

The Role of Social Capital in Regional Technological Innovation: Seeing both the wood and the trees

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Abstract. This paper both attempts to identify the key conceptual and methodological principles that can be extracted from the very complex literatures on social capital and innovation, and to draw out the interactions between these concepts. The paper argues that the social capital literature has been hijacked at one end by those solely taken by precise definitions and measurement, and at the other end by those that proclaim social capital to be the blanket solution, and the missing link. If we allow ourselves to get caught up in the too miniature details then we risk losing important insights from a fascinating concept. At the other end, broad-sweeping claims about social capital risk devastating policy prescriptions. The paper attempts to show that yes social capital does exist, and yes it is important for regional technological innovation. However, social capital can also be a hindrance for regional technological innovation, and cannot replace other important regional development resources.

Introduction

This paper necessarily addresses existing deficiencies in the literature concerned with the role played by social capital in the process of technological innovation and economic growth. We have two very broad bodies of literature on social capital in the technological innovation context which have become very complex and consumed with definitional issues. It is therefore desirable to identify the key

conceptual and methodological principles that can be extracted from the literatures, and to try to understand the interactions between these concepts (that is, social capital and innovation). The research focuses on the specific processes that impact on social capital in the context of regional technological innovation. The paper argues that the social capital literature has been consumed at one end by those concerned solely with precise definitions and measurement, and at the other end by those that proclaim social capital to be the solution to all the world's ills. Social capital does exist, and yes it is important for regional technological innovation, however, social capital can also be a hindrance for regional technological innovation, and cannot replace other important regional development resources. Essentially, the concept needs to be brought back into perspective, otherwise we risk losing important advances from a fascinating concept.

The remainder of this paper is divided into three main sections. The first section discusses the importance of technological innovation for economic prosperity in the new knowledge based economy (KBE), and identifies key themes of the stages and elements of the technological innovation process. The second section identifies key conceptual and methodological principles that can be extracted from the social capital literature, and draws out interactions between the social capital and innovation concepts. Lastly, the third section analyses the role of social capital in regional technological innovation and development, and makes suggestions for further research.

The technological innovation process

The literature on sustainable competitive advantage and the growth of firms, regions, and nations widely recognises the generation and use of knowledge as the most important element of that process. This recognition furthermore, has been reinforced by the development of the 'new knowledge-based' or 'learning' economy¹ in which a capacity for learning is considered a key attribute of success (Wolfe 2002:5, Maskell 1999). Innovation, broadly understood as the adoption, adaptation, and diffusion of novelty through firms and markets, is therefore seen as the essential source of economic dynamism, though this observation is not new, with writers as diverse as Smith, List, Marshall, Schumpeter, Marx, and Porter all viewing innovation as the primary foundation of competitiveness in capitalist systems (Lundvall et al 2001:5, Freeman & Soete 2000:2). In recognising that innovation is the primary source of competitive advantage, both Schumpeter and Marx realised that innovation could wield destructive as well as creative (hence Schumpeter's famous '*creative destruction*' metaphor) social and

¹ For a pertinent discussion on whether or not a 'new economy' actually exists, see Gordon (2000) and OECD (2000).

economic effects on existing inventions². Schumpeter stressed the importance of ‘quality’ over ‘ordinary’ competition, arguing that it ‘strikes not at the margins of the profits and the outputs of the existing firms but at their foundations and their very lives’ (Schumpeter 1942). Thus innovation, because of its revolutionary capabilities, is paramount for growth, employment (in particular the growth of high-skilled and high-quality employment), productivity, environmental sustainability, and overall welfare in both regions and nations, and its generation should be of fundamental importance to governments and thus public policy (OECD 2001:7).

It is said that Schumpeter was the first to distinguish between invention and innovation (Cantwell 2001: 3), and it must again be emphasised that an innovation does not necessarily need to be ‘new to the universe’ (Nelson & Rosenberg 1993) but simply new to the firm, region, or nation. In the economic sense of the word, something is only considered to be an innovation when a commercial transaction of the new (or enhanced) product, process, system, or device is in motion (Freeman & Soete 2000:6). Schumpeter’s understanding of innovation as a ‘new combination’ is fascinating because it highlights the fundamentally paradoxical nature of innovation: that is, finding a balance between continuity and change (Lundvall et al 2001:11), exploitation and exploration (Nooteboom 2000a:1) and evolutionary and revolutionary change (Tushman & O’Reilly 1996:8). Furthermore, innovation is often simply viewed as encompassing product designs and manufacturing processes, but innovation is broader than this, and includes institutional, organisational, and managerial technique changes (Morgan 1997: 492).

For a long time, the dominant approach to innovation has followed the orthodox ‘science model’ or ‘input-output perspective’, that is, the science push, market pull, research and development model (Langrish et al 1972: 72-3). The axioms underpinning this model, however, are far removed from the real world, and this approach is ill-equipped to deal with the innovation process. At the base of the orthodox model lie the behavioural assumptions about how actors in the economic system operate. It is assumed that consumers optimise utility (maximise benefits relative to costs) and producers maximise profits³. Preferences are taken as ordered, transitive, comparable, consistent, and purely internal (Sen 1977:

² Morgan (1997) refers to a passage in *Das Kapital* in which Marx uses the case of cotton to illustrate the power of innovation. Marx likens the process to a battle between the traditional hand weaving technology and the new power weaving technology, in which ‘the bones of cotton-weavers ended up ‘bleaching the plains of India’’ (Marx 1954 [1867]).

³ Hume’s explanation (1740 book 3, part 2, section 5, in Putnam 1993:163) of human nature is classic:

Your corn is ripe today; mine will be so tomorrow. ‘Tis profitable for us both that I should labour with you today, and that you should aid me tomorrow. I have no kindness for you, and know you have as little for me. I will not therefore, take any pains upon your account; and should I labour with you upon my own account, in expectation of a return, I know I should be disappointed, and that I should in vain depend upon your gratitude. Here then I leave you to labour alone; You treat me in the same manner. The seasons change; and both of us lose our harvests for want of mutual confidence and security.

322). Following a narrow reading of Smith⁴, the utilitarians and later the rational choice theorists and neoclassical orthodoxy have particularly emphasised the extreme self-interest and profit maximisation motivation of economic agents (Coleman 1998: S95, Woolcock 1998:160). Another assumption of the orthodox account of innovation is that the economy is in a state of equilibrium and that innovation temporarily creates disequilibrium, and then moves back to equilibrium (Lundvall 1992: 8). A third assumption of the model is that innovation follows a linear trajectory, that basic research moves to applied research and then to commercial application, translating into better performing firms, regions, and nations.

The growing literature on the innovation process, however, rejects these assumptions, and Andersen et al (1981: 55) believe that the orthodox economic perspective on innovation ‘has led to a misjudgement of some of the important mechanisms to the national and regional development process’. History has shown us that innovation does not follow the orthodox model, as regions and countries that have dedicated considerable resources to research and development, have not achieved economic success. Freeman and Soete (2000) illuminate the non-linear nature of the innovation process with a comparison of Japan and the former USSR. Both Japan and the USSR planned for the long-term (the Ministry of Trade and Industry in Japan, and the five year plans in the USSR), both directed considerable resources to basic research, and both had excellent technical education systems. The linear model of innovation oversimplifies the process, *as systemic factors play a major role*. The major difference between the two cases of Japan and the USSR was that Japan had strong links between all stages of the innovation process, whereas the USSR had very weak institutional links. The reality is that a wide range of qualitative factors may act as impediments to a firm’s, region’s, or nation’s ‘absorptive capacity’ (Cohen & Levinthal 1990).

There is now a voluminous literature (the National Systems of Innovation (NSI) approach, institutional and new institutional economic approaches, as well as the evolutionary economic approach) that firstly acknowledges that economic actors are motivated by a variety of institutions (understood as norms, habits, and rules of society), and that these are influential in shaping how actors interact, learn, and utilise knowledge (Johnson 1988, 1992, Sen 1977, Earl 1983, 1988, Etzioni 1988). Where the economic environment is characterised by uncertainty and continuous change, both the informal and formal ‘institutional setting’ will have a major impact on both the way that economic actors choose to behave, as well as the way in which the entire system will perform (Lundvall et al 2001: 17).

⁴ Many writers of these traditions overlook sections of *The Wealth of Nations* and his earlier writings such as *The Theory of Moral Sentiments* in their interpretations of Smith (Klamer 1989:141). Sen says that in reality Smith took a more extensive view of human nature and did not see the pursuit of self-interest as being uniquely rational. While Smith did see self-interest a major motivation, he did not exclude other factors such as humanity, justice, generosity, and public spirit. Smith saw the situation more as being the prudential pursuit of self-interest.

For example, the difference between the short-term outlook nature of corporate governance in the Anglo-Saxon system as opposed to the long-term nature of investment decisions seen in Japan, is illustrative in emphasising the key impact of institutional differences. Furthermore, many focal actors of the innovation process such as universities and publicly funded research think-tanks are established with a range of motivations other than profit maximisation (Edquist 1997: 6). Other formal institutions such as intellectual property rights, corporations law, and the industrial relations system are also fundamentally important to the innovation process (Dosi 1988: 1121, Lundvall et al 2001: 19).

The literature on the characteristics of the innovation process emphasises a number of notions. Innovation is firstly said to occur in a 'learning by doing and by searching environment' (Lundvall et al 2001: 13) (this informal element is said to be embodied in people and organizations, and its origins are hard to pinpoint (Dosi 1988:1125)). Innovation is furthermore conceptualised as a problem-solving activity involving both discovery and creation (Dosi & Egidi 1987), and emphasis is placed both on path dependency on the knowledge base (Nelson & Winter 1982) as well as on tacit⁵ knowledge. This is because innovation requires previous formal and informal experience to be drawn upon. Formal knowledge is often in reality seen as complementary to tacit knowledge in the innovation process, for example the results of a Yale questionnaire in the 1980s showed that university research was considered to be important for innovation in only 30 out of 130 sectors surveyed (Nelson 1986). Moreover, in the 'new knowledge-based economy', where the flow of public information is rapid and widespread, the importance of 'know-how' and tacit knowledge is arguably even more important to create a competitive advantage. Freeman and Soete (2000:297-8) discuss how an important part of Prussia 'catching up' to Britain in the 1800s was not reverse engineering, but the transfer of tacit knowledge through the poaching of British craftsmen to teach Prussian craftsmen the know-how.

Further emphasising the path dependency notion, firms, regions, and nations are said to follow 'technological trajectories' in that activities are 'strongly selective, finalized in quite precise directions, and cumulative' (Dosi 1988:1128) (for example, a region or firm that is successful in producing chemical products, will rarely move to a mechanical technological trajectory – that is, there is the possibility of lock-in). In contrast to the orthodox assumption of firms, regions, and nations having perfect, easily producible, and reusable information, 'bounded rationality' of actors in the innovation system is emphasised, in that agents cannot comprehend all possible options, but instead 'satisfice' (Simon 1959, 1976). Localised learning is therefore emphasised (Lundvall et al 2001: 13), with the

⁵ Tacit here is conceptualised in the sense that Polanyi (1967) intended, that is:

those elements of knowledge, insight, and so on that individuals have that are ill-defined, uncodified, unpublished, which they themselves cannot fully express and which differ from person to person, but which may to some significant degree be shared by collaborators and colleagues who have a common experience (Dosi 1988: 1126).

learning element highlighting the continual incremental nature of innovation instead of it simply being a single disruptive event that temporarily disturbs the state of equilibrium. As opposed to the purely internal orthodox conception, interaction with the external environment is stressed in the building of the knowledge base, and so, different contexts offer dissimilar prospects for processes of interactive learning (Dosi 1988: 1131-3). It is also argued that success in innovation requires long-term relationships (further emphasising the continual and gradual nature of innovation), many of which are necessarily of a non-price nature⁶ (Lundvall et al 2001: 16). Lastly, Nooteboom (2000a:7) says that innovation, like crime, requires the motive (the build up of unsatisfactory performance), the opportunity (of demand and or the technology), and the means (insights into what novel elements to obtain from what source and how to incorporate them). So overall, the general features of innovation are considered to be ‘tacitness, specificity, uncertainty, variety of knowledge bases, search procedures, and opportunities, cumulateness, and irreversibility’ (Dosi 1988:1164, Lundvall et al 2001, Nooteboom 2000a & c).

The concept of social capital

Social capital (SC) is an over and often inappropriately used concept, and is ill defined. Journal articles are increasingly appearing about the concept, whole books (for example Leenders & Gabbay 1999, Winter 2000), and a number of literature reviews are even being written on the ever-fashionable term (Adler & Kwon 2002, Woolcock 1998). Indeed a SC ‘google’ search returns over two million sites, with the concept being used to explain everything from lower levels of crime to better health (Aldridge, Halpern & Fitzpatrick 2002: 22-3). Furthermore, SC is increasingly cited in political circles (Portes & Landolt 1996:18) as a justification for less state involvement, espousing the argument that greater responsibility should be given to the community (Szretzer 2002, Giddens 2000, Fine 1999). There are three quite widely acknowledged (Fine 1999, Adler & Kwon 2002, Woolcock 1998) problems of the literature on SC: 1) there are problems surrounding the definition of the concept 2) it is considered to be a chaotic concept⁷ 3) many authors believe that it neglects issues of power and conflict (Kulynych & Smith 2002, Fine 1999:16). This section attempts to reconcile these problems. The disparate conceptualisation of the term can be seen in Table 1.

⁶ The importance of non-economic relationships will be discussed in more detail in the next section.

⁷ Because of the wide diffusion of use of the concept, some have argued that it is ineffective. However, there is, I believe, a need to distinguish reactionary and popular uses of the concept, from analytically ‘forward-thinking’ uses. Further, the term captures certain underlying processes and relationships which seem to be important for innovation.

Social capital is:

Author	Definition
Hanifan (1916:130)	‘those tangible assets [that] count for most in the daily lives of people namely good will, fellowship, sympathy, and social intercourse among the individuals and families who make up a social unit’.
Jacobs (1961:138)	‘networks...’.
Bourdieu (1986 :248)	‘the aggregate of the actual or potential resources which are linked to possession of a durable network of more or less institutionalised relationships of mutual acquaintance and recognition’ (1986:243) ‘made up of social obligations (‘connections’), which is convertible, in certain conditions, into economic capital and may be institutionalised in the form of a title of nobility’.
Coleman (1990:302)	‘defined by its function. It is not a single entity, but a variety of different entities having two characteristics in common. They all consist of some aspect of social structure, and they facilitate certain actions of individuals who are within the structure’.
Schiff (1992:160)	‘the set of elements of the social structure that affects relations among people and are inputs or arguments of the production and/or utility function’.
Putnam (1995:664)	‘features of social life – networks, norms, and trust – that enable participants to act together more effectively to pursue shared objectives...Social capital, in short, refers to social connections and the attendant norms and trust’.
Fukuyama (1995:10)	‘the ability of people to work together for common purposes in groups and organizations’. (1999:16) ‘a set of informal values or norms shared among members of a group that permit cooperation among them’. (2000:3) ‘an instantiated informal norm that promotes cooperation between two or more individuals’.
Knack & Keefer (1997:1251)	‘trust, cooperative norms, and associations within groups’.
Woolcock (1998:155)	‘the norms and networks facilitating collective action for mutual benefit’ (1998:186) ‘(i) within their local communities; (ii) between local communities and groups with external and more extensive social connections to civil society; (iii) between civil society and macro-level institutions; and (iv) within corporate sector institutions’.
Lin (1999:471)	‘resources accessed in social networks...focuses on the instrumental utility of such resources’.
Gargiulo & Benassi (1999:299)	‘networks [that] facilitate access to information, resources, and opportunities...’ that ‘help actors to coordinate critical task interdependencies and to overcome the dilemmas of collective action’.
Serageldin & Grootaert (2000:44 & 46)	the ‘certain degree of common cultural identifications, a sense of ‘belonging’ and shared behavioural norms’ ‘the social and political

	environment that enables norms to develop and shape social structure’.
Nooteboom (2000b:1)	‘positional advantage’ (Stoehorst 1997) and this entails both the creation and utilisation of networks...obligations, expectations, norms, and sanctions: they are based on networks and form the basis for networks’.
Burt (2000: 347)	‘advantages that individuals or groups have because of their location in social structure’.
Adler & Kwon (2002: 17)	‘the goodwill that is engendered by the fabric of social relations and that can be mobilized to facilitate action’.

Table 1: The disparate nature of the social capital definition: some selected definitions

From this growing literature, a number of themes can be identified in the definition of SC. The first is participation in networks: the notion of dense interlocking networks of relationships between a variety of actors (Burt 2000: 347, Lin 1999:471). The second is reciprocity: the notion of short-term altruism and long-term self interest – an actor may act for the benefit of others at a personal cost, with the general expectation that this kindness will be returned at some undefined point in time. Otherwise referred to as the ‘favour bank’, Elster (1989: 101, 111) gives the simplistic example of present giving. The third is trust: this entails a willingness to take risks in a social context based on a sense of confidence that others will act as expected and in mutually supportive ways (at a minimum that others do not intend harm) (Fukuyama 1995, Elster 1989: 100) The fourth theme is the institutional setting (norms, taboos, etcetera): they provide a form of informal social control that precludes the necessity for formal institutions (Knack & Keefer 1997:1251). The fifth is the stock or commons: networks, reciprocity, trust, and the institutional setting combine to form a strong community, with shared ownership over the SC. Finally, the sixth, pro-activity, is implicit in earlier themes, that is, a sense of individual and collective worth requires the active and willing engagement of citizens within a participative community. SC is not located in the individual actor or within the social structure, but in the space between (Coleman 1988). It is not the property of organisations, the market, or the state, though all can engage in its production. Inherent in the concept, is the notion of people as creators.

The disparate nature of the concept will not be addressed further in this paper for reasons of space. Suffice to say that many authors fail to explain the metaphorical, philosophical, and analytical origins of the concept, and choose to focus or emphasise certain aspects to support their respective cases. The above synthesis of both the wider literature and definitions shows that SC broadly has six dimensions: networks, reciprocity, trust, the formal and informal institutional settings, the commons, and proactivity. Further, all dimensions of SC need to be incorporated in SC analyses in order to reflect its actual scope.

Two further issues must be raised in the context of defining SC. Firstly, the usefulness of SC as a concept is often critiqued because of its 'dark side' (Putzel 1997: 939). That is, its exclusive nature – one group's SC may negatively impact on another group – cartels are often cited as an example in the business environment. It is misleading to say however, that a concept needs to be purely positive for it to be useful. For example, physical, human, financial, and natural capital can all be used in destructive ways (Fountain 1997), but most of the time they are used in constructive ways. Furthermore, it must be emphasised that at its core, SC is a relational, network concept (Burt 1992:12), and the 'capital' itself is not a property of individuals or the group, but is located in the space between (Fountain 1997). A number of authors have differentiated SC into two categories: ties that are strong or weak, bonding or bridging, internal or external, communal or linking (Granovetter 1973, 1983, Gittel & Vidal 1998, Putnam 2000). Specifically relating to the innovation process, it has been argued that bridging SC is important at the exploration stage, whereas bonding SC is important at the exploitation stage (Nooteboom 2000b & 2000c)⁸. Therefore, for the generation of innovation, and success over the long-term, it will be important even for exclusionary groups to establish external ties. If SC is conceptualised in this network and relational sense, then really cartels and other exclusivist groups are indicative of a lack of connectedness, that is, there is insufficient SC. The network would essentially have broken down, and greater levels of SC (connections) would need to be created.

Secondly, the use of the 'capital' metaphor in SC is also often critiqued (Dolfsma 2001, Kulynych & Smith 2002, Baron & Hannon 1994). Dolfsma (2001:73) argues that in light of the development of the concept, and considering its contemporary usage, 'capital' can be conceptualised as three things: 'tangible, external to the economic agent, that can moreover, be measured or valued in terms of money'. SC can be considered to be 'capital' in five major ways: a) it is an asset into which resources can be invested, and it can be expected that it will be possible to reap gains in the future, b) it is 'appropriable' in that it can be used for purposes other than its intended primary purpose (Coleman 1988), c) it is 'convertible' into other types of capital (Bourdieu 1985), d) it can replace or add to other resources (Adler & Kwon 2002: 21) e) it requires maintenance, however it depreciates with non-use or abuse, but unlike say physical capital, it does not depreciate with over-use, but would instead strengthen or even appreciate (Adler & Kwon 2002: 22).

SC is also considered to be very dissimilar to 'capital' for two fundamental reasons. Firstly, as discussed above, it is a relational concept. This is problematic for some authors because it cannot be exclusively owned and can be easily destroyed. However, the fact that SC requires a collective effort for its creation and durability is perhaps the concept's most illuminating characteristic.

⁸ See Granovetter's seminal 1973 work on 'the importance of weak ties', and also Granovetter 1983.

Furthermore, Adler & Kwon (2002:22) note that this feature is not unique, and that the efficacy of other network goods like for example communication devices, is also related to the number of users. SC is secondly considered to be fundamentally different from other forms of capital in that it is not tangible and is very difficult to measure⁹ (Solow 1997, Fukuyama 1997, Abramovitz 1986:368). It must be said, however, that SC is a relatively new analytical tool, and that it took considerable time for a consensus to be reached on how to measure other forms of capital. Lucas (1988:35) discusses the problems of human capital measurement when the concept was in its embryonic stages: 'after two decades of research applications of human capital theory we have learned to see it in a wide variety of phenomena'. Much discussion about the measurement of SC has emphasised the inherently normative (and thus difficult to precisely measure) trust component (Fukuyama 1995, Knack & Keefer 1997, World Bank). Attempts to measure, the core network and relational component would be considerably easier and less contestable¹⁰. In terms of measurement, the fundamental point to note is that for a concept to be analytically useful, it does not have to be precisely and discretely measurable. SC is too intertwined and complex a concept for there to be a precise measurement. It is therefore perhaps only necessary to have broad indicators as to whether or not SC is strong or weak in a particular context; this point pertains particularly to the study of social capital and regional innovation.

Many scholars fundamentally reject usage of the capital metaphor not because they consider the term to be technically incorrect, rather on the basis that it is inappropriate for social processes¹¹ (Kulynych & Smith 2002, Fine 1999). However, the 'capital' in SC is illuminating because it implies both something that lives longer than the costs involved in its creation, and is necessary for other types of constructive pursuits. As long as one is explicit about the metaphorical meanings of the term, then there is nothing wrong with the use of the metaphor per se if use of it is illuminating. Moreover, the combination of 'social' plus 'capital' is compelling because it highlights both instances in which non-economic arrangements (both informal – norms, taboos, ethics - and formal –

⁹ Indeed, the problematic measurement of SC has begun to dominate the literature surrounding SC.

¹⁰ For example, the European Commission releases statistics that reveal the number of small and medium sized enterprise that have actively engaged in cooperative measures in the preceding three years (available at www.innovating-regions.org/).

¹¹ Metaphor is a phenomenon of language where what is said or written is not literally intended across language. It is an interactive process involving both principal and subsidiary subjects (Black 1962:40). Metaphor is to apply a word or phrase to an object or action in order to imply a resemblance (for example, 'the world is my oyster', 'truth is a woman'). Metaphors carry over a language process, and the two subjects then interact to create a new meaning, a meaning which cannot be achieved by some literal equivalent (Klamer & Leonard 1994:46). This is interesting to note, considering that a number of authors in critiquing the use of 'capital', have suggested the alternative use of capacity or capability. These terms are not, however, as illuminating, and have been critiqued on similar grounds to the capital metaphor (Dolfsma forthcoming: 2).

taxes, the rule of law - institutions) account for ensuing success, as well as the growth possibilities of successful 'collective action' (Fountain 1997). Furthermore, in the context of analysing SC in regional technological innovation, the capital metaphor is arguably entirely appropriate, because of the focus on positive economic outcomes. In this context, a conceptualisation of the social is being used to explain economic phenomena (that is, the social contribution to economic outcomes).

The importance of social capital for technological innovation

Virtually every commercial transaction has within itself an element of trust, certainly any transaction conducted over a period of time. It can plausibly be argued that much of the economic backwardness in the world can be explained by the lack of mutual confidence (Arrow 1972:357).

There has been a long history of the intuition that 'society matters' for success in the economic arena (Winter 2000:19-20). It has been acknowledged in the contemporary literature that SC contributes to economic performance in a number of ways. However, it must be emphasised that the disparate definitional state of the SC literature carries on into the theoretical conjecture on the subject. This is problematic because all are talking of SC, but some are referring to the trust component, some to the network component, some only to horizontal associations, and some only to vertical associations. Furthermore, the object of analysis for a number of authors is the individual, whereas for others it is the firm, and some authors are discussing bonding SC over bridging SC. It is therefore difficult to identify the state of knowledge on the outcomes of SC, as there are many dimensions to the literature. An associated problem is that these different 'schools' of SC thought have now moved on to deal with the problems of measurement¹². So authors like Putnam for example have focused on measuring SC in terms of participation in voluntary community organisations¹³, while Knack & Keefer (1997) have focused on the World Values Survey¹⁴. Again SC research would benefit immensely from the concept being 'reigned in'.

¹² For a discussion of these issues see Fukuyama 1997 and Solow 1997.

¹³ Putnam et al (1993) argue that century old differences in SC have impacted on the success of the reforms of regional government. In another study, Putnam (1996) presents compelling evidence of the 'disappearance of civic America' measured through a decline in the participation in voluntary community organizations. The article provides a systematic analysis of possible explanations for the decline, and dismisses factors that are usually held accountable such as urbanisation and mobility, the civil rights movement, time and money, and the changing role of women. The main culprit according to Putnam is television (because of its time taking ability) as this seems to be the only factor that can account for the steady decline of SC since the 1940s and 1950s. There is a whole literature that has emerged directly critiquing Putnam's approach, arguing that Putnam is merely nostalgic for earlier times, and that while membership in traditional church and school organisations may be in decline, there are a whole variety of other groups that have emerged to address issues such as community environmentalism and AIDS.

¹⁴ 'The question used to assess the level of trust in a society is: Generally speaking, would you say that most

Firstly, activities where actors depend to some extent on the future behaviour of other actors will possibly be achieved at a lower cost in high-SC contexts (Knack & Keefer 1997¹⁵). This is because future dependent transactions (such as the provision of goods and services with the promise of payment at some point in the future, or employment contracts that rely on the employee to carry out tasks that are difficult to monitor, or employer-funded training) will be achieved at a lower cost, because less resources will be directed into protection from exploitation. That is, less written contracts will be required, and those that are written will not specify every possible incident, and there will be overall less litigation. The resources that are being diverted from exploitation protection will be directed to more economically productive activities. Where SC is high, there is a possibility that there will be less reliance on formal sanctions to enforce agreements. This is particularly pertinent in the technological innovation process because in low SC environments, entrepreneurs are forced to direct considerable resources away from innovative activities to the monitoring of possible non-compliance by others. Where there is no formal financial institutional arrangement, investment can be facilitated through informal credit markets that depend on high levels of SC. This is especially important in the development context, where inadequate assets make it difficult to obtain finance through formal channels. It is also argued that government officials and thus government policies will have greater credibility in societies with higher levels of SC, and investment may thus be enhanced because the time horizon of agents will be extended from the short to the long term. This is because economic policy announcements on interest rates remaining low or the set up of the industrial relations and taxation systems are taken as reliable. An example of this can be seen in the Japanese system, where there is considerable autonomy of the bureaucracy, creating a degree of stability in the policy set-up. It is also said that higher levels of SC could enhance human capital, through increased benefits from more specialised and higher-level education.

Adler and Kwon (2002:17) discuss studies that have promoted SC as an explicatory factor, some of them relating to elements of the innovation process. SC is said to possibly: aid workers in finding jobs (Granovetter 1973, Lin & Dumin 1996, Lin, Ensel & Vaughn 1981), facilitate the exchange of resources between firms and enhance product innovation (Gabbay & Zuckerman 1998, Tsai & Ghosal 1998), assist intellectual capital creation and team success (Hargadon & Sutton 1997, Nahapiet & Ghosal 1998), provide greater skill pools for recruiting firms (Fernandez, Castilla, & Moore 2000), reduce the rate of employee turnover

people can be trusted, or that you can't be too careful in dealing with people?' (Knack & Keefer 1997:1254). This is a most problematic method of measurement, and the reasons why will not be discussed here for reasons of space. Suffice to say for example: which 'people' should the survey respondents be thinking of? Friends, family, foe...

¹⁵ The definition of SC used by Knack & Keefer focuses on the trust component, and this is what carries throughout this paragraph.

(Krackhardt & Hanson 1993), reduce firm failure rates (Pennings, Lee, & Van Witteloostuijn 1998), aid entrepreneurship and companies to get established (Chong & Gibbons 1997, Walker, Kogut, & Shan 1997), and enhance relations between suppliers and learning between firms (Uzzi 1997, Baker 1990, Kraatz 1998).

Morgan (1997), in a theoretical discussion, highlights the importance of SC for innovation at three levels: national, inter-firm, and intra-firm. At the national level, the importance of SC is emphasised because it smooths firm, science-base, finance, intermediate-institutional, and industry cooperation. At an inter-firm level, SC is said to facilitate 'integrated supply chains' which have historically delivered superior performance because of 'their problem-solving capacity' through an 'effective system of interactive learning'. At the intra-firm level, internal, bonding SC between for example research and development, engineering, and marketing units, is seen as important for innovation.

The fundamental importance of SC to technological innovation, however, lies in repeat cooperation. That is, for example, firms that have collaborated together successfully on a small scale, might be pushed to engage in riskier, larger scale projects. Through the development of trustworthy reputations, repeat interactions will arguably reinforce, enhance, and enlarge the existing network, being made to include other players in the wider political and economic environment. This highlights a conjecture about a productive feature of SC: its transitive nature (Fountain 1997). For example, James trusts Paul, and Paul trusts Jeremy, and it would follow that James will trust Jeremy.

As discussed in the previous section, in the new KBE 'knowledge is the most strategic resource and learning the most important process' (Lundvall & Johnson 1994). In this KBE context, with seemingly endless technology choices, Roos, Field, and Neely (1997) suggest that it has become almost impossible for single firms to remain fully technologically adept in their fields, and that the risks inherent in the investments required in doing so, would be too great to bear. This has highlighted the important role that supplier relationships are said to play.

This is even more so the case for the transfer of tacit knowledge because SC is said to increase the 'richness' of knowledge transfers. It supposedly gives meaning to information. This is illustrated in the example discussed in the previous section of Prussia 'catching-up' to Britain, where the key was in establishing links with British craftsmen who could transfer their know-how (Freeman & Soete 2000:298). SC is also beneficial to participating actors because it is believed that participants are able to learn about emerging opportunities and challenges more quickly than if they were insulated from the system. Problem solving and learning is also considered to be of a higher quality because various ideas will have been exchanged and debated between different nodes of the network. The idea here is that 'two heads are better than one' – actors in the system will view knowledge and information differently because of different

experience bases, and the solution will therefore be more appropriate and accurate. Conversely, actors that do not participate in networks, would (it is thought) be unable to engage in such productive ‘brain-storming’ and thus risk not only arriving at an inaccurate decision, but also wasteful duplication. In such an insular context, much of the resources that would otherwise be directed towards exploratory activities necessary for technological innovation would instead have to be diverted to protecting secrets. Regions and nations in which these types of firms predominate will, it is argued, find it difficult to innovate, especially in a rapidly changing environment.

Fountain (1997) discusses the example of biotechnology networks in the United States to illustrate the importance of SC for innovation. A study of cooperation in the most research-intensive section of the industry (therapeutics and diagnostics) found that the percentage of firms cooperating increased from 74 in 1990 to 86 in 1994. Furthermore, those firms with ties to other actors in the system (universities, research labs, other firms) tended to be both older and larger. Moreover, the successful firms of the study were all found to be extensive collaborators, with none of the non-participating firms turning out to be successful. These findings are particularly pronounced in the biotech sector because activities are highly interdisciplinary, and innovative activities are thus located mostly within the network as opposed to in one firm.

The aspects discussed above are just some of the reasons why SC is important for technological innovation. The fundamental point made in the literature, is that SC is more than a simple input – its nature is *multiplicative*. Therefore, in terms of its role in technological innovation and economic growth, its importance cannot be ranked equally next to physical or human capital for example. Nor can it simply be said that SC is of greater importance than physical or human capital. It is multiplicative in the sense that it will lie at the base of physical or human capital creation. For example, you and I cooperating, or two firms cooperating will create opportunities that, as separate entities could not even be imagined. SC will to a significant extent, determine what the existing forms or stocks of capital will be able to achieve.

The role of social capital in regional technological innovation and development

In a ‘learning economy’ the competitive advantage of firms and regions is based on innovation, and innovation processes are seen as socially and territorially embedded, interactive learning processes.

The most effective scale at which to create competitive advantage is at the level of regional clusters. (Asheim 1996, Krugman 1993 in Green & O’Neill 1999:1).

The literature on national systems of innovation (dominated by the Lundvall et al led Aalborg school in Denmark) came about in the mid-1980s with the realisation that most innovation is concentrated within twenty advanced nations, each with distinctive characteristics (Niosi 2001:2). The literature on regional innovation systems has emerged in the 1990s, with the realisation that within the twenty nations, the bulk of the innovation / economic growth occurs within a few regions (the well known examples are Silicon Valley in the United States, Cambridge in the United Kingdom, Baden-Württemberg in Germany, and the 'Third Italy'¹⁶) (European Commission 2002:9). Indeed throughout history, successful regions like the aforementioned have built successful nations.

The processes of globalisation have created a paradox¹⁷, in that the integration of the national and regional into the global, has actually emphasised the importance of the local or 'home market' for innovation and the creation of competitive advantage¹⁸ (Patel & Pavitt 1994, Archibugi & Michie 1995, Lundvall et al 2001). Indeed it has been argued that the process occurring that we should be referring to is in fact '*glocalisation*' (Humbert 1993). The 'new' economy has reinforced this importance, as less-difficult and less-expensive access to information (through for example information and communication technologies) has reduced the value of public / codified knowledge, and increased the value of tacit knowledge (Wolfe 2002:5).

The regional level is considered critical for the transfer of tacit knowledge for three main reasons: 1) learning through interaction is encouraged, because spatial immediacy supposedly frequents interaction on a close level, the kind of interaction that is said to enable learning 2) a 'common regional culture' is said to be shared by firms in regions, which is said to facilitate the 'social learning' process, bestowing critical advantages to firms engaged in such networks (Patel & Pavitt 1994). 3) The interaction is furthermore supported by the regional institutional structure, which in turn governs the way in which firms of the region will behave (Wolfe 2002:6). This third point is really the critical one. The literature linking the public policy setting to social capital argues that social capital can be consciously created and is not simply an inadvertent spin-off of other actions (see for example Levi 1998, Tarrow 1996). However, many of these institutional arguments of SC have not particularised which institutions matter in the creation of SC, and it is clear that a plethora of institutions with many

¹⁶ This refers to north-east and central Italy, renowned for its many industrial districts based predominantly around manufacturing sectors (European Commission 2002:9)

¹⁷ Storper (1995) calls this 'the principle dilemma' of economic geography.

¹⁸ The literature on globalisation through authors like Kenichi Ohmae has claimed that the extensive diffusion of technology and knowledge and its easy accessibility, has rendered both national boundaries and capacities unimportant. Evidence has however shown that the bulk of technology flows is between 'rich' or OECD countries (Freeman & Hagedoorn 1993). Furthermore, the core technological innovation activities of multi-nationals still largely occur in the base country (Morgan 1997). It can therefore be said that globalisation has largely been overstated (Cassiolato & Lastres 1999:5-6).

combinations exist. Rothstein & Stolle (2002) differentiate between institutions that represent and institutions that implement, arguing that the institutions that matter in the creation of 'generalized trust' (their definition of SC) are the ones that implement. This is because a major role for representative institutions is to be partisan, and thus people who support the prevailing ideology will have trust in the representative institutions, and those that do not, will not. On the other hand, implementation institutions (law and order, health care, education, social welfare agencies) can have a great impact on SC for two main reasons. Firstly, this type of institution is usually more permanent in nature and can thus exercise significant influence on SC in the regional context. Secondly, because contact with these institutions is most frequent, they make known the principles and norms of the political culture, which in turn shapes people's and firm's belief systems. What is important here is not simply whether the institution solely represents the particular citizen or firm, but whether the standards of 'universalism, equality before the law, impartiality and a reasonable degree of efficiency' (Rothstein & Stolle 2002: 13) are upheld.

There is also a growing body of work that emphasises the fundamentally geographical nature of innovation¹⁹ (Morgan 1997, Amin & Thrift 1995, Saxenian 1994, Storper 1995). This is because a number of regional assets including the store of embedded knowledge, learning capacity, as well as entrepreneurial approaches, are considered to be of fundamental consequence to the innovation capacity and success of firms (European Commission 2002:9). Patel and Pavitt (1994) further argue that the spatial nearness allows decisions to be made quickly, and the proximity is also thought to aid the collection of what Rosenberg (1976) calls 'grubby and pedestrian forms of knowledge'.²⁰ Both of the aforementioned processes are considered to be especially important in the contexts of innovation and the 'new' economy. Storper (1995) unites all of these points, calling the region 'a key necessary element in the 'supply architecture' of learning and innovation'. Regional clustering is thus seen as the answer to 'the globalisation trap' (Steiner 1997, Legendijk 2000: 165, European Commission 2002:9), because it is superior for the overall stimulation of innovation (Asheim & Isaksen 2000).

However, we must be careful not to overstate the role that SC plays in the regional technological innovation context. As discussed in section two, it has been argued that bridging SC is important at the exploration stage, whereas

¹⁹ The study of regional innovation is said to be merging three disciplines: the regional innovation systems approach, as briefly discussed above, the economic geography approach, and also the cluster development approach (Morgan 1997, Wolfe 2002:2-3).

²⁰ Rosenberg (1976) argues that 'grubby' forms of knowledge (such as engineering), which are fundamentally important in the innovation process, are regarded as second-rate to more pure scientific forms of knowledge in the West. In contrast to this, Japanese authors such as Nonaka and Takeuchi (1994) have argued that Japanese firms take very different views on knowledge than in the West, seeing 'grubby' and tacit knowledge of utmost importance to the innovation process.

bonding SC is important at the exploitation stage (Nooteboom 2000b & 2000c).²¹ Therefore, for the generation of technological innovation, and success over the long-term, it will be important that there is both communal SC and external SC. Without both of these kinds of SC, regional success will only be a short-term phenomenon. Furthermore, it would be naïve to say that SC is the only regional development resource necessary for success. Indeed a policy recommendation that emphasises only the importance of regional clustering may have devastating ramifications if there are not reasonable stocks of physical, financial, and human capital, for example. It would be patronising for those already at advanced developmental levels to pretend that they achieved success only in this way, and this would be the flawed DIY approach that we have seen in cases in the Third World. In reality, it is important for policy makers to realise that yes SC is important, but that it must be used and prescribed in conjunction with a wide range of factors. Essentially it is the glue that holds the structure together – it does not replace other resources.

Conclusion

This paper has attempted to address deficiencies in the existing literature on SC in the context of regional technological innovation and development by identifying key conceptual and methodological principles and by trying to understand the interactions between the concepts of social capital and innovation. If the spin-off themes are allowed to dominate the entire social capital literature, then we risk losing important insights from a fascinating concept. Thus future social capital research needs to move beyond the pedantry of precise definitions and measurement, by realising that such a thing as **social capital does exist**, and that it is a combination of reciprocity, networks, trust, the institutional setting, the commons, and pro-activity. Further, because social capital is a contextual concept, it needs to be acknowledged that precise measurement is not really possible. Two points need to be noted here: firstly, it is reflective of our times that only tangible, precisely measurable things are considered to be of importance. One only needs to take stock of one's life, however, to realise that this is indeed not the case. Secondly, the social capital literature emerged precisely to highlight the importance of intangibles over traditional units of analysis. Why then, is the concept being caught up in tangible concept issues (debate continues to rage even over the measurement of physical capital for example) when broad indicators of social capital will suffice. Thus future empirical research on social capital and innovation should focus on the dynamic and explanatory level, specifically through in-depth case studies and interviews for example.

This paper has also shown that at the other end of the spectrum we need to be very careful in hailing social capital as the answer to all the complexities of

²¹ See Granovetter's seminal 1973 work on 'the importance of weak ties', and also Granovetter 1983.

modern life. Proclaiming social capital as the blanket solution is far too crude, and misses the fact that social capital, by nature, is exclusive and thus will inevitably inhibit factors that are necessary for success. Broad-sweeping claims such as these, risk devastating policy prescriptions at all levels. Therefore, future research again needs to analyse the specific mechanisms through which social capital gives rise to outcomes. Yes social capital does exist, and yes it is important for regional technological innovation. However, social capital can also be a hindrance for regional technological innovation, and cannot replace other important regional development resources. Essentially, the concept needs to be taken stock of: we need to see both the wood and the trees.

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