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# Networked innovation: a concept for knowledge-based agrifood business

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## Abstract

Research on innovation in agrifood business is looking for new perspectives and for new ways of implementing actual results and of combining different theoretical perspectives. To do so we propose the concept of 'networked innovation' to summarize what we consider as the core notions necessary to mobilize to understand the complex phenomena of innovation in modern agrifood knowledge-based businesses and economies. Firstly we summarize the theoretical backgrounds and propose our own definition of the concept, which is rooted in a processual treatment of knowledge creation and transformation that came out mainly from the relevant literature on organization theory, strategic management and knowledge management. Then the content of the notion is developed around three main items, which are: (1) the multilevel embeddedness of innovation; (2) the roles and forms of learning for innovation; (3) the becoming nature of innovation processes. In the concluding comments some implications of the research for agrifood business are proposed.

*Keywords:* agrifood, innovation, knowledge, network, multilevel, process

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## 1. Introduction

Until today a growing number of innovation researchers are working to develop our understanding of innovation processes. Some of them are interested in the sources of innovation (Von Hippel, 2007), the organizational changes in innovation process (Van de Ven and Poole, 2005; Van de Ven *et al.*, 2000), innovation and proximity (Bouba-Olga and Grossetti, 2007, 2008), sectoral approaches of innovation (Malerba, 2002), the role of users in the innovation process (Von Hippel, 2009). Others are interested by the role of networks in innovation processes (Cross *et al.*, 2003; Swan *et al.*, 1999), particularly the social network processes (Borgatti and Cross, 2003; Borgatti and Foster, 2003; Borgatti *et al.*, 2009; Coulon, 2005; Freeman, 1991; Wasserman and Faust, 1994, 2004). A large number of fields and different contexts have been explored (Edquist, 2010).

More specifically, in the context of innovation in agrifood business, the learning and network dimensions of innovation processes have been widely acknowledged and highlighted (Batterink *et al.*, 2010; Gellynck *et al.*, 2007; Omta, 2002; Sarkar and Costa, 2008; Schiefer and Dieters, 2013; Sporleder and Peterson, 2003). Others subjects such as innovation capacity, innovation drivers and determinants

of innovation process in this sector have also been studied (Avermaete *et al.*, 2004; Fortuin and Omta, 2009; Gellynck *et al.*, 2007, 2011).

For us, one of the future challenges of agrifood companies facing innovation is to develop a knowledge-management logic, putting knowledge as the core strategic asset. To do so we need new perspectives on this complex topic of innovation process, linking together several angles of the phenomena. In order to capture the essence of innovation some authors have proposed the concept of 'networked innovation' (Swan and Scarbrough, 2005) in order to identify the multifaceted and complex phenomena of innovation. Not yet stabilized, we will nevertheless consider that this concept of networked innovation could be a valuable notion to put forward because it brings together several branches of the researches on innovation that have been until now scattered in different and sometimes antagonist fields. More importantly we show that this concept is in fact an original way to define a novel unit of analysis and to study its permanent transformation in a contextual construct.

In Section 2 we trace back the origin of this concept and propose our own definition of *networked innovation*.

Stemming from this definition we identify three central items that according to us are helpful to characterize the specificity of the concept in Section 3: the embeddedness of innovation in a multilevel approach, the learning dimensions of innovation, the becoming nature of innovation processes. Each of these notions is developed in the following subparts. From this concluding comments for agrifood business are drawn in Section 4.

## 2. Networked innovation: antecedents of the notion and tentative definition

The studies linking innovation with the network forms of organizing economic activities have witnessed a rapid development since the mid nineties, following the seminal works of authors such as Powell *et al.* (1996) and Oliver and Liebeskind (1998). One of the common denominator of these researches is to put forward some central features of innovation in modern economies. Among these features, we will find the multilevel approach of innovation processes and its interaction learning characteristics (Asheim and Coenen, 2005; Conway and Steward, 2009; Lam and Lundvall, 2007; Lundvall and Johnson, 1994). Indeed, innovation, due to the dispersed and heterogeneous nature of knowledge that is necessary to implement it, needs different categories of players and different processes of knowledge conversion (Crossan *et al.*, 1999; Nonaka, 1991, 1994; Tsoukas, 1996). These players are themselves highly diverse in terms of size, nature, strategies, structural and cognitive characteristics. In a pioneering work, Conway and Steward (1998) suggested a mapping of the network, which highlighted the networking activity of key players and their respective positions. The mapping shows the configuration of the network and its components: actors, links and flows. In this vein 'the network concept is a useful framework for evaluating the structure and operation of existing networks, and for highlighting factors that might improve their performance' but 'there is a risk that networks are used widely and not always appropriate' (Conway *et al.*, 2001; Jones *et al.*, 2001). Furthermore, the range of informal and formal relationships that will support innovation processes will be increasingly diverse. The processes can be focused on collaborative relationships (Pettigrew *et al.*, 2001; Ring and Van de Ven, 1994), on developing trust-based organizational relationships and formal innovation networks (Dhanaraj and Parkhe, 2006), or in creating a web of informal social networks (Conway and Steward, 2009), fostering learning and interactions between the players involved in innovation (Argyris and Schön, 1996).

Thus emerge an idea of innovation as being, simultaneously, permanent networking activities and supported by

innovation networks. This will be encapsulated, in a growing literature, in the term 'networked'. Understanding and learning from innovative companies are key issues from the perspective of market trends knowledge and profiles of innovative companies. For Alfranca *et al.* (2004), this knowledge could be particularly useful when a core business influences technological developments in any international industry for a long period of time. There is an important link between the market and innovation. In this vein, Colurcio *et al.* (2012) are interested in the networked innovation processes in the food sector by focusing on asymmetric relationships for three reasons: (1) the context of food market is not favorable for innovation because of its saturation, conservative consumers behavior about food preferences; (2) innovation in food sector is very risky; and (3) the opportunities for network innovation depend on the market, which might support or accentuate power asymmetries.

According to Swan and Scarbrough (2005), the starting point of the definition of networked innovation is to be found in Hardy *et al.* (2003) and Philips *et al.* (2000), who define it as 'innovation that occurs through relationships that are negotiated in an ongoing communicative process, and which relies on neither market nor hierarchical mechanisms of control' (Philips *et al.*, 2000). These authors have identified and integrated, in relation to this notion of networked innovation, the different bodies of research that differentiate 'three broad types of effects, which refer as strategic, knowledge creation and political effects of collaboration' (Hardy *et al.*, 2003). These findings constitute a first step in the definition of the concept. For them, in complex innovation processes, companies are willing to gain capacities through the transfer or the pooling of resources. Hardy *et al.* (2003) suggest that 'a primary rationale for collaboration is the acquisition of resources through the direct transfer of assets, the sharing of key equipment, intellectual property, or personnel, and the transfer of organizational knowledge' (Hardy *et al.*, 2003: 324). But the interorganizational collaborations have also knowledge creation effects. In other words, alliances and collaborations are vehicle for learning about new technologies, new modes or organizations or new human skills. This is, in this case, a situation where a partner will learn from another partner, a situation often describe as a single-loop learning (Argyris and Schön, 1996). But frequently the interorganizational relationship also helps creating new knowledge not possessed or not available before. Powell *et al.* (1996) suggest for instance that 'sources of innovation do not reside exclusively inside firms; instead they are commonly found in the interstices between firms, universities, research laboratories, suppliers and customers'

(Powell *et al.*, 1996: 121). A third aspect of collaboration effects is their political consequences. The term political here is taken in its primary meaning of power effects of one organization over another one. A power relationship could facilitate or constrain actions, or even shape them. This point is crucial for a deeper understanding of innovation processes. Indeed, the structural patterns in which players are embedded will probably have 'a significant impact on the degree to which organizations are able to control their own actions and influence those of others' (Hardy *et al.*, 2003: 327). This structural dimension affecting innovation processes has also been widely developed in the literature (Pittaway *et al.*, 2004; Powell and Grodal, 2005).

For Swan, and in line with these different streams of research, it is possible to identify three main characteristics of networked innovation: 'the importance attached to mechanisms of knowledge creation; the critical part played by social networks; and the pervasive role of technology' (Swan, 2005). We will stress upon the first two aspects which are also found in authors who put forward the importance of knowledge in relation to network dimensions (see for instance Gulati, 1999; Nooteboom and Gilsing, 2004; Tidd *et al.*, 2004; Tsai, 2001), but we will extend these ideas toward the topic of knowledge integration. Indeed this question of knowledge integration in innovation processes is the central node of the networked approach of innovation. For some authors the explicit/tacit nature of knowledge should be considered as a determinant aspect of innovation: while explicit knowledge necessitates market-oriented relationships, tacit knowledge needs different forms of integration (Jensen *et al.*, 2007). The embeddedness of knowledge integration is also developed in complementary researches (Nonaka and Toyama, 2003). But the characteristics of knowledge can also be seen from a relational point of view: the development of shared comprehension is seen as a pre-requisite on integration. Different types of boundary-spanning activities are thus created by players in order to overcome different kinds of barriers (Cantner and Graf, 2006; Chan and Liebovitz, 2006; Conway and Steward, 2009; Giuliani and Bell, 2004). Influenced by network theorists (Bass *et al.*, 2004; Pittaway *et al.*, 2004), other researchers (i.e. Borgatti and Li, 2009; Borgatti *et al.*, 2009) put forward the idea of the combination of actors and relationships that is the starting point of the structural analysis of innovation processes embedded in network relationships.

Following this overview of the literature and combining it in a novel concept, we propose our own definition. Networked innovation is

'a conceptualization of knowledge creation and distribution processes, seen as a phenomenon contingent to the intentional design of inter-organizational and interindividual relationships and mechanisms. This design is activated by the players with different kinds of interaction and learning processes which aim is, for the implementing players, to bring a significant competitive advantage. This wide diversity of players has different structural and cognitive characteristics. Thus it necessitates, in an analytical perspective, a contextualization of the situation of their own idiosyncratic positions regarding this knowledge creation and distribution environment.'

This definition puts clearly forward a distinctive approach on innovation: the unit of analysis is neither the innovation itself, nor the innovation system, nor the player. This is instead the knowledge, seen here not just as a flow of information and resources but as a process being continuously translated, transformed, remodeled by actors, with the intentionality of reaching a competitive advantage. This point is central to the understanding of the networked innovation seen as an original concept. Indeed, doing so, in modifying the lenses through which the innovation is studied, allows us linking different bodies of literature previously scattered. Following and extending the main authors that have mobilized this perspective, it is henceforth possible to organize what could constitute the basic components of such a conceptual view of innovation and delineate its main characteristics around three core items.

### 3. A delineation of the concept of networked innovation in three items

We propose here to summarize what could be the basic theoretical components of the concept of networked innovation: the multilevel embeddedness of innovation, the learning roles and forms in innovation processes, and the becoming nature of innovation.

#### Taking stock of the multilevel perspective: the embeddedness of innovation

'Embeddedness refers to the fact that economic action and outcomes are affected by the partners' relations and by the structure of the overall network of relations' (Duyster *et al.*, 2003). From this definition, we can distinguish three levels of embeddedness: structural, relational and positional embeddedness (Granovetter, 1985, 1992), at which some authors also add the institutional level (Grandori and Soda, 1995). The institutional level of innovation is embedded, foremost, in a contextual dimension. In particular, it



is argued that the national systems of innovation play a considerable role in the diffusion of innovations and in the development of networking activities. Institutions, defined as the set of the legal system (i.e. the banking and finance system, the structure of labor markets, the education system and the political system) can make network formation easier (Grandori and Soda, 1995). Taking the cluster as a unit of analysis, many authors consider that all firms are similarly concerned with external environment, and equally benefit from external economies and opportunities for joined action in the cluster. Likewise, firms are equally facing the constraints of the environment. Access by firms to some types of resources can be influenced by the constraints of the context, concerning resources in particular, and may drive firms to adjust their networking behavior and also to give the innovation network configuration specific traits (Salavisa *et al.*, 2012).

*The relational embeddedness* refers to the direct links between actors and their role in knowledge transfer and acquisition (Gulati, 1998). Relational embeddedness focuses primarily on the quality of relations between network actors (Granovetter, 1992) developed through a history of interactions (Nahapiet and Ghoshal, 1998). Therefore, at the dyadic level, relational embeddedness generates trust and feeling of closeness (Moran, 2005; Nahapiet and Ghoshal, 1998). Coleman (1988) considers the network as advantageous when partner relationships are redundant and dense because it involves trust between them, encourage them to form future inter-firm alliances (Chung *et al.*, 2000). For Chang (2011), the degree of relational embeddedness depends on two conditions: pre-existing ties between partners and frequent contacts. In the two cases, firms search to reduce uncertainty. This is especially true when partners work closely on complex tasks (Jones *et al.*, 1997), which is difficult to complete or require a high degree of collaboration and coordination or also when the task is developed in parallel by both partners (Terwiesch *et al.*, 2002). Relational embeddedness has two levels: (1) relational closeness is indicated by the number and the quality of contacts which will have individuals from each partner; and (2) collaborative commitment is indicated by the willingness of a firm to sustain its partner.

*The structural embeddedness*, which refers to the interconnectedness between network members, signifies the establishment of norms at the network level (Rowley *et al.*, 2000). Whereas relational embeddedness takes into account the dyadic level and stimulates the creation of trust between the actors in the network, structural embeddedness refers to the structural positions that the network members occupy and their impact on the information value (Gulati,

1998). Several authors have searched what kind of network structure is better for innovation. Some studies highlight the idea that the actors of a network are different and that is why they perform differently. For Burt (1992, 2001), a network sparsely connected is more efficient than a network densely connected, particularly because information is non-redundant. But theory highlights the importance, not only of ties and inter-units (between individuals or organizations) connectedness, but also the importance of holes than can exist in the network. An actor of a network can benefit from the existence of holes. It can play the role of bridge in the network, by creating links with other actors where connection has failed to form. The firm in such bridging position, called the node, benefits of many advantages. The most important is the access of non-redundant information and ideas arising from others members. Then a firm in a position of a node is more able to innovate than others. Finally in the case of clusters can emerge 'powerful leading firms' (knowledge gatekeepers) (Gebreyesus and Mohnen, 2013) that are able to perform R&D or to play a role of 'bridging enterprises' that link the actors of the cluster with the external environment (Boschma, 2005; Boschma and Ter Wal, 2007).

*The positional embeddedness* puts forward the following central idea: the position for each member in the social system is a determinant of its role, behavior and decisions in alliances formation (Gulati and Gargiulo, 1999), and of the resource fit between partners (Rooks *et al.*, 2013) i.e. the resource alignment between one's needs and the partner provisions (Das and Teng, 2000). One network actor may occupy strategic position which allowed it to have many significant ties with others. This strategic position is called centrality (Rooks *et al.*, 2013). Rooks *et al.* (2013) have proposed that resource fit is affected by the network position of firms. For Ahuja (2000), central firms, which have a strategic position in the network, have more capacity to innovate than others. In similar terms, central firms are more able to benefit from their alliances than less central firms (Gilsing *et al.*, 2008). In terms of information access, these firms are better informed about what happens in the network (Gilsing *et al.*, 2008) and consequently it will increase their possibilities to create new alliances (Gnyawali and Madhavan, 2001; Gnyawali and Steward, 2003).

Beyond the consensus about the importance of each level of innovation embeddedness, we consequently presume that innovation processes are deeply embedded and that levels count. In other words, all forms of embeddedness play a strong role in enhancing innovative capacity of firms and of the network as a whole.

### Learning roles and forms in innovation processes

Since Cohen and Levinthal's (1990) seminal article putting forward the central idea of learning and knowledge accumulation, the notions of innovation and learning are intrinsically intertwined. For these authors, learning is fundamentally a cumulative knowledge-based process. Indeed 'the notion that prior knowledge facilitates the learning of new related knowledge can be extended to include the case in which the knowledge in question may itself be a set of learning skills' (Cohen and Levinthal, 1990: 129-130). Thus 'this progressive improvement in the performance of learning tasks is a form of knowledge transfer that has been referred to as learning to learn' (Cohen and Levinthal, 1990: 129), a competence which has been identified as the central skill of innovation competence. Another idea linking innovation and learning is the notion of learning performance. Learning performance 'is greatest when the object of learning is related to what is already known' (Cohen and Levinthal, 1990: 130), but at the same time 'knowledge diversity also facilitates the innovative process by enabling the individual to make novel associations and linkages' (Cohen and Levinthal, 1990). Consequently, their works lead to the view of innovative capacity as the ability of an organization to create a *structure of communication* between on the one hand this organization and on the other hand its external environment, and within the organization (between for instance subunits), opening the way to the open innovation approaches (Chesbrough, 2003). Finally Cohen and Levinthal (1990) argue that 'the problem of designing communication structures cannot be disentangled from the distribution of expertise in the organization', a conceptualization which emphasizes the forms and characteristics that could take learning processes in innovation settings (Nooteboom, 2000).

On this point, the works of Argyris and Schön (1996) can be considered as a complementary stream of research on learning, useful in their attempt to define the concrete forms that could take learning processes in companies and sectors. More specifically, and in line with this tradition focused on innovation learning, some works (such as Gherardi, 1995, 2000; Gherardi and Nicolini, 2002; Van Wijk *et al.*, 2003) have provided valuable results and insights. For instance, following the seminal book of Argyris and Schön (1996) on organizational learning, the role of actors within networks and the networking activity for learning has been widely acknowledged (Gherardi, 1995; Hislop, 2003; Hislop *et al.*, 2000; Van Wijk *et al.*, 2003). Usually, three levels of learning are identified: individual, group and organization, with subsequent learning processes (Crossan *et al.*, 1999). Crossan *et al.* (1999) explain organizational learning as

a dynamic process and as a tension between assimilation of new knowledge (exploration) and using what has been learned (exploitation). This learning occurs at multiple levels (mainly individual, group and organizational levels) and is described in four processes: intuiting, interpreting, integrating and institutionalizing. Another key finding is the fact that learning processes are usually, in organizational innovations, single-loop of learning, meaning that actors modify their actions according to results or a double-loop or second-order form of learning, meaning that actors question the values and assumptions, with radical (in the case of disruptive innovation for instance) and complex changes involved (Argyris and Schön, 1996). On this question of learning, other works have also focused on the characteristics of the learning activities. Lundvall (2010) for instance identify the different forms of learning under the categories of learning by doing, by using, by interacting, by spillovers effects. But learning related to the issue of innovation can also be viewed in a holistic manner. This is the perspective adopted by authors such as Gherardi and Nicolini (2002), and authors from the knowledge management field (Van Wijk *et al.*, 2003). For these authors, learning is not an isolated phenomenon. Its strength lies in the complementarity of the network relationships, seen as a stable structure, with the interacting processes that occur (mainly) at the inter-individual level. Thus emerges a view of learning for innovation very close to an idea of networking activity for innovation. These perspectives, i.e. the dynamic interrelationships between network and organizational learning, are well summarized by Berthon *et al.* (2007); for them the networking activity is double-sided phenomena: it is a 'channel for learning but, recursively, the network is transformed by the learning taking place. In other words, the network is, at least partially, constructed by the learning processes dynamically, deliberately and in an emergent manner' (Berthon *et al.*, 2007: 23). Innovation networks and networking for innovation are thus the two sides of the same coin: consequently innovation should be studied as such, i. e. as a global phenomenon of becoming. Similar views for the food sector are developed by Colurcio *et al.* (2012), Mele *et al.* (2010) and Russo Spena and Colurcio (2010).

### Innovation network(ing) as a phenomenon of becoming

Innovation processes are inherently seamless, complex, evanescent and fluid phenomena. But, in complementarity with the strands of theories about embeddedness and learning previously developed, how to capture their essence? Many social scientists have argued that theory should provide tools to understand it accordingly. For researchers, considering the innovation activity of firms seen as a whole necessitates mobilizing at the same time

the existence of formal innovation networks and the practice by managers of informal network activity, but also of permanent interactions at structural networks level as well as networking activities level between various entities. Nevertheless research works on innovation usually considers separately these two main perspectives: the first one is focused around the role, characteristics and dynamics of formal structured networks; the second stream of research deals with the innovation activity in itself and especially with the way companies will create and activate informally different (individual) partners. But relatively few research works consider these two perspectives jointly. Authors such as Geels (2004), Langley *et al.* (2013), Miettinen (1999), Bathelt *et al.* (2004) and Dhanaraj and Parkhe (2006) provide interesting approaches on such perspectives. They rely, implicitly or not, to an idea of any organizational phenomena as 'processes of becoming' (Hernes, 2008), in coherence with constructionist approaches of the knowledge within firms (Tsoukas, 1996).

Hernes (2008) has summarized and shown the importance of recent fields of organization theory for the study of innovation, and more specifically Actor-Network Theory (hereafter ANT) proposed by Callon (2002), Latour (2005) and Law (2007). The starting point to consider for this theory is that innovation processes create connection with, and between, various actors. But, in looking at innovation processes, the most important fact for the tenants of this theory, and which is lacking or under emphasize to most of the traditional theories about innovation, is not to identify particular actors but to 'single out those elements that seem to influence what is going on' (Hernes, 2008). These elements are called 'actants' (Latour, 2005). Thus an 'actant' is an object or a person (or an organization) that is stronger than others and has survived. Hernes argues that 'rather than looking for context, we are better advised to follow connections and association that are made between heterogeneous actors. Then to see networks as relational rather than consisting of neatly delineated actors adds fluidity and freedom to the notion of actors' (Hernes, 2008). What could tie actors between them is called association and the nature of such an association is not important per se. The question which matters is the purpose of this association and its strength over time, which can be of course an innovation process. Thus for ANT theorists nothing is stable in nature and the inherent characteristics of connected entities are neither human nor technical.

Consequently, in considering this status of actants in innovation processes, one must consider first what constitutes relations. This is the notion of referencing which 'enables meaningful interaction to take place

between actors'. These references are not stable but instead evolve constantly as 'chains of transformation'. Of course the constant circulation and transformation of knowledge in innovation processes provide a perfect validation of such a perspective. For Hernes, 'the idea of circulating reference helps circumvent dichotomies such as those between subject-object and global-local' or between levels. Nevertheless, this ANT theory does not reject traditional approach of structured actors, called macro-actors, and of levels. These macro actors, like institutions and organizations, may emerge and stabilized over time. But at sub levels of innovation processes, there is more than these permanent structures. Thus the complementarity of network embeddedness and ANT lies in the fact that innovation encompasses these interactions, simultaneously structured *and* fluid.

Finally, for ANT, 'making sense of relations that tie actors together, rather than making sense of the actors themselves, thus becomes constitutive of actor-networks. Networks, then, do not consist of stable nodes and links, but consist of relations that shape actors recursively. Actors become actors through their relations with other actors' (Hernes, 2008). Other recent research works in sociology have also developed the idea of a complementarity between network relationship categories and types, for instance individual and organizational relationships (called the 'double link design', Lazega *et al.*, 2007). Similarly, some works show that innovation processes extend beyond formal organizations: activation of relevant networks overcome categories or formal classifications (cf. Conway and Steward, 2009, for an overview). Thus complementarity, instead of exclusivity, should be the focus. In modifying the lenses through which one could analyze innovation, the idea of innovation network(ing) as a phenomenon of becoming open up new avenues. The focus is then on socio technical networks, define by Callon (2002) as 'a way in which actors and intermediaries are constituted and defined one another within such networks'. Then, as suggested by Akrich *et al.* (2002a) 'as for the socio-technical analysis, it positions itself at the exact place where innovation is situated, in this hard-to-grasp middle-ground where technology and the social environment which adopts it simultaneously shape one another' (Akrich *et al.* 2002a: 205). This approach considers the innovation as the result of complex and multiple interactions between diverse actors such as firms, universities, public institutions, researchers, and so on. Innovation is defined as the 'art of intersement' of allies (Akrich *et al.*, 2002a, 2002b). It succeeds as soon as it reaches the 'art of interesting an increasing number of allies who will make you stronger and stronger' (Akrich *et al.*, 2002a), building up progressively an association of



actants. This view of innovation puts a lot of emphasis on the duality of innovation incorporating both formal and informal dimensions.

#### 4. Concluding comments

Finally, drawing from these different perspectives and based upon relevant works from the fields of sociology, organization theory and knowledge management, we suggest considering the concept of networked innovation. This concept allow considering innovation processes as multi-sided processes where the structural and formal dimensions of innovation must be considered in parallel with the innovation activity in itself, embedded in different contexts, and putting interaction learning for knowledge integration and transformation as the central issue. This concept encapsulates the idea of a syncretic approach of innovation useful to be mobilized in the era of agrifood

knowledge-based economies, in emphasizing the multiple forms of knowledge creation, transformation and distribution between a wide diversity of partners. Further research on innovation using these lenses could be greatly relevant and could be operationalized thoroughly in the future, in taking as a starting point the postulates about what really is innovation in its core components in knowledge-based businesses, and especially in the highly dynamic and complex agrifood and life sciences sectors (Powell *et al.*, 2005; Sarkar and Costa, 2008).

This concept also opens some new directions for future research on innovation. First of all, scholars have to explore combinations between levels (mainly between policy and network levels) interindividual and interorganizational learning interactions (Gittel and Weiss, 2004; Langley *et al.*, 2013; Yu *et al.*, 2013), as it is sketched in Figure 1. These cross-level studies are interesting and would allow researcher to

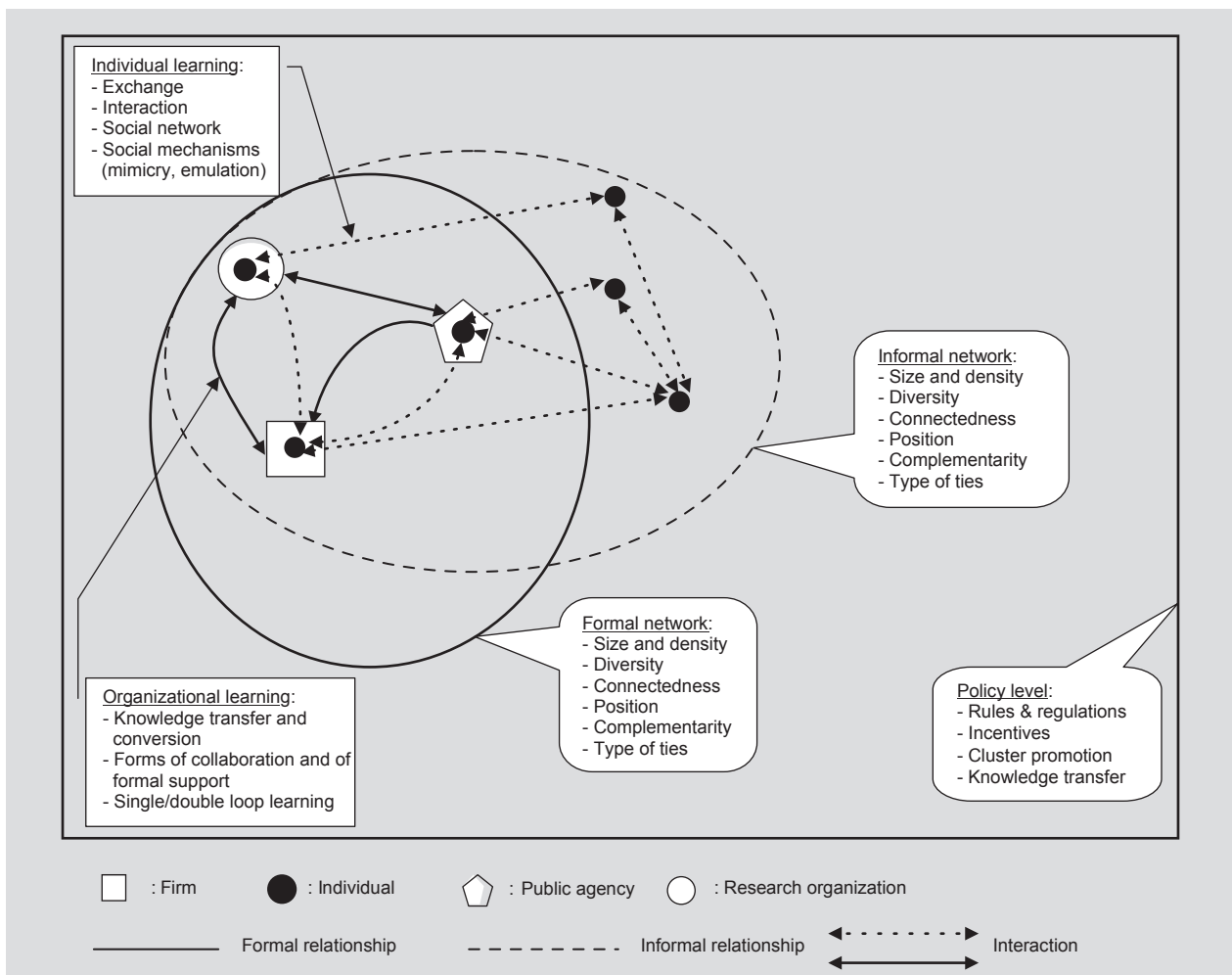


Figure 1. Networked innovation: a chart.

explore and analyze the relationship between different levels (Hofmann, 1997) that are usually under emphasized in the literature. The informal network is not left as the interaction between partners is the antecedent of the integration of resources (Mele *et al.*, 2010). Our chart also shows that this informal network is created around the formal network setting, and the crossing between the two gives rise to the networked concept. We also emphasize the importance of the complementarity between formal and informal networks (Lazega *et al.*, 2007) that plays an important role in the dialectics of innovation processes. Finally future researches should integrate networked innovation perspectives in their studies on interorganizational collaborations in innovative projects. Indeed, the networked innovation concept has also practice-based implications (Gherardi, 2000; Van de Vrande *et al.*, 2010) and provides an integrative perspective on innovation management by combining formal and informal networks.

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