

Learning and knowing in networking innovation

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Purpose

Some recent studies promote the focus on practices to analyse innovation as something that people do (i.e., a practice) (Russo-Spena Mele 2012a; 2011b) as opposed to a linear process of knowledge application. The focus is on the social connections occurring among a group of peers - individuals, collectives, organisations, and institutions- integrating a multitude of resources (tools, know-how, images, material objects), as well as the contexts in which knowledge production and sharing take specific forms for innovation to occur (Orlikowski, 2002; Dougherty, 2004, Swan et al. 2007).

Within practice studies innovation and its link with learning and knowledge processes is only marginally debated. Most of the research on practice includes a focus on the learning and knowledge process, which is largely derived from the field of organisational and knowledge management studies. Less attention has been dedicated to the analysis of the social and complex aspects of the learning process in collaborative and open innovation (Araujo 1998).

By drawing from recent studies in the practice-based approach to innovation, this work aims at deepening the understating of how innovation and learning take place in the practical context of networking innovation. To address this aim, we take a point of departure from practices that are seen as the locus of interactive and social actions. Our focus is on how innovation and learning manifest themselves in practice and how they are sustained through practices within a collaborative network context.

Design Method:

We adopted an emergent, flexible and abductive process by oscillating between theoretical insights and empirical work (Dubois and Gadde 2002).

The analysis of innovation activities and the knowledge processes within a network working environment became the locus of study of the learning processes. A specific innovation project was selected on the basis of the intriguing aspect of the collaborative dimension involving its development. The centre of analysis was the practices of knowledge creation and sharing within the innovation project.

Findings

Drawing from recent practice-based studies, the study debated two main questions: 1) how does a firm practice collaborative innovation and 2) how does a firm learn in practicing networking innovation?

Regarding the “How a firm practices” question, our findings showed that the investigated Firm understands innovation as an emerging process that is developed in a highly collaborative networking context. Four practices of alignment are identified at the base of

the collaborative innovation model of firms. These practices work together in enhancing alignment in heterogeneous internal and external networks. The alignment practices describe the complex and social activities of the Firm in combining different perspectives across boundaries of knowledge domains and practices.

In analysing the arguments of how a firm learns in practicing networking collaborative innovation, the model of the 4-ways of knowing framework added evidence to the practice-based view of innovation and its link with knowing and learning dimensions. The learning is viewed as emerging from a mixture of four knowing practices -who, what, why and how practices - that work together and support each other in the accomplishment of bridging and alignment actions.

Research implications

The study contribute to the development of a practice based view of innovation and learning. Innovation and learning emerge in a non-linear pathway within problem-setting context associated with the development of codified and practical knowledge embedded and embodied in the ubiquity within and at the boundaries of co-creating activities. In accordance with studies of practice scholars (Melkas and Harmaakorpi 2012; Dougherty 2004), we determined that networking innovation appeared to be a more emergent, ongoing, deliberate and negotiated activity of practicing alignments and knowledge in action.

Original/value

This work advances the practice base approach to innovation by investigating the connection between learning and innovation in practice.

Paper type

Research paper

Key words

Collaborative innovation, practice based innovation, learning, knowing

Introduction

In recent years, a fundamental change in the way we understand innovations has occurred. From the linear model of standalone processes, scholars have moved towards understanding innovation as an open, collaborative set of activities wherein several actors interact to exchange and integrate knowledge and expertise (Chesbrough 2003; 2006). In this context, established concepts such as learning and knowledge are receiving increased attention (Nooteboom 2004, 2006; Hallikas et al. 2009).

First, based on the foundation of organisational learning studies, the network learning literature (Hallikas et al. 2009) emphasises the aspect of multiple, emergent and interconnected business and institutional relations that combine knowledge, expertise and technology in novel ways. The exploration of knowledge through weak connections will be discussed, as well as the essential flexibility of networks (Håkansson et al. 1999; Ford and Håkansson 2006). The knowledge and learning processes are discussed in relation to the nodal position held by an actor in the network. Feedback is critical for effective learning, as well as coordinating the link between organisations and participants. In particular, Peters (2010) widely explores the concept of collaboration and collective learning and discusses how the nature and purpose of the interactions between network partners facilitate key learning capabilities, as well as influence what learning is shared and how such learning is utilised by partners.

Despite the fact that collaboration is considered an important source of knowledge and learning for innovation, studies about open and collaborative innovation have some limitations. It is apparent that the social and contextual nature of interactions in network innovation has received less focus by researchers. More focus has been placed on the structure of relationships, and the conditions that are required for the effective sharing of knowledge and aims among participants have been reduced to a more general discussion of opportunities and threats instead of considering how interaction and knowledge really occur.

Some preliminary attempts to overcome these limits have been provided by recent studies that have emerged within the tradition of the practice-based studies. The concept of “practices” is used by many different research traditions in business studies as a new lens through which to evaluate social and economic phenomena. The focus is neither the individual nor the organisation, but the practices are viewed as a way of doing that is embedded in a context of interlinked elements (Schau et al. 2009; Korkman et al. 2010)). Practices are not simply synonymous with action or processes as Schatzki (2001, 2005) argues; practices refer to an embodied materially mediated array of human activity that is centrally organised around shared understanding.

Some recent studies promote the focus on practices to analyse innovation as something that people do (i.e., a practice) (Russo-Spena Mele 2012a; 2011b) as opposed to a linear process of knowledge application. The focus is on the social connections occurring among a group of peers - individuals, collectives, organisations, and institutions- integrating a

multitude of resources (tools, know-how, images, material objects), as well as the contexts in which knowledge production and sharing take specific forms for innovation to occur.

Within practice studies, innovation remains a relatively undeveloped topic, and its link with learning and knowledge processes is only marginally debated. Most of the research on practice includes a focus on the learning and knowledge process, which is largely derived from the field of organisational and knowledge management studies. Less attention has been dedicated to the analysis of the social and complex aspects of the learning process in collaborative and open innovation (Araujo 1998).

By drawing from recent studies in the practice-based approach to innovation, this work aims at deepening the understating of how innovation and learning take place in the practical context of networking innovation. To address this aim, we take a point of departure from practices that are seen as the locus of interactive and social actions. Our focus is on how innovation and learning manifest themselves in practice and how they are sustained through practices within a collaborative network context.

The remainder of the paper is organised as follows: first, we conduct a brief review of practice studies within organisational and knowledge literature and in the more recent research field of innovation. Next, research methods and findings are presented. Finally, we present the main discussion and conclusion.

Practice and innovation

‘Practice’ is a broad term that encompasses many different theories (Gherardi, 2006) that are unified by the common premise that social reality is fundamentally composed of practices (Schatzki, 2001). Rather than viewing the social world as external to human agents, this approach views the social world as being produced and reproduced through everyday actions. A focus on everyday actions is not simply a focus on routines. The practices are understood to be constitutive of the socio-material world (Orlikowsky 2002) in which human agency is not only shaped by but also produces, reinforces, and changes structural conditions in a recursive process of reproduction and transformation.

This debate on practices has given rise to a specific group of organisational studies that Gherardi et al. (2010) label as ‘practice-based studies’. Borrowing insights from practice debates, some recent studies have emerged in the field of innovation that have aided innovation studies that strive to bring innovation into new ideas (Melkas and Harmaakorpi 2012). The practice approach to innovation originates from researchers from different traditions who have become intrigued by the potential that the practice view provides for analysing social and technological issues of innovation activities.

In the following paragraphs, we provide a brief review of practice-based knowledge and practice-based innovation.

Practice-based knowledge

The concept of practice has been rediscovered within organisational studies during the last decades (Cook and Brown 1999). The term 'practice' originates from a long tradition in philosophy and sociology (Gherardi 2002). Several scholars have turned to practice theory as an alternative to the cognitive notion of knowledge that is traditionally used in the management literature. The meaning of knowledge is challenged by the shift from *knowledge*, which is viewed as an object and a commodity, to *knowing*, which is the activity that people conduct together, collectively and socially (Gherardi 2000, 2001, 2006). Giddens' (1984) insights into human's ability to acquire knowledge guided the research by scholars (Wenger, 1998, Brown and Duguid 1991, 2001, Orlikowski 2002, Carlile 2002, 2004, Gherardi and Nicolini 2003, Gherardi 2006, Nicolini et al. 2003, Tsoukas 2005) who agree on the idea that knowledge is enacted and dynamically produced as actors who recurrently engage the world in practice. Orlikowski's (2002) perspective of knowing-in-practice provides an important contribution to the tradition of practice-based studies in organisation. She argued that practice is a system of activities in which knowing is not separated from doing that overcomes the traditional distinctions between knowledge that exists "out there" and is encoded in external objects, routines, or systems and knowledge that exists "in here" that is embedded in human brains, bodies, or communities (Orlikowski, 2006). As a consequence, learning is an activity that is situated in social working and organisational practices as a collective knowledgeable doing that widely supports the idea of situated activities within a collectivity that socially sustains it.

The situated nature of organisational practices inspired a large influx of research on communities of practices that act as pioneers for the studies of practice in an organisation. These works support a view of learning as situated in communities of practice (Wenger, 1998), networks of practice (Brown and Duguid, 2001), or knowledge communities (Lindkvist, 2005); it is located within the social gatherings that are sustained by specific practices. Knowledge is integrated and distributed in the life of the community, and learning is an act of belonging that necessarily requires active participation and involvement in a practice (Lave and Wenger, 1991).

Other scholars have advanced the role of knowing in practice in organisation. In their statements, practices are not simply viewed as routine actions; rather they consist of a collective accomplishment, which depends on a range of spatially and distributed knowledge within a network of relationships (Sole and Edmondson, 2002; Amin and Roberts, 2008). Knowledge production is situation- and context-specific as it is based on the alignment of peoples, symbols and technologies working together in practical environments that are composed fragmented knowledge. According to Gherardi (2006) and Van de Ven and Johnson (2006), people and groups in organisations create knowledge by participating in and contributing to negotiations of meanings of actions and situations. They embrace the view of co-participants in practices and advocate the replacement of the notion of a

community of practice with that of the practices of a community. The misalignment and negotiation of meanings among participants in practice constitute the dynamics that are important for the innovation of practices. Based on this concept, the knowledge process and learning are viewed necessarily as provisional and unstable, and they are sustained by a mechanism of social interactions.

According to Nicolini et al. (2003), important knowledge creation processes occur at the boundaries between communities or at a distance; therefore, new insights must be articulated across these boundaries in a way that knowledge is understood by different groups. Carlile (2002, 2004) in particular, argues that in the knowledge transfer, each form of knowledge needs to be translated or transformed into another, and it can be used as an aid in acquiring and creating new knowledge. He refers to the boundary objects as mechanisms acting at the interface of different knowledge domains as an 'integrating device' through which knowledge is transformed and collective learning can be achieved.

Practice-based innovation

The idea of practice-based innovation found its route in the processes and dynamic view of innovation that occurred as emergent and interactive process (Nooteboom 2007, 2012). The idea focuses on a collaborative form of creating and producing knowledge in which several actors leverage their different perspectives, concepts, ideas and competencies to co-produce new knowledge and innovation (Melkas and Harmaakorpi 2012).

Some of this research has been developed with the path of organisational learning studies and integrates literature on work as practice with strategic innovation and knowledge management issues.

In the field of service innovation, Dougherty (2004, 2012) claims that work activities are the locus where knowledge for innovation is generated. She suggests that knowledge that resides in the ongoing actions and interactions of practices that are necessary for innovation. She also identifies three work activities: 1) interweaving designing and using, 2) participating and 3) reflecting, as crucial to allow people to articulate, transform and replicate practice-based knowledge for innovation. The analysis explains how conventional organising destroys this knowledge and develops organising principles for the continued generation, acquisition and use of practice-based knowledge for innovation.

Furthermore, Elstrom (2010) focuses on practice-based innovation (PBI) and conceptualised this notion in terms of learning in and through everyday work- that is, everyday innovation. The work portrays a practice-based innovation as a cyclical process of adaptive and developmental learning that is driven by contradictions and tensions between explicit and implicit dimensions of work processes in organisation. This process creates connections between formal learning conceived as managerial action that aims to support and encourage resource competence and informal learning that is developed by workers through the use of knowledge and skills in daily work. The knowledge is produced by a balanced process lead by the logic of performance with a main focus on effective knowledge

in action and the logic of development with an emphasis on issues of questioning actual knowledge for expanding learning and the development of knowledge bases.

In the tradition of organisational studies, the research of Swan et al. (2002) and Swan et al. (2007) has led to the further development of concepts that focus on, and try to grasp, the interrelatedness of innovation. The idea is that actors cannot innovate in isolation; they are part of networks where partners with different backgrounds and interest are dependent on each other. Innovation is defined as a process “that occurs through relationships that are negotiated in an ongoing communicative process, and which relies on neither market nor hierarchical mechanisms of control” (Swan and Scarbrough, 2005: 916). It is at the interstices between individuals and organisations, through the operation of underpinning relationships between practice, politics, networks and technology that distributed knowledge can be brought together and integrated into new products, processes and services (Swan, 2005).

Other practice-based innovation authors claim that PBI is created by many triggers and takes place in the practical contexts of multi-actor innovation networks. Melkas and Karmaakorpi, (2012) describe PBI “as innovation processes triggered by problem-setting in a practical context and conducted in non-linear processes utilising scientific and practical knowledge production and creation in cross-disciplinary innovation networks (pag. 2)”. They strive for the need to combine knowledge interests from theory and practice, as well as knowledge from different disciplines. The social nature of innovation is discussed as knowledge production takes place within a group of people having a common interest that is determined by the practical context in which the group is working although the group members could have different backgrounds (work history, education, etc.). A valuable innovation source becomes the ability to interact, learn collectively, and build trusting relations between the innovating partners.

Similarly, the recent contributions of Russo Spena and Mele (2012a; 2012b) promote the studies of practices as the locus of innovation creation. Innovation is viewed as an emergent process that is composed of a set of five co-creating practices involving an array of factors, namely actors, actions and resources. The co-creation of innovation is viewed as a set of practices, and innovators are carriers of practices who perform actions through the use and integration of resources (symbolic, linguistic and material).

Research aim

Most research in the field of practice studies relates innovation to knowledge and organisational learning. However, the level of analysis of these studies remains mainly anchored to the “passive” view of the material nature of knowledge that is transferred and exploited in creative and innovation action. In addition, the practice-based innovation studies, with their focus on workplace learning, help to gain insights mainly into the micro-processes of learning that involve an individual within an organisation and his or her actions and experiences that occur in the social setting of an organisational context.

How firms learn in the context of networking innovation and how organisations question established thoughts and patterns by interacting within a differentiated network of actors has not yet been determined.

Based on a practice-based approach, the following research questions guide our efforts:

- 1) how firms practice innovation in a networking context;
- 2) how firms learn in practicing networking innovation.

In addressing these open-ended questions, the paper aims at connected innovation and learning studies from a practice-based perspective.

Research method

We adopted an emergent, flexible and abductive process by oscillating between theoretical insights and empirical work (Dubois and Gadde 2002). Due to the emergent multi-faceted and complex nature of this field, we chose to adopt a qualitative research method (Yin 2004). Through case study-based research, we conducted an intensive and in depth study of a new innovation project of a leading multi-national firm operating in the pharmaceutical business. The same characteristics of the pharmaceutical business provide us a well-suited with which context to analyse the complex and social dimension of practices of innovation.

The analysis of innovation activities and the knowledge processes within a network working environment became the locus of study of the learning processes. A specific innovation project was selected on the basis of the intriguing aspect of the collaborative dimension involving its development. The centre of analysis was the practices of knowledge creation and sharing within the innovation project.

This analysis allowed the empirical investigation of how interactive collaboration in an innovative working context promotes organisational learning and co-innovation. In this study, the interviewed participants includes the Firm's project members who were represented by an innovation manager in Italy, the medical research manager, the team research leader, Clinical study Manager, Clinical Research Associate responsible.)

To collect data, we chose the technique of the "problem-centred interview" (Witzel 2000) as a method to access the narrated experiences of the participants. To this end, we began by asking the interviewees to tell how they personally experienced the project; we asked them for their own story about how the company conducts innovation and manages knowledge at the network. All interviews were guided by an open approach to questions that were generated from their realm of understanding on knowledge and innovation. The focus was on the participants' experience: it began with the description of innovation activities and their dynamics and explored more closely the participants' interpretation of the organisational practices to foster learning and innovation. A total of 20 interviews were conducted.

Project and program documentation, published sources, follow-up e-mails and telephone calls were also used as other sources of information. The interviews were taped-recorded, transcribed and analysed. First, we coded all material without predefined categories. Then, transcripts of the interviews and other documents were scrutinised for identifying patterns in the data and recurring themes. An iterative process of comparing empirical evidence with existing literature gave rise to some initial conceptualisations.

The Case Study

The case study concerns a pharmaceutical firm that was founded at the end of the twentieth century by the merger of Swiss chemical and life science giants. In the less than twenty years since its foundation, the Firm has become a world leader and one of the top innovators in the pharmaceutical industry.

The Firm's mission is to discover, develop and successfully market innovative products for patients and consumers worldwide. The innovation efforts reach across the entire healthcare spectrum throughout the company: pharmaceuticals, eye care treatment, generics, consumer health products, and vaccines and diagnostics. As a result of this effort, the Firm has one of the strongest and most productive pipelines in the industry, with 152 projects including new molecular entities and additional indications or formulations for marketed products.

Innovation process at the pharmaceutical firm

Healthcare innovation generally refers to a complex process of drug discovery and development that involves two main activities: an exploratory phase and a confirmatory phase.

Typically 'making a drug' begins with identifying a protein associated with human disease. This protein is known as the "Target". When it is confirmed that a target plays a role in the disease, an experiment is conducted to find a chemical compound that binds or hits the target in a way that alters the disease. The identified chemical compound becomes a drug candidate. An initial profile of a drug candidate's safety and effectiveness must be determined through the use of computer models and laboratory tests before the drug is tested in humans.

In the confirmatory phase, the drug enters the full development. Clinical studies in different phases are conducted in larger groups of patients to test the effectiveness of the drug, to determine the appropriate dosage and to further evaluate its safety. To register a new drug, the result of all preclinical and clinical studies along with the description of the manufacturing process are submitted to regulatory authorities to obtain the relative authorisation to market the drug.

The Firm investigated this process through a complex network organisation including internal as well as external partners. The internal networks involve two main types of

research networks that are built through a progressive strategy of mergers and acquisitions that are located internationally.

The first network is the Biomedical Research Institutes where scientists and physicians work to discover compounds and move them along through the initial tests. The Biomedical Research network has its headquarters in Cambridge and other strategic locations in the USA (California, Texas and Massachusetts), UK, Italy Switzerland, Japan and China. This internal network has developed well-established collaborations with academic scientists, clinical investigators and biotechnological companies who provide the Firm with a strong research capability that is comprised of 6000 scientists, physician business professionals and other research expertise all around the world.

The second network includes the Development pharmaceutical units that lead the confirmatory testing and the process of gaining regulatory approval. These units are located in the most strategic regions for research activities, and in these units, most of the global line functions are represented.

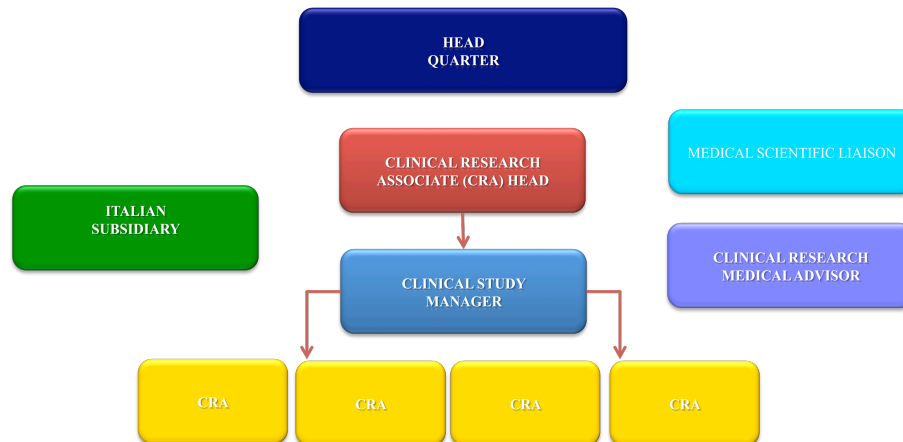
The following paragraphs detail the innovation that is conducted in the confirmatory phase, with a focus on the clinical studies. The description is led by the analysis of practices and their elements, actors, activities and resources. In addition, the knowledge practices of the Firm are discussed by the analysis of how knowledge is put into action at different points of the Firm's interactions and how this process contributes to modify existing practices and create new knowledge.

The Clinical trials and the Medical Research Direction

Clinical studies represent a critical phase of the development processes of the Firm. They are conducted to determine whether a new treatment is safe and effective. Such studies are possible because volunteers agree to participate and try new medicines.

In these phases, the network of internal as well as external partners plays a crucial role. This network includes the Corporate Medical Department at the Firm's headquarters, the Regional medical Department and the Contract Research Organisations, which is where the clinical trials are implemented. The Regional Medical Department operating locally is responsible for the process, and it acts through an inter-functional team, named the Research Team, that is composed of actors who are positioned at different levels of the Firm's organisation. The Team has the responsibility of providing direction, guidance and support to the innovation phases because of their specific competencies.

Figure 1.- The Research Team



Source: Firm's Document

The confirmatory phase involves a highly negotiated and mediated process between the actors who are involved. At the preliminary stage, the owner of the clinical proposal is the Medical Department operating at the Firm's headquarters. The Medical Department at the corporate level identifies and approves the area of clinical research within a broader program of clinical development of a product. This Department offers to the medical division at the local regional area a brief of the study protocol, requesting in a very short time a quick response in terms of the commitment to participate in the clinical trial. The demand for qualitative and quantitative feedback responds to precise and rigid timing.

Within 48 hours, a unit of the local medical Department- the Clinical Operations- is called to express an opinion on the draft study proposal. The response of a local Unit relies on a preliminary evaluation of the availability of competencies and financial resources to be used for the testing proposal, as well as the interest of the local scientific community regarding the possibility of the clinical studies.

After the preliminary acceptance, the Clinical Department develops a more in-depth analysis of the strategic feasibility of the proposal. With the support of Key Opinion leaders (KOLs) who are selected from the Firm's local network, specific research and methodological contents of the proposal are evaluated (number and type of patients); the evaluation also includes considerations regarding the difficulty of the methodological procedures of the study.

The analysis of Centres where clinical projects need to be implemented is one of the most critical phases of the confirmatory process. The Research team identifies a portfolio of clinical centres, selecting from the centres that have been involved in previous trials with the Firm and new centres. An important contribution to feed the cluster of potential new centres is provided by the Medical Scientific Liaison (MSL), a leading figure in the scientific networking with KOLs. In this phase, a highly participatory process is implemented that places the potential of clinical centres at the focus. The feasibility of research objectives is

evaluated in the context of common clinical practices that characterise the specific therapeutic area of the potential Clinical Centre. In addition, the following aims and scientific interest of the clinical centre are considered: the goal of trial program needs to match the goal of the Clinical Centre in terms of the innovative approach the trial assures for the diagnostic and/or therapeutic treatment of patients. The following quote by the Project leader clarifies this aspect.

The complete alignment between the "real life" of clinical centre and our expectations must be verified and negotiated. Only this allows us to proceed into the first step of the clinical trial program. The compatibility of the methodological criteria must be ensured and fixed in the Trial proposal with the specific context of clinical Centre and, if necessary, consideration to intervention should be given. The choice of Centres is based on quantitative and qualitative evaluation. This process includes consideration of strict protocol criteria such as the portfolio of patients enrolled, the methodological standard adopted and the quality of data processed. Also, our choice is to prioritise centres that are investing to enhance the performance and strive to learn with us how to perform best in class clinical research.

As result of clinical studies, the effectiveness and quality of the data and its diffusion also must be assured. The Firm's Research Team works as part of a Firm-wide corporate effort to expand and improve clinical research information and to share data across disciplines and across partners, including local institutions and other actors in the local and international network.

The knowledge practices of the Firm: The project of valorisation of clinical Trials

To win in an area of science and pharmaceutical business, the involvement in clinical trials is considered a crucial process. Clinical trials are a key part of the Firm's investments in research and development (R&D), and they represent an important point to match the research aims of the Firm with the possibility to guarantee a response to the scientific communities in terms of innovative approaches to diagnostic and/or therapeutic treatment, as well as to specific patient needs.

The company strongly aims to establish a common background knowledge, skills and practices among the partners of the process.

To optimise the R&D investment through improved knowledge and skills in the trial research process, in mid-2012, the Firm launched a new project that is called the project of valorisation of clinical trials.

This process has two objectives. It aims at reinforcing and increasing the knowledge base of key Clinical Centres to diversify the Firm's medical investments and achieve a more appropriate allocation of trials considering the pipeline and business of the Firm. At same time, it supports the Firm in building a strong knowledge and relationship space where clinical trials can be addressed, scientific needs can be met, and a community of knowledge for new research can be built.

The project is in progress and it involves strategic and organisational aspects at the Firm's internal network and at its interaction with external partners. In Italy, the project

involves 9 clinical research centres and the process owner is the Director of the Medical Research Department of the Firm.

At the forefront of the internal network, what is stressed is the fragmentation effect that emerges by managing trial activities by counting the different autonomous and separated units of the Firm's network organisation. Previously, at the internal organisation, the clinical project research saw the participation of different figures of the Research Team (see fig. 1) who were involved at different stages of the trials' development and often according to a partial perspective of the project's aims. In addition, the complex interactional context emerging by these complex and articulated relationships only partially involved the Business Franchising unit of the Firm which has a commercial responsibility in the regional area. The Firm's internal policy prioritised the need to avoid a strong interaction between the research and commercial tasks. The consequence of this complex set of interactions was represented by a critical misalignment of the purpose and the critical milestones of the project among the different functions that were involved with the perception by the external partner (the clinical research centres, the KLOs and scientific communities) to interact with different companies with diversified objectives and competencies.

The new practices that the research team task force implemented to combine competencies, experiences and perspectives into shared aims is the first example of building a collaborative innovation network in action. The first change introduced by the Valorisation project was a new practice, the "valorisation visit", which consists of preliminary interactions between the Research Team and the Clinical Centres. These contacts aim to introduce partners to a better knowledge of competences and the roles of each research team and to present the research aim in a more integrated and unified way. These articulated interactions at the preliminary stage of the clinical trial project arose from the need to respond effectively to the alignment of different research needs of the Firm's different units that were involved in the team and to propose a local partner as a unique organisational identity that is able to share a different language by a communal perspective of interest. The constant negotiation between the Firm's practices at different units and the linking pin among them is explained by company's medical research director:

In uncertain and complex interaction activities such as those that are characterised in the first stage of a new project, it is necessary to rely on the integration of different perspectives and interests inside and outside the firm. The firm strives to establish a communal knowledge background among the different competences involved in the team, a strong corporate culture, an organisational identity and kinds of shared understanding that effectively lead the clinical research work in addressing a unified aim.

After the first contacts on the project stage, continuous and more in-depth interactions between the clinical local partners and the research team continue at the Firm. The need is to make the partner aware of the knowledge, competencies and financial resources that the Firm makes available to the trial project, as well as to fine-tune the knowledge of the Firm about the real contribution of the partner to their research aims. In terms of learning, the

Firm can better verify the potential contribution of the partners in their real working context; at the same time, the local partners could benefit from updated know-how and expertise regarding the therapeutic area that is under clinical investigation. The project leader notes the following regarding this aspect:

It begins a series of contacts (face-to-face, conference call) that provide a continuous exchange of expertise, of technical information, scientific insights and shared reflections on the ultimate purpose of the project, representing the real added value in terms of "learning" for both the sponsor (the Firm) and the investigator (the local partners). In this way the firm may know more clearly how the potential outcomes of the research will or not be able to meet its objectives of clinical trials, verified by the clinical center in his real life daily. At the interaction among firm and partners the contamination of skills, know-how, professional experience who regularly face in the ongoing context of experimentation, create a continuous flow of information between the organizational units and these units and the partners and this inevitably leads to a real added value in terms of learning interaction. It becomes evident the potential benefits for the partner resulting from the updated know-how and expertise on the area covered by the therapeutic clinical trial.

The valorisation project relies more strongly on a large network knowledge infrastructure where each partner knows their own part, but they are also required to know “who knows what”. The strategy is to let knowledge flow in place and let actors learn how to search for relevant partners and knowledge bases that fit each other’s interest and practices. What is stressed by the Firm at the outset is that the continuous interaction between the local centre and the various members of the research team allows the Firm to add new skills in terms of methodological-clinical, scientific and organisational protocols that are used, as well as the different management models that are implemented at the local partner’s research centre. The project leader describes this process characteristically:

What to achieve is rarely just reasonably clear in advance at our partners and for this the clinical trial process is always a matter of a complex collaborative multidisciplinary and organizational efforts. We bring new different knowledge and methodologies to bear on understanding the fundamental practices behind clinical partner context. Rather than dump simple information, the focus is on understanding the clinical context as experienced by the partners and then to shape each other knowledge to the clinical research objectives. We work at fostering the creation of collaborative groups that are not close in their background and interests but that are used to join their experience in a collaborative effort. We strive to promote interaction across units and knowledge area, the negotiation on compromises and the alignment of the actors’ aims. We know that this effort requires not only a simple transfer of information or other form of material knowledge. We need to work hard in a mediated process to provide our partners with something that they can understand and share and that they can transfer in their process. This requires more attention on the way we dialogue with our partners and on the tools and artifacts (document, protocol, dataset) we use to interact with them even if we know that we have our interest to accomplish.

The valorisation project promotes the efforts of the research teams to work in collaboration with partners to translate and disseminate new findings into real-work practice. Towards this aim, the project creates and promotes the diffusion of multi-centre research protocols. This method of practicing clinical trial protocols is based

on constant and structured interactions among the local centres that are involved in the same or different trial projects. The Firm strives to develop well established networks among different clinical centres that are involved in the Firm's different research trials. The expected value of these multiple interactions is identified in the possibility to promote the enrichment of different clinical centres by encouraging a mutual sharing of scientific and/or technical study protocols and the exchange of know-how, skills and insights to clinical, diagnostic and management practices with the possibility to increase the experience of the centre in new therapeutic areas that are far from their specific knowledge domain. The project leader details this aspect in the following sentences:

The Research Team of Firm works in collaboration with partners to translate, disseminate and translate new findings into real-clinical practices. It promotes the creation of a social space to encourage the adoption of shared knowledge and practices. In the multidisciplinary context, there is a high potential of overlapping knowledge base at all stages of clinical development, and the Firm works quickly to establish a communal and integrated knowledge that boosts the innovation process. Working closely with different research partners becomes an increasing necessity for us; it expands our horizons and acts as a quality control. The basis of partner relationships for us is the partner-to-partner collaboration. We've tried to remove institutional and cultural barriers so that our organisation and our partners can work together because they are unique entities.

Finally, the valorisation project acts to expand the multilevel interaction at different stages of the Firm's and the partners' network. From the Firm's perspective, a formal interaction with clinical partners also includes the Business Franchise with the aim of reinforcing the communication action of the clinical partners in the context of the local scientific community. The need to strengthen links with local research communities is pursued by creating two-way synergies with the national and regional medical communities helping to disseminate new technologies and new advances into clinical practice. An Advisory Board is set up with the involvement of the clinical partners who have distinguished themselves for their achievements in research projects. The Board, in collaboration with the Medical Director and the Firm's Business Franchise, is responsible for improving the scientific information process through the creation and diffusion of different tools (e.g., reports, documents, news, web site) to allow not only a simple information transfer to the scientific community but also to support training programs for clinical researchers and general practitioners. Training meetings and working sessions are also among the Board's planned activities. These actions aim to introduce clinicians and general practitioners to new practices in the health service on the basis of a more integrated approach to the care of patients' disease and wellness.

To reinforce our knowledge, community is a priority for us. The quality of scientific data produced by studies, the effectiveness of our information protocol and the improvement in the sharing and dissemination of our results are increasingly becoming our priorities in the management of trials. We strive to improve all these activities and to contribute to the advancement of the knowledge of the scientific community.

Discussion

The firm that was investigated represents a typical category of project-based firms that are organised according to a typical network configuration including internal as well as external interacting partners. The Firm carries out all innovation activities within projects, and the projects in this Firm are driven by a strong commitment to bring together and align different interests, contexts of knowledge and practices of different actors that are involved in innovation development.

The following paragraphs presented a categorisation of alignments practices and the linked 4-ways knowing framework that we formalised to grasp how innovation and learning take place in a practical context of networking innovation.

Distributed knowledge and alignment practices in the networking innovation

The investigation of the confirmatory phase within the Firm's new drug development process allows us to examine the ways in which a 'practice-based approach' to knowledge in the networking context of innovation helps to illuminate the nature of this collaborative knowledge work and the challenges therein. We highlight the challenges in the Firm's efforts to mobilise and align the necessary people, knowledge and materials, from variously connected contexts. These alignments involve the Firm's organisation at the internal and external network level and can be summarised by the four following practices:

- 1) Align corporate and local clinical research aims
- 2) Align the clinical interests of Firm's units at the interface with the partner
- 3) Align the interests and practices between the Firm and the clinical centres
- 4) Align practices and knowledge among clinical centres and within scientific communities

In the conceptualisation of this practice, we were inspired by Nicolini et al. (2003) who viewed the practices as "a bricolage of material, mental, social, and cultural resources" and followed their suggestion that "to know is to keep all these elements in alignment" (2003: 27).

The four alignment practices allow us to address our first research question: how does a firm practice innovation in a networking context?

The analysis of a critical project indicates that the first step of networking innovation is the alignment process among the Firm's organisations units mainly involved the need to connect the corporate and local unit research aims. A negotiation activity takes place at different levels of the multinational network of the Firm by promoting and mobilising the participation of local research departments in accordance with their specific competencies and interest, as well as those of the scientific community in which they take part. Networking innovation is viewed as a means of connecting heterogeneous actors and resources, and it gives continuity to their interactions.

The following step of the alignment efforts concerns the Firm's need to match its clinical interests at with those of the involved external partners. Again, the internal organisation is

scrutinised based on the need to present itself in transparent or unambiguous ways, which is complicated by the multiple areas of expertise that are involved in the clinical project.

Externally, the alignment needs are devoted to connecting the multiple interest and practices of the Firm with those of the external clinical centres that are involved in the execution of trials. The development phases are viewed as mediated and collaborative activities. The possibility for effective collaboration is influenced by the Firm's access to the clinical centres in their actual context. This requires knowledge abilities to look internally and to communicate the knowledge from each partner. In addition, the persuasive abilities of the Firm are used to involve individuals with expert knowledge in a given domain in a collaborative effort to inquiry common practices and to develop a shared perspective on the proper methods and approach to follow.

Finally, the alignment of practices and knowledge among clinical centres and within the local scientific community answers the Firm's need to expand and strengthen its external network through the translation and dissemination of new findings into real-clinical practices. A clinical trial is a complex activity that involves multiple expert knowledge domains using different technologies and methods that rely on a widely available body of knowledge within the scientific community. Significant alignment effort is entailed in fertilising method know-how and the various ways to navigate the therapeutic and other practices of clinical centres. These occurrences are characterised by the interplay of enacting and changing practices in the local community context that are mutually composed of the material nature of work interactions and dissemination activities.

The 4-ways of knowing framework and learning

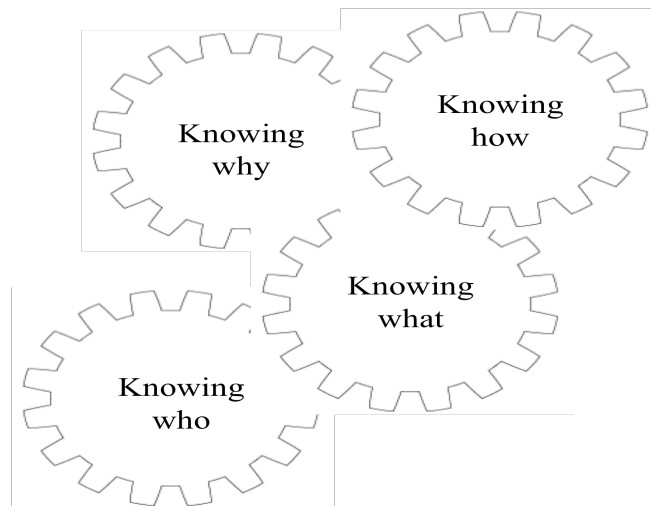
We are intrigued by the way that the Firm manages its knowledge processes in networking innovation and the interconnections or 'entanglements' of different forms of knowledge or the 'ways of knowing' that are practiced by the Firm to collaboratively bring the actors together. Based on the research of Nicolini et al. (2003), who view knowing-in-practice as the creation of a complex web of elements in mutual interrelationship and continuous struggle, we identified a 4-ways of knowing framework. This model includes the following knowing practices:

1. Knowing who
2. Knowing what
3. Knowing why
4. Knowing how

Each of these knowing practices brings together heterogeneous practices and resources in a multiple context of collaborative innovation and gives continuity to interaction and sensing about the who, what, why and how of innovation. The 4-ways of knowing framework provides the means by which the Firm learns in networking innovation by a practice-based view. The learning process at the base of networking innovation is an active state focused on what the Firm does. At same time, learning can be understood as something more than

know-how in action. Learning emerges by a mixture of the four knowing practices working together and supporting each other in the accomplishment of bridging and alignment actions.

Figure 2.- Learning as Knowing set



Regarding the "knowing who" practices, we find that the collaborative innovation strategy of the Firm relies more strongly on a large knowledge network where each research partner is required to know his own part, but he is also required to **Know Who** knows what. The Firm's practices of "knowing who" include efforts to frame the set by building a sense of relatedness among all partners who are internal and external to the Firm's boundaries. The strategy is to enable knowledge flow and to allow members to learn how to search for relevant partners and knowledge bases. Whether knowledge flow is perceived positively depends on a significant interaction and recognition between knowledge holders in the activities of their daily work. The Firm plays a sensitive role in the promotion of conscious interaction on the basis of partner knowledge and competencies, which draws partners into a deeper sense of their relatedness to each other. Relying on their knowledge of "who knows what", partners not only view each other as external sources of information but also as partners with whom to be engaged in purposeful exchange and the co-evolution of knowledge.

The Knowing What practices describe the process of knowledge construction in interactions between different partners with regards to the aims and content of collaborative interaction. The multidisciplinary and complex project to identify what to achieve is not simply to determine and clarify in advance. Determining the relevant aspects, defining the partner to involve, the activities to be made and the aims to be achieved cannot be identified as pre-specified outcomes transferred among partners. As the investigated project shows, in

a complex collaborative innovation, the setting of the problem is a critical step that involves a highly negotiated process at the internal and external network organisation. This process relies on the continuous experimentation and construction among the involved partners of what make relevance in the context of innovative clinical interests and practices. Advancing knowledge at the boundaries of partners requires practice, and scientific interest becomes the locus of “knowing what” practices. The practices contribute to making a collective sense of the value of a new project and they foster a sense of community as partners recognise the need to be dedicated to a significant new project in medicine and clinical practices.

Knowing Why includes the aspects of knowledge practices that question the contextual principles underlying the current practices. In promoting these knowledge practices, the focus of the Firm is the continuous experimentation at the boundaries of different clinical and work domains. The Firm looks for clues in partners’ clinical trial experience and the compendium of different medical and scientific knowledge, as well as their integration with the growing knowledge of new practices in the therapeutic and clinical areas. By promoting the confidence of the Firm and its partners within different contexts and work domains, these practices allow knowledge to be used more productively. Concurrently, they contribute to generating deviations, and they also trigger relevant reflection and critical inquiry beyond traditional and routine medical practice. “Knowing why” practices become a prerequisite to making informed partners and putting them in a continuous competition, which fosters improvement and changes in practices.

Finally, **knowing how** practices include considerations about the social interaction context of collaborative innovation. Although the majority of the knowledge practices that are related to clinical trial innovation are developed under formal projects that are determined by the Firm, these “knowing how” practices are arranged to fulfil the expectations of all the involved partners. Rather than simply prescribing the tasks to perform according to a rigid structure that needs to be adhered to, the “knowing how” practices work as a call for collective knowledge and practices to be developed. The actions and practices of all partners are arranged on the well-connectedness of different knowledge bases, and collective knowledge emerges by the shared context of practical working interaction. A different type of characterisation of expert and codified knowledge is experienced. Firm specialists do not simply put knowledge into the innovating practice of partners and go away. Ongoing articulation and the negotiation of knowledge become central to a collective sense-making process that is promoted by the Firm. Toward this end, knowledge and artefacts are managed by the Firm to be adapted to the partners’ needs and constraints without ignoring the need to make them robust enough to establish a common point of reference among the partners.

Conclusion

The paper aims at deepening the understating of how innovation and learning take place in the practical context of networking innovation. Drawing from recent practice-based

studies, we empirically investigated this topic by analysing two questions: how does a firm practice collaborative innovation and 2) how does a firm learn in practicing networking innovation?

Regarding the “How a firm practices” question, our findings showed that the investigated Firm understands innovation as an emerging process that is developed in a highly collaborative networking context. Even while under the process and knowledge leadership of the Firm, the collaborative innovation emerges by interacting actors who tested new experiments and consolidated their knowledge through their practices of collaborative working activities.

The Firm acts as interconnected community of Knowledgers (Lindkvist 2005) that fosters innovation and learning by bringing and aligning different knowledge domains in a working context. Four practices of alignment are identified at the base of the collaborative innovation model of firms. These practices work together in enhancing alignment in heterogeneous internal and external networks. The alignment practices describe the complex and social activities of the Firm in combining different perspectives across boundaries of knowledge domains and practices (Wenger et al. 2002). The Firm operates on distributed knowledge tasks among an articulated network of internal and external partners, and its means of enabling integrated collective actions relies on the well-connectedness of practices and knowledge in action.

In analysing the arguments of how a firm learns in practicing networking collaborative innovation, the model of the **4-ways of knowing framework** added evidence to the practice-based view of innovation and its link with knowing and learning dimensions. The learning is viewed as emerging from a mixture of four knowing practices -who, what, why and how practices - that work together and support each other in the accomplishment of bridging and alignment actions. The **4-ways of knowing framework** moves from the practice-based conceptualisation of many organisational studies (Gherardi 2001, 2006.) and goes a step further in moving from the knowing in a setting context to the complex configuration of linkages in a networking collaboration for innovation. The model frames the ongoing dimension of the learning process as an active and recursive state including multiple knowing processes in action, whereas know-how is only an aspect of the process.

In accordance with studies of practice scholars (Melkas and Harmaakorpi 2012; Dougherty 2004), we determined that networking innovation appeared to be a more emergent, ongoing, deliberate and negotiated activity of practicing alignments and knowledge in action.

Innovation in a collaborative context emerges in a non-linear pathway that is associated with the development of codified and practical knowledge (Melkas and Harmaakorpi 2012) embedded and embodied in the ubiquity within and at the boundaries of a collaborative network.

These first results provide evidence of Nicolini et al.’s idea (2003) of practices as “bricolage” and by paraphrasing their opinions; we find that to innovate is to know *how* to

keep all these elements in alignment. We find that the innovation management issues are described better as a question of boundary work (Carlile 2002, 2004) involving the social dynamic aspect of ‘bridging, translating and making use of the knowledge disseminated among different contexts and domains’. This presumes more efforts by researchers in reading innovation management by a new perspective where the focus is more on the social constitutive nature of the innovation process rather than following the rational, fully planned and controlled approach to technology and the strategic management tradition.

In addition, our results position our work in accordance with the research of practice scholars (Nooteboom 2007, Elstrom 2010, Melkas and Harmaakorpi 2012) who recognised an epistemological foundation to practices and practical terms. As Noteboom noted (2012 pag: 27), the practical term has not been observed in its *derogatory sense of ignoring foundations and principles.... that ...allowing for ignorance, incoherence, or even inconsistency.... ..the application (practice) is part of a learning process where ideas change in their application and yield new ideas* (knowledge in our sense), *so that application is part of discovery.*

This study extends the debated question of knowledge transfer from tacit-codified-tacit knowledge as an aspect of the driving force that leads and sustains innovations. Learning should be viewed in innovation as an exercise in the intermeshed and ongoing application of the generation and transfer of knowledge that is useful for providing the exploitation that inspires exploration in an endless process as one move from one context of application to another.

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