for the solution to satisfy the needs of the different stakeholders. Second, we observe that the management of actors’ heterogeneity is strictly related to communication activities. Quite often it emerges the need to mediate between the different actors’ positions or to understand the other parties, even when maintaining its own idea. As a consequence, it would be interesting to develop communication training programmes, addressed to companies in the science park, studied around the profiles of the actors’ features characterizing a certain project. Standardizing communication practices could be in fact less effective in a context where the interplay among the different actors features seems to lead specific problems and behaviours to emerge. Finally, we see implications for the management company of the science technology park, which should think in a comprehensive way to all the different sources of actors’ heterogeneity and their potential consequences once they build inter-disciplinary teams.

References

Alter, C. & Hage, J. (1993*). Organizations working together*. Newbury Park, Calif: Sage

Tether B. S. (2002). Who Co-operates for Innovation, and Why? *Research Policy*. 31 (6), 947 – 967

Baum, J., Calabrese, T., Silverman, B.R. (2000). Don't go it alone: alliance network composition and start up performance in Canadian biotechnology. *Strategic Management Journal* , 21, 267–294.

Biemens, W.G. (1991) User and third party involvement in developing medical equipment innovations. *Technovation*, 11 (3), 163–182.

Birley, S. (1985).The role of networks in the entrepreneurial process. *Journal of Business Venturing*, 3(1), 107-117.

Bourne, L. (2009). *Stakeholder Relationship Management: a Maturity Model for Organisational Implementation.* Farnham, Surrey, UK, Gower

Brown, T. E. & Ulijn, J. (Eds.). (2004). *Innovation, entrepreneurship and culture*. Edward Elgar Pub. UK, USA.

Bruce, M, Leverick, F. Littler, D.,& Wilson, D., (1995). Success factors for collaborative product development: a study of suppliers of information and communication technology. *R & D Management*, 25 (1), 33-44.

Calia, R.C., Guerrini, F.M. & Moura, G.L. (2007). Innovation networks: From technological development to business model reconfiguration. *Technovation*, 27(8), 426-432.

Cantù C., Corsaro D. & Snehota I. (2012). Role of Actors in Combining Resources into Complex Solutions. Journal of Business Research, 65(2), 139-150.

Cheesbrough, H.(2003). *Open Innovation: The New Imperative for Creating and Profiting from Technology*. Boston: Harvard Business School Press.

Cooke, P. (2001). Regional innovation systems, clusters, and the knowledge economy. *Industrial and Corporate Change*, 10 (4), 945-974.

Corsaro D., Cantù C.& Tunisini A (2012). Actors' Heterogeneity in Innovation Networks. *Industrial Marketing Management,* 41 (5), 780-789.

Diez, JD (2000). Innovative networks in manufacturing: some empirical evidence from the metropolitan area of Barcellona. *Technovation* 20 (3), 139-150.

Fagerberg J. & Verspagen B (2009). Innovation studies—The emerging structure of a new scientific field. *Research Policy,*38, 218-233.

Fischer, M.M. and Varga, A. (2002). Technological innovation and interfirm cooperation. An exploratory analysis using survey data from manufacturing firms in the metropolitan region of Vienna. *International Journal of Technology Management,* 24(7/8), 724-742.

Fleming, L. (2001). Recombinant uncertainty in technological search. *Management Science*, 47 (1), 117-132.

Florida, R. (1995). Toward the Learning Region. *Futures,* 27 (5), 527-536.

Freytag, P.V., & Clarke, A.H. (2001). Business to business market segmentation. Industrial Marketing Management, 30 (6), 473– 486.

Gemunden,H.G. & Heydebreck, P. (1994). Matching Business Strategy and Technological Network Activities - the Impact on Success, *Meeting the Challenges of New Frontiers*. Conference Proceedings, X. IMP-Conference, 29.September - 1. October 1994 in Groningen, W. G. Biemans and P. N. Ghauri (eds.), 534 - 553.

Gittell, J. H. & Weiss L. (2004). Coordination networks within and across organizations: A multi-level framework. *Journal of Management Studies*, 41(1), 127-53.

Gulati, R., & Garguilo, M. (1999). Where do interorganizational networks come from?.*American Journal of Sociology*, 104 (5), 1439-1493.

Hagedoorn, J.(2002). Inter-firm R&D partnerships: An overview of major trends and patterns since 1960.

Research Policy, 31: 477-492.

Håkansson H. (1987). *Industrial technological development: a network approach*. London: Croom Helm.

Hardy, C., Phillips, N., & Lawrence T. (2003). Resources, knowledge and influence: The organizational effects of interorganizational collaboration. *Journal of Management Studies,* 40(2), 321-347.

Hargadon, A. B. (2002). Brokering Knowledge: Linking Learning and Innovation. *Research in Organizational Behavior*, 24, 41-85, Elsevier Science Ltd.

Henderson R.M. & K.B. Clark (1990). Architectural Innovation: The Reconfiguration of Existing Product Technologies and the Failure of Established Firms. *Administrative Science Quarterly*. 35 (6), 9-30.

Kaufmann, A. & Tödtling, F. (2001). Science-industry interaction in the process of innovation: the importance of boundary-crossing between systems. *Research Policy*, 30, 791-804.

Lichtenthaler, U. 2011. Open innovation: Past research, current debates, and future directions. Academy of Management Perspectives, 25(1), 75-93.

Lundvall, B. (1995). *National Systems of Innovation: Towards a Theory of Innovation and Interactive Learning*, Pinter, London.

Malmberg, A. & Maskell, P. (2002).The elusive concept of localization economies: towards a knowledge-based theory of spatial clustering. *Environment and Planning A*, 34(3), 429 – 449.

Mason K. (2011). A commentary on "The role of actors in combining resources into complex solutions, *Journal of Business Research*, 65 (2), 151-152.

Nelson RR & Winter SG (1982). *An Evolutionary Theory of Economic Change*. Harvard University Press.

Nieto, M. J. & Santamaria, L. (2007). The importance of diverse collaborative networks for the novelty of product innovation. Technovation 27(6-7), 367–377.

Perks, H M.& Jeffrey, R. (2006). Global Network Configuration for Innovation: A Study of International Fibre Innovation. R&D Management 36(1), 67-83.

Phelps, C.C. (2010). A longitudinal study of the influence of alliance network structure and composition on firm exploratory innovation. *Academy of Management Journal* 53 (4), 890-913.

Pittaway, L., Robertson, M., Munir, K., Denyer, D., & Neely, A. (2004). Networking and innovation: a systematic review of the evidence. *International Journal of Management Reviews*, 5/6(3&4), 137–168.

Porter, M.E.& Stern, S. (2001). *Measuring the 'Ideas' Production Function: Evidence from International Patent Output*. MIT Sloan School of Management, Mimeo.

Powell, W.W., Koput, K.W.& Smith-Doerr, L. (1996).Interorganizational collaboration and the locus of innovation: Networks of learning in biotechnology. *Administrative Science Quarterly*, 41(2), 116-145.

Rycroft R. W.& Kash D. E. (2002). Path Dependence in the Innovation of Complex Technologies. *Technology Analysis & Strategic Management*, 14 (1), 21-35.

Sturdy, A. (2004). The adoption of management ideas and practices: theoretical perspectives and possibilities. *Management Learning*, 35 (2), 155-179.

Svendsen A. (1998). The stakeholder strategy: profiting from collaborative business relationships, Beret-Kaheler Publisher, San Francisco CA

Teece, D.J. (2000). *Managing Intellectual Capital*. Oxford: Oxford University Press.

Thether BS (2002). Who cooperates for innovation, and why? *Research Policy,* 31 (6), 947-967

Varamäki, E. & Vesalainen, J. (2003). Modeling Different Types Of Multilateral Co-Operation Between SMEs. Entrepreneurship & Regional Development, 15(1), 27-47.

Whitley R. (2002). Developing innovative competences: the role of institutional frameworks," Industrial and Corporate Change, Oxford University Press, 11(3), 497-528.