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The Influence of Social Capital on Cluster-Based Knowledge Sharing and Value Creation: An Empirical Analysis of the Hsinchu Science-based Industrial Park in Taiwan

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ABSTRACT

Geographic location not only connects dispersed companies and institutions across vertical and horizontal value activities, but also influences specialization benefits, procurement, technology diffusion, and public policy support. Those studying cluster networking and knowledge management usually emphasize the importance and antecedents of a cluster economy; however, a social capital perspective is sparsely employed when researchers looked into knowledge sharing and value creation. Social capital is usually defined as an asset that exists in social relations and networks. This paper intends to examine a cluster's value creation by employing the concept of social capital. While social capital and value creation is respectably set as the independent and dependent variable, knowledge sharing is set as the mediator to clarify the cause and effect. Because the Hsinchu Science-based Industrial Park (HSIP) in Taiwan is famous for its state-of-the-art technology in world competition, it is selected as the research sample. This study uses Structural Equation Modeling to test the hypotheses. Empirical results reveal a good overall fitness of the research framework. Social capital is found to significantly influence knowledge sharing and value creation, while knowledge sharing is confirmed to yield higher productivity and innovation.

Keywords: cluster, Hsinchu Science-based Industrial Park (HSIP), social capital, knowledge sharing, value creation

I. INTRODUCTION

A cluster is the aggregation of enterprises within an adjacent geographic region and industry (Schmitz, 1992). Companies, whether of a homogeneous or heterogeneous industry, experience business operation advantages due to geographic proximity (Doeringer & Terkla, 1995). Several related organizations engaging in different value activities are found within a cluster. Participants such as parts suppliers, infrastructure service providers, intermediaries, academic institutions, and others collaborate to increase information and upgrade technology.

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By examining how a high-tech cluster is born, Porter (1990) deduced four strategic factors that influence the formation of a cluster and competitiveness. These are high quality human resources, technological infrastructure development, knowledge resources, and financial capital. Following this concept of four strategic resources, Sabourin & Pinsonneault (1997) analyzed the structure of Canadian high tech clusters and found that human resources in particular play a pivotal role in cluster development and determine competitiveness. While intangible knowledge assets are crucial to sustain competitive advantages, the extent to which the technological infrastructure develops indicates a cluster's capability for producing new products and R&D techniques. To speed up a company's technology development and product commercialization, it is also necessary to leverage its financial capital.

Luger (1992) proposed that a high tech industrial cluster is usually developed for two reasons. First, it is a 'naturally born' geographic concentration of an industry due to market competition. Secondly, it is a 'planned development' guided by government efforts to eliminate the industrial entry barriers and attract companies to locate within a planned area. Bahraml & Evans (1995) further examined the case of high tech industrial clusters in Silicon Valley in the United States, and identified six mutually-related determinants of cluster growth, namely academic research institutions, joint venture capital, a supportive infrastructure, high-quality human resources, entrepreneurship, and lead users. These determinants are believed to guide successful cluster development. Olson (1998) contended that the phenomenon of strategic clustering could drive the rapid transformation of community development from a resource-based economy to a technology-based economy. In addition, the development of core capabilities in a technology-based economy relies on another four resources possessed by a cluster community. These resources, namely a skilled workforce, colleges and R&D centers, transportation and communication infrastructure, and a high quality of life, must be leveraged to enhance the growth of a high tech industry.

Anderson (1994) categorized the relationships between firms in a cluster into three types from the perspective of individual efficiency and competitiveness. These types are the relationship between buyers and suppliers, the relationship between competitors and collaborators, and the relationship between resource

providers and receivers. Feser & Bergman (2000) indicated that an industrial cluster, where groups of related companies gather, encompasses at least one or more of the following dimensions: formal input-output or buyer-supplier linkages; geographic co-location; shared business-related local institutions; and evidence of informal co-operative competition. When scrutinizing a high tech industrial cluster in Taiwan, Cheng (2001) divides the relational types into geographic proximity, inter-firm vertical integration, inter-firm horizontal competition, and inter-firm horizontal cooperation.

Companies are mutually bounded and interdependent in a cluster. Porter (1990) demonstrated that though differences as well as conflicts may exist between these companies, more merits, such as efficient interactive mechanisms, knowledge flow, and collaboration, would develop by virtue of the relationships. Grounded on frequent and long run interactions, companies would learn to share norms and a sense of trust which thereafter would facilitate the acquisition of other parties' valuable resources and knowledge. Only under such circumstances will companies be able to remove obstacles in the knowledge transfer process and to receive tacit knowledge or techniques from their partners (Wu, 2000). The more frequent the knowledge flow is, the easier it would be to motivate creative ideas (Sternberg & Lubart, 1995; Yli-Renko et al., 2001).

In a knowledge-based economy that focuses on speed, linkages, and intangible business value creation, knowledge has replaced traditional assets, such as physical land, labor, and financial capital, as the key of business core competencies. To create continual competitive advantages, organizations have to keep on developing or learning new knowledge (Grant, 1996). However, knowledge itself does not promise innovation, but the capability of leveraging knowledge assets does. Unlike a static stock, knowledge can flow between providers and demanders (Holtshouse, 1998) in order to reinforce business value and raise organizational competitiveness. Once barriers emerge in the knowledge flow system, market operation would become inefficient. This study deduced from previous studies that obstacles to knowledge flow include: the knowledge gap between knowledge provider and demander (Leonard-Barton & Spensiper, 1998), knowledge monopolization by specific organizations (Szulanski, 1996), information asymmetry (Teece, 1998), mindset gap, lack of trust (Davenport &

Prusak, 1998), lack of informal interaction and learning, lack of common consensus (Brown & Duguid, 1998), and inadequate organizational culture (Dixon, 2000).

Unlike products that can be freely delivered, knowledge has to be shared and utilized through certain mechanisms. This is because knowledge sharing is a dynamic process involving 'teaching and learning' (O'Dell & Grayson, 1998; Verkasalo & Lappalainen, 1998). In other words, participants can transfer knowledge to those who demand it through the process of socialization, education, and learning. The transferred knowledge, after being absorbed and comprehended, can strengthen organizational capabilities and in turn upgrade business performance and value (Joanne, 2000). As Appleyard (1996) asserted, knowledge sharing that involves the communication and exchange of know-how is concerned with a sophisticated socialization procedure in which social activities and cooperation are the main issues (Stallkamp & Hanke, 2003). Tacit knowledge embodies plans, decisions, learning, innovation, controlling, and coordination, and requires an adequate learning environment and multiple sharing conduits. These mechanisms can be helpful in encouraging knowledge participants' own initiative and responsiveness, eliminating communicating gaps, accelerating knowledge dissemination (Lahti & Beyerlein, 2000), and increasing overall competitiveness as well as innovation (Rogers & Larsen, 1984; Powell et al., 1996; Maskell, 2001; Saxenian & Hsu, 2002).

Owing to the knowledge characteristics of uniqueness, tacitness, externality, and complexity, knowledge sharing activities greatly rely on an organization's social capital. Organizational members can make good use of the relationships and norms rooted in social capital to integrate network resources and appropriate knowledge. Thereafter, organizations can decrease the transaction cost incurred in the process of knowledge exchange, which in turn facilitate organizational learning and value creation (Nahapiet & Ghoshal, 1998; Tsai & Ghoshal, 1998). Facing a capricious industrial environment and the challenge of low profits, companies in a cluster have to leverage their network structure and relationships embedded in social capital to foster a shared cognition and trust which can facilitate resource exchange and knowledge sharing. Furthermore, by utilizing social capital, cluster participants can also extend their external network boundaries as well as strategic

relational boundaries. Therefore, they not only broaden their perspective, but also improve business value in terms of creativity and innovation (Uzzi, 1996; Perry-Smith & Shalley, 2003).

Social capital is defined as the aggregate of resources available in and through the relational networks possessed by an individual, group, or social entity (Nahapiet & Ghoshal, 1998; Tsai & Ghoshal, 1998). It also signifies the tangible and intangible resources created by network participants who make good use of their social relationships and network structure (Gabbay & Leenders, 1999; Alder & Keok, 2000). Regarded as an activator of knowledge flow, social capital resembles resources embedded in network relationships. Participants frequently interact with one another and thereby reinforce mutual trust and trustworthiness that are favorable in eliminating opportunistic behavior. In other words, cluster members would not have to be wary of being hurt by one another and would be more willing to share their distinctive knowledge. Through knowledge sharing and organizational learning, cluster participants would benefit from collaborative activities and finally increase the innovativeness and productivity of a cluster (Wolfe, 2002).

With regard to cluster theories, past studies have focused on the determinants and different types of clusters, rather than explored a cluster's value creation from the perspective of social capital and knowledge sharing. In view of the importance of social capital in building trust and relational connection, this study employs the concept of social capital to examine how it influences value creation through knowledge sharing. Specifically, social capital would extend information contacts and conduits through the relational networks of companies in the same industry or from heterogeneous industries. That is to say, companies with a higher level of social capital would be more likely to mobilize multiple resources to achieve goals (Coleman, 1990). In addition, participants involved in the network would mutually trust and collaborate with each other based on a shared vision and value concept (Fukuyama, 1995). The opportunity to interact with other participants, particularly from external communities, would not only motivate cluster members to get rid of existing frames of thought, but also provide them with a platform to share ideas for technological innovation (Morrissey et al., 2003). For this reason, this study integrates theories of social networks, transaction cost, knowledge management,

and organizational learning using the Hsinchu Science-based Industrial Park (HSIP), the top-notch cluster in Taiwan, as the research sample. This research also clarifies the relationships between variables of social capital, knowledge sharing, and value creation in a cluster. At the same time, a thorough questionnaire investigation is conducted to collect first hand information from companies in the HSIP. This research applies the Linear Structural Relation (LISREL) to test the hypotheses, expecting to obtain valuable results and thus provide strategic suggestions to cluster participants.

II. Literature Review and Hypothesis

Social capital is rooted in social relationships, social structure, and social systems that embody general principles, norms, obligations, reciprocity, mutual understanding, trust, and common values. It can govern the network participants' behavior and encourage cooperation to reach individual or collective ends (Narayan, 1999). Reviewing prior research regarding social capital, Woolcock (1998) identified three facets of the studies: the Macro level perspective, the Micro level perspective, and the Meso level perspective. Each level of social capital involves indispensable components in driving social and economic development (Cook & Will, 1996).

Social capital at the macro level pertains to norms, reputation, diplomacy, trade, and national roles (Halpern, 2001). In other words, it is not only the social interactions and networking between countries, societies, and groups, but also shared capital in terms of group structures, consciousness, spontaneous behaviors, and mutual trust (Coleman, 1988; Putnam, 1995; Fukuyama, 1999). On the other hand, social capital at the micro level puts emphasis on individual or organizational capabilities to exchange resources and information (Nahapiet & Ghoshal, 1998; Leana & Van Buren, 1999; Lin, 2001). Based on love, concern, reciprocity, and shame, these social relationships develop between individuals and organizations. Finally, social capital at the meso level focuses on the development of a regional social economy. It highlights the relatively beneficial status or location that an individual occupies in the structure. Network participants with social capital at this level can enhance the efficacy of information flow by virtue of their network

density and mutually understanding relationships (Burt, 1997; Morrissey et al., 2003). Since this study attaches much importance to the building of relational networks between firms within a cluster, the meso level is examined in order to interpret the content of social capital in a cluster.

Practitioners have examined social capital in various analysis units as follows. (1) Countries: Putnam (1993) argued that social organizations can utilize social capital to promote collaborative activities such as trust, reciprocity, and network relationships, and in turn, effectively amplify common benefits. (2) Groups: Fukuyama (1995; 1999) defined social capital as the ability of people to co-work in a group or an organization for collective ends. It also signifies the radius of trust, informal norms, and communal value concepts that reside in society or specific groups and which drive collaborative activities. (3) Industries: Social capital is born of the industrial network established through interaction with other firms (Baker, 1990; Walker et al., 1997). (4) Organizations: Inter-organizational members, through successful and effective collective activities, enjoy collective goal orientation and shared trust. Therefore, social capital possessed by an organization would not only foster intellectual capital (Nahapiet & Ghoshal, 1998), but also benefit the organization and its participants (Leana & Van Buren, 1999). (5) Individuals: While Coleman (1990) defined social capital as an interpersonal relationship network, that is, the linkages with others, Lin (1999) further contended that an investment in social capital could assist individuals in obtaining opportunities of employment or job promotion.

Gittel & Vidal (1998) classified social capital as bonding social capital and bridging social capital. While the former represents the inner network structure, the latter resembles the external structure. Woolcock (1998) added another category, named linking social capital, to symbolize the relationships established with authorities or public institutions. This study aims to explore the relationships between inter-organizational social capital, knowledge sharing, and cluster value creation. As a result, this research takes into consideration the current social interactions in clusters and employs the categorization of Woolcock & Narayan (2000), Adler & Kwon (2002), and Morrissey et al. (2003), classifying social capital as bonding, bridging, and linking social capital.

Bonding social capital, also termed the inner social capital, attaches importance to the level of network connectivity and density. It coordinates individuals to establish norms, trust, and shared value concepts so that all network participants are able to cohere and cooperate to accomplish collective goals (Putnam, 1993). Grounded upon similarity, informality, and familiarity, the concept of bonding social capital resembles the strong ties in relational social capital. That is to say, the extent to which network participants connect with each other is likely to influence the level of group cohesiveness and their efforts in the pursuit of common goals (Adler & Kwon, 2002). This would further moderate the social coordination between individuals.

Bridging social capital, also named the external social capital, represents the interplay and engagement between different communities. It consists of the resources attached to the social network (Adler & Kwon, 2002). Similar to the structural hole that has received attention in structural social capital; the concept of bridging social capital implies the capability of individuals to get external benefits based on their managerial competence and adaptability to the organizational environment. Bridging social capital may be characterized by network overlapping which implies that a participant of one group may also draw resources from other groups due to his/her multiple identities in other communities.

Finally, linking social capital refers to interaction with voluntary organizations, resource agencies, and policy makers (Morrissey et al., 2003). It accentuates the relationships between a community and other independent institutions, including public organizations, schools, research institutions, and non-profit organizations. Linking social capital is helps a community to establish resource linkages with other institutions and influence policy enactment.

1. The Influence of Social Capital on Knowledge Sharing

Like physical capital or human capital, social capital is a productive resource used to facilitate business operation (Gulati et al., 2000). Even under uncertain circumstances, social capital is viewed as a long-term profitable asset. In addition, social capital does not experience depreciation and requires time as well as commitment to sustain its growth and quality (Alder & Kwon, 2002). Furthermore, social capital belongs to all network participants rather than private individuals.

Unlike other capital which can be created alone and exchanged freely, social capital can create value only through interactions; that is, enterprises have to keep constant formal or informal interactions with other parties and make good use of network resources or relational capital (Kale et al., 2000) to encourage knowledge sharing between organizational members.

Lin (2001) deduced that the function of social capital is to accelerate information flow, to influence individual behavior, and to establish social credentials with a view to increasing communal identification and reinforcement. Social capital can encourage collaborative activities held by organizational members to effectively achieve collective benefits. Unlike general tangible resources, knowledge is hard to acquire through market mechanisms. Since knowledge owners may be wary of losing status and power by sharing valuable knowledge with others, a large amount of invisible transaction costs could exist. Granovetter (1985) and Gulati (1995) pointed out that with abundant social capital, knowledge contributors and receivers would be able to establish mutual trustworthiness along with frequent social contacts and cooperative relationships. This would help avoid opportunism and reduce monitoring costs. Knowledge contributors would thus be able to exchange and share important resources under the premise that intellectual property rights are ensured and guaranteed.

Social capital is accumulated through long-term interactive and cooperative activities, through which cluster participants with similar backgrounds, characteristics, benefits, and opinions gather and foster a shared vision. Bonding social capital, an adhesive in a community (Putnam, 2000), would ultimately lead to a higher extent of trust and sense of identification. Undoubtedly, it acts as an information filter, sifting unnecessary messages out (Shipilov & Danis, 2002). It cracks down on improper behavior that violates communal norms, keeping cluster participants away from tricks and maneuvers and thus effectively diminishes the potential transaction costs of knowledge sharing in a community (Fukuyama, 1995; Wolfe, 2002). Therefore, participants in a cluster can learn through seamless and frequent social interactions, foster perennial relationships founded on trust and trustworthiness, be willing to actively exchange resources and knowledge, and in turn deepen the scope and frequency of knowledge flow (Yli-Renko et al., 2001).

Companies are supposed to access necessary resources by building strong ties with those engaging in the same industry. Through formal and informal networks, they establish bonding social capital for collaboration and knowledge sharing. However, to activate more knowledge, cluster participants must build connections spanning different domains or industries where they can retrieve best practices and new technologies for incremental or radical innovation. The intersection and integration of different domains is more likely to stimulate innovative ideas because it usually breaks the original thinking framework and helps participants jump out of traditional strategic models (Frans, 2005). A loose and open structural position would provide cluster participants more opportunities to access external resources and multiple channels for knowledge (Burt, 2000). Compared with the strong ties that strengthen the common norms and mutual trust in bonding social capital, weak ties allow bridging social capital to encompass relatively heterogeneous participants and to be open for multiple perspectives.

Linking social capital, embedded in the relationships with those who possess political power, authority, or sufficient financial capital, entails more resources from external public organizations. For example, if cluster participants hold high amounts of linking social capital, it would be more likely for them to influence the direction of policy enactment and government or industrial association support funds. Additionally, cluster participants could also acquire high quality human resources and knowledge by cooperating with academic or research institutions. This would encourage breakthroughs in R&D or basic research and help cut down the possible costs incurred in innovation (Woolcock, 2001). As far as the HSIP is concerned, these academic institutions conclude National Tsing Hua University, National Chiao Tung University, and the Industrial Technology Research Institute. Other external public associations, non-profit institutions, and policy makers who hold authority and financial power include Monte Jade Science & Technology Association of Taiwan, the K. T. Li Foundation for the Development of Science and Technology, the Association of Industries in Science Parks, the Taiwan Semiconductor Industry Association, the Chinese Professional Management Association of Hsinchu, the Taiwan Nanotechnology Industry Development Association, the Taiwan Biotech Association, and more.

In summary, bonding social capital, bridging social capital, and linking social capital together will provide multiple and convenient media for cluster participants to communicate and learn from. They also open the scope of knowledge through direct or indirect 'networks', reciprocal 'norms', communal 'beliefs', 'principles' for coordination, and 'trust' mechanisms. An atmosphere filled with concern, trust, and commitment would form a context which could reduce opportunistic behavior. Cluster participants would then be willing to exchange knowledge resources and in turn increase the efficiency of organizational learning as well as knowledge exchange (Fukuyama, 1995; Dyer & Singh, 1998; Rousseau et al., 1998; Alder & Keok, 2000). As a result, this study infers the following hypothesis:

H_1: The extent of social capital that cluster participants have developed is positively related to the extent of knowledge sharing in the cluster.

2. The Influence of Social Capital on Cluster Value Creation

While Coleman (1990) argued from the social network perspective that network density represents the average relational strength between network participants, Wasserman & Faust (1994) further expounded that a higher extent of network density usually symbolizes frequent interactions between each actor. That is to say, network actors occupying a central position of dense connections with other parties would have more opportunities to exchange information and resources. Burt (1997) pointed out that network ties offer network participants three advantages, namely the 'access' to catch valuable information, the 'timing' in acquiring information, and the 'referral' ability to search information. As a result, cluster participants often consider trust partnership the priority when they interact with one another, whether formally or informally (Crosby et al., 1990). Due to a sense of justice and reciprocity, cluster participants would not attempt to take advantages of their partners for private benefits. Instead, in the pursuit of collective goals, they limit improper behavior, enhance interactive relationships, and together contribute to knowledge creation (Hakansson & Snehota, 1995). In other words, mutual understanding and trust encourage them to share important information and knowledge (Wasserman & Faust, 1994), which in turn strengthens the relational

rent as well as dynamic business capability (Kale et al., 2000; Gnyawal & Madhavan, 2001).

Norman & Ramirez (1993) asserted that customer value is created through interactions and involvement of both consumers and collaborators. In particular, when a cluster is formed, the embedded bonding social capital can help individual firms in the cluster to acquire more resources which would then bring higher economic benefits and value. Particularly those who locate in a dense social network would be more likely to trust one another based on common norms. An invisible hand would then emerge to prohibit opportunistic behavior, reduce information searching time, increase knowledge exchange channels, and thereby upgrade knowledge learning efficiency and innovativeness (Gulati, 1998). In addition, the common languages, principles, and approaches for communication form a shared context. This shared context can eliminate perception obstacles and egoism (Wolfe, 2002), which is quite helpful to push the transfer of best practices as well as integrate network resources and productivity (Zaheer et al., 1998; Alder & Kwon, 2002).

The forming of a cluster usually implies the aggregation of key technology, information, relationships, and infrastructure in a certain region. To undertake a recession in the economic cycle and acute industrial competition, cluster participants, as part of a value chain, have to respond flexibly against environmental changes. They are forced to innovate due to the market competition (Porter, 1990). As Darwin's ideas of 'natural selection' and 'survival of the fittest,' companies in a high tech industry could be knocked out if they cannot keep pace with industrial change. To reach a 'blue ocean,' these companies have to search opportunities for value innovation, such as bringing in new technologies from another domain or resorting to strategic alliances. In other words, the bridging social capital of a firm may broaden its contact with diverse knowledge and at the same time motivates a firm to be creative. The integration of new ideas may be positively related to innovation (Porter, 2001).

Social capital and knowledge resources play a pivotal role in creating business value. Intra-cluster firms with rich linking social capital are more likely to access external resources because of their connections with governments, academic institutions, and other public associations (Woolcock & Narayan, 2000). By

maintaining good relationships with them, companies in a cluster can inform the government of their difficulties and needs encountered in economic development. Cooperating with academic institutions is a good way for cluster participants to foster the high quality talent that is indispensable to pushing the growth of a cluster. Therefore, this research infers the following hypothesis:

H_2: The extent of social capital that cluster participants have developed is positively related to the cluster's value creation.

3. The Influence of Knowledge Sharing on Value Creation

There has been disagreement in scholars' viewpoints on knowledge transfer. Most researchers, however, agree that knowledge, rooted in personal or communal beliefs, past experiences, and value concepts, is difficult to become formal and specific documents owing to its tacit-ness (Nonaka & Takeuchi, 1995). Moreover, knowledge usually belongs to a large number of different individuals and groups. Each kind of knowledge entails multiple domains, which intensifies the complexity and ambiguity of knowledge. This makes knowledge hard to comprehended or share (Winter, 1987), increasing barriers in knowledge transfer (Hedlund, 1994; Simonin, 1999).

Knowledge is a key for businesses to keep continual competitive advantages (Nonaka, 1994). Hansen (1999), Loebecke et al. (1999), Lee & Al-Hawamdeh (2002) all indicated that whether or not experts engage in knowledge sharing on their own initiative, the knowledge-sharing behavior is determined by the potential benefits and costs predicted. In viewing the possible barriers of knowledge sharing, practitioners have identified some reasons for which people are unwilling to share their know-how: the concern of losing face, the concern of losing power, the concern of divulging truth, insufficient experience, the lack of incentives, and the attitude of regarding knowledge sharing as redundant or extra work (Disterer, 2003). Undoubtedly, social obstacles including a conservative attitude, different language, different recognition (Fahey & Prusak, 1998), and hierarchy systems may also hinder communication and cooperation and so reduce the possibility of knowledge sharing.

Drucker (1985) noted that innovation is the capability to create wealth by leveraging resources and knowledge. Maskell (2000) delineated that in a knowledge economy, the most prominent benefit of a firm is derived from common cognition and knowledge exchange. Since knowledge transfer among intra-cluster firms is often hindered due to knowledge stick-ness, knowledge transfer performance becomes inconspicuous. To upgrade the efficiency and effectiveness of knowledge transfer, both knowledge contributors and receivers have to express their willingness to share knowledge and carefully choose the best ways to transfer knowledge by utilizing certain efficient instrument or procedures (Szulanski, 1996). Companies should build a knowledge management platform where strategies, mechanisms, cultures, and technologies can be effectively integrated.

The infrastructure of digital communication technologies has brought intra-cluster firms the advantage of holding knowledge networks by efficient knowledge searching, knowledge delivering, and collaboration (Gottschalk, 2000). It also removes barriers of time and space and makes knowledge sharing more efficient by simplifying as well as systematizing the process of knowledge transfer (Wijnhoven, 1998; Hendriks, 1999; Roberts, 2000), but it cannot do the same things for tacit knowledge. By contrast, official and informal interactions among network participants, such as conferences, lectures, practical training, inspection, picnics, and so forth, are favorable for tacit knowledge transfer. This is because face to face experience sharing could be the best way to explain details and reach a mutual understanding. Such interactions not only reduce communication costs, but also raise learning efficacy. Therefore, participants are able to improve their responsiveness towards potential defects, manufacture delays, or organizational change, which in turn improves decision quality, operation efficiency, and cluster competitiveness (Nelson & Cooprider, 1996).

Innovation often resides in knowledge gaps (Powell, 1996) and therefore more and more organizations recognize the contribution of knowledge sharing to value creation. As far as a cluster is concerned, the broader scope of knowledge sharing is, the more abundant the knowledge feedback will be (Yli-Renko et al., 2001). Knowledge sharing encourages cluster participants to get rid of existing frameworks and to reconsider routines from a brand-new perspective, increasing innovation capabilities. In addition, knowledge diversity and accessibility depend

on frequent knowledge flow. Frequent interaction would increase opportunities to cooperate and communicate; generating not only shared languages and vision (Csikszentmihalyi, 1999; Stallkamp & Hanke, 2003), but also creativity and new ideas (Sternberg & Lubart, 1995). In doing so, cluster participants are able to upgrade their productivity, innovativeness, and develop unparalleled competitive advantages (Rogers & Larsen, 1984; Nonaka & Konno, 1998; Saxenian & Hsu, 2002). As a result, this study infers the following hypothesis:

H_3: The extent of knowledge sharing among cluster participants is positively related to the cluster's value creation.

4. Knowledge Sharing as a Mediator between Social Capital and Cluster Value Creation

Social capital can be acquired through interactions among network participants (Starkey & Tempest, 2004). Firms that posses a comparatively high amount of social capital can generally obtain more vital interests (Leana & Van Buren, 1999; McElroy, 2002), which, due to the spillover effect, would further benefit other network participants (Bourdieu, 1986; Coleman, 1990; Putnam, 1993). Consequently, social capital not only reinforces the relationships among cluster actors, but also guides interactive cooperation across communities (Lin, 2001).

Though social capital guides the beliefs and attitudes of network participants, it cannot ensure positive value creation. However, knowledge sharing does ensure positive value creation. In the view of the transaction cost theory, trust is a kind of social control mechanism to reduce risks (Gulati, 1998). The building of mutual trust can eliminate both partners' opportunistic behavior and monitor costs (Wathne & Heide, 2000). By trusting one another, network participants would be more willing to share appropriate resources and knowledge (Dyer & Singh, 1998) rather than being wary of being taken advantage of or suffering from free riders (Bradach & Eccles, 1989; Parkhe, 1998). Therefore, the cost to access information would be largely reduced; message flow among network actors would be more frequent; organizational knowledge assets on techniques and markets would be more abundant (Dyer & Nobeoka, 2000); new technological capabilities

(Yli-Renko et al., 2001) and intellectual properties (Ahuja, 2000) would develop thank to benefits from complementary resources.

Despite the emphasis on the minimization of risks and costs by virtue of trust, transaction cost theory relatively ignores the learning process. Rousseu et al. (1998) noted that the extent of trust would influence governance mechanisms. The governance mechanisms may in turn influence the inter-organizational learning climate. Network participants that interact and connect with one another for a long period of time would influence the perception of trust, and at the same time enhance mutual respect, trustworthiness, and friendships. In such a case, all participants share common values, consensus, and collective goals. Their similarities of experience and share of culture would facilitate their mutual acceptance for knowledge exchange; thereby accomplish the organizational learning performance (Krackhardt, 1992; Granovetter, 1992) and driving the value creation of the cluster. In brief, the shared context would encourage organizational learning and knowledge sharing, and thereby create higher productivity and innovative capabilities (Yli-Renko et al., 2001). As a result, this study infers the following hypothesis:

H_4: The extent of social capital that cluster participants have developed would influence a cluster's value creation through the extent of knowledge sharing.

5. The LISREL Operational Model

To examine the relationships between social capital, knowledge sharing, and cluster value creation, this study conducts Structural Equation Modeling (SEM) and Maximum Likelihood Estimation (MLE) to test the hypotheses. Since SEM accommodates the advantages of path and confirmatory factor analysis, it can more effectively examine sophisticated cause and effect factors among variables than general multivariate analysis (Jorekog & Sorbom, 1993). The operational model of this framework is shown as Figure 1. Social capital, signified by ξ_1, is the exogenous variable, while η_1 and η_2, denote the endogenous variables, namely knowledge sharing and value creation. X_1 (bonding social capital), X_2 (bridging social capital), and X_3 (linking social capital), represent the manifest variables that

are used to assess social capital. Y_1 and Y_2 symbolize the willingness and the approach to share knowledge, respectively. Y_3 and Y_4 denote productivity and innovativeness, respectively. The arrows termed γ_{11} and γ_{21} signify the cause and effect between exogenous and endogenous variables, whereas the arrow β_{21} illustrates the relationship between knowledge sharing and value creation.

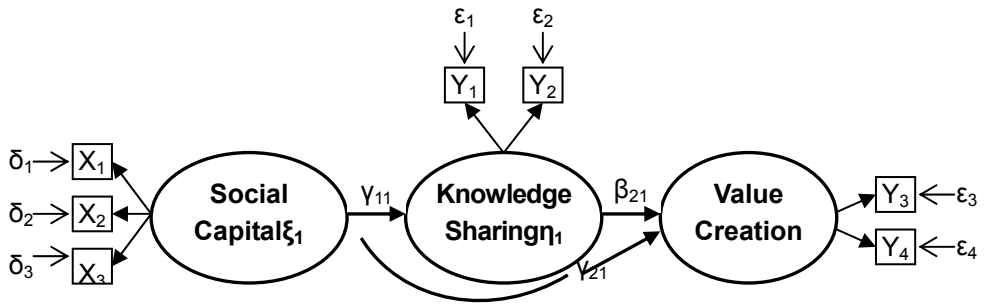

Figure 1. LISREL Operational Model

III. Methodology

1. Questionnaire Design

The questionnaire is divided into 3 constructs along with a Likert 7 points scale to test the extent of social capital, knowledge sharing, and cluster value creation that an enterprise owns. Companies in the HSIP were asked to fill in the questionnaire and indicate their current situation (1=strong disagreement and 7=strong agreement). The higher score the respondents indicated, the more they agree with these questions.

2. Measurements

2.1 Social Capital

Bonding social capital: Bonding social capital is reinforced between participants with common characteristics (Putnam, 2000). The extent of bonding social capital existing in a network or cluster not only represents the extent of

mutual trust (Woolcock, 2001), but also defines how network participants are supported, particularly when they are in demand of resources (Putnam, 2000; Woolcock, 2001). The indicators of bonding social capital include personal relationships with other companies engaged in the same industry, the frequency of participatory social activities and public associations, close relational networks, the extent of mutual trust and assistance to partners, knowledge interactivity, activities of R&D and production of new products, shared vision and goals, exploration of overseas markets with partners, and cooperation with other parties to push industrial development.

Bridging social capital: Bridging social capital refers to the adherence between social groups of different communities (Putnam, 2000). It can help network participants acquire certain distinctive information and materials from heterogeneous industries (Narayan, 1999; Kozel & Parkel, 2000; Putnam, 2000). The indicators of bridging social capital comprise private friendship with companies in heterogeneous industries, participation in activities held by companies in heterogeneous industries, partnership through strategic alliances, the bridging role of collaborative activities, helping other companies on one's own initiative, the frequency and extent of receiving assistance from other firms, the frequency of knowledge exchange, the extent to which resources and best practices are shared or transferred, solving difficulties or acquiring new ideas through interactions, and accepting suggestions or recommendations provided by other firms in heterogeneous industries or communities.

Linking social capital: Linking social capital refers to relationships between organizations with power, authority or governance. Woolcock (2001) defined linking social capital as the capability to obtain resources, new concepts, and information based on relationships with formal institutions, politicians, or those with extensive funds. The indicators of linking social capital include receiving preferential taxes, levies, or financial support provided by governments or financial institutions, recruiting employees through governmental organizations or job training institutions, participating in international or domestic marketing activities and exhibitions held by public institutions, benefiting from support and services provided by the Science Park Administration, actively offering suggestions for the improvement and development of the Science Park environment, donating money

or goods to public organizations, offering financial support to establish necessary infrastructure for academic institutions, and accepting projects for new product prototypes recommended by the Industrial Technology Research Institute.

2.2 Knowledge Sharing

The willingness to share knowledge: According to discussions by Yli-Renko et al. (2001), Lee & Al-Hawamdeh (2002) and Stalkamp & Hanke (2003) about barriers to knowledge sharing, indicators of the willingness to share knowledge include the following items: sharing knowledge on the principle of reciprocity, actively providing messages and information to other firms at meetings or conferences, keeping an open mind rather than concealing something on purpose, sharing knowledge no matter how intricate it is, and actively seeking and collecting information for other companies.

The approach to share knowledge: By employing both information and communication technologies (ICT) and interpersonal contacts, a company could more easily interact with other network participants, formally and informally. The communication channels incorporate phone and fax, e-mail, e-bulletin, group net software such as Lotus Note, visual camcorders or on-line meetings (Marchand et al., 2000; Probst et al., 2000; Tiwana, 2002), publication of periodicals, files and documents, research conferences and discussion forums, inspections abroad, exhibitions or displays, and learning by doing (Gupta & Govindarajan, 2000).

2.3 Value Creation

Productivity: Drawing upon previous studies, this study specified factors to examine the productivity of a company as follows: bringing in new technologies, simplifying the manufacture processes, improving the goal-achievement process, decreasing time spent in product R&D (Griliches et al., 1987), cutting down the manufacturing cost per product share, reducing defect probability, and rapidly providing new products and services.

Innovativeness: Factors developed for this construct include: exploiting new know-how (Kuczmarski, 1996), improving the manufacture process, launching new products or services (Yoon & Lilien, 1985), adopting new strategies or new

concepts, flexibly adjusting organizational structure, and improving existing administrative approaches.

2.4 Data Description

According to the list on the website of the Science Park Administration, there are 384 companies distributed in 6 industries, including 181 in the integrated circuits industry, 62 in the computer & peripherals industry, 53 in the telecommunications industry, 78 in the optoelectronics industry, 35 in the precision machinery industry, and 35 in the biotechnology industry. From April 2005 to July 2005, a total of 384 questionnaires were sent through e-mail and on-the-spot interviews with companies in the HSIP. 136 questionnaires were collected. Three of the responsive questionnaires were eliminated because of incomplete answers. Therefore, only 133 valid questionnaires were left for hypothesis examination. The effective responsive rate was about 34.63%.

The valid questionnaires represent 64 companies in the integrated circuits industry (48.1%), 19 companies in the precision machinery industry (14.3%), 24 companies in the computer & peripherals industry (18%), 10 firms in the telecommunications industry (7.5%), another 10 firms in the optoelectronics industry (7.5%), and 6 companies in the biotechnology industry (4.5%).

IV. DATA ANALYSIS

1. Reliability and Validity

The reliability of a measure indicates the trustworthiness and stability of the research instruments. It ensures consistent measurement across time and across various items in the instrument (Uma, 2003). Validity examines the extent to which the concept measured is tapped (Uma, 2003). This study uses both lambda loading (factor loading) and Cronbach's α coefficient to examine reliability. The former indicates the extent to which the ratings of items depend on the latent variable, while the latter is often used to approve the consistency of measures. The lowest value of lambda loading in this model is 0.53, implying a high measuring quality for each estimate. As for the Cronbach's α, the values range from 0.7249~0.8278

(Table 1), all of which are higher than the threshold of 0.6 recommended by Fornell & Larcker (1981).

To further prove the reliability of the instrument, this study also calculates the average variance extracted (AVE), which is supposed to be higher than the threshold of 0.5, to measure the extent to which each manifest variable can explain the latent variables (Chen & Cherng, 1998). Ranging from 0.6517 to 0.8540, the value of the AVE reveals that both reliability and convergent validity are acceptable (Chiou, 2003). Furthermore, discriminant validity, used to ensure the non-correlation between two variables, is confirmed when the AVE of each construct is larger than the squared correlation coefficients between any two other constructs (Espinoza, 1999). As table 2 shows, the lowest value of AVE on the grey area along the diagonal line is significantly larger than any other value of squared correlated coefficients in the other triangle area (distributing from 0.1936 to 0.2992). That is to say, each construct can be distinguished from one another.

Table 1. Measurement of Model Results

Item	Measurement of Model Results		
	Lambda Loadings	Variance Extracted	Construct Reliability
Social Capital		0.6517	0.7249
Bonding Social Capital	0.78		
Bridging Social Capital	0.81		
Linking Social Capital	0.53		
Knowledge Sharing		0.8540	0.8278
The Willingness to Share	0.86		
The Approach to Share	0.86		
Value Creation		0.8475	0.8146
Productivity	0.84		
Innovativeness	0.83		

Table 2. Discriminant Validity

	1	2	3
1. Social Capital	0.6517		
2. Knowledge Sharing	0.2560	0.8540	
3. Value Creation	0.2992	0.1936	0.8475

Notes: The number in grey area denotes the average variance extracted while that in triangle area represents the square of correlation coefficient.

2. Fitness of Model

The fitness of model can be ensured according to the following indicators: (1) The χ^2 ratio (χ^2/df): The lower the χ^2 ratio is, the higher the fitness will be. The statistical outcome of this study indicates that the χ^2 ratio is equal to 2.09. This value is under the standard value of 3, implying a good fitness of model. (2) The RMSEA (Root Mean Square Error of Approximation): This index, which is often used to see the overall index, is equal to 0.091. This value is a little higher than the acceptable ceiling (0.08) set by McDonald & Ho (2002). (3) The GFI (Goodness of Fit Index): This index equals 0.95 for our study. It is similar to the R^2 in regression analysis (Tanaka & Huba, 1989) and a value higher than 0.9 would illustrate a good fitness. (4) The AGFI (Adjusted Goodness of Fit Index): The statistical outcome of this study shows that the AGFI is equal to 0.88. This value is quite close to the lowest acceptable value (0.90) set by Hu & Bentler (1999). Though the value of the RMSEA and the AGFI is not as ideal as the predicted value, other indicators such as the GFI, the CFI, the IFI, and the SRMR match the ideal threshold. (5) The CFI (Comparative Fit Index): The CFI and the IFI are also often examined to measure the fitness of model in this study. If the two indexes are close to 1, the fitness of model will be good (Bentler, 1995; Bollen, 1989). The value of the CFI is 0.98, implying a good fitness of this model. (6) The IFI (Incremental Fit Index): This index is equal to 0.98. As Bentler (1995) and Bollen (1989) pointed out, the value of the IFI in this model is good. (7) The SRMR (Standard Root Mean square Residual): The SRMR is the standardized difference between the observed covariance and predicted covariance. Though a value of zero implies a perfect fitness, Hu & Bentler (1999) recommended that a value less than 0.08 would be considered an indication of good fitness of model. The SRMR for this study is equal to 0.037. In view of these indicators, it is inferred that the conceptual model is of a good fitness.

3. Path Analysis

3.1 The Relationships between Social Capital, Knowledge Sharing, and Value Creation (H_1, H_2, and H_3)

This framework is a partial mediate model. In brief, social capital not only directly influences a cluster's value creation, but also indirectly engenders a higher value creation through knowledge sharing. In the statistical outcomes shown in Table 3, social capital is found to have a significant and direct effect on both knowledge sharing (path coefficient=0.63, t-value=5.70) and value creation (path coefficient=0.54, t-value=3.95). Therefore, H_1 and H_2 are accepted in this framework. In addition, H_3 is also accepted because knowledge sharing is confirmed to positively yield productivity and innovativeness (path coefficient=0.24, t-value=1.97). These results confirm the indirect effect of social capital on value creation, with a path coefficient = 0.15 and t-value=1.97.

Table 3. Path Analysis

Path	γ_{11}	β_{21}	γ_{21}
Independent Variable	Social Capital	Knowledge Sharing	Social Capital
Dependent Variable	Knowledge Sharing	Value Creation	Value Creation
Direct Effect	0.63 (5.70)	0.24 (1.97)	0.54 (3.95)
Indirect Effect	na	na	0.15 (1.97)
Total Effect	0.63 (5.70)	0.24 (1.97)	0.69 (6.10)

* na means not available.

3.2 The Mediator Effect between Social Capital and Value Creation (H_4)

In order to ensure the mediate role of knowledge sharing in the framework, two other models (full mediate model and non-mediate model) are taken into consideration (Kelloway, 1998). Compared with paths in the partial mediate model, as this conceptual framework shows, the direct influence of social capital on a cluster's value creation in the full model would not be taken into account (γ_{21} doesn't exist here). In the non-mediate model, the path of direct effect of knowledge sharing on value creation is skipped. That is to say, β_{21} doesn't exist in this model. The Chi-square test, along with the degree of freedom measure, is

often employed as an indicator for comparing these three models (Bentler & Bonnet, 1980).

Table 4 shows that both the full mediate model and the non-mediate model have an inferior Chi-square (their Chi-square are individually 38.36 and 26.52; df=12) to our framework (Chi-square=23.02; df=11). With regard to other indexes of fitness including the RMSEA, the GFI, the AGFI, the CFI, the IFI, and the SRMR, the partial mediate model obviously has a better fitness than the other two models do. Therefore, this study infers that knowledge sharing mediates between social capital and value creation. H_4 is acceptable within this framework.

Table 4. The Mediation Effect

	χ^2	df	χ^2ratio	RMSEA	GFI	AGFI	CFI	IFI	SRMR
Full Mediate	38.36	12	3.19	0.13	0.92	0.82	0.95	0.95	0.088
Partial Mediate	23.02	11	2.09	0.091	0.95	0.88	0.98	0.98	0.037
Non Mediate	26.52	12	2.21	0.096	0.95	0.87	0.97	0.97	0.045

V. MANAGERIAL IMPLICATIONS AND SUGGESTIONS

1. Discussion and Managerial Implications

This study attempts to examine the relationships between social capital, knowledge sharing, and value creation in a cluster and intends to confirm the importance of the mediator, knowledge sharing, by comparing the partial mediate model with the full mediate and non-mediate models. Drawing upon previous research on social networks, this study focuses on how that value is created in a cluster network where each value activity is seamlessly connected. To scrutinize the interaction and collaboration occurring in a cluster from the transaction cost theory perspective and a social capital context, this study follows the concept described by Gittel & Vidal (1998) and Woolcock (1998) and divides social capital into bonding, bridging, and linking social capital. Each facet of social capital involves a different scope of knowledge exchange, a different scope of interaction, and a different mindset of network participants, which then influence the extent of trust building, aggregate complementary resources, and stimulate novel ideas.

The statistical outcomes of this study have proved that the extent of social capital is not only positively related to the extent of knowledge sharing (H_1 is accepted), but also positively related to a cluster's value creation, whether directly (revealed in H_2) or indirectly (shown in H_4). Rather than born out of the void, innovation has to ground itself upon a certain domain of knowledge (Sternberg & Lubart, 1995; Csikszentmihalyi, 1999). However, knowledge by itself is static stock and doesn't guarantee innovative ideas unless it can be shared, learned, and applied. The statistical outcomes of this study also affirm the inference of H_3 and show that knowledge sharing in terms of its frequency and multiple approaches would positively influence a cluster's productivity and innovativeness. The sharing of valuable resources, information, and best practices can effectively remove inefficiencies incurred during operating processes. At the same time, an open system to receive or contain multiple sources of knowledge provides a platform where knowledge can be integrated and disseminated, which in turn stimulates the birth of new ideas and even creates competitive advantages.

Cluster actors, as part of the value chain, would build trust and mutual respect through frequent interaction and communication. In general, bonding social capital is like the internal cohesiveness and connectivity of a community. Here, participants of an organization or community not only share the same culture, but also are willing to collaborate under a climate of trust and trustworthiness. Thus, bonding social capital serves as the power to restrain opportunistic behavior, monitoring each firm to behave on the premise of communal benefits. Based on trust and commitment fostered, firms would be more likely to undertake uncertainties and risks when sharing valuable know-how and cooperating for innovation; thereby, a virtuous cycle would emerge along with durable relationships.

Moreover, bridging social capital embedded in the relationships between other industries or networks is particularly precious for a cluster's value creation. When different prowess and knowledge come together, a brand new idea may be inspired. By broadening the existing frame of thought and network, bridging social capital leads cluster participants into contact with something new that may complement their existing knowledge. Frans (2005) coined the term "the Medici Effect" to illustrate how such an intersection of different domains would contribute to

innovation. Again, knowledge sharing serves as an activator to ensure potential value creation.

Linking social capital represents the connectivity and interaction with public associations and non-profit organizations, including governments, academic institutions, schools, R&D institutions, labor associations, industrial associations, and others. By providing financial support, protecting patents in transfer, coordinating conflicts, and cultivating necessary human resources, these institutions remove barriers to smooth business operation and innovation. Linking social capital also involves a good relationship with politicians, researchers, and the public. Their opinions and research outcomes are important for the strategic development of a cluster and may even determine the direction of a cluster's economic development.

In order to maintain competitiveness in global competition and the current trend of specialization, companies in the HSIP have dealt with the pressure of low costs as well as the challenges of a fast product life cycle. With the comparative advantages of abundant natural resources, low labor costs, and unbelievable market demand, Mainland China has attracted an incredible amount of foreign investment each year. Both its economy and talents continue to grow at a very rapid pace. In addition, companies from Korea or Japan have consistently devoted themselves not only to technological innovation, but also to branding their products globally. By holding key techniques or patents, they may dominate international industrial development and seize a niche market from other companies.

Suffering from these threats, firms in the HSIP have learned about the importance of forging core competencies as well as networks. Whether engaging in the same value activities or not, these firms realize that individual power cannot fight against global competition but that cooperation and collaboration can. Staying in the same boat, each participant in the cluster has to abandon prejudice towards the others and make good use of industrial know-how. It is necessary for them to frequently interact with each other for resource integration. Bonding social capital, therefore, functions effectively in forming shared visions and norms, fostering commitment and trust, and driving the valuable knowledge sharing. In such a situation, they would specialize in their best value activities, transfer best practices,

solve bottlenecks together, and curtail costs with economies of scale or process reengineering.

A competitive product depends on the perfect linkage of each activity in a value chain, and may possibly rely on the interaction of two or more heterogeneous industries. Vertical and horizontal collaboration in a cluster could promote synergy in product innovation and minimize the manufacturing cost. This is because companies in each value activity plan the product blueprint together and respond flexibly towards the production process. For example, Taiwan Semiconductor Manufacturing Company Limited (TSMC), concentrating on OEM, is quite careful in supply chain management. To decrease time to market and help its customers grab the lead position, TSMC first compiled its past experiences about IC design, standardized IC design principles, and provided the Cybershuttle system to its suppliers. These suppliers can then effectively raise IC design quality and diminish risks and costs in experimentation. To closely connect with companies who provide characterization services, substrate design services, and test services, TSMC also created the One-stop Turnkey to help lower costs and integrate the whole value chain efficiently. As a result, companies in this value chain have built a sense of identification and trust. Thus, they are willing to contribute their know-how to the cluster's value creation.

To forge human resources and make breakthroughs in technologies, companies in the HSIP usually cooperate with colleges and academic institutions, such as National Tsing Hua University, National Chiao Tung University, and the Industrial Technology Research Institute. The government of Taiwan is also devoted to integrating ideas and knowledge from different domains by launching the National SoC Program for the development of national SoC and the Silicon Intellectual Property. This program is sponsored by the National Science Council and coordinated by National Chiao Tung University. Linking social capital, therefore, acts as an invisible hand to drive the development of the HSIP.

In brief, network participants, whether from the same industry or from heterogeneous industries, can make good use of social capital to build mutual respect and trust, and create partnerships through interaction. The structural hole of the social network serves as an information floodgate where prowess and knowledge intersect, and through which network participants cooperate to solve

problems, leading to a higher probability of innovation. In light of the long term interaction and trust established, cluster participants would be willing to engage in economic activities that can drive resource exchange or combination (Portes & Sensenbrnner, 1993), to push forward the sharing of tacit and complex knowledge (Conner & Prahalad, 1996), and to complement their knowledge gaps. In doing so, innovation can be fostered.

2. Strategic Suggestions

The development of a cluster relies on long-term and frequent interactions among companies, whether in the same value chain or across different industries. As the catalyst of innovation, social capital can reduce transaction costs in information seeking and business bargaining because of the shared vision and trust built through interactive activities and collaboration. Only if counterparts trust one another will they be willing to share valuable resources rather than being wary of suffering from some other parties' behavior. With rich bonding social capital, cluster participants can not only obtain necessary or complementary know-how from collaborators, but also work together toward a shared vision. Bridging social capital stimulates cluster participants' innovativeness by helping them get rid of limitations. It would also facilitate economic activities by building good relationships with public associations. These associations, in turn, could offer favorable policies or supportive resources.

2.1 Building an Adequate Social Environment for Interaction

To create such an ideal network, the concept of social ecology, put forward by Gupta & Govindarajan (2000), requires the communal efforts of all cluster actors to build a social system in which people and communities are encouraged to interact with one another. For example, incentives may encourage the inner motivation of organizational members to actively contact other communities to learn valuable know-how. Under the premise of communal benefits, such interactions and organizational learning would promote the intersection of domains and in turn expedite innovation.

The policies and guides of the government could determine the competitiveness of a cluster. With regard to the policy enactment on preferential

taxes and levies, and the restrictions on investing in Mainland China, the government of Taiwan has to carefully assess the industrial environment from long-term perspective. Since bonding and bridging social capital is so important in both vertical and horizontal value chain integration, the government should not only budget for cluster development, but also plan an industrial platform where dispersed systems and databases could be integrated. Despite the sound infrastructure and financial support given externally, the HSIP also needs public associations that can motivate cluster participants to move on their own initiatives. For example, the Association of Industries in Science Parks offers job-training services, collects dynamic industrial information for all participants, and serves as a platform to connect dispersed clusters in Taiwan.

2.2 Extending Opportunities to Participate in Formal and Informal Activities

To increase intersection opportunities, cluster participants are encouraged to attend official or informal activities, such as research conferences, sports games, joint exhibitions, public projects, and so on, to extend their knowledge boundaries and to form a common consensus in the strategic direction of cluster development. By maintaining both strong ties and loose ties with other groups, companies can learn from the best practices of another domain and search out new solutions for bottlenecks they encounter in operation. Since R&D and production costs are important in the technology industry, it is also necessary for cluster participants to pay attention to the newest breakthroughs or technologies in academic research. Applying new technologies and learning novel knowledge may solve some difficulties in development and reduce production costs by reengineering the production process.

3. Research Limitations and Suggestions for Future Study

The research sample of this study is restricted to the domestic cluster of the HSIP. However, there are usually differences existing between different clusters. For example, the scope of interaction and number of social activities may be higher in a high technology industrial cluster than in a traditional industrial cluster. The collaboration and relationships in domestic networks of small and medium sized

business may also differ from those in other countries' networks due to distinctive policies, different levels of economic development, and different supportive resources. Therefore, further analysis is suggested to take other clusters into consideration and make comparisons to see the possible differences between clusters. It is also recommended to explore the relationship between different facets of social capital and other influential variables on value creation, for instance, intellectual capital. Additionally, the mediate effect of knowledge sharing may be moderated by other variables, such as a network actor's learning ability, the ability to absorb knowledge, and so on. Future research is required to explore these possible moderators.

Though this study contends that bridging social capital could encourage innovation, Goerzen & Beamish (2005) argued in another way. They mentioned that owning to the heterogeneity of communities, gulfs or schisms might emerge and thus make knowledge exchange more difficult. The distrust and animosity induced by conflicts and indifferent social interaction may diminish the potential benefits of heterogeneity. Consequently, it is worthwhile to delve deep through this issue to develop the insufficient discussion of previous studies. Also this study is a cross-sectional analysis. A time series analysis or panel analysis can be conducted to examine whether social capital can still make great differences on a cluster's value creation as time goes by. Future studies are also suggested to compare the results of longitudinal research and that of this research paper to examine the differences.

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社會資本對知識分享與群聚價值創造影響之研究—以新竹科學工業園區加以實證

林妙雀・郭智輝*

摘要

地理區位不僅將使分散於各地之企業與機關團體，透過垂直與水平價值活動彼此連結，而且群聚在同一區域，相互間可以專業化分工，發揮採購利益、技術分享與獲得政府政策協助之效益。回顧過去對群聚理論之探討，大多著重於群聚之形成原因與不同類型之群聚型態，較少從社會資本與知識分享角度，深入探討其對群聚之價值創造的影響。有鑑於社會資本是確保群聚內廠商彼此信任與關係連結的重要資源，可擴展資訊接觸來源、深度與管道，是以本研究參酌社會網絡、交易成本、知識管理與組織學習之相關理論，並對照新竹科學園區發展現況，深入探討群聚內廠商的社會資本、知識分享及群聚價值創造之關係。同時配合實地問卷普查，採用線性結構關係模式進行研究假設驗證，根據實證結果得悉群聚內各廠商，擁有的社會資本愈豐富，藉由彼此誠信與互動交流，愈有益於相互間知識分享與群聚價值創造。

關鍵詞彙：群聚，新竹科技園區，社會資本，知識分享，價值創造

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