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HUMAN CAPITAL, SOCIAL CAPITAL, AND INNOVATION: A MULTI-COUNTRY STUDY

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ABSTRACT

We examine the effects of two forms of capital, i.e. human capital and social capital, on innovation at the country level. We use secondary data from the World Development Report on a country's overall human development to test for a relationship between human capital and innovation. We also use previous conceptualisations of social capital as comprising trust, associational activity, and norms of civic behaviour to test for relationships between these indicators of social capital and innovation using data from the World Values Survey. Unlike most previous studies that examined human and social capital within a given country, we develop and empirically test a theoretically grounded model that relates human and social capital to innovation at the societal level across 59 different countries, thus providing a more global view of the role of these two forms of capital in generating value. We find strong support for the positive relationship between human capital and innovation and partial support for the positive effect of trust and associational activity on innovation. However, contrary to our prediction, we find a negative relationship between norms of civic behaviour and one of our innovation measures.

Keywords: social capital; human capital; innovation; cross-country comparison

INTRODUCTION

There has been significant increase in the knowledge-intensive side of economic activity at the global level. This has in turn increased academic and practitioners' interest in the various facets of knowledge creation and transfer within and between borders (Crosby, 2000). In this paper, we focus on innovation as one of the most important aspects of knowledge creation (Collinson, 2000) and we explore the role of two forms of capital, i.e. human capital and social capital, as antecedents to innovative activity at the societal level.

Prior researchers have examined how countries differ in terms of their level of innovative activity and have used Hofstede's (1980) cultural dimensions (i.e. uncertainty avoidance, individualism, power distance, and masculinity-femininity) to explain why certain countries innovate more than others. For instance, Shane (1992) found that individualistic and non-hierarchical societies are more inventive than other societies. Further, it has been suggested that societies that are more willing to accept uncertainty may be more innovative than uncertainty-avoiding societies because the legitimacy of innovation championing roles is greater in corporations within the former societies (Shane, 1995). Similarly, prior research has examined how different societies differ in terms of their 'entrepreneurial behaviour' based on the cultural values that are prevalent within a country. That is, it has been suggested that individuals from 'doing-oriented' cultures (e.g. the US) emphasise personal accomplishments and goal achievement to a greater extent than people from more 'being-oriented' cultures (e.g. the Netherlands) (Adler, 1997). For instance, Kemelgor (2002) found significant differences in the level of entrepreneurial orientation between US firms and their Dutch counterparts. In this paper we further build on the notion that commonalities within countries with regard to (1) individuals' resources and (2) the manner in which individuals interact with and relate to each other affect a country's economic activity.

More specifically, we examine the relationship between the amount of human capital and social capital within a country on the one hand, and the country's level of innovation on the other hand. It should be noted upfront that an important part of the literature that examined the effect of human capital and social capital on economic outcomes has focused on processes and phenomena that take place at the *regional* (i.e. subnational) rather than the *national* level. For instance, the research on industrial districts and innovative milieus has argued that economic development at

the regional level may be fostered by factors such as a shared attitude towards mutual trust in business exchanges, social prestige related to local entrepreneurial behaviour, and geographical proximity between a critical mass of human and physical capital (Bellandi, 2001; Maskell & Malmberg, 1999; Saxanian, 1994) as well as by the existence of 'untraded interdependencies' such as common procedures and rules for processing and exchanging knowledge (Storper, 1995). Furthermore, prior research on social capital has outlined differences in the levels of social capital between regions and communities within the same national borders. Onyx and Bullen (2000), for example, found that the level of social capital differs between five communities in Australia. Putnam (1993a, 1993b) also discussed differences in the level of social capital between Northern and Southern Italy and argued that the disparity in the economic development levels between these two regions are attributed to differences in social capital. Consequently, we acknowledge that the value of human and social capital on society often stems from the dynamics that occur in tightly-knit social groups, but at the same time, we argue that economic development and output at the national level is the result of the aggregate economic activity of individual regions within a country. That is, we confer with a 'generative growth' model for societies (Maillat, 1998) which maintains that the economic well-being of a region within a country does not necessarily occur at the expense of another region within that same country. In other words, we assume that 'the growth performance of an individual region can be raised and may have an impact on the national growth rate without necessarily adversely affecting the growth rate of its neighbours. Growth through new technical innovation is a case in point' (Maillat, 1998: 2). Therefore, our study is consistent with prior research that speaks to the role of government and policy makers in enhancing overall national growth by stimulating the innovative capability of individual regions (Camagni, 1992). Nonetheless, one has to remain cognizant to the fact that within-nation, and even within-region variations in the levels of human capital, social capital, and innovative activities do exist.

Human capital

The concept of human capital pertains to individuals' knowledge and abilities that allow for changes in action and economic growth (Coleman, 1988). Human capital may be developed through formal training and education aimed at updating and renewing one's capabilities in order

to do well in society. Prior researchers have made a distinction between different types of human capital (Florin & Schultlze, 2000).

Firm-specific human capital pertains to skills and knowledge that are valuable only within a specific firm. For instance, prior researchers have examined the impact of firm-related know-how within the founding team on the success rate of high-growth start-up firms (e.g. Sandberg, 1986). Although firm-specific skills may give firms an advantage over their competitors as these skills are not transferable to other firms (Grant, 1996), the limited amount of communication and interfirm reaction attached to those skills makes this type of human capital only have a limited impact on the level of innovative activity within a region or the wider society.

Industry-specific human capital pertains to knowledge derived from experience specific to an industry, and several researchers have examined the role of industry experience on the growth and economic performance of entrepreneurial ventures (e.g. Siegel, Siegel, & MacMillan, 1993) as well as society (e.g., Kenney & von Burg, 1999). Prior research has suggested that industry-specific human capital may play an important role in the generation of innovative activity within an industry if it is characterised by high-quality knowledge exchange among the main players within that industry (e.g. Bianchi, 2001). The presence of industry-related know-how will be in particular powerful in creating innovations when new product or process ideas result from the combination of intimate communication among network partners on the one hand and tacit know-how present in existing technology on the other hand. The tacit nature of industry-specific know-how makes this second type of human capital often only understandable for industry specialists and therefore offers a protective mechanism which may decrease the need for patent protection (David, 1975). Similarly, Maskell and Malmberg (1999) argued that proximity in a ‘cultural’ sense within a region or industry matters in terms of innovation in that the exchange of tacit knowledge often requires a high degree of mutual understanding. Further, Saxanian (1999) argued that the success of Silicon Valley is partly related to the presence of an intensive flow of tacit know-how among local firms and a culture directed at open communication, which ultimately resulted in a steady process of incremental knowledge development within that region; the problems facing the Route 128 area, however, may be explained by a local culture of secrecy and limited inter-firm cooperation.

Individual-specific human capital refers to knowledge that is applicable to a broad range of firms and industries; it includes general managerial and entrepreneurial experience (e.g.

Pennings, Lee, & van Witteloostuijn, 1998), the level of academic education and vocational training (e.g. Hinz, & Jungbauer-Gans, 1999), the individuals' age, and total household income (e.g. Kilkenny, Nalbarte, & Besser, 1999). Prior research has shown that one's overall level of human capital has an impact on economic success, both at the business level and the macro-level. For instance, Kilkenny and al. (1999) discussed a human capital model for success and suggested that business success is positively related to one's level of training, overall business experience and total income. Also, Prais (1995) examined how a country's education and training system may foster overall productivity. For instance, this author pointed to the need to have a right balance of educational resources devoted to general academic issues and matters directly connected to professional life, as well as to stimulate vocational training in order to provide future employees with job-specific technical skills.

The focus in this paper is on the last type of human capital, i.e. one's general ability and skills in terms of education, physical condition and overall economic well-being. That is, although we believe that industry-related expertise is an important driver for local innovative activity, we take more of a macro-approach towards the effect of human capital on economic success by focusing on the societal impact of human capital measured as a combination of the overall educational attainment, economic resources and physical well-being of a country's citizens. One could argue that economic resources and physical well-being are potential outcomes rather than indicators of human capital. For instance, Maskell and Malmberg (1999) argued that some regions may be more viable and economically successful than others based on factors such as the availability of knowledge and skills. However, as mentioned in the methodology section of the paper, we check whether and how our representation of a country's overall human capital is related to a proxy of the level of business expertise and skills relevant to innovation, i.e. the number of professionals active in R&D related activities.

Social capital

Unlike the economic view of human action that perceives individuals as resources that can be developed and that can shape environmental factors, social capital takes a sociological view of human action and perceives individuals as actors who are shaped by societal factors. Social capital has received an increased attention in the literature and has been studied at multiple levels,

including the individual (Burt, 1992), organisational (Nahapiet & Ghoshal, 1998), and societal (Putnam, 1993; Serageldin & Dasgupta, 2001). The central proposition in the social capital literature is that networks of relationships constitute, or lead to, resources that can be used for the good of the individual or the collective. First, at the individual level, social capital has been defined as the resources embedded in one's relationships with others. The emphasis in this case is on the actual or potential benefits that one accrues from his/her network of formal and informal ties with others (Burt, 1992). Second, at the organisational level, social capital has been defined as the value to an organisation in terms of the relationships formed by its members for the purpose of engaging in collective action (Freel, 2000; Nahapiet & Ghoshal, 1998). Third, the role of social capital has also been examined on a more macro-level in terms of its impact on the well-being of regions or societies (Bourdieu, 1986; Coleman 1990; Putnam, 1993a, 1993b). Serageldin and Dasgupta (2001), in their review of social capital, concurred with Coleman (1990) and emphasized the role social capital has in the creation of human capital. Prior research has also examined the impact of industry structure on regional and societal development and explained how 'industrial districts' represent local configurations that are high in social capital as they are characterised by mutual trust, cooperation, and entrepreneurial spirit as well as a multitude of local small firms (as opposed to large firms) with complementary specialised competencies (Saxanian, 1994). In others words, some scholars have suggested that regions with a large number of smaller but intensively interacting firms (and large firms possibly being embedded in these networks of small firms) may be more likely to enjoy economic prosperity and entrepreneurial vitality compared to areas dominated by large firms (Granovetter, 1973, 1985; Herrigel, 1996). Similarly, Putnam (1993a, 1993b, 2000) conceptualised social capital as features of social organisations, such as network structures, norms, and trust that facilitate coordination and cooperation for mutual benefit within a society. His recent thesis on the decline of social capital in the United States, and the negative consequences of this decline, has stirred an intense debate as to the importance of social capital and its relatedness to the well-being of societies.

We focus on the value-generating potential of human capital and social capital at the societal level. We develop arguments that speak to the role of human capital as a catalyst for innovation, discuss the concept of social capital and review the way it has been conceptualised in the literature, and develop arguments as to how the different dimensions of social capital affect innovation. We test out model using a variety of secondary data sources including the World

Value Survey and the United Nations. We discuss our findings, their implications as well as the limitations of the study. We also provide directions for future research.

HYPOTHESES

Human capital and innovation

Human capital emanates from the fundamental assumption that humans posses skills and abilities that can be improved, and as such can change the way people act (Becker, 1964). Human capital is said to be embodied in the skills, knowledge, and expertise that people have; it has been seen as an important source of competitive advantage to individuals, organisations, and societies (Gimeno, Folta, Cooper, & Woo, 1997; Coleman, 1988). For example, Gimeno et al. (1997) found a positive association between the overall level of human capital, as measured by education level and work experience, and economic performance at both the entrepreneur's level and the firm's level. Pennings, Kyungmook, and van Witteloostuijn (1998) found similar results in their study of the effects of various forms of capital, including human capital, on firm dissolution.

The relationship between human capital and innovation at the country level is grounded in what Bourdieu (1986) termed as 'conversions', that is different forms of capital can be converted into resources and other forms of economic payoff. At the individual level, this conversion process has been studied and validated by a number of researchers (e.g. Becker, 1964; Gradstein & Justman, 2000). In general, the argument is that those who are better educated, have more extensive work experience, and invest more time, energy, and resources in honing their skills are better able to secure higher benefits for themselves, and at the same time are better able to contribute to the overall well-being of the society. For instance, Maskell and Malmberg (1999) argued that the overall stock of knowledge and skills in a society or region may enhance its overall competitiveness. Further, innovation, as a knowledge intensive activity, is expected to be related to human capital in multiple ways. Black and Lynch (1996) proposed that investment in human capital through on-the-job training and education are the driving force behind increases in productivity and competitiveness at the organisational level. Along the same lines, Cannon (2000) argued that human capital raises overall productivity at the societal level as the human input to economic activity in terms of physical and intellectual effort increases. The overall

growth in economic activity generates, then, higher needs for new processes and innovations to further support this growth. Based on the arguments above, we propose the following:

> Hypothesis 1: The higher the level of human capital within a country, the higher the country's level of innovation will be.

Social capital and innovation

In this paper we also examine the value-generating potential of social capital at the societal level. We concur with researchers who argue that social capital creates value that is vital for effective functioning of communities and societies. Some scholars have used the 'innovative milieu' as an example of how social capital affects innovation at the regional level. Innovative milieus are characterised by intensive interactions among local firms as well as by other characteristics such as physical and institutional elements, the local labour market and a willingness to learn (Maillat and Lecoq, 1992; Maillat, 1995). It has been argued that the success of such milieus in terms of innovation depends on a region's ability to stimulate intensive cooperation as well as high-quality relationships among the local scientific, operational and financial systems (Maillat, 1998). As Storper (1995: 203) stated it: 'The milieu is essentially a context for development, which empowers and guides innovative agents to be able to innovate and to co-ordinate with other innovating agents.' However, the existing literature on innovative milieus has also been criticized for a lack of clarity in terms of the direction of causality. That is, does innovation occur because of the existence of a milieu, or does a milieu develops when there is innovation in a region (Storper, 1995)?

A number of studies that focused on social capital and the overall well-being of societies support the arguments for the positive effect of social capital on innovation. For instance, in a study of social capital in 29 market economies Knack and Keefer (1997) found social capital to be associated with better economic performance. Along these same lines, Nichols (1996) attributed the recent social and economic problems that Russia is facing to the lack of social capital. Decades of communist rule, this author suggested, have eroded trust and eliminated all forms of voluntary civic engagement. In line with a growing body of research in the field, we define a country's social capital as societal features that comprise trust, associational activity, and

norms of civic behaviour that together facilitate coordination and cooperation for collective benefit (Paxton, 1999; Helliwell & Putnam, 1995; Nichols, 1996; Knack & Keefer, 1997. Below we advance hypotheses that link these different dimensions of social capital to innovation.

Previous researchers have argued that trust, both within organisations and in inter-organisational settings, may foster innovation. First, within organisations, trust has been found to be important to innovation in that it lessens the need for rigid control systems (Quinn, 1979). Tight monitoring and control mechanisms reduce creative thinking, while freedom from rigid rules and job definitions enhances idea generation. Second, trust is not only important for innovation through interactions between individuals within an organisation but also through inter-organisational cooperation. The literature on innovation has emphasized that the development and adoption of new processes and products within a country is the result of the interaction between capabilities that are specific of each firm and industry (Dosi, 1988). The capacity to maintain a continuous flow of innovation within a country, therefore, depends on the ability to diffuse basic knowledge to organisations that interact in R&D and production activities among others. A high level of trust among organisations within a country facilitates the exchange of confidential information by diminishing the risk that one party will opportunistically exploit this information to the other's disadvantage (Knack & Keefer, 1997). In short, trust has for long been considered an essential component for most forms of social exchange and interdependence and many have even argued that the willingness to interact with others (individuals or organisations) is for the most part contingent on the prevalence of trust (Blau, 1964). Trust facilitates social exchange by reducing the need for time consuming and costly monitoring, and therefore makes it possible for people and organisations to devote added time for other beneficial actions and endeavours.

Research on trust, however, has shown that trust is a multidimensional construct and that various forms of trust exist. In their review of the trust literature, Rousseau et al. (1998) advanced three forms of trust: deterrence-based, calculus-based, and relational-based. Deterrence-based trust emphasizes utilitarian considerations and is founded on the belief that efficient sanction mechanisms are in place. These sanctions make breach of contract costly and thus enable parties to cooperate and expect reciprocation. Calculus-based trust, on the other hand, arises out of rational choice and objective information regarding the credibility and competence of exchange partners. Finally, relational-based trust describes a type of trust that may be the product of repeated interactions that foster norms of reciprocity, reliability, and dependability. Here,

emotions enter into the relationship because of the formation of attachment and interpersonal care.

Trust has also been discussed as a cultural variable whereby societies' propensity to trust differ. For example, Kluckhohn and Strodtbeck (1961) discussed differences between nations in people's propensity to trust. These authors argued that certain societies have a positive view of human nature, and as such are more likely to trust (e.g. Japan). Other societies (e.g. the United States) have less of a positive view and are likely to formalise most types of economic exchange with contracts and other monitoring and deterrence tools.

The above brief description of how trust has been conceptualised provides some guidance to our investigation of the role of trust in fostering innovation at the societal level. We examine two types of trust, with each dimension referring to a different focus, i.e. individuals or organisations. The first dimension relates to the trust that people have in others in any given society. This, in fact, captures the interpersonal facet of trust and includes both the calculus-based (i.e. rational) and relational-based (i.e. emotional) of trust as discussed earlier. This is what we will refer to as generalized trust. The second dimension relates to trust people have in institutions or organisations in the given society; in line with previous research, we term this institutional trust. This type of trust, in fact, captures the deterrence basis for trust as described earlier. That is, to the degree that the institutions in the environment are seen as efficient in mediating exchange and protecting individuals against any breach of trust, people are more likely to exhibit higher willingness to interact and assume risks in their transactions with others. For example, in societies that have effective patent-registration and protection laws, one may be more willing to enter in a cooperative relationship, e.g. a joint R&D project, knowing that there are credible and efficient mechanisms that will deter a partner from any possible breach of trust. On the other hand, where patent laws and institutions are ineffective or, even worse, absent, one may be more likely to focus on cooperating with those partners with whom one maintains a stronger interpersonal trusting relationship.

Consequently, we see both forms of trust, i.e. generalized trust and institutional trust, as factors that reduce the need for monitoring, increase the willingness of people and organisations to interact and to share information, knowledge, and other resources, albeit for different reasons. Therefore, we offer the following two hypotheses:

Hypothesis 2: The higher the level of generalized trust within a country, the higher the country's level of innovation will be.

Hypothesis 3: The higher the level of institutional trust within a country, the higher the country's level of innovation will be.

Associational activity describes the general tendency for people in a society to be active members in associations and voluntary-type organisations (Knack & Keefer, 1997). The important role of these associations in fostering the economic and social well-being of communities and societies is well documented. Associational activity is often a local activity that provides individuals with contacts with others within the own community as well as with others at the regional level, whereby the associations' members are from a variety of backgrounds and professions. For example, Putnam (1993) suggested that the higher success of the northern Italian communities as compared to the southern communities is, to a great degree, based on richer associational life. These voluntary associations, this author argued, create in their members habits of mutual support and solidarity. In addition to support and solidarity, the presence of a dense network of associations within a region may also play an important role in attracting resources such as venture capital, which will ultimately increase investment in innovative activities. For instance, Tyebjee and Bruno (1984) argued that the entrepreneurs' professional relationships with influential people helped significantly in locating capital for project funding. Furthermore, Chell and Baines (2000) showed how many owner-managers of small businesses use their contacts in organisations like Chambers of Commerce and Small Business Federations and also more informal organisations to provide a source of useful ideas and business relationships: ' … you pick up the phone to have a chat with somebody … or you 're on the golf course – the classic kind of think – and people are going to give business to each other …' (Chell & Baines, 2000: 209).

Therefore, associational activity may foster innovation through membership in multiple organisations, which increases one's exposure to different ideas and provides different sources of information. The prevalence of such associations in a society and high participation in these associations increases information and knowledge exchange at both the individual and organisational level, and is as such an important factor that fosters innovation.

The arguments above are consistent with the resource dependency theory (Pfeffer & Salancik, 1978) and its application in the context of a firm's board of directors as a network of interlocking directorates (Johannisson & Muse, 2001). Zajac and Westphal (1996), for example, argued that board members are often selected as a mechanism to reduce environmental uncertainty. That is, as boundary spanners, board members that belong to a variety of external organisations and associations help link firms within a society to their external environment, and therefore, provide access to novel information and other critical resources (George, Wood, & Khan, 2001). Along these same lines, in their study of managerial networks, Carroll and Teo (1996) found widely dispersed managerial social networks to be associated with higher accessibility to resources. Although managerial networks, including interlocking directorates, may be characterised by their own particular value system and therefore function somewhat differently compared to non-managerial networks and associations, these managerial networks can provide business professionals with a variety of ideas and resources necessary for new, innovative activity.

In short, the diversity of business and social circles to which one belongs (e.g. clubs, charitable organisations, and business associations) provides the opportunity to access multiple domains that may provide unique sources for information, financial funding, and political support, among other desirable resources that increase the propensity for innovation. The above discussion can be stated more formally through the following hypothesis:

> Hypothesis 4: The higher the level of associational activity within a country, the higher the country's level of innovation will be.

Norms of civic behaviour describe the general tendency of people in a society to cooperate and to subordinate self-interest for that of the society (Knack & Keefer, 1997). Such norms are said to act as informal mechanisms that limit predatory, self-interest behaviour and encourages individuals to exhibit higher care and concern for the public good. Norms of civic behaviour and associational activity often go together in many cases since individuals that are committed to the well-being of the local community or broader society may be more willing to participate in a variety of communal activities and expose themselves to others' views with the ultimate goal of reaching a consensus that is best for all. However, the two concepts are distinct

and do not necessarily evolve in the same direction. For example, Onyx and Bullen (2000) found multiple distinct components that collectively define social capital. In addition to trust, these components include items that speak to people's participation and involvement in local events and association, and norms of helping and good citizenship. The distinction between associational activity and norms of civic behaviour is further supported by a number of cross-cultural researchers. Hofstede (1991) and Triandis (1995), along with many others, discussed cross-national differences in collectivism-individualism. This cultural trait describes societies' preferred fundamental organisation, i.e. the individual versus the group. Across nations, differences were found in the degree to which people prefer to belong to cohesive groups. At the same time, Hofstede (1980, 1991) identified masculinity-femininity as a cultural attribute of societies. This variable addresses differences in whether societies value caring and concern for others, versus subordination of others needs and goals for one's own achievement. While, the two cultural variables discussed above differ conceptually from associational activity and norms of civic behaviour, we argue that at the societal level, the tendency to join formal groups, and the tendency for good citizenship are distinct constructs.

Furthermore, the distinction between associational activity and norms of civic behaviour is also supported by Olson (1984) who argued that the main objective of some regional or national associations is mainly the accomplishment of the members' self-interests rather than the overall well-being of the local community or society. This author found that associations can impose high costs on a society's well-being as they function as special interest groups that lobby for preferential treatments. Finally, while being a member of an association may provide a venue for civic engagement, an array of other options are available to individuals who consider being a good citizen and caring for the society's overall well-being as an important personal goal. In short, we confer that associational activity and norms of civic behaviour along with trust constitute three facets, or components, that collectively define social capital at the societal level.

Prior research has examined the role of 'being civic' at the company level as well as the societal level. For instance, Kilkenny, Nalbarte and Besser's (1999) study on small towns located in Iowa showed that civic participation in the community had a positive impact on business success. Similarly, Putnam (1993) argued that certain areas within Italy have become more economically prosperous compared to others because they were more civic, and, at the national level, Knack and Keefer (1997) found countries with stronger civic norms to have enjoyed more

economic growth in the period 1980-1992 compared to their less civic counterparts. Norms of civic behaviour may foster innovation directly through their effect on the exchange of ideas and knowledge, which has been regarded by numerous researchers as a facet of cooperative behaviour. For instance, Argyle (1991) argued that successful cooperation in work groups includes coordination, helping, communication, and division of labour. Along these same lines, Tjosvold (1988) identifies various dimensions associated with a cooperative relationship, including the exchange and combination of information. Tjosvold's view of cooperation provides a direct and parsimonious link to innovation, that is, where norms of civic behaviour are high, there is a higher tendency to share ideas and information (either within or outside formal groups), and consequently, knowledge transfer is expected to be more extensive. Therefore, given the positive effects of extensive and free flow of ideas and resources on innovation, we advance the following hypothesis:

Hypothesis 5: The higher the norms of civic behaviour within a country, the higher the country's level of innovation will be.

METHODOLOGY

Data and sample

In testing our hypotheses we use three secondary data sources. First, we assess the level of human capital using the Human Development Index (HDI) provided by the United Nations World Development Program. The Human Development Index is a composite of three basic components of human development within a country: life expectancy, educational level and standard of living. Second, we measure the level of *social capital* within a country based on the data provided by the World Value Survey. The World Values Survey is a worldwide investigation of socio-cultural and political change conducted by the University of Michigan and includes national surveys on the basic values and beliefs of the population in more than 65 countries. This survey complements the European Values Survey, first carried out in 1981. The wealth of data generated by the multiple waves of the survey have been widely used to investigate a number of phenomena at the country or national level. In addition to many other phenomena, the survey was used to investigate trust and well-being across nations (Inglehart, 1999), values and cultural

change (Inglehart & Baker, 2000), political and economic change (Basanez, 1993; Inglehart, 1997), nationalism (Dogan, 1994), and educational attainment (Doring, 1992). In general, these studies and many others, confirmed that important political, economic, social, and cultural phenomena are changing, and are doing so differently across nations. Our study leverages the third wave of the World Values Survey, which was carried out in 1995. The surveys in the countries were carried out through face-to-face interviews at home and in the respective national languages. Within each country, the sampling universe consisted of all adult citizens, with ages 18 and older. The sample size for each country ranges from about 600 to 3,000. Third, we assess country-level *innovation* from a database maintained by the World Bank. By using innovation data pertaining to 1998, i.e. three years later than the year in which human capital and social capital were measured, we effectively test for the causality of the relationships implied in our hypotheses. In short, we base our analyses on countries on which we had data on human capital, social capital and innovation. Our final sample includes 59 countries from all five continents, i.e. 30 countries in Europe, 12 countries in America, 3 countries in Africa, 13 countries in Asia, and Australia.

Constructs

Human capital: Several measures has been used to gauge individuals' human capital, such as the highest level of education, the amount of vocational training, one's age, and relevant management or industry experience (Hinz & Jungbauer-Gans, 1999; Guzman & Santos, 2001; Kilkenny, Nalbarte, & Besser, 1999). We measure human capital at the country level as the combination of three indicators covering the citizens' overall knowledge, economic resources, and physical well-being. More specifically, we represent a country's human capital as being represented as its citizens' educational attainment (i.e. a combination of the average years of schooling and literacy rate), average income, and longevity (i.e. life expectancy). Each dimension of this composite index has a value between 0 and 1, and reflects where each country stands in relation to this scale. For instance, the minimum for life expectancy is 25 years and the maximum 85 years, so the longevity component for a country where life expectancy is 55 years would be 0.50. The scores for the three dimensions are averaged in an overall index. The mean value is .80, with a standard deviation of .15. The Cronbach's alpha for this measure is .75.

We acknowledge that other dimensions such as professional and vocational training or industry-specific experience may be useful indicators of human capital as well. As mentioned earlier, prior research has argued that the level and quality of vocational training may foster a country's productivity and economic growth (Prais, 1995). Although we did not have access to country-level data pertaining to vocational training or overall relevant industry experience among a country's citizens, we checked for the validity of our human capital measure by examining its correlation with a proxy for a country's overall know-how pertaining to innovation, i.e. its relative number of scientists, engineers and technicians working on R&D related activities. We indeed found that a country's relative number of R&D-related professionals is positively related to its overall level of human capital ($r = .571$; $p < .001$) as well as to our human capital dimension 'educational attainment' ($r = .592$; $p < .001$).

Building on previous research on social capital at the country level, we measure social capital through assessing the levels of generalized trust, institutional trust, associational activity, and norms of civic behaviour (Knack & Keefer, 1997; Putnam, 1993; Paxton, 1999).

Generalized trust: Generalized trust is measured by asking the respondents: 'Generally speaking, would you say (1) that most people can be trusted, or (2) that you can't be too careful in dealing with people' (Knack & Keefer, 1997). Our generalized trust indicator is the percentage of respondents in each country that chose for the first option. The mean value is 28.6%, with a standard deviation of 14.0%.

Institutional trust: Institutional trust is measured by asking the respondents how much confidence they have in a variety of organisations or institutions, such as the legal system, the government or major companies (Knack & Keefer, 1997). The respondents could choose a number from 1 (a great deal of confidence) to 4 (no confidence at all). We reversed the scales so that larger values reflect greater institutional trust, and we averaged the values over all (sixteen) items. The mean value is 2.47, with a standard deviation of .20. The Cronbach's alpha for this measure is .88.

Associational activity: Associational activity is measured by asking the respondents whether they are an active member of various organisations, including professional associations and political parties (Knack & Keefer, 1997). The respondents could choose a number from 1 (active member) to 3 (don't belong). We reversed the scales so that larger values reflect greater

associational activity, and we averaged the values over all (nine) items. The mean value is 1.24, with a standard deviation of .22. The Cronbach's alpha for this measure is .94.

Norms of civic behaviour: Consistent with prior research (e.g. Knack & Keefer, 1997) we assess norms of civic behaviour by asking the respondents whether a list of five behaviours 'can always be justified, never be justified or something in between', e.g. 'accepting a bribe in the course of your duties,' or 'cheating on taxes if you have the chance'. The respondents could choose a number from 1 (never justifiable) to 10 (always justifiable). We reversed the scales so that larger values reflect greater norms of cooperation, and we averaged the values over the five items. The mean value is 8.70, with a standard deviation of .75. The low variation of this measure across countries may be explained by the respondents' reluctance to admit to cheating. The Cronbach's alpha for this measure is .86.

We find that associational activity and norms of civic behaviour do not covary (Table 1; $r = .094$, $p = .489$), which illustrates that these two dimensions of social capital are indeed different constructs. In order to further assess the discriminant validity between associational activity and norms of civic behaviour, we examine the correlations *among* the items measuring associational activity and norms of civic behaviour respectively, as well as the correlations *between* items measuring the different constructs. We find that all correlations *among* the items measuring associational activity are positive and significant (except for one correlation) at $p < .001$. Similarly, the correlations *among* the items measuring norms of civic behaviour are all positive and significant ($p < .001$). However, none of correlations *between* items measuring associational activity and norms of civic behaviour are significant. This finding further illustrates that associational activity and norms of civic behaviour are indeed different constructs.

We measure innovation by combining several dimensions related to the level of *technology-related* activities and output generated in a given country. Prior research has suggested several indicators to measure innovation, such as the amount of patents filed and used (e.g. Jaffe, 1989), the expenditures for research and development (Ritsilä, 1999), the number of innovations reported in trade journals and research periodicals (Acs, Audretsch, & Feldman, 1994), the use of industry-specific yardsticks (Smallbone & North, 1997), and self-reported data (Keeble, 1997). Further, some researchers have argued that countries with export-oriented firms may enhance their international competitiveness since such firms help to foster modernization and living conditions, especially if the focus is on technology-based export (Bianchi, 2001; Berry,

1997; Nadvi, 1997). Since many of the previously used dimensions for innovations have strengths and weaknesses (e.g. Kalantaridis & Pheby, 1999), we assess country-level innovation using a combination of three indicators. The first is the number of patents registered in a country for a given year; the second is the expenditures for R&D (as a percentage of a country's GNP), and the third is the volume of high-technology exports (relative to the total manufactured exports). These data were drawn from the Worldbank.

Number of patents: Some scholars have questioned the validity of the number of patents for innovation as this measure focuses on a rather narrow aspect of innovative activity, excluding product modifications as well as process innovation or activities such as fashion design (Kalantaridis & Pheby, 1999). Further, some previous researchers have argued that patent statistics are more appropriate for measuring inventions rather than innovation as many ideas patented never become viable products (Shane, 1992). However, we think that the number of patents is a valid measure for tapping a country's innovative output because this measure captures an important aspect of the level of *technological* activity, and because several fundamental conditions need to be fulfilled in order for an activity or invention to qualify for patent eligibility, e.g. the invention must be novel, useful, and exhibit an 'inventive step' in that it is non-obvious to practitioners skilled in the technology field (Evenson, 1984). Our measure for the number of patents is the aggregate of patents filed by residents and non-residents in a country. The mean value is 57,581, with a standard deviation of 71,259.

Expenditures for R&D: Our second measure of innovation assesses the level of investment made in R&D as a percentage of a country's GNP (Ritsilä, 1999). This dimension reflects the extent to which a country allocates resources to systematic activities aimed at increasing the overall stock of knowledge, including fundamental and applied research and experimental development work leading to new devices, products, or processes. The mean value of this measure across all 59 countries is 1.26%, with a standard deviation of .88%.

High-technology export: Our third technological innovation measure assesses the importance of a country's export of high-tech products relative to the total manufactured export. As mentioned earlier, some prior research has argued that a country's overall productivity and competitive posture depends on the ability to foster export among its firms (e.g. Berry, 1997). Therefore, we maintain that the extent to which a country's technological output is spread over the rest of the world, relative to its total export level, is an alternative indicator of how much

'innovative activity' is created and disseminated by a country. Because industrial sectors characterized by a few high-technology products may also produce many low-technology products, the identification of high-tech export is based on the calculation of R&D intensity (i.e. R&D expenditure divided by total sales) for groups of products, rather than industries. Our final measure is the ratio of a country's export in high-technology products to the total manufactured export. The mean value is 12.3%, with a standard deviation of 12.9%.

In order to assess the convergent validity of our several measures for innovation, we examine their correlations with each other. One way of assessing convergent validity is indeed measuring the extent to which different constructs of the same concept are correlated to each other (Babbie, 1990). We find that all three measures of innovation are positively (ranging between .351 and .694) and significantly ($p < .02$) correlated with each other (Table 1). Further, we also assess predictive validity by examining the correlations between our innovation measures on the one hand and a country's overall economic well-being (measured by its GNP) on the other hand. Again, we find that a country's GNP is positively (ranging between .323 and .723) and significantly ($p < .02$) correlated with all three innovation measures.

Country size: We include country size in terms of total population as a control variable since country-level innovation is also effected by the number of people within a country. Larger countries are characterized by more extensive exchange of all types of resources at multiple levels. Therefore, larger countries may generate more patents, involve in more R&D expenditures, and have more high-tech export compared to smaller countries. The mean value of this control variable is 75.05, with a standard deviation of 203.51.

Income gap: Prior research has argued that it is not as such the average income within a country that drives overall productivity but rather how well income is distributed among a country's citizens (Knack & Keefer, 1997). That is, it has been argued that in societies with high social polarization (i.e., with a large income gap between the 'rich' and the 'poor'), groups within the country are more willing to impose costs on society, are less likely to engage in high-quality relationships with others, and therefore ultimately hamper economic development. For instance, Knack & Keefer (1997) found a negative relationship between the level of trust within a society on the hand and the income gap on the other hand; however, these researchers did not find that the effect of the level of trust among a country's citizens on its overall economic wealth changed after the effect of the 'income gap' was taken into account. In order to examine whether social

polarization affects the impact of the level of social capital on a country's innovation, we include a country's 'income gap' as a control variable in some of the regression equations. Income gap is measured as the difference in income between a country's 'top 10% household group' and its 'bottom 10% household group.' The mean value of this variable is 25.69 with a standard deviation of 8.34.

RESULTS

An analysis of the bivariate correlation coefficients provides some interesting results (Table 1). First, human capital is positively correlated with the number of patents filed, expenditures in R&D, and high-technology export. Second, generalized trust and institutional trust are also positively correlated with at least one of the innovation measures. Interestingly, generalized trust and institutional trust are unrelated to each other, which illustrates that the levels of trust one has in other individuals versus institutions do not necessarily covary. Finally, associational activity, and to a lesser extent norms of civic behaviour, is unrelated to our innovation measures. As mentioned earlier, associational activity and norms of civic behaviour are unrelated to each other, which is an indication that these dimensions of social capital are separate constructs.

Insert Table 1 About Here

Hypotheses 1 to 5 are tested using multiple regression analyses. The results are summarized in Table 2. Hypothesis 1 is supported, in that we find a strong positive relationship between human capital and all three innovation measures. Further, partial support is found for Hypotheses 2 and 3: generalized trust and institutional trust are positively related to at least one of the three innovation measures, that is generalized trust positively affects the number of patents and the level of R&D expenditures whereas institutional trust has a positive effect on the level of high-technology export. In other words, it appears that the level of trust that one holds in other persons as well as in institutions to some extent encourages innovative activities within a country,

after controlling for population size. Further, we find only partial support for Hypothesis 4: there is a significant effect of associational activity on only one of our innovation measures, i.e. R&D expenditures. Finally, contrary to Hypothesis 5, we find a negative relationship between norms of civic behaviour and high-technology export. We also include income gap as a control variable in three additional regression equations and find that countries in which welfare is more equally distributed score higher on all three innovation measures, but the effect is only significant for R&D expenditures.

Insert Table 2 About Here

DISCUSSION

The results provide significant support as to the role of human capital as a catalyst for innovation. This is in line with our predictions which were based on theoretical support for the positive effects of human capital on a wide array of country-level outcomes including economic growth, productivity, and in this case innovation. In other words, although the beneficial effect of human capital on economic development may be based partly on the extent to which resources, experience and educational background are embedded in open interactions within a specific community or region, we find that the overall level of human capital across all individuals within a *country* positively impacts overall innovative activity.

The results with respect to social capital are mixed. These findings support the idea that proxies for social capital, widely used in the literature, do not necessarily constitute a set of coherent indicators and may not work in a similar way. The results also support the idea that places with only high levels of social capital do not prosper when human capital is weak. Prior researchers have indeed noted that social capital does not necessarily have a positive impact on economic development (Portes, 1995; Portes & Sensenbrenner, 1993; Woolcock, 1998). For instance, some communities or regions may possess too much social capital in that tightly-knit groups may impose significant constraints on the members of local communities which inhibits

these members' attempts to join larger, more extensive, and perhaps more innovative networks (Woolcock, 1998).

The results of our analysis confirm the important role of trust as a driver of innovation. By facilitating exchange and reducing the need for time consuming and expensive monitoring, trust fosters more extensive and unconstrained cooperation, freer exchange of information, which may ultimately lead to more R&D related activities and inventions (Jones, & George, 1998). The strong positive association between institutional trust and high-tech export may be explained by the role of government agencies and chambers of commerce in promoting and stimulating export of high-end technology-based products. Overall, our results are in line with previous research that has consistently underscored the value of trust to individuals, organisations, and societies (Fukayama, 1995; Putnam, 1993).

As mentioned earlier, in order to test whether and how the distribution of wealth within a country affects the impact of social capital (especially trust) on innovation, we also included a country's income gap (i.e. the income difference between the 'top 10%' and 'bottom 10%' households) in three additional equations (Table 2). We found that the positive impact of generalized trust on innovation diminishes significantly when the effect of income gap is taken into account. This finding suggests that high income differences within a country's borders do not only decrease the extent to which its citizens trust each other (cf. the negative and significant correlation $r = -.459$, $p < .001$ between both constructs, Table 1), but also that even in countries where individuals *do* trust each other, high income differences between the 'rich' and the 'poor' may hamper innovative activity. An important implication is that policy makers may need to develop policies that do not focus solely on supporting a limited group of the population or particular industries, but also on examining how welfare can be distributed in a more equal way across the population within a given community, region or country.

The positive relationship between associational activity and only one of our innovation measures (i.e. R&D expenditures) may be explained by the fact that membership of and participation in associations is often a local activity whereas we measured innovation at the societal level. A related possible explanation for the weak relationship between associational activity and innovation lies in the potentially conflicting influences of associational activity on economic growth in general, as suggested by prior research (e.g. Knack & Keefer, 1997; Portes & Landolt, 1996). That is, whereas a rich associational life within a country may foster habits of

cooperation and solidarity among its population, and therefore lead to economic success (Putnam, 1993), the potential conflict of the goals of smaller groups within society with goals of other groups may diminish the overall effect of associational activity on economic performance at the country-level (Knack & Keefer, 1997). In other words, many associations may work as special interest groups that lobby for preferential policies and protection of the status quo, and therefore hamper risky, innovative activities. As mentioned earlier, prior research has indeed suggested that strong, tightly-knit groups may hamper economic development by protecting a disproportionate part of natural resources or by inhibiting individuals' personal advancement and posing strong personal obligations on them (Portes & Landholt, 1996). It can be noted that this phenomenon has also been found by researchers in the field of organisational behaviour. For instance, in his study of intergroup conflict, Sherif (1958) found that high levels of identification with a particular group may often foster animosity and hostility against other groups.

Similarly, the relationship between norms of civic behaviour and innovation is very weak and even negative for one of our innovation measures (i.e. high-technology exports). One possible explanation could be that adherence to norms that reflect the general tendency of 'being a good citizen' is generally contradictory to the general willingness to deviate from existing rules and procedures that has often been shown to be necessary for innovative activities. Radical innovation often entails risky decisions since the costs related to innovation are high and the market success of radical new products is uncertain (Zahra, 1993). Also, innovations often require proactive behaviour in that aggressive actions are undertaken by firms which challenge the rules of competition in an industry and the industry's well-established leaders (Lumpkin & Dess, 1996). Such 'aggressive actions' may indeed involve decisions that are not readily accepted by the norms within a society. For example, the rise of privately-owned start-ups in China may have led to greater national development and may have improved the country's competitive position in high-technology sectors. However, such start-ups were often not regarded as a respectful and wise career path as they did not belong to the standard, though widely constraining network of public enterprises (Gargiulo & Benassi, 2000).

LIMITATIONS AND DIRECTIONS FOR FUTURE RESEARCH

In this study we test a model that speaks to the role of human capital and social capital in fostering innovation at the country level. While we believe our investigation provides additional insight as to the societal benefits of these two forms of capital, one should be aware of a number of limitations. First, significant within-country variations in the levels of human and social capital often exist and lead to disparities as to the benefits generated to regions and communities within a given country. So while Putnam (2000), Paxton (1999), Nichols (1996), Knack and Keefer (1997), Wong (1998) and Hyden (1997), among others, discussed social and/or human capital at the societal level (e.g. United States, Russia, Former socialist Czechoslovakia), many authors have shown how within-country, community, and industry variations in the levels of one or both forms of capital lead to differences in the value generated (Putnam, 1993; Onyx & Bullen, 2000; Pennings & van Witteloostuijn, 1998).

Second, in operationalizing our three constructs, human capital, social capital, and innovation, we used secondary data sources published by academic and international organizations. As is often the case, secondary data do not perfectly cover the domains of the constructs they attempt to measure. For example, individual-specific human capital, the focus of this study, has been defined as the knowledge that persons hold that is applicable to a broad range of domains. Prior research has used a number of proxies to operationalize this construct including managerial and entrepreneurial experience, level of academic education, vocational training, age, and income among others (Hinz & Jungbauer-Gans, 1999; Guzman & Santos, 2001; Kilkenny, Nalbarte, & Besser, 1999). In this study, our measure of human capital at the country level includes three facets. These are the citizens' overall knowledge, economic resources, and physical well-being. Consequently, our measure does not fully capture prior experience and vocational training that have been advanced as proxies for human capital. Furthermore, while economic and physical well-being may be seen as a consequence of educational attainments, we believe that their use as proxies provides a more complete picture of the human potential to innovate.

In summary, in this paper we propose a model of human capital, social capital and innovation at the societal level in which human capital and social capital are posited to increase innovation. The support for the relationship between human capital and innovation is strong, and

that for social capital and innovation is mixed. We believe that more research is needed on the role of human capital and social capital in fostering innovation within and across societies. For instance, our indicators of innovation are biased towards technology-based innovation activity and exclude other forms of innovation in domains that are either non-science based or are process-type innovations. Future researchers may also examine more in-depth the nature of the relationship between social capital and human capital. For instance, one could argue for a recursive positive relationship between social capital and human capital (Coleman, 1988; Gradstein & Justman, 2000; Serageldin & Dasgupta, 1999). That is high levels of social capital may be expected to enhance one's chances to further his or her skills, ability, and education. Likewise, one's own education and well-being can also lead to greater involvement in associations and greater access to others with resources. Future longitudinal studies may shed more light on the nature of the relationship between human capital, social capital, and success of societies. Finally, the question of how and why the two forms of capital create value differently across different cultures and regions remains an area that warrants further investigation.

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TABLE 1:

Means, standard deviation, ranges, coefficients alpha, and correlations of the variables

		1	2	3	4	5	6	7	8	9	10
1	Human capital										
2	Generalized trust (%)	.399** (.002)									
3	Institutional trust	-.427*** (.001)	.067 (.613)								
4	Associational activity	-.389** (.004)	-.051 (.711)	.411** (.002)							
5	Norms of civic behaviour	-.048 (.725)	.207 (.120)	.301* (.022)	.094 (.489)						
6	Population (million)	-.321* (.038)	.227^{+} (.084)	.243^{+} (.064)	-.018 (.893)	.209 (.115)					
7	Income gap	-.307* (.038)	-.459*** (.001)	.145 (.336)	.210 (.176)	.113 (.458)	.173 (.249)				
8	Number of patents	.461*** (.000)	.472*** (.000)	-.008 (.954)	-.071 (.619)	.244^{+} (.075)	.027 (.844)	-.261^{+} (.091)			
9	R&D expenditures (% of GNI)	.619*** (.000)	.662*** (.000)	-.126 (.394)	.093 (.543)	.155 (.299)	-.122 (.408)	-.464** (.002)	.694*** (.000)		
10	High-tech export (% of total export)	.286* (.040)	.312* (.024)	.421** (.002)	-.059 (.689)	.008 (.958)	.032 (.820)	.057 (.716)	.396** (.004)	.351* (.017)	
Mean		.80	28.55	2.47	1.24	8.70	75.05	25.69	57,581	1.26	12.27
Stand. deviation		.15	13.96	.20	.22	.75	203.51	8.34	71,259	.88	12.86
Minimum		.37	5.00	2.07	1.07	5.51	1	13.10	226	.03	.00
Maximum		.96	63.90	3.37	2.27	9.80	1,239	46.60	417,974	3.76	71.00
Alpha		.75	-	.88	.94	.86	-	-	-	-	-

N=59. *** $p \leq .001$, ** $p \leq .01$, * $p \leq .05$, $^{+}$ $p \leq .10$; two-tailed tests.

TABLE 2:

Regression tests

Dependent variable →	Number of patents		R&D expenditures (% of GNI)		High-tech export (% of total export)	
H1: Human capital	.410* (.013)	.565** (.010)	.525*** (.001)	.724*** (.000)	.491** (.002)	.512** (.005)
H2: Generalized trust	.252^{+} (.060)	-.015 (.47)	.415** (.002)	.035 (.43)	.083 (.29)	.081 (.36)
H3: Institutional trust	.045 (.39)	.031 (.44)	.051 (.33)	.063 (.32)	.635*** (.000)	.713*** (.000)
H4: Associational activity	.018 (.45)	.078 (.35)	.149^{+} (.096)	.410** (.005)	.082 (.25)	.194 (.12)
H5: Norms of civic behaviour	.095 (.25)	.141 (.21)	.031 (.39)	.057 (.33)	-.365** (.003)	-.514*** (.001)
Population	.069 (.33)	.211 (.16)	-.038 (.38)	.149 (.16)	.112 (.22)	.138 (.21)
Income gap		-.223 (.13)		-.390* (.013)		-.112 (.28)
Adjusted R^2	.241	.211	.574	.627	.425	.471
F-value	3.642** (.005)	2.487* (.037)	10.89*** (.000)	9.901*** (.000)	6.909*** (.000)	5.957*** (.000)

Coefficients are standardized beta weights. *** $p \leq .001$, ** $p \leq .01$, * $p \leq .05$, $^{+}$ $p \leq .10$; one-tailed tests.