INNOVATION AND MIND
COGNITIVE ISSUES IN INTERACTION

Working paper

Keywords: Innovation, Cognitive mapping, Interaction, Network approach

ABSTRACT

Based on a case study, this working paper aims to introduce a cognitive dimension in the study of innovation, adopting a network approach. Through a cognitive mapping technique, we identify the representations held by three actors in a network about their innovation. Great differences in defining the detail components direct our attention to the consequences of this cognitive dissonance on interaction.

INTRODUCTION

Innovation, as a turning point of business life, emerges not within a single company, but among companies that interact in order to find new solutions. Innovation lies in the minds of the actors involved in discovering it. This paper aims to study the relevance of cognitive dimensions of interaction among the actors dealing with an innovation. In particular, the paper aims to understand how innovation—as a matter of interaction—is represented in actors' minds and how actors' cognitive maps influence the interaction among them.

This paper offers preliminary understanding about this issue and for this reason can be considered a working paper.

In the following paragraphs, we present a literature review of innovation, interaction and cognitive issues in order to position our paper in the IMP literature while trying to fill the gap about how the cognitive representations of actors influence their interactions when dealing with an innovation. Next, via case study, we show a cognitive representation of actors with regard to innovation, highlighting their different views and trying to explain why, in their past interactions, they do not share common ideas as well as how actors' cognitive distance influences future interactions.

LITERATURE REVIEW

Innovation emerges in interactions among actors

Innovation is defined as the result of the composition of old and new ideas in a different manner or context that is considered new by the actors involved (Van de Ven, Polley, Garud, & Shane, 1999).

The process of composition, combination and re-combination of old and new ideas, cannot be solved inside the company as the venerable tradition about innovation often takes for granted. No one individual or company has all resources necessary to discover and solve new problems alone. Accordingly, over the years, particular research streams show that most of what we perceive to be competitive markets can be considered more effectively interacted networks of business organisations (Olsen & Hoholm, 2010). Business networks imply that innovation is a result of the combination of different knowledge, expertise and resources that

exist within different organisations, developed across company boundaries (Dubois & Araujo, 2006).
Daily, firms are embedded in continuous interactions with others companies (Hakansson & Snehota, 1989) and through such interaction, they discover problems, opportunities and gaps in which innovation can take place. If we consider that interactions are affected and affect others interactions (Håkansson, Ford, Gadde, Snehota, & Waluszewski, 2009), innovation is a complex product of a multitude of interdependent interactions among firms, where a boundary cannot be defined.
Within relationships and so, within networks, innovation is performed. A series of IMP researches focuses on how networks may impact innovation, both positively and negatively. Innovation is dependent on relationships, direct and indirect, and this dependency means not only that innovation is constrained by what happens in the network, but also that companies can have access to the resources located in the network (Ford & Johnsen, 2000).
Consequently, according to the network approach, it is extremely difficult to foresee how the innovation process evolves as well as what will be the "final" innovation product (Gressetvold & Torvatn, 2006); innovation processes are characterised by a series of decisions over time (Gressetvold & Torvatn, 2006). During this process, the innovation product changes (Seidel, 2007) as it is influenced by actors and their resources.

Innovation requires a variety of actors

Innovation emerges in interactions as a result of combining, in a different way, existing and new knowledge and expertise held by different actors (Freeman, 1991) (Hagedoorn & Schakenraad, 1990). Innovation requires a variety of actors and often implies a combination of different technologies as well as a combination of technological resources within the market. Different actors can develop and accumulate a variety of resources that they can mobilise for innovation. Actors interact because they are different and because they can complement one another. Through interaction, they also find who they can complement and how (Håkansson, Ford, Gadde, Snehota, & Waluszewski, 2009).

Different actors have different cognitive frames

As human beings, actors must develop simplified schemas – defined as cognitive frames - about their world in order to reduce the confusion that emerges from the multiple stimuli in the environment (March & Simon, 1958) (Taylor & Fiske, 1984). Cognition is used to describe the belief system of an actor who uses it to perceive, construct and make sense of the world; using it to make decisions about how to act in the world (Weick, 1979) (Walsh, 1995). Knowledge is incorporated in the cognitive structure of actors and it changes over time (Bartlett, 1932) due to the acquisition and elaboration of new stimuli.
IMP researchers find that there is a difference between the network and representation of that context in actors' cognitive maps. Each actor in the network holds a network picture, a conceptualisation of the network as it is perceived by actors, and has its subjective interpretations of the relationships. As highlighted above, innovation is performed through interaction in a network; consequently, each actor can contribute to the innovation process according to the cognitive representation in which its knowledge is embedded (Naude, Mouzas, & Henneberg, 2004).

Interaction implies a change in cognitive frame

Stimuli emerge during interactions because actors acquire and process data, information and knowledge. We know that interactions are characterised by capabilities, mutuality, particularity and inconsistency (Ford, Hakansoon, & Johanson, 1986). From a cognitive viewpoint, interactions change actors' cognitive frames in orders to process new pieces of

knowledge and integrate them into their viewpoints. On the basis of their understanding, actors can act and develop resources as well as carry out activities to further develop an innovation.

Actors have some difficulty changing their cognitive frames

Adding new information is not simple because it requires a change in the structure of the frames actors use to see and interpret information. Actors understand and interpret their environments on the basis of previous cognitive schemas; if new information represents a different description of the reality, they experience cognitive dissonance. Cognitive dissonance occurs when a subject experiences a negative state in which two cognitions are inconsistent. Due to the unpleasant nature of this experience, he/she attempts to reduce the dissonance, usually changing one or both cognitions in effort to make them more consistent with one another (Festinger, 1957).

Consequences for the interaction and the innovation

The difficulties involved in changing cognitive frames have important consequences on interactions; an issue not well explored in the IMP literature. This stream of research dedicates enormous efforts toward studying how innovation emerges in networks and in the features of interactions, but cognitive dimension is only initially explored in some contribution within IMP. Some of these studies examine business relationship value (Bouzdine-Chameeva, Durrieru, & Mandjak, 2001), network evolutionary process (Wilkinson & Young, 2004), evolving interactions (Medlin, 2002) and learning processes in networks (Pressey, Peters & Jonston, 2009).

In addition, these difficulties have substantial consequences on innovation. The role of cognition in an organisational context is still lacking research and extant studies about it in the innovation process are not well established (Swan, 1997). This paper attempts to fill such gaps, showing the different cognitive frames held by different actors dealing with innovation and discussing the consequences on interaction and innovation.

RESEARCH METHODOLOGY

In order to have a wide picture of cognitive issues in interaction, the empirical research is based on case study. Due to the descriptive and exploratory aim of this type of research, the case study method is chosen in effort to study cognitive issues in a real-life context.

The present research focuses on cognitive perception of actors involved in a development process of innovation.

The innovation under study is a smart phone application that represents a new field of software development as a retail solution to proximity marketing (named PROMO). The application is a software and hardware solution that sends promotional messages over Wi-Fi or 3G connectivity; these messages are sent to end-users who have previously installed the application on their smart phones. The application enables users to define their shopping preferences and allows them to receive messages tailored to their needs. The solution also identifies the end users' location.

Various entities are involved in the development of this innovative solution: industrial partners, academic researchers, technological experts, business consultants, funding partner, potential customers and so on. In this web of actors, the innovation is generated as a result of continuous interactions.

The unit of analysis is the actors' cognitive perceptions of three actors involved in the project. Technocell, DTI and DSAS are chosen in order to offer a complete view of the innovation due to their central roles in the project.

Data collection is based on face-to-face, in-depth, semi-structure interviews with the actors mentioned above, who are directly involved in the project. The interviews are designed to discover various aspects, including:

- Cognitive representation of the solution for each actor;
- Common and different perceptions of actors involved.

Cognitive representations are analysed via cognitive mapping techniques, the relevance of which is recognised by extensive literature in management (Eden, 2007), (Barr, Pamela, & Huff, 1992), (Axerold, 1976). This method also allows us to represent graphically the cognitive maps of each actor. Researchers analyse all interviews together in order to share the same codifying approach of interviews. Researchers share the same representation of cognitive maps and work together in order to compare the different perceptions of the solution using a qualitative approach.

EMPIRICAL EVIDENCE

The empirical evidence comprises two parts: a brief profile of the actors involved in order to understand their roles in the innovation process as well as their cognitive representations about the innovation.

Brief profile of the actors and backgrounds

A profile of the actors involved allows us to understand the context in which the innovation is generated while, at the same time, offering interesting explanations about the differences among the cognitive representation of each actor. The actors involved in the present project and considered in this study are: Technocell, DTI and DSAS.

Technocell, located in the southern Switzerland, specialises in the international trade of electronic audio/video equipment and is one of the major distributors of mobile phones in Switzerland. Over the years, Technocell has developed numerous important capabilities and competencies in commercializing electronics products.

DTI is an acronym for the Department of Innovative Technology of SUPSI, University of Applied Science of Italian Switzerland. The DTI department deals with the sciences of engineering in the applied field, generally within the industrial sector and with technology and information services for firms located principally in its region. In particular, a laboratory of the department, named NetLab, has developed numerous competencies in mobile technologies, wireless networks, localisation and so on, in various projects at both national and international levels. DTI is interested in developing an application for the smart phone in order to exploit its existing competencies.

DSAS is an acronym for the Department of Management and Social Science of SUPSI, which has extensive expertise in innovation management. DSAS has carried out various researches in this area and is now developing consulting services for firms in this field.

Cognitive representations of the actors involved

In the present study, the interviews are codified in order to develop three different cognitive maps comprising 65 concepts for each interview.

Analysing and comparing the cognitive maps, eight topics emerge as the most relevant. The components of these topics emerge as a result of combining the different concepts expressed

in interviews and offer an exhaustive view of each actor's cognition about innovation. These components are as follows:

1. Definition of the innovation
2. Main features of the solution
3. Opportunity from technological and business viewpoints
4. Business customers for the solution
5. Relationship with business customers
6. Price of the solution
7. Time necessary to develop the solution
8. Priorities

The cognitive representations of the topics cited for each actor are summarised in Table 1.

Table 1: Actors' Cognitive Representations

Central Concepts		DTI	Technocell	DSAS
1	Definition of the innovation	Promo is a research project.	Promo is a product /system.	Promo is a solution for proximity marketing.
2	Main Features			
2a	*Personalised messages*	Promotional messages are sent on the basis of end user preferences.		
2b	*Localisation*	End users can receive messages that account for their position in the store.	It is useful to get end users' locations in large shopping centres.	This feature is not relevant.
2c	*Where and when promotions are sent to end users*	End users receive promotional messages only when they are inside the store.	End users receive promotions whilst inside and outside the store.	
2d	*Integration with business customers' information systems*	Not cited	Not cited.	Integration is one of the most critical aspects of the solution's attractiveness.
3	Opportunity From Technological and Business Viewpoints	A detailed analysis about relevance and diffusion of wireless technologies available on mobile phone, with a particular focus on Wi-Fi; Some insights about new trends in marketing communications	Not cited.	A thorough analysis about the new trends in the retail industry and the rising adoption of a variety of possible technological solutions to improve the effectiveness of marketing communication in the industry.
4	Business Customers for the Solution	Mall/factory stores and chain stores; No other details provided about their profile and geographical location.	Mall/factory stores in South Switzerland; In the future, business customers could be found in other regions. Airports and train stations are other potential business customers in the future.	Retail industry, with a particular focus on chain stores; Some insights about the possible profiles of target business customers; mall/factory stores considered a difficult segment to reach
5	Relationship with Business Customers	Some insights about the need to personalise the solution on the base of business customers' needs. The dimension of business customers may influence the personalisation level requested.	Personalisation will be requested by business customers but it will not require a long interaction with the business customers.	Thorough analysis as to the means of interaction with business customers; analysis of business customers' communication strategies in the store is the basis for development of a wide offering that will include PROMO. Integration with the existing information systems of business customers is considered an important issue.

6	Price of the solution;	License fee and cost of personalisation	License fee Cost per messages sent to end users.	Pricing should be defined considering the cost of applications developed by competitors.
7	Time Necessary to Develop the Solution	Fulfil the project's schedule	Time to market is important. They perceive the need to go faster into the development phase in order to launch the product to market.	Time is necessary to collect other information in order to define certain critical issues.
8	Critical Issues of the Project.	Not cited.	Find business customers interested in the solution.	Mall/factory stores are business customers that require different approaches and this aspect should be considered in depth. The ability of the solution to be integrated in business customers' information systems is crucial.

Source: Authors' elaboration

Comparison among the cognitive maps of three of the actors analysed shows that even if there are some points of convergence, many aspects are viewed completely different by each actor.

Regarding the *definition of the innovation,* three different, but complementary concepts emerge: Promo is a research project for DTI, a product to commercialise for Technocell and a solution for proximity marketing for the retail industry for DSAS. The differences in the descriptions of the same innovations can be explained considering the position of each actor in the network, given each actor's role in the project, experience and competencies previously acquired.

DTI is working on this project in order to produce useful research for its industrial partner, but also to accumulate knowledge that can be used for further projects and research activities. Technocell is an industrial partner, so it is mainly interested in the commercialisation of the innovation while DSAS, the consultant partner for business aspects, underlines the context in which the innovation will be introduced.

All actors agree that one of the *main features* of PROMO is the idea of sending promotional messages to end users on the basis of their express preferences, but certain differences emerge in the localisation issue. PROMO is able to recognise the position of end users throughout the store using Wi-Fi access points inside the store; this feature is conceived differently by DTI and Technocell. For the former, knowledge of the subject's location allows application to send promotional messages on the basis of his/her location while for the latter this information is useful to help end users find their bearings in large shopping centres. On the other hand, DSAS does not consider this feature significant from a business point of view. Regarding integration of business customers' information systems, it is also interesting to observe that DTI and Technocell do not cite this issue while DSAS considers it crucial.

A clear view of the *opportunity* that PROMO will exploit is well expressed by DSAS and DTI, though with different focus, whereas Technocell does not cited the market opportunity, perhaps considering it for granted. DSAS stresses retail industry trends in proximity marketing and in communication based on new mobile technologies while DTI highlights the technological evolution of mobile devices.

Different views are also expressed in terms of potential *business customers*. Technocell primarily addresses the innovation to malls and factory outlets, but DSAS states that it is better to focus on chain stores, highlighting that the innovation's approach to malls could be problematic. DTI thinks that both business customers should be targeted, but it offers no other insights. Moreover, DSAS has a detailed picture about the profile of business customers that could be interested in the solution.

The *relationship with business customers* is also an interesting point that shows the divergences among actors. In particular, the actors do not share the same view about the personalisation level requested by business customers. While DTI and DSAS agree about the importance of the personalisation -DSAS offers a clear view of this -Technocell is quite worried about the issue and thinks, and likely hopes, it will require little effort and a few conversations with businesses in order to sell the solution.

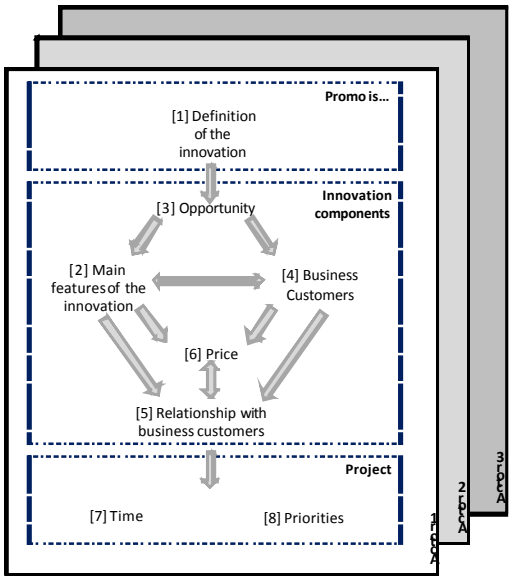
Time is the most critical issue cited by Technocell. Reducing the time to market is imperative for the commercial partner of the project. Rather than time to market concerns, DSAS stresses, instead, the need to collect more information about the market, competitors and so on. DTI expects to fulfil the project schedule and it is not interested in reducing the time necessary to develop the solution.

In terms of *price of the solution,* all actors share that the belief that pricing will be based on a license fee, but the additional economic agreements with customers are differently articulated. Technocell thinks that the best solution requires a fixed cost for each message sent by the business customers, without accounting for the cost of personalisation, as cited by DTI and DSAS. While Technocell and DTI express their beliefs about the prospective price for this solution, DSAS highlights the idea that more information is necessary in order to define, in detail, the economic aspects of the offering, particularly considering competitor offerings.

Regarding possible *critical issues* to account for, Technocell primarily addresses finding possible business customers that are interested in the solution. DSAS highlights their primary concern about the solution is in the relationship with the business customers: some will require a different approach. DSAS also feels that integration with their existing information systems will be critical in defining and developing relationships with the business customers.

The eight components can be grouped into three different dimensions as shown in Figure 1. These component include: actors' views about PROMO (1), innovation components (2,3,4,5 and 6), organisational issues of the project (7,8). These dimensions offer a detailed picture about the perceptions of each actor of the innovation as a whole.

Figure 1 – Actors' Pictures of the Innovation and the Link Between Components



Source: Authors' elaboration

Analysis of the interviews shows the links between the eight innovation components. The *definition of the innovation* (1) for each actor (a project, product or proximity marketing

solution) influences all the innovation components; for instance, considering PROMO a research project, DTI recognises the opportunity in the development of new knowledge in its technological field. For DTI, the opportunity is recognizable in the contribution that it offers to the scientific community.
Regarding the various different innovation components, the schema shows that all are linked together. The *business and technological opportunities* (3) define which *main features* (2) the innovations can have, influencing which *business customer* (4) may be interested. Also, the *business customer* (4) may show interest in *new features for the innovation* (2). *Price* (6) is a central concept of the innovation that may have multiple influences, such as the *main features of the innovation* (2), the target *business customer* (4) and the *relation* (5) with business customer. Case study also shows how there are some differences as to the right process for defining the price of the innovation. For instance, DSAS, recognizing the needs of business customers to have a solution integrated into their existing business processes, highlights the need to personalise the product.
The components of the project (7 and 8) are mainly influenced by a combination of the other dimensions. For instance, Technocell, considering PROMO a product, stresses the need to reduce the time to market and begin sales. Moreover, for Technocell, relationships with business customers will not require deep interactions, so it believes the product will be ready for market soon.
The links do not clearly emerge in the cognitive maps of each actor, due to the different relevance that each actor affords each component.

DISCUSSION

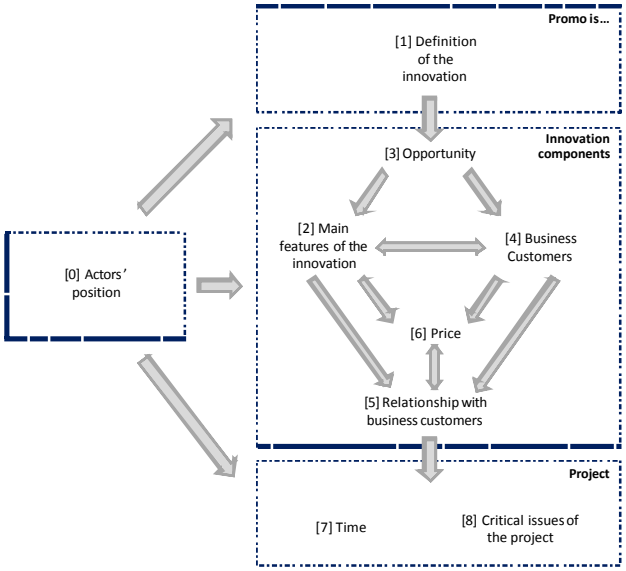
Multiple views about the innovation

The present case study shows that each actor develops its own view of the innovation. As a result, no "integrated" solution emerges, but a multiple versions of solutions cohabit in the network. They share the same generic innovation concept, when analysing their perceptions in detail, great differences emerge, particularly in terms of their customers, their business relationship with their customers, the price of the solution and the development time required for the solution. In addition, some issues are considered critical for some though not for others. The level of convergence among the actors seems low.
Why does each actor develop different views about the innovation? Analysing their cognitive representations, we observe that each actor is highly affected by its role in the web and by the position held in the network.
In fact, each actor plays a different role in the web of actors: DTI is in charge of software development for the solution, Technocell will launch the product in the market and support the development process, and finally, the consultants at DSAS are responsible for developing in depth knowledge about market as well as various business aspects of the innovation.
Each actor's views are also given by their positions. Technocell has relationships with chain stores and malls developed in the course of its business; therefore, it will seek to exploit these resources through the innovation. It will introduce PROMO to its customers and develop relationship with other interested businesses. DTI has relationships with universities in the information science domain and will use this innovation to develop its knowledge and expertise, allowing the development of existing relationships and the development of new ones. DSAS has relationships with certain firms in the retail industry that it will develop as a result of the innovation. Each actor has different goals and expectations, according with to position.
The resources owned by each actor also influence their perceptions and each remains anchored in its view, given their position and resources. The central theme, given by the

number of related concepts, are also different in each cognitive map: DTI stresses the technological background of the innovation and DSAS its understanding of the retail industry while Technocell focuses on the need to reduce the time to market.

As shown in Figure 2, the actor's position influences its cognitive representation of the innovation: its definition, components and development plan.

Figure 2 – The Links Among the Eight Elements Emerge in the Interview



Source: Authors' elaboration

The ability to integrate the others' viewpoints in one's own mind appears limited. The contribution given by each actor influences its view of the whole solution. The present case study shows that each element, in the actor's view, is strongly linked with other elements and so change of the whole view implies the changes of different components. A partial convergence on some components may produce different effects on the perception of another linked component. Resistance to change views explains why the cognitive representations remains stuck in each actor's mind over time. So each cognitive representation is strongly anchored to the actor's previously held representation.

The existence of multiple views about the innovation solution is not positive or negative alone. Differences in cognitive representations of the solution can open new directions of development for the innovation. A unique view can stifle exploration of the solution and some opportunities can be lost. The distance among subjects' representations has relevant consequences on the interactions as well.

Multiple views influence the interaction

Cognitive representation of the innovation is the result of past interactions among actors and will influence future interactions among them. Each actor activates resources and carries out activities according with its cognitive representations.

We know that parties have different interests and the interdependency is affected by motion in the relationship. Therefore, conflict is an important feature in the relationship and it will be functional or dysfunctional, which is especially relevant in the promotion of the innovation (Gadde & Hakanson, 1993).

A high level of distance between the cognitive representations in the web of actors may produce a sort of cognitive dissonance in the network. The concept of cognitive dissonance is

introduced by Festinger (1957), who applies this concept to individuals and social groups. A network can be considered a social group and thus, the concept can be applied in our study.
Cognitive dissonance has important consequences in interactions. The difficulties that actors may experiment in interactions due to their cognitive distance can be traceable in heated discussions, disagreements, conflicts and misunderstandings. It can result in difficulty making decisions about future directions for the innovation.
Cognitive dissonance can also waste time, extend development time of the innovation and delay the time to market, or can result in ineffective compromises. Moreover, conflicts and misunderstandings can damage the relationship among the actors. As numerous studies in social psychology show (Hovland, Rosenberg, McGuire, Abelson & Brehm, 1960), cognitive dissonance creates negative tension because people can be afraid to disagree with others. A deep and substantial disagreement about the nature and specific aspects of innovation may influence - in a negative way - the "relational atmosphere" (Ford, 1980), (Hallen, 1986). Interaction becomes critical to develop the innovation and the ability of each to deal with different views and different understandings about the innovation is crucial for the success of the project.

Continuous interaction should reduce the distance among actors in terms of their cognitive viewpoints. Cognitive dissonance cannot be solved only with more clear communication among actors, notwithstanding the importance of this role. However, each actor is anchored in its view, given the position it plays in the network and resources owned. If each actor does not acquire knowledge that creates a tie among them, the actors cannot resolve their dissonance and find a common view about the development of the innovation. Some pieces of knowledge owned by each must be partially transmitted and transferred to others in order to understand the others' viewpoints. The critical matter is mainly the development of resource ties among the actors.
Due to the negative tension produced, the social psychologists stress the relevance of interpersonal strategies to achieve consensus. Matz & Wood (2005) find that actors can persuade others, change one's own position or join another group in which they do not experience cognitive dissonance. The first two strategies take place within the network, through interactions, while the third changes the configuration of the web of actors. If actors do not agree about the object of their interactions, they can decide to leave the web and find other contexts in which their positions will be more consistent with others.

Future interaction within the web of actors described will likely be addressed to find a consensus about the innovation with all components considered. The consensus is relevant because consistent behaviour is more predictable and stable than disagreements. The ability of actors to interact with others, solving the cognitive dissonance observed, is the most critical issue involved in developing innovation in the future.

CONCLUSION AND FURTHER RESEARCH EFFORTS

This research offers a deeper understanding of the complexity of interactions for innovation, adding insights about the relevance of cognitive dimensions. It suggests that the cognitive dissonance among actors influences the interactions among them as well as the definition of the innovation. Our contributions suggest that a variety of degrees of consensus and disagreement among actors can facilitate or obstruct the development of an innovation.
We observe that differences influence the activities and resources mobilised by actors. Due to these differences, actors can follow different and conflicting directions, reducing the ability of the network to develop the innovation. The degree and content of the cognitive dissonance that results among actors can play an important role in interactions for innovation and the innovation itself. At the same time, those conflicting directions can contribute to finding new

ways and opportunities for the innovation that a similar cognitive framework among actors may not achieve. Nonetheless, cognitive dissonance should be reduced, avoiding negative consequences for future interactions or on configuration of the actors involved in the innovation process.

In further research efforts, we will study the difficulties encountered by actors in their interactions as well as their awareness of the other actors' differing views about the innovation. After some months, a new analysis of the actors' cognitive maps after some could offer further interesting empirical evidence about the changes in the cognitive representations over time. Comparing them, we can be aware of the effectiveness of the strategies adopted by actors to find consensuses.

Improvements in the representations of the cognitive maps (not included here, but available upon request) and the inclusion of other actors in the analysis are also important advancements of our research.

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