INDIRECT SOCIAL CAPITAL AND OPEN INNOVATION

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ABSTRACT

The proposed research seeks to demonstrate that indirect social capital has a positive effect on open innovation (OI) output. Specifically, it focuses on the roles played by trust and knowledge diversity in leveraging indirect social capital for OI returns through a *trusted bridging chain* made up of individuals referred to the chain through trust relations. Essentially, indirect social capital can be seen as the returns derived specifically from indirect relationships, either through a chain of referred relationships or through by-chance relationships. Indirect social capital may therefore be defined as *'information or knowledge (new or improved resources) made available to individuals or collectivities through a trusted bridging chain or through (by-chance) indirect relationships'.* Studies on innovation networks show the importance of both supporting relations (depicting trust) and bridging relations (representing access to diverse information) for innovation returns. In essence, it is argued that individual A will ask individual B to help solve an innovation problem or to find another person (C) who can solve it, if A thinks B has benevolence-based trust in A, and A has competence-based trust in B. Hence, competence-based trust would drive the quality of the chain and thus the innovation solutions submitted. Typically, the search horizon for external innovations is at a single (direct) level, representing mostly direct relationships between the focal organisation (or intermediary) and the innovators. Studies on OI suggest that organisations can over-search, as too many diverse relationships can become less effective and more expensive. So there is an opportunity to develop an OI search "filter" to facilitate external search. Studies on OI have not openly covered either the role of ordinary individuals' indirect relationships in innovation searches, or the context and nature of dyadic external relations *per se*. Studies on social networking, such as small-world studies, demonstrate how new or enhanced resources can be obtained using an instrumental search through supporting relations, alongside "short paths" formed through bridging relations, in effect resulting in a chain. The context and nature of a search chain have not featured much in such studies, though. Furthermore, in most social networking studies diversity is identified by measuring structural holes (the disconnects between direct relations to an ego) or the strength of ties (particularly weak ties). Yet, the latter measurement has not always proven to be a proxy for diversity, and analysing structural holes requires access to network ties around the ego and not merely a dyadic relation. This study suggests an improved measurement of dyadic tie diversity that encompasses knowledge and geographic distance between individuals in a dyadic relationship. Considering the importance of diversity for innovation *per se*, it is argued that a chain that bridges knowledge and geographic boundaries may better deliver innovative solutions. A trusted bridging chain could reach across the world to solve a developing-world problem in the developed world, for example. Finally, the proposed study puts forward levels of social capital – direct and indirect – to help define social

capital better. The research problem requires an outcome-driven analysis based on variance logic, and a quasi-experiment to set up the necessary treatment to examine the proposed relationship between indirect social capital and OI with hypothesised relationships.

Key words: Open innovation, social capital, trusted bridging chain, direct social capital, indirect social capital

INTRODUCTION

Background and problem statement

This paper examines the effect of indirect social capital on open innovation (OI) with particular focus on the roles played by trust and diversity in unlocking indirect social capital for OI returns.

Organisations are compelled to transform their innovation processes; investing merely in internal research and development (R&D) functions and resources for innovation purposes may be inadequate to stay ahead of the competition or to make inroads into new markets. Over recent decades organisations have progressively begun to incorporate external technologies into their innovation processes through alliances and partnerships or in-licensing, coined "open innovation" by Chesbrough in the early 2000s. Examining novel processes to search externally for innovative solutions is an opportunity this paper explores.

Organisations practising OI do not only tap external knowledge for innovation processes; they search for external innovations at different levels of maturity to include into their own innovation processes (inbound OI). Increasingly, organisations understand the importance of external innovation networks, and many have implemented processes and procedures to manage external OI relationships. Organisations often form part of clusters and innovation communities to support their innovation processes or forge inter-organisational relationships through strategic alliances or joint ventures.

The support of strong relationships inhering trust (Powell, Koput & Smith-Doerr, 1996; Tsai & Ghoshal, 1998; Landry, Amara& Lamari, 2002; Lee & Choi, 2003; Dakhli & Clercq, 2004; Moran, 2005), alongside access to diverse information (Burt, 1982; Hargadon & Sutton, 1997; Almeida & Kogut, 1999; Ahuja, 2000; Murray, 2002; Belderbos & Carree, 2004; Owen-Smith & Powell, 2004; Jack, 2005; Porter, Whittington & Powell, 2005; Uzzi & Spiro, 2005; Fleming & Marx, 2006; Lowik, Van Rossum, Kraaijenbrink& Groen, 2012) jointly stimulate organisational innovation. It seems that trusted relations provide organisations with the support to innovate through, *inter alia*, collaboration, learning, communication, access to resources and cooperation. These types of supporting relations are usually inherent in dense environments and usually associated with trusted relations.

Today, many organisations are developing their own innovation networks, while others contract the services of intermediaries to find innovations outside their boundaries. However, over-searching (searching too wide) has a detrimental effect on innovation performance (Ahuja, 2000; Katila & Ahuja, 2002; Laursen & Salter, 2004, 2006), and external searching can also add other hidden costs linked to communication and control (Stuermer, Spaeth and von Krogh, 2009). Moreover, developing and maintaining networks are known to be expensive and time consuming.

Time and again, novel innovations are developed through the application of innovations from industries outside the problem domain (Hargadon, 2003), underscoring the need for diversity in the innovation process. For the most part, innovation networks are developed by searching for known innovators within specific problem domains. These innovators usually comprise suppliers, customers, R&D organisations, universities and other partners (e.g. joint ventures). Usually, these networks consist of one-to-many relationships between the organisation (and intermediary) and known innovators, the number of which often determines an organisation's openness (Laursen *et al.*, 2004). The network horizon is rarely, if ever, developed and managed deeper than one level (between the organisation/ intermediary and the innovators).

Briefly, the challenges with current OI networks and processes are that firstly, it is costly to develop and maintain an external innovation network, especially if organisations search far and wide for innovators (too much openness has proven to be less effective); and secondly, not all innovators are known or even market themselves, and they may thus not be found in the process of establishing an innovation network. There is an opportunity to find innovators through the connections / relations of individuals – who are not necessarily innovators – and their respective relations and so on (thus through indirect connections). This should speed up the search process and decrease the cost of searching and maintaining innovation networks. There are limited (possibly not any) known OI processes that deliberately tap a deeper innovation network of indirect relationships, beyond the directly linked network of innovators as described above.

Social relations, through direct and indirect ties, contain rich resources of, *inter alia*, knowledge and information that can be tapped for the advantage of individuals and organisations (or collectivities); these advantages can be seen as returns on social capital. One definition of social capital is that it is "the goodwill available to individuals or groups. Its source lies in the structure and content of the actor's social relations. Its effects flow from information, influences, and solidarity it makes available to the actor" (Adler & Kwon, 2002: 23). A review of social capital definitions pointed out main typologies of social capital as being bonding (Coleman, 1988; Putnam, 2000) and bridging (Granovetter, 1985; Burt, 1992; 2005). In particular, in this paper it is suggested that bonding social capital consists of supportive *features* of social capital, generally to maintain unity or a current situation; whereas bridging social capital is generally associated with instrumental action (purposive action) in finding a new or better resource (diversity). It is suggested that supporting and bridging features of social capital can be evident in the same dyadic relationship, similar to studies that found strong ties that bridge (Levin *et al.*, 2004; Jack, 2005; Tiwana, 2008; Levin & Barnard, 2013). There are multiple other conceptualisations of social capital as well. These include, *inter alia,* the strength of ties, structural holes (disconnects between the relations to a focal person or entity), trust, norms, identity, obligations and expectations. This paper suggests two levels of social capital, namely direct and indirect. It is anticipated that this will be a more simple approach to alleviating the challenges regarding social capital conceptualisations.

Direct social capital is suggested to incorporate two sub-levels: firstly, alongside supporting features with an aim to maintain unity or preserve current resources; and secondly, relevant to instrumental action (purposively finding something new or improved) associated with both supporting and bridging features of social capital, although through direct relationships. Existing studies refer to bonding and bridging social capital and not necessarily to bonding and bridging *features* of social capital. It is suggested that bonding social capital be referred to as *supporting features of social*

capital and bridging social capital as *bridging features* of social capital and not social capital *per se.* For example, both these features can be evident in the context of knowledge sharing (particularly new knowledge), such as strong ties that bridge. Direct social capital is suggested to be *the information or knowledge (new or improved resources) or else the preservation of unity and maintenance of the current state, available to / for individuals or collectivities through trusted direct relationships.*

Indirect social capital is suggested to be relevant to finding something new or improved (instrumental action) through indirect relations (from the focal point of view). It is suggested that either a trusted bridging chain or by-chance indirect relationships could unlock indirect social capital. A trusted bridging chain is argued to contain both supporting (particularly chain trust) and bridging (chain knowledge diversity) features of social capital. Furthermore, a trusted bridging chain is made up of a chain of individuals where each new referral to the chain (brokerage) is enabled through trust, but where all the individuals in the chain do not necessary share the same knowledge. A definition of indirect social capital is suggested to be *the information or knowledge (new or improved resources) available to individuals or collectivities through a trusted bridging chain or through (by-chance) indirect relationships.*

The research propositions endeavour to answer the research question of whether indirect social capital has a positive effect on OI output, although it is suggested that trust and knowledge diversity play important roles in the unlocking of indirect social capital through a trusted bridging chain. It is proposed, firstly, that competence-based trust will affect OI output positively insofar as it may drive the quality of agents in the chain and hence the outcome; secondly, that benevolence-based trust will drive the chain forward in an attempt to find an innovative solution; and finally, that diversity within the search chain will positively affect the OI solutions proposed (OI output).

Existing studies do not seem to cover the exploitation of external, ordinary individuals' *indirect* ties for the OI process in an attempt to find innovative solutions to problems. Apart from Burt's (2007, 2010) and Ahuja's (2000) exploration of the return on indirect ties (e.g. Burt's second-hand brokerage), there seems to be limited research on purposive searching for specific resources. Many studies have shown that strong ties are also bridges (Levin *et al.*, 2004; Levin *et al.*, 2013; Jack, 2005; Tiwana, 2008), which demonstrates that the strength of ties is not always an appropriate proxy for diversity. In most respects, diversity is identified by studying structural holes or the strength of weak ties. However, when studying structural holes, more network relations than merely a dyadic tie are required for analysis. The individual knowledge diversity of a tie is suggested to be *a (probably linear) combination of the distance between geographic (spatial) locations and the knowledge difference between agents which characterise a dyadic tie*.

Extant theory suggests a return on indirect relationships under some conditions, but lacks explicit attention to the value of indirect relations (such as indirect social capital) unlocked through active brokerage (and recursive brokerage) and what the context and preconditions for the relations as such are. There is also negligible research focusing on the nature and context of external innovation sources (Dahlander & Gann, 2010).

This is a conceptual paper forming part of a research study where a model and propositions for indirect social capital and OI are introduced, arguing for a positive relationship between indirect social capital and open innovation output, enabled through trust and knowledge diversity.

The research problem requires an outcome-driven analysis based on variance logic. A quasi-experiment is required to set up the necessary treatment to examine the proposed relationship between indirect social capital and OI with hypothesised relationships.

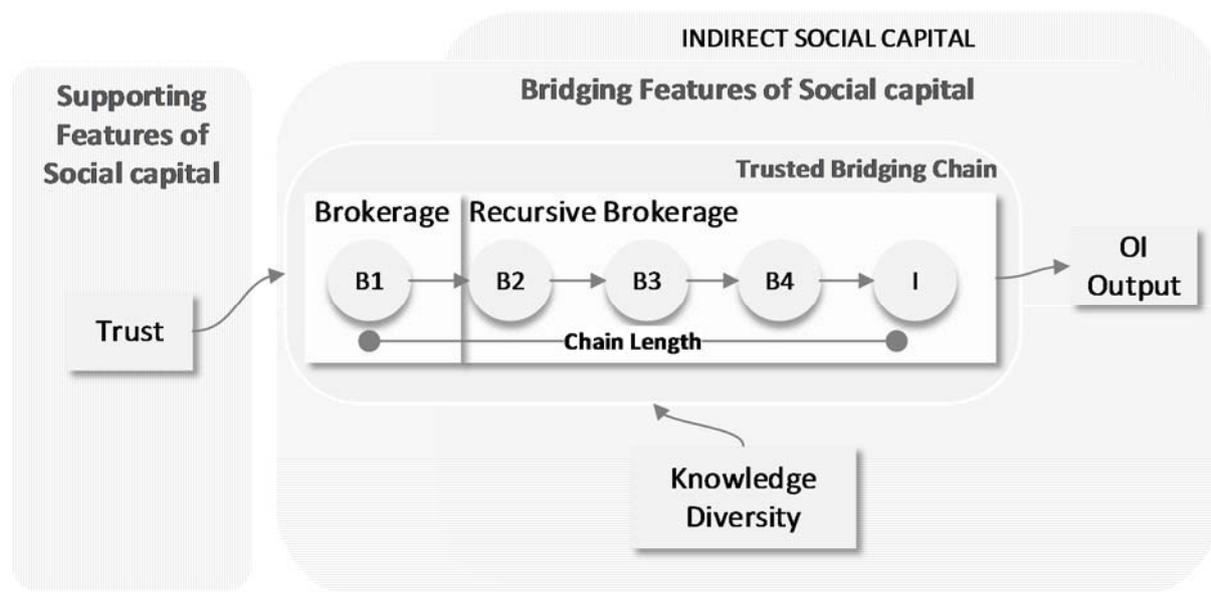## SPECIFICATIONS OF THEORY

Conceptual Framework

Figure 1: Indirect Social Capital and Open Innovation

Figure 1 illustrates the concept of indirect social capital and open innovation. It is proposed that a trusted bridging chain (middle of Figure 1) is the key to unlocking indirect social capital (in short, returns derived from indirect relationships). A trusted bridging chain is made up of a chain of individuals (agents), where each new introduction to the chain (brokerage) is enabled through trust relations (supporting features of social capital), but where all the individuals in the chain do not necessarily know one another well or share the same knowledge (bridging features of social capital). Indirect social capital is viewed from the perspective of the seeker (first person or collectivity in the chain); so all other links (other than the first direct link) in the chain can then be seen as indirect relationships to the seeker.

It is envisaged that a *trusted bridging chain* can be leveraged to solve innovation problems for organisations, government departments and other entities. For example, suppose a government department wants to find a solution for "proactive identification and reporting of crime in informal settlements". Consider that this government department has a starting sample of citizens and asks them to help solve this problem, or those individuals ask other individuals to help solve the problem. It is envisaged that a *trusted bridging chain* (thus a chain size longer than one individual) can be formed through trust relations. It is therefore argued that individual A would ask individual B to help solve the problem or find individual C who can solve it, if A thinks B has benevolence-based trust in A and A has competence-based trust in B (trust has been shown to be reciprocal). Competence-based trust is foreseen to drive the quality of the chain and thus the solutions submitted. Furthermore, considering the importance of diversity for innovation *per se*, it is argued that a chain that bridges

knowledge and geographic boundaries (individual knowledge diversity) has more of a chance to bring about innovative solutions. In fact, a trusted bridging chain could reach across the world to solve a developing-world problem in the developed world, for example. Benevolence-based trust could move the chain forward to reach across boundaries, and competence-based trust could enable the quality of returns. Thus ordinary individuals' indirect relations can be leveraged through an instrumental search for innovative solutions. As the chain is 'assembled', the search is facilitated through the multiple brokerage of relations (recursive brokerage), which is suggested to form a trusted bridging chain of individuals (B1 to B4 and I in Figure 1). Considering that each link in the chain can be related to individual (dyadic) trust and individual knowledge diversity, a pattern of trust and knowledge diversity should emerge in the chain. All things considered, it is argued that indirect social capital has a positive effect on OI, although trust and knowledge diversity play a positive role in indirect social capital returns (OI output).

Extant theory on OI and networks has shown that both supporting and bridging features of social capital facilitate OI returns. Yet, returns from indirect relationships, unlocked through a trusted bridging chain, have not as yet been explored for OI searching (searching on a deeper horizon than one level – refer to Figure 2). The notion of a *trusted bridging chain* is novel; as such, the context and nature of the chain of relationships (especially in terms of patterns of trust and knowledge diversity within the chains) have not been covered explicitly. Furthermore, although the notion of knowledge distance exists in theory, it is extended in this paper to focus on dyadic knowledge diversity and chain knowledge diversity instead of using the strength of ties as a proxy for diversity. There are challenges with using the strength of weak ties as a proxy for diversity, considering that many studies have shown that strong ties can also bring about new information (e.g. Levin *et al*, 2013; Tiwana, 2008).
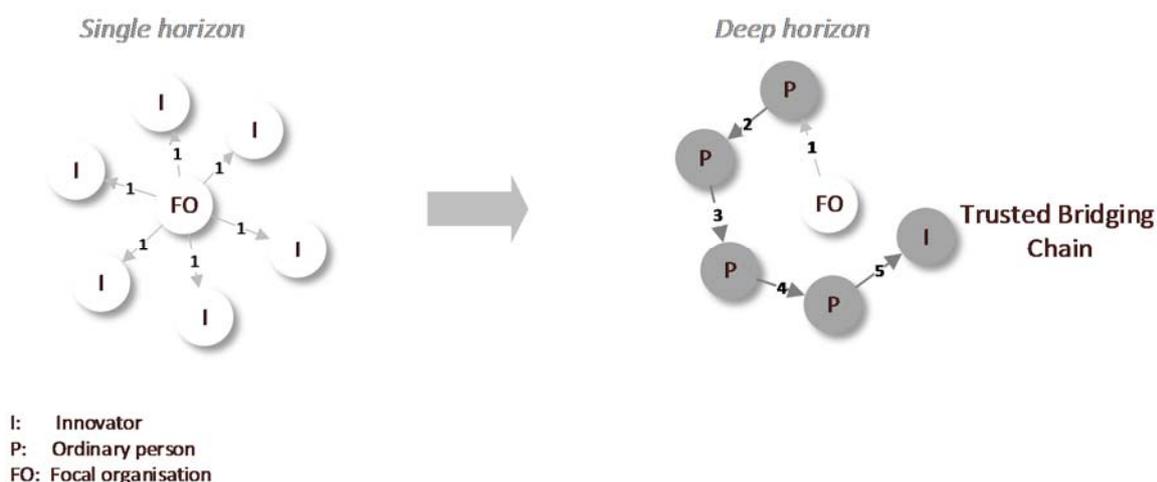

I: Innovator
P: Ordinary person
FO: Focal organisation

Figure 2: Single-horizon innovation search versus a deep horizon search through a trusted bridging chain

There is a collection of concepts in literature within the context of social networks (and social capital) which can be associated with the notion of 'supporting' features of social capital. These concepts include strong ties, trust and dense clusters / groups (where most people know one another). Supporting types of relationship are generally reciprocal, with individuals supporting one another and sharing information and resources.

Furthermore, there is also a cluster of concepts that can be grouped under bridging features of social capital which includes weak ties, structural holes and technology distance. It is proposed that a trusted bridging chain could be the vehicle to unlock indirect social capital for OI return. For this reason, it is suggested that OI leverages deeper horizon levels for searching (instead of one horizon level), as depicted on the right-hand side of Figure 2.

Innovation

Innovation is critical for organisations to outsmart their competition and remain profitable. In today's unpredictable economic climate, not to innovate is business suicide. Innovation is not merely an outcome, such as a new and innovative product, service or business model; rather, it is a process consisting of activities with the aim to produce and capitalise on the aforementioned. Innovation has also been defined as "a sequence of activities involving the acquisition, transfer and utilization of information" and "the initial market introduction of a new product or process whose design departs radically from past practice" (Abernathy & Clark, 1984: 3; 6). Traditionally, innovation was performed within the R&D or strategy and marketing divisions of an organisation, which can be considered as a closed innovation process. Purposefully opening up the innovation process for external ideas and knowledge, and increasing the balance of external ideas and knowledge for input into the innovation process demonstrates open innovation.

Open Innovation

In the early 2000s, Chesbrough (2003: XXIV) introduced the concept of "open innovation" by explaining that it is "the use of purposive inflows and outflows of knowledge to accelerate internal innovation, and expand markets for external use of innovation, respectively". Organisations may source actual innovations, knowledge, technical inventions, market knowledge, innovation components or other information in support of the innovation process of the organisation (Bogers and West, 2012). OI is not an entirely new concept, considering that external knowledge has been incorporated into innovation processes for some time (Cohen & Levinthal, 1990); yet the contribution of external resources has increased and they have become more purposive, according to Chesbrough, who demonstrates a paradigm shift from closed (i.e. only internal to the organisation) to open innovation.

There are various channels through which organisations can practise OI, including research organisations (including universities) with direct contracts with the focal organisation; electronic requests for proposals raised by the focal organisation to solve problems (a tender process or innovation competitions); off-shoring; and crowdsourcing (Howe, 2008). In terms of innovation, the latter means to request ideas from crowds of people, generally in the form of an online competition that is broadcasted to relevant communities. Other channels for OI include consulting organisations and entering joint ventures (Bingham & Spradlin, 2011). The main external sources of knowledge are depicted in Figure 3.
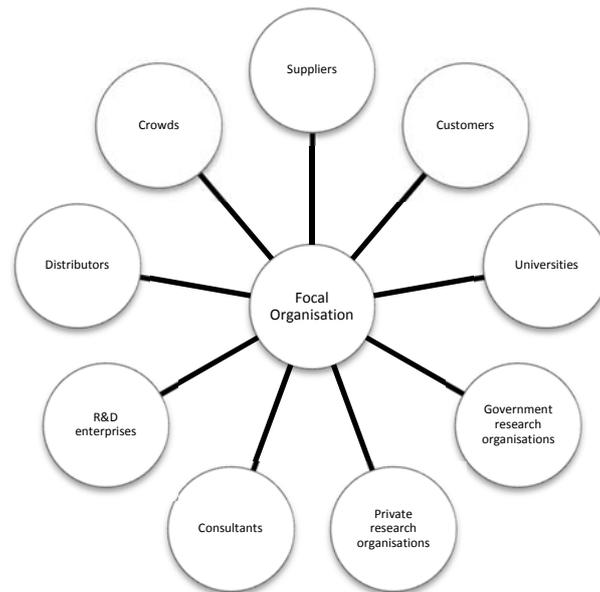
Figure 3: Main external sources of knowledge, according to Gemunden, Ritter & Heydebreck (1996); Laursen & Salter (2006); Howe (2008)

Thus far, in most cases OI has been operationalised through direct links with innovators or by contracting an intermediary (such as NineSigma) to source innovators through its networks, which is also mostly at a direct level (single horizon). The majority of mechanisms for OI include formal arrangements through strategic alliances, joint ventures, license agreements or other types of agreement (Ye & Kankanhalli, 2013) between the focal organisation and the innovator, facilitated either directly by the focal organisation or through an intermediary organisation. There seems to be no OI mechanism (in practice or covered in literature) for finding innovators to solve problems through informal indirect relationships, which would entail searching at a deeper horizon level through a network chain. In most instances, an organisation will either build a network of innovators linked directly with the organisation, use an intermediary to find an innovator to solve a problem through the intermediary's network, or broadcast the challenge directly to a crowd of people. The formulation of the problem that is broadcasted is important in facilitating the OI process.

Two core network patterns emerge from the theory on innovation and networks: (a) the effect of *bridging* relations on innovation, and (b) the effect of *supporting* relations on innovation.

Supporting Relations in OI

Supporting relations with intrinsic trust form a foundation for, *inter alia,* coordination, integration, communication, learning, knowledge transfer and access to resources. Hence, individuals and organisations are more inclined to support another entity (individual or organisation) if there is underlying trust in the relationship (Coleman, 1988; Granovetter, 1985; Levin *et al.*, 2004; Levin, Walter & Appleyard, 2011). In addition to this, most groups (or collectivities) have a radius of trust (Fukuyama, 2001). Trust is particularly important for innovation and the sharing of resources (Powell *et al.*, 1996; Tsai *et al.*, 1998; Clegg, Unsworth, Epitropaki & Parker., 2002; Landry *et al.*, 2002; Lee *et al.*, 2003; Dakhli *et al.*, 2004; Moran, 2005).

Supporting relations enhance the building up of absorptive capacity, which is often necessary to screen or interpret novel information (Gilsing, Nooteboom, Vanhaverbeke, Duysters & van den Oord, 2008). Individuals or entities in supporting relations are more inclined to share information amongst themselves (Wellman & Wortley, 1990; Krackhardt, 1992; Uzzi, 1996; Garton, Haythornthwaite & Wellman, 1997). Supporting relations also aid coordination, knowledge sharing and communication between member organisations or individuals (Reagans & Zuckerman, 2001), and this often enables the spreading of ideas (Uzzi, Amaral & Reed-Tsochas, 2007). Clusters and groups (supporting relations) also allow for social interaction amongst member organisations or individuals (Gnyawali & Srivastava, 2013), which would understandably lead to spill-overs, bringing about diversity and novelty – and hence bridging. A balance of dense supporting relations and bridging relations would lead to more positive innovation performance (Uzzi *et al.*, 2005).

In today's electronic age, individuals invariably form part of many groups (personal and business), physically or electronically, alongside various trusted relationships (supporting relations). Therefore, not leveraging the interpersonal supporting relationships and indirect distant relationships of ordinary individuals (bridging) by means of a trusted bridging chain is a lost opportunity for increased returns on OI for organisations. The ubiquity of the web, online social and business groups, and electronic communication makes the formation of trusted bridging chains more possible than before.

Bridging Relations in OI

Bridging (alongside diversity) is an important network feature for innovation and is accomplished through connections to diverse industries and knowledge sources (Hargadon *et al.*, 1997; Li & Vanhaverbeke, 2009), knowledge spillages (Belderbos *et al.*, 2004; Owen-Smith *et al.*, 2004), a multiplexity of relationships (Lowik *et al.*, 2012), indirect relationships (Ahuja, 2000), co-mingling across networks (Murray, 2002), inter-organisational mobility (Almeida *et al.*, 1999) and / or connections to a diverse range of partners (Powell, Koput, Smith-Doerr & Owen-Smith, 1999; Baum, Calabrese & Silverman, 2000; Miotti & Sachwald, 2003; Becker & Dietz, 2004; Vanhaverbeke, 2006; Roper & Lover, 2008; Pullen, Weerd-Nederhof, Groen & Fisher, 2012). The number of diverse relationships can be expressed in terms of an organisation's search breadth or the openness of an organisation (Laursen *et al.*, 2004). Organisations are at risk of over-searching (too many diverse innovation relationships) over a threshold, which can detrimentally affect their innovation performance (Ahuja, 2000; Katila *et al.*, 2002; Laursen *et al.*, 2004, 2006). Extant theory on the use of "filters" to impede over-searching is lacking. Apart from the technological distance between organisations, the number of diverse partners they have and the structural holes across their relationships, there seems to be a lack of focus on the knowledge diversity of the dyadic relationship *per se* between organisations (or individuals). Furthermore, extant theory does not seem to cover instrumental searching through ordinary individuals' relationships and their relations' relationships and so on – forming a trusted bridging chain – or the exploitation of spillages to find innovators. Most extant theory covers direct innovation relationships with organisations (or the crowd), albeit different types of direct relationships. A negligible number of studies focus on the effect of indirect relationships on the innovation process. As illustrated in Figure 3, it is argued that OI models can evolve from a single-horizon relationship model (one to one, or one to many/crowd) to an OI model that leverages a trusted bridging chain of indirect relationships (to the FO), built on trust and knowledge diversity, for OI returns. Thus, indirect social capital can be unlocked for OI returns by

leveraging a trusted bridging chain. The next section will further build the argument of applying the trusted bridging chain to bridge beyond boundaries in order to find needed resources in a process facilitated by trust.

Social Capital

Basic Typologies

Definitions of social capital vary, depending on whether they focus on the source, the substance or the effects thereof (Adler *et al.*, 2002). The development of theories on social capital has been retarded by manifold definitions and theories with different and misaligned theoretical foundations and operationalisations (Payne, Moore, Griffis & Autry, 2011). Social capital is therefore not well defined, and for this reason there has been a lack of conceptual clarity about it as well as issues with its causality and measurement (Patulny & Svendsen, 2007). Theories on social networks and social capital overlap in terms of the various conceptualisations shared by both, e.g. the relational and structural qualities of networks such as the strength of ties and clusters (or groups) respectively. Essentially, social capital refers to the *return/s* that one (or many) can gain through social networks, embedding certain structural and relational characteristics.

It is proposed that there are collections of theoretical concepts that can be grouped under *supporting features of social capital* and *bridging features of social capital*. The theory on social capital refers to bonding social capital and bridging social capital respectively (Portes, 1998; Putnam, 2000; Lin, 2005). It is suggested that the concepts under the umbrella of bonding social capital should be gathered under *supporting features of social capital,* considering that there is a strong notion of density underpinning the concept of bonding, which creates ambiguities when the focus is on dyadic relations.

Historically, bonding social capital referred to closed, inward-looking networks (Putnam, 2000), making it more relevant to homogenous groups or clusters. In short, the features of bonding social capital include trust, obligations, expectations, reciprocity, norms and values (Coleman, 1988). At a dyadic level, the strength of ties can provide the same benefits as network closure and can therefore be a substitute for network closure, which stimulates sharing and cooperating behaviour (Granovetter, 1985; Coleman, 1988; Levin *et al.*, 2004; Levin *et al.*, 2011). It is suggested that the notions of trust and strong ties be categorised as *supporting features of social capital*. In fact, trust facilitates obligations, expectations and reciprocity. In many respects social capital has been analysed from the perspectives of groups (different levels of density) and bridges. Yet, it is argued that the concept of a trusted bridging chain is a combination of supporting and bridging features of social capital. In effect, supporting relations (particularly trust) are needed to bridge, which resonates with Levin *et al.'s* (2004) study that demonstrated the mediating effect of trust between the strength of ties and the receipt of useful information.

Bridging social capital suggests open networks and encompasses people across diverse social circles (Putnam, 2000). In short, bridging features of social capital can be leveraged through direct relationships with others through weak or strong ties that bridge diverse information (Granovetter, 1973; Burt, 1992, 2005; Levin *et al.*, 2004; Levin *et al.*, 2013), and also through brokerage that taps indirect relationships for returns (Granovetter, 1973; Bian, 1997; Lin, 1999).

Social capital can have supporting social capital features (e.g. trust) and bridging social capital features (diverse information) simultaneously; often, supporting features (such as trust) are necessary preconditions to achieve bridging (Levin, *et al.*, 2004; Levin, *et al.*, 2011). In addition to this, it is suggested that there is direct bridging (through direct relationships) and indirect bridging (through one or multiple indirect relationships); this distinction has not been covered explicitly in theory. There are challenges with the measurements used, such as using the strength of ties (weak ties in particular) as a proxy for diversity, which is not always the case; for example, multiple scholars have shown that strong ties can also bridge and therefore bring about diversity (Levin *et al.*, 2004; Jack, 2005; Tiwana, 2008; Levin *et al.*, 2013). Therefore, it cannot always be assumed that weak ties are the only ties that bring about diversity. All these nuances cause issues around conceptual clarity, and for this reason, direct and indirect levels of social capital are proposed, and it is suggested that these be aligned with the supporting and bridging features of social capital.
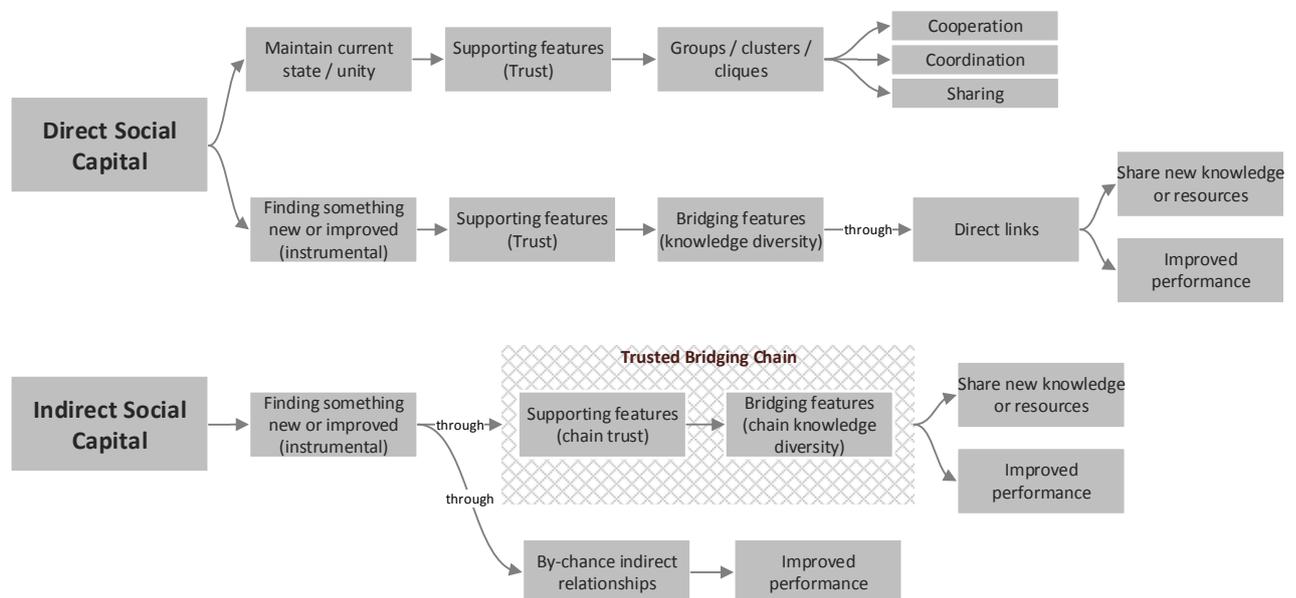
Levels of Social Capital

Figure 4: Proposed Levels of Social Capital: Direct and Indirect Social Capital

Extant theory does not explicitly outline a simple typology for social capital to make sense out of the plethora of conceptualisations and building blocks of social capital, in particular through levels of direct and indirect relationships in social networks, encompassing the notion of supporting and bridging features of social capital. The idea of indirect social capital has been covered in theory mostly through by-chance access to resources through indirect ties (Ahuja, 2000; Burt, 2007, 2010; Lazega, Jourda & Mounier, 2013), which could affect performance positively (see bottom of Figure 4). The association of indirect social capital with indirect relationships also appears in psychiatry journals (Nakhaei & Sacco, 2009), entrepreneurial studies (Salaff, Greve, Siu-Lun & Ping, 2003) and studies in international entrepreneurship (Kontinen & Ojala, 2011). These studies mostly refer to indirect social capital as a proxy for indirect relationships, resulting in returns through serendipitous (by-chance) indirect relationships and not through instrumental search. However, indirect social capital, as a concept, has not been clearly defined.

There has also been a lack of clarity when bonding social capital (e.g. strong ties) is concomitantly leveraging bridging social capital (when strong ties bridge). Furthermore, the notion of dyadic tie diversity has not been explicitly and extensively covered as an alternative to strength of ties to measure diversity. Finally, the notion of recursive brokerage (repetitive brokerage) in forming a *trusted bridging chain* for indirect social capital return has not been covered explicitly in extant theory.

It is argued that there are two levels of social capital: Direct social capital and indirect social capital (refer to Figure 4 above). Direct social capital (top of Figure 4) is suggested to be relevant to maintaining unity and resources (generally within groups and cliques) or alternatively to finding something new or improved, in both cases through direct relationships. In the case where the function of social capital is to maintain unity / resources, supporting features of social capital (in particular trust) are necessary to facilitate cooperation, coordination and sharing within groups or clusters (or collectivities). In the case where the function of social capital is to obtain something new or improved, it is suggested that supporting (trust) as well as bridging (e.g. to diverse knowledge) features of social capital are necessary to fulfil this function, in both instances through direct relationships. The historic notion of bonding social capital is suggested to form part of supporting social capital features.

The indirect level of social capital is relevant to the function of finding something new or improved (including improved performance) through indirect relationships (from the focal point of view). As noted, obtaining returns from indirect social capital has been covered through by-chance indirect relationships to improve performance (bottom of Figure 4) but not through the notion of a trusted bridging chain, although the concept of a network chain is inferred by small-world and job search studies (covered further on). Yet, the context and nature of the chain have yet to be explored. It is argued that the chain is formed through recursive brokerage (repetitive brokerage that forms a chain). A definition for direct social capital is suggested, which is then extended to formulate a definition for indirect social capital.

Direct social capital is the information or knowledge (new or improved resources) or else the preservation of unity and maintenance of the current state, available to / for individuals or collectivities through trusted direct relationships.

Indirect social capital is the information or knowledge (new or improved resources) available to individuals or collectivities through either a trusted bridging chain or by-chance indirect relationships.

 A trusted bridging chain is suggested to be *a chain of agents, brokered through trust relations that are characterised by strong chain trust and strong chain knowledge diversity.*

Direct Social Capital

Direct social capital is suggested to be the level of social capital returns derived through direct ties between individuals or within a group. Direct social capital returns could be the maintenance of unity and the preservation or upholding of resources through supporting features of social capital which inhere trust and benefit cooperation, coordination and sharing. For example, if house owners in a neighbourhood take turns to patrol their boomed-off area at night for communal safety and security, then they collectively gain from this action of each of them. Therefore, this kind of action is intended to maintain the status quo of safety and security. So, direct social capital is gained

(maintain safety and security) through the trusted relations between the people in a neighbourhood (group), which results in cooperation and the coordination of actions.

It is reasoned that direct social capital returns could also be derived by seeking new or improved resources (e.g. new knowledge acquisition) through instrumental action (Lin, 2001; Lin, 2005), albeit through direct relationships. Evidently, bridging features of social capital are needed to find something new or improved. Historically it was shown that stronger ties between people often occur when there is homophily; "Homophily is the principle that a contact between similar people occurs at a higher rate than among dissimilar people" (McPherson, Smith-Lovin & Cook, 2001: 416). Likewise, Granovetter (1973: 1362) claims that "the stronger the tie connecting two individuals, the more similar they are, in various ways". It is argued, however, that the presence of supporting features of social capital (particularly trust) is a *requirement* to bridge, and that bridging can occur whether the tie is weak or strong. Trust in particular is shown to be an important predictor for bridging, regardless of the strength of ties (Levin *et al.*, 2004; Levin *et al.*, 2011). Since Granovetter's (1973) study on the strength of weak ties, the emergence and ubiquity of the web, electronic and mobile communications have made it easier for people from different circles to be connected. All things considered, relationships based on trust lead to better knowledge exchange (Levin *et al.*, 2004; Levin *et al.*, 2011), which is affirmed by Inkpen & Tsang (2005) when they argue that trust is a key motivator for knowledge sharing between actors.

There are arguably more opportunities for strong ties to be more diverse in knowledge than before, which begs the question whether the strength of ties is then the appropriate measurement for dyadic tie diversity (from a dyadic relational perspective). In effect, Marsden & Campbell (2012) assert that the measurement of the strength of ties would depend on how they are conceptualised and what the context of the study is. Many scholars have shown that strong ties can also bridge, and thereby bring about useful information (Jack, Dodd & Anderson, 2004; Levin *et al.*, 2004; Tiwana, 2008; Lowik *et al.,* 2012, Levin *et al*., 2013). Geographic distance can also play a role in diversity; Levin *et al.* (2013) have shown that strong ties from abroad can provide useful information in knowledge exchange. Strong ties that bridge then assume supporting and bridging features of social capital. Previously, it was challenging to conceptualise this situation, as social capital was referred to as bonding *or* bridging social capital. However, if trust (supporting) and bridging are conceptualised as *features* of social capital (as suggested), then it is possible to have more than one feature of social capital (both supporting and bridging features) in the same situation.

Trust is an important enabler of innovation and the generation of new ideas (Clegg *et al.*, 2002; Lee *et al.*, 2003; Dakhli *et al.*, 2004). So trust can be seen as a key supporting feature of social capital and an enabler for the sharing of useful information (thus bridging), and diversity should be measured through dyadic tie knowledge diversity as an alternative to the strength of ties.

Dyadic tie knowledge diversity, in this context, is not understood to refer to how many diverse ties an organisation or person has, or what the technological distance (e.g. differences in patent classes) between actors is, but rather to the diversity in terms of knowledge across the dyadic relationship between two actors *per se*. As such, the individual knowledge diversity of a tie is suggested to be *a (probably linear) combination of the distance between geographic (spatial) locations and the knowledge difference between agents which characterise a dyadic tie.*

In summary, it is suggested that diverse (and possibly useful) information can be shared directly between a provider and a seeker, firstly if there is trust between these two agents and secondly if individual tie knowledge diversity is strong (meaning that there is much diversity between the agents). Therefore, both supporting and bridging features of social capital (through trust relations and individual knowledge diversity) are the key to unlocking social capital for knowledge exchange.

Indirect Social Capital

As illustrated in Figure 4, it is argued that indirect social capital can be unlocked through (1) a trusted bridging chain which has supporting (chain trust) and bridging (chain knowledge diversity) features of social capital, or (2) by-chance indirect relationships. In both cases it is assumed that there is a need to find something new or improved.

A chain of referrals (containing referred individuals) is formed through the act of recursive brokerage, enabled through trust – which is a supporting feature of social capital. Recursive brokerage can be defined as *the repeated act of brokerage in an instrumental search where several actors (at least more than one) form a trusted bridging chain, whilst mediating the flow of interim resources or information (referrals) between themselves and the seeker to find an ultimate new or improved resource.*

The chain as a whole is suggested to be a *trusted bridging chain* used to unlock indirect social capital for access to the new or improved resource, considering the suggested roles played by chain trust and chain knowledge diversity. As such, a chain will contain a number of brokers who do not necessarily move information, or control introductions, between the adjacent unconnected others in the chain, but who do share information with the seeker. A trusted bridging chain is suggested to be *a chain of agents, brokered through trust relations characterised by a pattern of strong chain trust and knowledge diversity.*

Unlocking social capital for a specific purpose, e.g. to find something new or improved (through an instrumental search), may require various referrals brokered between agents and the Focal organisation (FO), forming a network chain in the process which may ultimately facilitate finding the required resource. Figure 5 illustrates a chain formed as an example where an organisation (FO) searches for an innovative solution for a problem, which is supplied at the end of the chain by I (innovator) but only after having been brokered through a chain of brokers (B1 to B3). It is not envisaged that the chain will continue to form in the absence of trust, and for this reason the chain is suggested to be a trusted bridging chain; bridging, because it is envisaged that the chain will bring about new knowledge, considering that in most respects the agents in the chain would have diverse knowledge dyadic ties between one another, especially between indirect relationships, e.g. B1 with B3. It is therefore argued that a network chain is not a clique, where most individuals share the same knowledge.
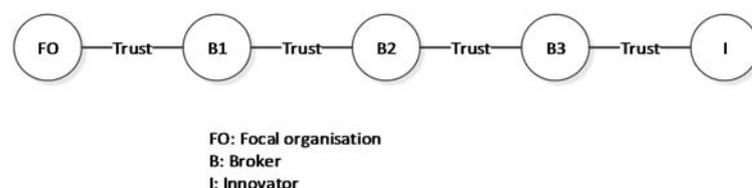

FO: Focal organisation
B: Broker
I: Innovator

Figure 5: Example of a chain in search for an innovative solution

Existing studies on instrumental searching imply recursive brokerage, although in the case of job search studies it appears not to be an explicit directed search through a chain of brokers, but rather "by chance" linkages (Kilduff, 2010). In most network studies on referral chains (which mostly cover job referral studies), the seekers are individuals that tap their social network for a job and not an organisation that sets out to tap the social networks of individuals for some return (e.g. innovative solutions to problems). In most cases the network chain length is short (Bian, 1997; Lin, 1999), as it is seemingly difficult to maintain network horizons from a seeker's perspective (Friedkin, 1983; Lin, 2003). Most job referral studies have been conducted post hoc, by asking individuals how they found a job (or who helped them find a job). Granovetter's seminal paper on the strength of weak ties demonstrates how an individual could leverage weak ties to obtain the benefits of social capital, such as a job (also studied post hoc). Granovetter's, Bian's and Lin's studies did not truly demonstrate instrumental searching but rather an incidental find; weak bridges (as per Granovetter's study) were more incidental in nature, as noted by Burt (1992). Furthermore, the reason why these weak ties in Granovetter's study were enabled through a chain of ties (albeit short) in unlocking social capital, resulting in job referrals, is not clear. In Bian's (1997) study, about 55% of randomly selected individuals found their jobs through mostly strong direct links, while 45% found their jobs through an intermediary that they mostly had a strong relationship with, although the seeker had a weak relationship with the job provider, while the intermediary had a strong relationship with the ultimate job provider. Hence the chain was mostly made up of strong adjacent ties. Lin (2003) asserts that social resources will be negatively associated with the strength of the chain (for Lin and Bian, the chain strength was related to the strength of adjacent ties in the chain). However, Bian (1997) finds support for adjacent strong ties in the Chinese context, although the chains are particularly short.

Small-world studies also resonate with the notion of a trusted bridging chain. A small world stems from the old saying "what a small world it is" when people meet by chance, and also the notion that "everyone is six handshakes away from everyone else in the world". Research on small-world studies mostly focuses on algorithmic small-world problems, and there is therefore a need for other more naturally occurring social processes (Schnettler, 2009). Furthermore, apart from the job-matching research by Granovetter and others (Bian & Lin), studies on directed search processes are rare (in both social sciences and small-world studies). A directed/targeted search process is similar to an instrumental search process in that a seeker is looking for a specific resource (e.g. an innovative solution). Most small-world studies have been completed post hoc – for example, analysing the network around individuals in a creative industry (e.g. the Broadway musicals study by Uzzi *et al.*, 2005) or around innovators in a small world (mostly by analysing patent citations).

Milgram (1967) conducted a small-world experiment whereby he asked randomly selected individuals to send a package – through acquaintances – to a target person (which created a network chain). Travers and Milgram (1969) propose that chains are completed only when (1) the potential sender is motivated to send the document closer to the target; (2) a sender has a strategy (alike to a search strategy) for moving the document closer to the target; and (3) reasonably short paths are required to link to the target. However, a negligible amount of research focuses on the motivation behind why individuals link with one another in the formation of a small world. Extant theory on the small-world concept does not explicitly cover the motivation to support the unlocking of social capital, but it does show the importance of both clusters (density) and bridges / short paths / structural holes (diversity) in a small world. Watts and Strogatz (1998) point out how social networks

have a *small-world effect* as small-world networks. Small-world networks are found to have high clustering / density (e.g. clusters and groups) and short average paths (bridging structural holes) between agents (Watts, 1999: 12-13). Studies have not explicitly shown that supporting relations (of clusters, strong ties or trust) embody the reason for the bridges to other clusters. Newman (2003: 181) defines the small-world effect as "the fact that most pairs of vertices in most networks seem to be connected by a short path through the network". The short path may be motivated through trust and enabled through the diversity of ties. Many small-world studies carried out so far required the analysis of clustering to ascertain small-world effects, and possibly for this reason there has not been much focus on the context and nature of the chain *per se*, in particular regarding (1) what moves the chain forward (e.g. supporting relations associated with trust) and what could affect the quality of the chain (e.g. diversity and competence-based trust).

Finally, the bottom of Figure 4 also illustrates the by-chance access to indirect social capital as suggested by Burt's (2007, 2010) notion of second-hand brokerage. Second-hand brokerage is posited to be different from recursive brokerage, although it is still said to be associated with the indirect level of social capital. According to Burt (2007, 2010), there is no return to second-hand brokerage if one does not have access to structural holes oneself – structural holes are related to the disconnects between the individuals that are linked to a focal person. The more access a person (ego) has to his own opportunities (structural holes) and the more his alters (persons connected to ego) also have access to opportunities (their structural holes), the more benefit it will have for the ego (better performance and pay, for example). If, however, the ego has no opportunities himself, but only his alters do, then he would not reap many benefits from his secondary holes. Second-hand brokerage thus also refers to indirect social capital, although not through the salient act of brokerage in finding a resource purposively (instrumentally), but rather from an incidental perspective.

In terms of social capital and its controversies, in particular regarding closure / bonding social capital vs structural holes, Burt (2000) empirically demonstrates that performance is the highest where group closure is high (high density and supporting relations), but there are also many non-redundant contacts beyond the group (bridging relations). It is argued that trust between individuals could be the supporting social capital feature needed to enable bridging (recursively whilst forming a trusted bridging chain). As reasoned, the ubiquity of the web, mobile devices and electronic mail enables much more connectivity of people to diverse others, and thus overlapping networks. Due to this ubiquity of the web and electronic means, from a research perspective, it is becoming more difficult to map complete networks of people to ascertain density (of groups) and links to diverse others. People can invariably tap other people's diverse knowledge across many groups (or collectivities) that they belong to (each with a radius of trust), for a specific function or purpose, through direct and indirect relationships. Bridging is therefore much easier than before, and for this reason there have been more studies that point out that strong ties bridge. Hence the strength of ties is arguably not an appropriate indication for diversity, particularly not when analysing dyadic exchanges. As argued, supporting features of social capital, particularly trust, enable brokerage (and recursive brokerage), thereby forming a trusted bridging chain through which to unlock indirect social capital returns. It is therefore argued that indirect social capital can be leveraged to obtain OI returns by allowing OI to explore deeper levels of the horizon by means of a trusted bridging chain. Unlocking indirect social capital for OI returns would also act as a filter to inhibit the decreasing of OI performance when increasing search breadth.
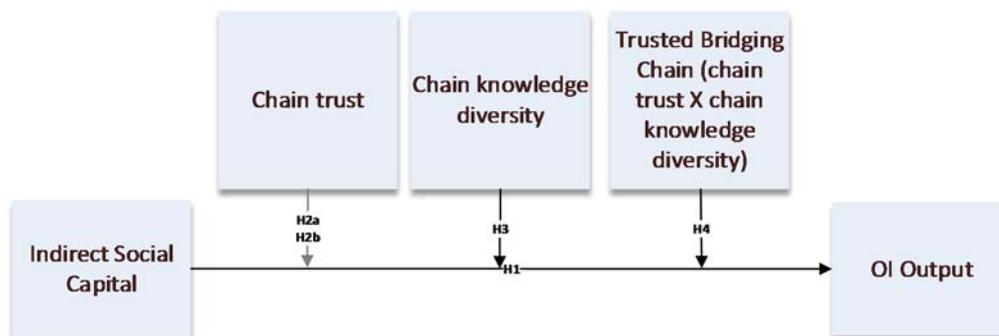
Hypotheses / Propositions

Figure 6: Propositions / Hypotheses

Indirect social capital is made available through recursive brokerage, which is argued to be a repeated act of brokerage (sharing of information) that forms a trusted bridging chain of agents where each agent mediates the flow of information between themselves and the seeker to find an ultimate resource (Burt, 1992; Fernandez & Gould, 1994). Bridging is associated with diversity (Burt, 1992; Lin, 2005). Small-world studies have also demonstrated how required resources could be found by means of an instrumental search, both through supporting relations and alongside short paths, that is, bridging relations (structural holes and diversity), to find an ultimate resource (Milgram, 1967; Travers *et al.*, 1969; Watts *et al.*, 1998; Burt, 2004). However, most small-world studies are either algorithm-based or an ad hoc analysis of a complete network or scope of ties (e.g. Broadway musicals). Apart from chain length, the context and nature of the chain have not featured much in small-world studies; density and short paths (bridges) have been shown to indicate a small-world effect. Job referral studies have indicated that individuals could find an ultimate resource (a job) through a chain of helpers (even though short) (Granovetter, 1973; Bian, 1997; Lin, 1999; Lin, 2004). Literature on social capital points out that social capital can be defined by its function, and that instrumental searching is related to bridging social capital in its quest to find something new or improved (Coleman, 1988; Lin, 2005). Studies on innovation have shown the importance of diversity for the innovation process, which can be achieved through links to different industries (Hargadon *et al.*, 1997); spill-overs (Burt, 1982; Almeida *et al.*, 1999; Ahuja, 2000; Murray, 2002; Belderbos *et al.*, 2004; Owen-Smith *et al.*, 2004; Jack, 2005; Porter *et al.*, 2005; Uzzi et al., 2005; Fleming et al., 2006; Lowik *et al.*, 2012) and links to different types of entities (Powell *et al.*, 1999; Baum *et al.*, 2000; Landry *et al.*, 2002; Miotti *et al.*, 2003; Becker et al., 2004; Amara *et al.*, 2005; Vanhaverbeke, 2006; Roper *et al.*, 2008; Pullen *et al.*, 2012;). OI can leverage a trusted bridging chain, which can be a proxy of a small world to find a required resource in a more filtered way than increasing search breadth. Increasing search breadth beyond a certain threshold has been shown not to always be positive for innovation (Ahuja, 2000; Laursen *et al.*, 2004, 2006). The trusted bridging chain is hypothesised to embed knowledge diversity when the knowledge and geographic distance between dyadic ties are large; and diversity is important for innovation. It can then be hypothesised that:

> *H1: Indirect social capital correlates positively with OI output.*

> *H3: Knowledge diversity positively moderates the relationship between indirect social capital and OI output.*

The notion of a trusted bridging chain is argued to be formed through the act of brokerage and recursive brokerage (which is related to sharing information), considering the importance of trust in sharing information or knowledge as a supporting feature of social capital (Levin *et al.*, 2004; Levin *et al.*, 2011). Trust has been shown to be important for cooperation and coordination (Coleman, 1988). Trust facilitates the flow of information (Krackhardt *et al.*, 1993; Uzzi, 1996) and the sharing of knowledge (Tsai *et al.*, 1998; Inkpen *et al.*, 2005). Trust is reciprocated, so it would only be necessary to review one side of the relationship (Hansen, 1999). Trust is also important for innovation (Landry *et al.*, 2002; Dakhli *et al.*, 2004; Moran, 2005) and the generation of new ideas (Lee *et al.*, 2003; Clegg *et al.*, 2002). It was argued that a trusted bridging chain is formed, facilitated through supporting relations that inhere trust.

It can then be hypothesised that:

H2a: Benevolence-based trust positively moderates the relationship between indirect social capital and OI output

H2b: Competence-based trust positively moderates the relationship between indirect social capital and OI

H4: A trusted bridging chain positively moderates the relationship between recursive brokerage and OI output (moderation of the interaction effect of trust and diversity affecting the regression between recursive brokerage and OI output)

Methodology

A one-group post-test quasi-experimental design is required to test the hypotheses and thereby answer the research question – *Does indirect social capital affect OI output positively?*

An intervention to enable indirect social capital (a software platform was developed to enable this) is implemented and then a post-test observation is obtained.

The proposed methodology aligned with the research design is a quantitative study, based on collected survey data throughout the process and survey data for validity purposes post hoc as well.

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