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## Behavioral Foundations for Open Innovation: Knowledge Gifts and Social Networks

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### ABSTRACT

The literature on “open innovation” so far focuses almost exclusively on strategic issues. In this largely conceptual paper we propose behavioral foundations for knowledge exchange and knowledge sharing to address this gap in the literature. Innovation and knowledge development that result from knowledge transfer, is an uncertain and cumulative process that typically involves a number of parties. Knowledge transfer between people and firms has been fruitfully studied from a structural or network perspective. The social network literature however, faces an “action problem”. Focusing on structural elements such as an agent’s position in a network and the types of relations entertained cannot explain why actors actually do share knowledge. The exchange of knowledge is elusive and is a discretionary act for the people involved, certainly in the case of open innovation (OI). It is argued here that social network analysis is to be complemented by the concept of gift exchange, drawing on social exchange literature. Gift exchange – following Mauss’ dictum to “give, receive and reciprocate” – establishes obligations between people especially under circumstances of ambiguity, which explain why and how knowledge exchange relations are established, persist, and may also end. Relationships in a social network and the social capital that inheres in these cannot be drawn on at will to exchange knowledge. These obligations established by gift exchange between individuals who share a connection explain why agents exchange knowledge with each other even in the absence of markets or hierarchy.

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The innovation process has come to be seen as an interactive process where knowledge is continuously exchanged between individuals and actors internal and also external to a firm (Autio, Hameri, & Vuola, 2004; Huizingh 2011; Landry, Amara, & Lamari, 2002). Innovation is, primarily, cooperative undertakings (Wuchty, Jones, & Uzzi, 2007). Open Innovation (OI) plays an important role in innovation and will become increasingly important in the years to come (Chesbrough, 2003a, 2003b; Huizingh 2011). Open innovation involves knowledge being shared or exchanged with no or only limited contractual arrangements and no formal command and control relation between parties involved.<sup>1</sup> In the generally accepted definition of OI (“the use of purposive inflows and outflows of knowledge to

accelerate internal innovation, and to expand the markets for external use of innovation, respectively” Huizingh 2011, p. 2) a defining feature of OI is that sharing knowledge occurs across firm boundaries (cf. Dahlander & Gann, 2010). Cooperation may be with other firms, some of its employees, or with customers (Bogers, Afuah, & Bastian, 2010). This definition suggests that the flow of knowledge is the result of purposive behaviors by employees, following instructions of management, in effect seeing their behaviors being lined up with firm strategy. Individual employees involved in innovation activities, however, are in part and necessarily acting discretionary (Aalbers, Dolfsma, & Koppius, 2014), and can as well show purposive OI behaviors that is not in line with firm strategy and perhaps in direct conflict with it (Ferrary, 2003).

The behavioral dimensions of people sharing knowledge under such circumstances, especially across firm boundaries, are largely ignored: why would individuals share knowledge without a formal, contractual guarantee of some return? This conceptual paper argues that there is a need for a clearer understanding of the behavioral and motivational issues involved in knowledge sharing with a view to innovation, and offers suggestions to address this lacuna. Literature in psychology and on corporate citizenship indicates that motivational and behavioral issues can matter crucially if one is to understand success or failure of a (temporary) organizational form (Aalbers, Dolfsma, & Koppius, 2013; Foss & Lindenberg, 2011; Organ, 1990; Molm, 2003), particularly when activities are extra-contractual and thus discretionary. Innovation activities, including OI activities, are at least in part discretionary, extra-role and thus not the direct result of formal instructions as part of someone’s functionally defined role in an organization, provided by management. Some behaviors that ostensibly are to be characterized as open innovation behaviors, involving purposive knowledge transfer crossing firm boundaries, can, however, even be at odds with what somebody in a functional role is explicitly allowed to do (Ferrary, 2003). The contribution this paper offers thus complements the more strategic issues in this discussion about open innovation (Chesbrough, 2003a, 2003b; Henkel, 2006).

Social exchange (of knowledge) does not necessarily happen by itself (Szulanski, 1996), and may certainly have negative consequences as well (Gibney, Zagenczyk, & Masters, 2009). A shifting “locus of innovation” will not leave the interactions between persons unaffected: how can the interactions they have within and across firm boundaries be understood? In particular, from a behavioral point of view, what explains why people are involved in the largely extra-role and not-contracted-for behavior of sharing knowledge? Social network analysis (SNA) offers insights into knowledge transfer as it explores network structure and network position (Allen, 1977; Allen & Cohen, 1969; Burt, 1992, 2004; Coleman, Katz, & Menzel, 1966; Gabbay & Zuckerman, 1998; Galunic & Moran, 2000; Hansen, 1999; Landry et al., 2002; Nahapiet & Ghosal, 1998; Tushman, 1977). Social networks capture the important structural aspect of the cooperation involved in knowledge exchange. Social Network Analysis, however, purposefully ignores the motivational or behavioral dimension (see Aalbers et al. 2013; Obstfeld, 2005). This behavioral dimension may be important for knowledge transfer too, however (Bouty, 2000; Flynn, 2003). The OI literature has a similar lack of attention to the behavioral or motivational aspects of individual knowledge transfer. We seek to suggest a way of combining insights from social network analysis with those from social exchange theory to address this shortcoming.

Several unanswered questions thus remain, but we focus on one: What micro processes are involved in sharing knowledge, particularly when knowledge sharing crosses

firm boundaries (Darr, Argote, & Epple, 1995; Fellin & Foss, 2005; Henkel, 2006; Kim & Mauborgne, 1998; Tsai, 2001; Von Hippel, 1987; Obstfeld, 2005)? The “action problem” Obstfeld (2005) identified must be addressed: when, how, and how much will people actually share knowledge, using the network structure that is there?

This article proceeds as follows. We first discuss aspects of knowledge relevant for knowledge exchange. Social network literature (Section 2) is discussed to determine the extent to which it can be used to help explain knowledge sharing with reference to those characteristics of knowledge. Section 3 examines the “action problem” that social network literature is rightfully claimed to have, which Section 4 addresses by introducing and developing the complementary notion of gift exchange. Section 5 then critically discusses literature on knowledge exchange by scientists in R&D laboratories from this perspective, highlighting the added insight the combination of social network analysis and social (gift) exchange theory offers. Before we conclude (Section 7), Section 6 highlights some challenges for managers the argument in our paper suggests.

## 1. Knowledge characteristics

Schumpeter (1934/1978) has famously claimed that innovation emerges from re-combining existing knowledge, in other words from sharing it among individuals. Burt (2004) has argued that new knowledge will develop from knowledge exchange, and is particularly likely to emerge at intersections where structural holes connect otherwise disconnected communities. Cooperation involving a number of interdependent actors who are able to specialize to a certain degree is in part what organizations are there for (Lopes & Castro Caldas, 2015). What people are involved in needs to be coordinated, and details of the content of the work must be shared for organizational benefits to become available. Knowledge exchange may be less obvious than the exchange of more tangible resources (Szulanski, 1996). The exchange of innovative knowledge is different from that of other goods for a number of reasons that we will elaborate upon below, however (cf. Von Krogh, 1998). Importantly, the exchange of knowledge for innovation tends to be extra-role behavior in many cases (Organ, 1990), and so not straightforwardly mandated by management or specified in a contract and thus open to discretion by the individual. We identify four characteristics of new knowledge or knowledge relevant for innovations which in particular affect the way in which it is transferred, especially in the context of OI (cf. Von Krogh, 1998).

- Developing new knowledge is, first of all, fraught with *uncertainty* (rather than mere risk), even when development of new technological knowledge is path-dependent. Uncertainty of a technological nature is well documented, but uncertainty of a strategic nature is involved as well. How much investment is needed, for how long? What market will there be for the products that may ultimately be designed based on new knowledge? Which competitors will be faced? Knowledge easily spills over unintentionally, and is in general a commodity the use and development of which is affected by opportunistic behavior of other parties, increasing associated transactions costs (Jones, Hesterly, & Borgatti, 1997). If characteristics and value of the knowledge yet to be developed is impossible to determine beforehand, contracting for the complete set of future scenarios that may ensue where the knowledge to be developed is involved in cannot be undertaken (Field, 2003; Hodgson, 2005; Inkpen, 1996; Starpoli, 1998).

- The process of knowledge generation and the resulting technological advance for the most part is, secondly, a *cumulative* process, where scientists draw on the work done by others, possibly in the past, and is generally based on the efforts of many inventors and developers (Dolfsma & Seo, 2013; Mokyr, 2002; Scotchmer, 1991). Knowledge generation requires that individuals have related knowledge; acquiring new knowledge at least initially involves tacit dimensions and may require coding and decoding (Dolfsma, 2008a; Polanyi, 1966). While newly developed knowledge is likely to be of a tacit nature, knowledge that developed in the past is more likely to be explicit. New knowledge needs integration into an existing larger framework of knowledge of the individual in which meaning is given to new piece of information. Actors find it easier to adopt and interpret knowledge that is “related” to their knowledge base (Hansen, 2002; Markides & Williamson, 1994). Accumulated stocks of knowledge are essential to the innovation development process, first as a resource to directly develop innovations, and, secondly as a basis for absorbing new knowledge (Cohen & Levinthal, 1990; Hansen, 2002; Markides & Williamson, 1994; Obstfeld, 2005; Powell, Koput, & Smith-Doerr, 1996). The literature on technological paradigms has argued that what holds for individuals also applies to groups of individuals, for instance involved in the development of a technological field (Dosi, 1982; Mokyr, 2002). Knowledge then, in the words of Isaac Newton, is developed while standing on the shoulders of giants (cf. Merton, 1965).
- New knowledge is created in *communities of practice*, while the individuals interacting may or may not be members of the same organization (Bouty, 2000; Brown, 2001; Brown & Duguid, 1991; Nonaka, 1994; Wenger & Snyder, 2000). Individuals in communities of practice may interact on a regular basis to solve problems, establishing mutual trust in the process (van der Eijk, Dolfsma, & Jolink, 2009; Knight, 1967), building relationships of trust due to their affiliation and the engagement in common practices while sharing similar interests and/or expertise (Brown, 2001; Brown & Duguid, 1991; Wenger & Snyder, 2000; Wenger, 1998). Communities of practice are repositories of social capital, with members trusting each other, facilitating exchange; they enable quick identification of and connection between individuals who have relevant knowledge. Communities of practice thus are “significant repositories for the development, maintenance, and reproduction of knowledge” (Brown, 2001; cf. Lesser, 2000), allowing individual members to solve problems and transfer best practices (Wenger, 1998). Although co-location may be important for knowledge spillovers to occur (Decarolis & Deeds, 1999), communities of practices can also span geographical distances (Agrawal, Cockburn, & McHale, 2003; Brown, 2001; Ensign, 2009). Communities of practice tend to be associated with informal contacts between individuals (Furukawa & Goto, 2006; Park, 2002).
- Knowledge is, fourth and finally, a (quasi) *public good*. It is non-exclusive: consumption or use by non-payers cannot be excluded without such means as intellectual property rights. Knowledge is also non-rivalrous: it is not consumed by its use (Arrow, 1984). “Information [thus] is costly to produce but cheap to reproduce” (Shapiro & Varian, 1999, p.21). This has strategic implications for firms, but for individuals within firms as well. As imitation or communication of knowledge can be easy and cheap, there is a tendency for these goods to be under-produced (Romer, 2002). Information and knowledge are faced with an information paradox (Adler, 2001; Arrow, 1971): prior

to the acquisition of information the value to the buyer cannot be established. If the potential buyer is allowed to inspect the good as a whole so as to determine its value to her, there no longer is a need for her to actually obtain it. As the product cannot be repossessed after the inspection, the seller may not be able to sell the good unless additional institutional arrangements such as Intellectual Property Rights are in place to provide exclusivity. Providing a sample of the good may mitigate the paradox, but only if the provider can be trusted to indicate exactly how representative the sample will be of the complete product. There will be a tendency for the provider to adversely select what to show the buyer. From an economics point of view, markets for knowledge fail inherently (Stiglitz, 1994).

As a consequence of the characteristics of knowledge, its exchange between people is by no means an easy or self-evident process (Hansen, 1999; Szulanski, 1996), and likely to be an extra-role for individuals involved due in large part to the characteristics of what is exchanged. For these reasons a number of scholars suggest that a more informal mode of governance for exchange and coordination, different from that of market or hierarchy, may best suit exchange of knowledge (Bradach & Eccles, 1989; Dore, 1983; Hemetsberger & Reinhardt, 2009; Ouchi, 1980; Powell, 1990). Table 1 presents a summary of this position – rather than discussing the characteristics of this informal, social exchange in general, we will focus on what form such exchange actually takes, and how it would function in the context of knowledge exchange. This brings us to a discussion of the behavioral and motivational aspects of knowledge exchange, left largely unspecified in the literature so far. It is here that this paper contributes.

Coordination mechanisms need not mutually exclude one another (Dolfsma, Finch, & McMaster, 2005), but innovative knowledge transfer is subject in large part to the third

**Table 1.** Coordination Mechanisms.

Dimension	Coordination Mechanism		
	Market	Hierarchy	Social relations
What is exchanged?	Goods and services for money or barter	Obedience to authority for material and spiritual security; time in return for some type of monetary compensation.	Favors / gifts: tangible (goods/ money) and intangible (knowledge / information / services / love / status)
Terms of exchange	Specific	Unspecified, open (employee will follow directives within general limits of law and of morality)	Deliberately unclear (a gift/ favor creates an obligation to reciprocate; however, the value, form and timing of the counter gift is left open to discretion)
Expected individual orientation	Self-interest, short-term focus	Subordination to directives and rules, principal-agent perspective	Trust, reciprocity, social obligations (vertical & horizontal)
System regulation	Self-regulation, contract law, property rights	Organizational procedures; third party arbiters; labor law	Reputation effect; benefits of continued cooperation; hostages; moral norm of reciprocity; norms and solidarity; network closure

Adapted from Adler and Kwon (2002), Biggart and Delbridge (2004), Bugental (2000), Fiske (1992), Ouchi (1980), Powell (1990), Van der Eijk & Dolfsma (2008).

coordination mechanism. Even when trust and informal contacts thrive here, social relations importantly do have a structural aspect to them that literature in the Social Network analysis domain has explored.

## 2. Social Network Literature

A network is a set of relations linking nodes (e.g., people or organizations) (Knoke & Kuklinski, 1982; Scott, 1991; Wasserman & Faust, 1994). Social network theory focuses on the position of nodes in the structure. Actors' behavior, it is assumed, is determined by the structure of the social network in which they are embedded. The position of actors in a network and type and number of ties determines the actors' performance outcomes as well (Burt, 1992; Hansen, 1999). Social Network Analysis is increasingly recognized as a powerful perspective for studying innovation (Dolfsma & Leenders, 2016; Kastle & Steen, 2010a).<sup>2</sup>

Social network literature holds that while knowledge may reside in individuals, it is through networks that knowledge is exchanged and can be both put to use as well as developed further (Allen, 1977; Coleman et al., 1966; Tushman, 1977; Tushman & Scanlan, 1981). Network configurations and positions in the social network facilitate dissemination of information, and thus innovation. In line with what the literature on *communities of practice* suggests, social network theory indicates that, for instance, the shape of the network (its density, redundancy, clustering, size) (Allen & Cohen, 1969; Tsai, 2001) or the position of individuals (centrality, tie strength) (Hansen, 1999; Granovetter, 1973; Reagans & McEvily, 2003; Uzzi, 1997) represent an important *explanans* for knowledge sharing and creation. In case of a low redundancy level, for instance, if more weak ties constitute the network, this stimulates a search for new ideas possibly from a more diverse set of sources. There may also be loosely related subgroups in a network of relatively many weak ties (cf. Granovetter, 1973). Subgroups may be connected by structural holes that can exert great influence on the exchange (e.g. Burt, 1992, 2004). "Closed" or cohesive networks, where redundancy is high, cannot easily be controlled by outsiders but are also less likely to have access to novel ideas, information and knowledge as the inflow of new ideas into a closed network is more limited than in a non-redundant network (Granovetter, 1973). Such a network structure, usually marked by frequent communication and strong ties, does, however, offer actors the benefits of cooperative, coordinated action (Granovetter, 1985; Obstfeld, 2005) and the ability and willingness to exchange complex knowledge as a shared frame of reference and trust may more easily develop (Coleman, 1988; Hansen, 1999; Reagans & McEvily, 2003; Uzzi, 1997; Walker, Kogut, & Shan, 1997). Transfer of tacit knowledge, especially if of a sensitive nature, may require such close, personal interaction of individuals (Aalbers, Dolfsma, & Leenders, 2016; Bouty, 2000; Hansen, 1999; Kogut & Zander, 1992; Nonaka, 1994; Polanyi, 1966). Given the different strengths and weaknesses of the different network structures it is not surprising that research has taken a contingency approach emphasizing that different network structures are beneficial in different circumstances (e.g. Ahuja, 2000; Podolny, 2001; Rowley, Behrens, & Krackhart, 2000).

A network structure provides possibilities for actors to exchange with some actors and not with others (Skvoretz & Lovaglia, 1995). The structure of a network, in this view, determines with whom such extra-role behavior, "above and beyond" what may be required of people, can be expected (Kastle & Steen, 2010b; Zagenczyk, Gibney, Murrell, & Boss, 2008), with some structures being better at promoting some kinds of activities over other

activities (Ohly, Kase, & Skerlavaj, 2010). Under-emphasizing the role of agency, social network literature suggests implicitly that the exchange of knowledge depends (only) on the “pipes and prisms” of the network (Owen-Smith & Powell, 2004; Podolny, 2001; Tsai & Ghosal, 1998). Acknowledging a role for strategic uncertainty due to agents’ behavior is problematic within the SNA framework (Foss, Husted, & Michailova, 2010). Opportunistic behavior on the part of actors in a network, as a result of which knowledge may not be freely shared, is inexplicable for SNA. Even in an otherwise trusting community (of practice), some individuals may be inclined to show behavior that undermines trust. Social network theory, focusing on the structure of relations only, cannot explain why relations emerge, change in nature, or end (see van der Eijk et al., 2009). What may be claimed at most is that there is a *tendency* for certain kinds of behavior to be present in networks of a certain configuration. In a closed, dense network, for instance, where all the nodes are mutually connected, the risk of opportunistic behavior may be lower due to the emergence of enforceable norms (Coleman, 1988; Portes & Sensenbrenner, 1993), reputation effects (Coleman, 1988; Ferrary, 2003; Kreps, 1990; Ostrom & Ahn, 2003; Sherry, 1983), and repeat-interaction effect (Abreu, 1988, Fudenberg & Maskin, 1986; Kreps, Milgrom, & Wilson, 1982). Actors properly connected, it is then assumed, will not be excluded from knowledge sharing; there will be no rivalry in knowledge sharing.

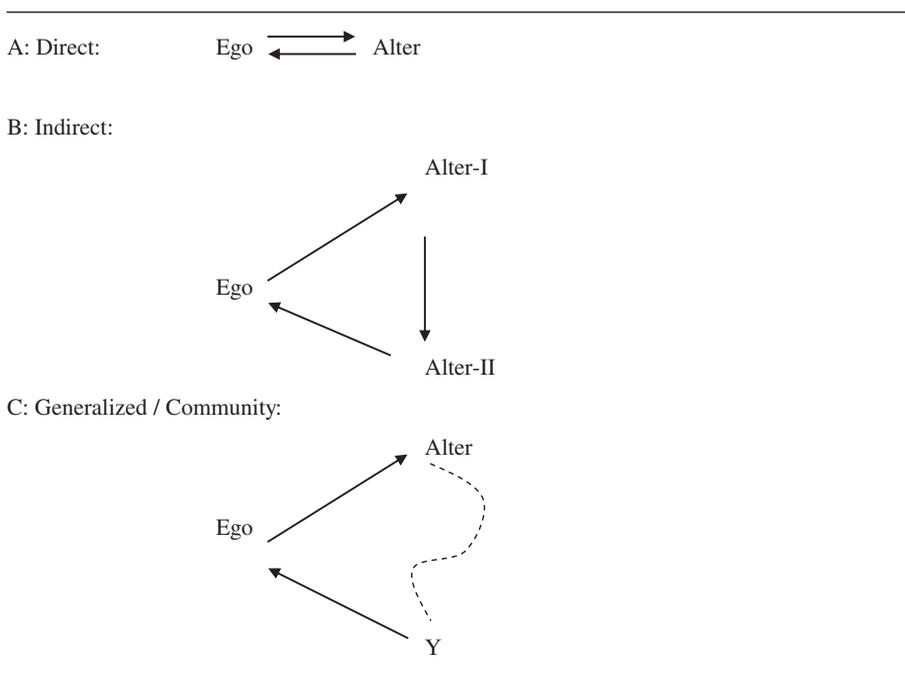
From an SNA point of view, knowledge as a public good may be under-produced only if a network is not properly configured. How network structures emerge or evolve is not much addressed in SNA, however (Ahuja, Soda, & Zaheer, 2012), since SNA does not discuss the content of what is transferred using the networks, it cannot address the *cumulative nature* and inherent *uncertainty* of knowledge development. The difficulties of the diffusion and further development of knowledge reach beyond the structural elements of networks. However, while SNA theory has recognized the information and resource benefits of specifics of network structures, it has not focused on motivational or behavioral issues (cf. van der Eijk et al., 2009; Hansen, 1999; Moran & Ghosal, 1996). A more thorough understanding of the micro processes and behavioral foundations of socially sharing knowledge is needed (Darr et al., 1995; Kim & Mauborgne, 1998; Obstfeld, 2005; Tsai, 2001; see especially Fellin & Foss, 2005 and Foss et al. 2010). Why actors share knowledge, or how relations get started, can be mobilized and coordinated, has received little attention (van der Eijk et al., 2009). Obstfeld (2005) has, thus, claimed rightfully that SNA has an “action problem”.

### 3. Action Problem

Whenever individuals can achieve a common goal through cooperation, but each have other goals as well that are not (fully) aligned with the shared goal, a potential problem of (collective) action exists (Olson, 1965; see also Randel & Ranft, 2007). As Huysman and de Wit (2004) point out, due to the kind of good knowledge is, “knowledge sharing cannot be forced; people will only share knowledge if there is a personal reason to do so” (cf. Brown, 2001; Brown, & Duguid, 1991; Szulanski, 1996; Wenger & Snyder, 2000; Wenger, 1998). Why do individuals, in the absence of clearly defined, formal, enforceable obligations, feel compelled to (continue to) provide others with knowledge? To achieve a mutually beneficial form of cooperation partially overlapping goals need to be aligned, addressing the motivational or behavioral dimensions of individuals’ involvement in joint activities. When needs, interests, or interpretations do not align and no way is found to address that, joint activities

may not develop whatever structural network connections are in place. This is what Obstfeld (2005) has dubbed the action problem for social network theory. The action problem may even be more pertinent in an OI setting where formal means to ensure knowledge exchange are absent to even indirectly have an effect (cf. Aalbers et al., 2014). Coordination through social relations is inevitable, but cannot be formally enforced, given what is exchanged in the context of OI relations. Referring to Figure 1, either a specific Alter (1A) or others one is more indirectly related to (Alter-II; 1B) may not act in the expected manner since individual motivations or interpretations may prevent them from doing so (Uehara, 1990). Interaction of the generalized type, (1C), may be least conducive to joint activity if interests do not align since not even an indirect structural connection exists between Ego and a Y who reciprocates. In such a situation Ego may nonetheless initiate exchange in hopes of reciprocation and inclusion into a community (van der Eijk et al., 2009; Ferrary, 2003). In each of the three cases, reciprocation is not inevitable, however, even when a direct relation exists (Ekeh, 1974; Ferrary, 2003). As a result of the foregoing discussion, in case of Figure 1A, market, hierarchy as well as social relations type of coordination can be expected to work. In a situation that Figure 1B represents, however market coordination is not (less) likely to be effective. At the very least, market coordination of the classical kind using bilateral contracts no longer work unequivocally – other mechanisms must be relied on (more). Other governance mechanisms can be those that are available in a hierarchy, or those that can be employed in social exchange situations. The situation portrayed in Figure 1C will require a variety of social interaction governance mechanisms to work.

Since SNA has focused exclusively on structural elements, it cannot assume what it in fact does assume: that the social capital and trust that may inhere in a network can be



**Figure 1.** A Classification of Interactions.

drawn on at will (cf. Coleman, 1988; van der Eijk et al., 2009). Due to socialization (Baer, Bodner, Erdogan, Truxillo, & Tucker, 2007), the alignment between group and individual motives may be larger between two individuals in a single organization when compared with individuals in different organizations. Since open innovation can and often does involve interactions between individuals from different organizations, the motivational challenges may be compounded. Coordinating intra- and inter-organizational collaboration, despite possibly conflicting goals and the possibility of opportunistic behavior, in the absence of coordination or regulation by external authority, does occur however (Ahuja, 2000; Bouty, 2000). Informal routines are typically established to accomplish this. Understanding how these develop and are used provides behavioral or motivational micro foundations for knowledge sharing, particularly in an OI setting.

#### 4. Gift / Favor exchange

For innovation it is clear that the flow of knowledge between agents within the same and across the boundaries of an organization is required. The flow of knowledge even within a single organization is far from obvious, however (Cross, Parker, & Borgatti, 2001; Ghoshal & Bartlett, 1988; Hansen, 1999; Kogut & Zander, 1992; Szulanski, 1996), knowledge may be present with actors in a network but not transferred for a number of reasons. Actors may not want to exchange knowledge, or may simply not know about the need that others have for their knowledge. The notion of sharing, conceptualized in the literature on gift exchange, provides an explanation of how actors are able to solicit the cooperation and exchange of knowledge from people within their network as well as from people beyond it (Bouty, 2000; Dolfsma, 2008b; van der Eijk et al., 2009; Flynn, 2003; Zeitlyn, 2003). In the context of the extra-role behavior of knowledge transfer, this argument has not been comprehensively made, nor were conceptual foundations developed.

Gift exchange theory offers insight into a wide variety of contexts (e.g. Akerlof, 1982; Blau, 1964; Heath, 1976; Homans, 1974). Gift exchange is sometimes, erroneously associated with the giving and receiving of explicit gifts on occasions such as birthdays, anniversaries, holidays, and other special personal moments, motivated by altruistic considerations only, but in actual fact is more encompassing. However significant in economic terms (The Economist, 2006), gift exchange is not limited to gifts in that sense. Informal relations of give and take are pivotal in cooperation between firms (Uzzi, 1997), even in markets where homogenous products are exchanged (Smart, 1993), as well as within a firm (e.g. Ensign, 2009).

Marcel Mauss (1954/2000) and other anthropologists and ethnographers have made the point that the obligation to give, receive, and reciprocate is universal, yet the way in which to give and what to give is context-dependent (Cheal, 1986; Ekeh, 1974; Sahlins, 1996; Simmel, 1996; Smart, 1993). In a social, cultural context, institutions determine also when a gift is to be reciprocated (van der Eijk et al., 2009). To the extent that gift exchange literature undergirds OI, one would expect inbound OI not to persist without outbound OI: in actual fact, over time, the two would be connected inseparably, even if conceptually distinct for some analytical purposes (Dahlander & Gann, 2010).

A mixture of motives is involved in gift exchange, including altruism, power and self-interest (Blau, 1964; Ekeh, 1974; Malinowski, 1996; Mauss 1954/2000). Smart (1993) points out that the exchange partners can, but need not be aware of the instrumental goals involved. Both the possibly instrumental goals involved as well as the perceived value of a gift must

ostensibly be ignored by the parties involved (Beltramini, 1996; Bourdieu, 1992). This is an important reason for favor or gift exchange to be ritualized (Khalil, 2004). If actors fall short of expectations about giving and reciprocating, the particular dyadic exchange relationship may be terminated and excommunication from the wider social network may follow (van der Eijk et al., 2009; Mauss 1954/2000): “individual aggressiveness is curbed by the prospect of ostracism among peers, in both trade and social circumstances” (Williamson, 1975, p.107). Mauss (1954/2000) has argued in this context that people are required to (1) give, (2) receive, as well as (3) reciprocate (Dore, 1983; Gouldner, 1960; Levi-Strauss, 1996; Malinowski, 1996; Sahlin, 1996; Schwartz, 1996; Simmel, 1996), at least with peers (Ferrary, 2003). Not being involved in gift exchange means one is not (yet) seen as a worthy peer, or one has violated context specific routines or rituals of exchange.

Most resources can be gifts, as gifts may be defined as those goods, material or immaterial, including knowledge, feedback, and tips, given to an alter in the expectation that it will be accepted and reciprocated at some point. Gift exchange needs to be out-of-balance at any moment in time so that it is clear that a relation will continue in the future. Because gift exchange is unbalanced when viewed at one point in time, a longitudinal perspective reveals the nature of gift giving: a gift is not reciprocated by an immediate return or compensation (Bourdieu, 1977; Deckop, Cirka, & Andersson, 2003; Ferrary, 2003; Mauss 1954/2000). A deferred return-gift obligates one individual to another, creating social debt. Reciprocity is open to discretion as to the value and form of the counter-gift; the nature of the compensation is not specified beforehand and highly context-dependent (Bourdieu, 1977; Deckop et al., 2003; Gouldner, 1960; Mauss 1954/2000; Zaidman & Brock, 2009). Specifying obligations a priori may prompt an abrupt end to the relation, yet not giving any specifications at all about the nature of the exchange may allow for misinterpretation or abuse of the situation. Gift exchange is carried out without a legal contract (Ferrary, 2003), but even so it creates an informal obligation (Gouldner, 1960; Levi-Strauss, 1996; Malinowski, 1996; Mauss 1954/2000; Sahlin, 1996; Schwartz, 1996; Simmel, 1996). Gift giving confers benefits of an economic and a social nature simultaneously (Belk, 1979; Larsen & Watson, 2001). Gift exchange is, however, not only an economic transaction providing economic (material) benefit, it is also a good in itself, a “process benefit”, in the sense of sustaining personal relationships (Avner, 1997). Relations between giver and receiver may become increasingly personal and are an important dimension of many transactions. They then come to have a value independent of their instrumental functions in regulating transactions (Rose-Ackerman, 1998). The notion of gift exchange thus explains how relations are established, maintained, or may discontinue (Belk, 1979; Gouldner, 1960; Larsen & Watson, 2001; Mauss 1954/2000; McGrath & Englis, 1996; Ruth, Otnes, & Brunel, 1999; Sherry, 1983).

As a corollary of the cycle of giving, receiving, and reciprocating, obligations, as well as trust and gratitude are generated between the (exchange) parties involved (Belk & Coon, 1993; Blau, 1964; Gouldner, 1960; Sahlin, 1996; Mauss 1954/2000). Gift exchange is associated with the generation of positive emotions and uncertainty reduction which generates cohesion and commitment (Homans, 1958; Ingram & Roberts, 2000; Lawler, Thye, & Yoon, 2000). Frequent gift or favor exchange is associated with the creation of trust facilitating further cooperation (Coleman, 1988; Fukuyama, 1995; Nooteboom, 2002; Putnam, 1993), and establishes a common frame of reference, lowering associated risk and uncertainty between parties, and establishing partners’ trustworthiness (McAllister, 1995; Shapiro, 1987;

Smith Ring & van de Ven, 1992). This process allows Ego to make inferences about both competence and intentional trust in Alter (Nooteboom, 2002). What may have started out as a mostly goal oriented interaction may become embedded over time in social relations (Granovetter, 1985; Uzzi, 1997), in part because individuals strive to derive a sense of pleasure or intrinsic satisfaction from their interactions (Du Gay, 1996; Eccles, 1981).

“Gifts can be described as an investment in the relationship between donor and recipient. The greater the value of the gift, the more substantial the investment” (Larsen & Watson, 2001). These investments are not only necessary since connections are not givens but require work (Bourdieu, 1977, 1986), but also expedient since they can purposively yet carefully be used to (try to) *create* social obligations (Bourdieu, 1977; Burt, 1992; Coleman, 1988, 1994; Darr, 2003; Granovetter, 1985; Kotter, 1985; Mauss 1954/2000; Walton & McKersie, 1969; Yukl & Falbe, 1991). By the same token, if alters are indebted to ego, he can use this as a basis for entitlement to future support (Coleman, 1988, 1994; Mauss 1954/2000). Given that these obligations are social, non-contractual, and legally unenforceable, actors cannot draw on them at will. Failing to reciprocate, nonetheless, will effectively prevent ongoing profitable exchanges but can also mean excommunication from the relevant group (Ferrary, 2003; van der Eijk et al., 2009; Williamson, 1975).

The literature on gift exchange is rightly placed in the broader context of social exchange theory (Ekeh, 1974), and so the explanation we offer for knowledge transfer in an open innovation context complements, we believe, the analyses of OI offered by others (Lakhani & Von Hippel, 2003; Von Hippel, 1987). As gift exchange not only transfer utility but also is socially meaningful interaction embedded in relations of mutual dependence and obligation, it contributes to the willingness to transfer knowledge (Camerer, 1988; Cheal, 1986). Especially when exchange involves uncertainties and interdependencies that can by definition not be fully foreseen and contracted for will social coordination through gift exchange be the coordination mechanism of choice. This is evident from the discussion of corporate scientists sharing knowledge: as knowledge develops cumulatively in the context of a community of practice, understanding what drives knowledge sharing is of some import.

## 5. Knowledge Sharing, Gifts, and Engineers

Considering the uncertainty and social dimensions related to knowledge development, market contracts or direction in a hierarchy may not, in all cases, lead to the desired result of knowledge exchange. Knowledge sharing can be largely extra-role or discretionary. In the context of the development of open source software, this already is readily acknowledged (Henkel, 2006; Lakhani & Von Hippel, 2003; Von Hippel, 1987). In this section we show how the mechanisms of gift exchange we have elaborated upon above plays a role in knowledge sharing (Darr, 2003; Sjostrand, 2004). Gift exchange, not necessarily fully voluntary but nevertheless extra-role in many instances, is driven by obligations of a social and informal nature, as argued. Gift exchange, involving altruistic as well as more self-interested motives, provides the parties involved with a mechanism for the exchange of resources as well as with incentives to do so especially in the kind of circumstances where both interdependencies and uncertainty are substantial as is the case for knowledge development. Social obligations stemming from gift exchange and the network position taken can be employed to elicit future support (Coleman, 1988) for instance to obtain the further knowledge that is needed (Bouty, 2000; Darr, 2003; Ensign, 2009; Humphrey & Hugh-Jones, 1992). Reciprocal gift

exchange establishes a transactional relationship between individuals (Sherry, 1983) and allows actors to forge and personalize relationships and to develop guarantees of personal bonding (Shapiro, 1987; Zucker, 1986). As these relationships develop and the exchange interactions progresses actors learn to cooperate with these particular others (Gulati, 1995; Powell et al., 1996; Starpoli, 1998) and establish a common frame of reference allowing actors to incorporate new, possibly complex and tacit knowledge (Hansen, 1999; Kogut & Zander, 1992; Von Hippel, 1994). As actors thus bridge 'cognitive distance' (Nooteboom, 2002) "tacit or personal knowledge which is anchored on the commitment of and beliefs of its holder" (Nonaka, 1994) can be interpreted and acted upon.

In studies looking at what determines the success that some corporate laboratory scientists have and others lack some noteworthy findings emerge. Those who actively engage in the publication of papers, giving to the scientific community at large, are more successful at developing knowledge than those who don't (Bouty, 2000). This is, obviously, partly due to the fact that this is a means for them to be up-to-speed with the most recent developments in their fields, keeping their own and their organization's absorptive capacity high (Cohen & Levinthal, 1990). There is more to this, however. These scientists claim themselves that they also receive more from others, working elsewhere, formally and informally, in the form of access to scientists in other organizations and unpublished or tacit knowledge (Furukawa & Goto, 2006; Hicks, 1995). Most of the knowledge at the frontier of advanced research may be tacit (Hicks, 1995); such knowledge will only be shared researchers whom one has established a longer term relationship of trust and understanding with, a relationship of strong ties (Hansen, 1999). Corporate scientists, creating goodwill and establishing obligations based on a history of given and take in a scientific community (Hicks, 1995), can act as technological gatekeepers and serve as a bridge between external sources of knowledge and their co-workers. This active behavior in publishing of some scientists in an organization boosts their effectiveness within their own organizations as well. The resulting flow of knowledge encourages innovation in which they themselves and their co-workers are involved, thereby benefiting the organization as whole (Furukawa & Goto, 2006).

The story of corporate scientists cooperating informally through gift exchange continues. Bouty (2000) has shown that laboratory scientists can be involved in relations with scientists they know in other, sometimes competing, organizations, helping each other out in ways that may sometimes counter explicit organizational regulations, and if abused by alters could seriously hurt ego's organization. Still, with specific others, laboratory tests, feedback, hints and the like are exchanged. Gifts are offered, received, and reciprocated. The element of limited circulation of gifts in a trusted circle of peers is clear: if a person is not known, no gifts are exchanged; if a person is not known well, gifts of low value such as commonly available knowledge is exchanged; if a person is known well and for a long time very valuable and highly sensitive knowledge can get to be exchanged. Indeed, contrary to expectations from economic theory, opportunities to exchange are not seized if ego knows that alter could just as well engage with others (Ensign, 2009, p.106). Also, rare and valuable knowledge is more likely to be shared than common and easily obtainable knowledge provided that "assurances that [return gifts] will follow" are there. Such assurances are not contractually enforced or mandated, and so failure to reciprocate will hurt ego. Exchange opportunities are preferably entered into that give rise to more substantial returns at some unspecified time in the future. In each of these cases, of course, no formal guarantee of a counter-gift, of equal value, is available. Opportunism remains possible at all times, but would lead to

excommunication and a loss of reputation. In gift exchange actors do evaluate the value of knowledge exchanged, especially in case of enhanced uncertainties and (strategic) interdependencies involved when crossing organizational boundaries (Bouty, 2000; Kreiner & Schultz, 1993; Von Hippel, 1987). These relations between corporate scientists within and between firms involved in exchanging knowledge is not an uncommon phenomenon (see Allen, 1977; Kreiner & Schultz, 1993; Von Hippel, 1987; Brown, 2001; Brown & Duguid, 1991; Wenger & Snyder, 2000), but has not been provided with proper behavioral micro foundations. Although we argue that such micro foundations are to be found in the gift exchange literature, we do acknowledge that the social coordination of knowledge sharing dynamics through gift exchange offers challenges for managers.

## 6. Challenges for Management of Coordination through Gift Exchange

While exchange of gifts provides a stimulus for the flow of knowledge, attempting to purposefully coordinate this by providing directed incentives for knowledge sharing does present specific challenges for management. Firstly, gift exchange for the most part takes place between concrete individuals, who may establish idiosyncratic rituals and expectations. It may be hard to formulate formal policy to stimulate this kind of activity. Secondly, for gift exchange to personalize, relations that may guarantee reciprocation need to develop over an extended period of time. One also is only able to initiate and maintain so many relationships in a given period of time (Lesser, 2000), and developing each relation to the necessary level of trust takes time too. Thirdly, social obligations established through gift exchange cannot usually be enforced and so actors are most likely to coordinate knowledge exchange via gift exchange when other options are not sufficient, too inflexible, too time-consuming, or otherwise impractical (Ferrary, 2003; Smart, 1993). Knowledge transfer through gift exchange is to some extent vulnerable from abuse. Fourthly, gift exchange effectiveness in part depends on the extent to which the incentive structure of an organization can be altered in such a way that honoring social debts and cooperation becomes an effective course of action for the individual. The effectiveness of social enforcement mechanisms can be impaired if the likelihood or benefit of continued informal cooperation is small (Kreps, 1990), or if the network structure is such that subsequent action cannot be monitored or communicated thus limiting the effectiveness of reputations (Coleman, 1988; Hill, 1990; Lazard & Lorenz, 1988). Fifthly, gift exchange obviously has no bearing on situations where knowledge is intentionally sought and non-voluntary or unknowingly obtained. Knowledge acquisition by means of hacking, reverse engineering, industrial espionage or “outlaw innovation” (Flowers, 2008) clearly do not fit the gift exchange model. Finally, while organizations generally strive to maximize knowledge flows within organizational boundaries or into the organization, they are likely to try to minimize knowledge flows across organizational boundaries. While spillover effects are pervasive (Audretsch & Feldman, 1996; Feldman, 1999; de Laat, 1999; Owen-Smith & Powell, 2004), they are not only associated with formal cooperative arrangements between firms but also with informal personalized exchange between knowledge workers (e.g. Agrawal et al., 2003; Allen, 1977; Kreiner & Schultz, 1993; Von Hippel, 1987). While it is evident that companies need to preserve core competencies (cf. Henkel, 2006), there is a danger that organizations attach too much weight to appropriability considerations, neglecting the dynamic of new knowledge creation and knowledge flows between firms and other social entities that they may also benefit from in the end (Chesbrough 2003a, b;

Nooteboom, 2002; Saxenian, 1994; Von Hippel, 1987). As a result of too strict a policy of spill-over control the firm might hamper the innovation development process (Soh, 2010). Those actors that do not give do not receive in return either.

## 7. Conclusion

Innovativeness of individuals and firms is largely dependent on people within and beyond the firm exchanging knowledge and information. SNA allows an analysis of the structure of interactions within a firm: *how* do interactions affect behavior of actors within a firm and ultimately firm performance? Given the nature of knowledge and its development, discussed in Section 2 above, however, the issue of *why* actors would actually use their relations for these purposes remains a mystery for SNA. SNA has an “action problem” as it does not allow for agency. The need for behavioral micro foundations for knowledge exchange is especially needed in the context of Open Innovation.

The notion of gift exchange allows one to explain why persons exchange knowledge with each other even if they are not obliged to by contract or instruction. Gifts can be non-material to include knowledge and are exchanged for multiple reasons, but especially provide a means of control in case of interdependencies and uncertainties. The literature of gift exchange explains how mutual trust and informal obligations between persons emerge, and allows one to understand how relations start, work, and come to an end. We have argued how gift exchange offers a powerful and necessary complement to the insights that Social Network Analysis offers. Especially for OI, research has shown how researchers involved in gift exchange are more successful as researchers. Thus we offer a perspective for the discussion on “open innovation” that complements the more strategic discussions by offering behavioral micro foundations for the processes of socially sharing knowledge within and between organizations.

## Notes

1. In this paper we will use the terms *knowledge exchange*, *knowledge transfer* and *knowledge sharing* interchangeably.
2. Note that in this paper we talk about relations between individuals only. In network analysis, nodes can also be different kinds of entities, such as events, artefacts, or locations, and a relation or tie between nodes need not signify knowledge transfer (Van der Valk & Gijsbers, 2010; Aalbers & Dolfmsa, 2015).

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