

# Promoting innovation through the accumulation of intellectual capital, social capital, and entrepreneurial orientation

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**This study attempts to explore how a firm's operational mode can reinforce the advantages of intellectual capital on innovation. Specifically, the main purpose of this study is to develop a comprehensive research model to integrate the interrelationships among social capital, entrepreneurial orientation, intellectual capital, and innovation. In addition to identifying the influences of intellectual capital on innovation, this study focuses in particular on the mediating effect of intellectual capital and the moderating effects of social capital and entrepreneurial orientation on innovation, which have largely been neglected in previous literature. The results support the mediating role of intellectual capital and the moderating roles of entrepreneurial orientation and social capital on innovation. Specifically, firms that have higher levels of social capital and entrepreneurial orientation tend to amplify the effects of intellectual capital on innovation.**

## 1. Introduction

The performance of an organization's members is determined by the inner organizational environment. Amabile and Karger (2007) indicate that members will perform better when they display positive emotion, passion for work, and favorable perceptions of their team or organization. Accordingly, firms require the molding of an appropriate environment wherein members can devote themselves to work without hesitation. Beyond the performance of the organization's members, this study argues that the inner environment is beneficial to the utilization and effec-

tiveness of intangible assets. We attempt to explore the organization's inner characteristics which are applied to nourish intellectual capital and reinforce its benefits.

Intellectual capital describes the intangible assets possessed by a firm (Bueno et al., 2004), consisting of human capital, customer capital, and structural capital (Bontis, 1998). While scholars had advocated creating innovation through intellectual capital (Subramaniam and Youndt, 2005), they have seldom explored how to mold the firm's inner environment for promoting and cultivating intellectual capital and innovation. Among other factors, social capital has been

regarded as having close associations with intellectual capital and innovation (Bueno et al., 2004). For instance, Nahapiet and Ghoshal (1998) argue that firms with higher levels of social capital will be aided in the accumulation of intellectual capital. Tsai and Ghoshal (1998) contend that social capital facilitates inter-unit resource exchange and product innovation. Thus, the relationships among social capital, intellectual capital, and innovation exist theoretically. However, further empirical efforts should be conducted to investigate the moderating effect of social capital on the relationship between intellectual capital and innovation in order to link the internal characteristics of firms with intellectual capital.

Entrepreneurial orientation is another pivotal factor for intellectual capital and innovation. Wiklund and Shepherd (2003) comment that the benefits of entrepreneurial orientation for firms have been empirically investigated; however, the relationships between the resources inside the firms (i.e. intellectual capital) and entrepreneurial orientation were ignored. Thus, using entrepreneurial orientation to leverage intellectual capital is the second focus of this study.

In sum, it is necessary to explore the effects of social capital and entrepreneurial orientation on the benefits derived from intellectual capital. The main purpose of this study is to develop a comprehensive research framework which integrates the influences of intellectual capital, social capital, and entrepreneurial orientation on innovation. It is expected that both social capital and entrepreneurial orientation will moderately influence the relationship between intellectual capital and innovation. The remainder of this study consists of a review of the relevant literature, the development of a hypothetical model, as well as the sampling frame and data analysis. Finally, the results are given, from which conclusions are drawn.

## 2. Literature review and hypotheses development

### 2.1. *Interrelationships among entrepreneurial orientation, social capital, and intellectual capital*

Nahapiet and Ghoshal (1998) define intellectual capital as 'the knowledge and knowing capability of a social collectivity.' Bontis (1998) further clarifies intellectual capital as a combination of

human capital, customer capital, and structural capital. Human capital embraces all of the skills and capabilities of the people working in an organization (Lynn, 2000). Additionally, customer capital represents the potential an organization has due to ex-firm intangibles (Bontis, 1998). These intangibles include the knowledge embedded in customers, suppliers, the government or related industry associations. In terms of structural capital, it includes all non-human storehouses of knowledge in organizations, including databases, organizational charts, process manuals, strategies, routines and anything whose value to the firm is higher than its material value (Bontis et al., 2000).

Bourdieu and Wacquant (1992) conceptualize social capital as the sum of actual or virtual resources which accrue to an individual stemming from a network of relationships. Nahapiet and Ghoshal (1998) further proposed three dimensions of social capital. The first dimension is the structural dimension, comprising social interactions or network ties (Nahapiet and Ghoshal, 1998; Tsai and Ghoshal, 1998), that is, the overall pattern of connections among actors. Nahapiet and Ghoshal's second dimension of social capital is the relational dimension, which refers to assets that are rooted in relationships, such as trust and trustworthiness (Nahapiet and Ghoshal, 1998; Tsai and Ghoshal, 1998). The cognitive dimension is the third dimension of social capital, which refers to those resources providing shared representations, interpretations, and systems of meaning among parties (Nahapiet and Ghoshal, 1998).

In terms of the relationship between social capital and intellectual capital, Nahapiet and Ghoshal (1998) propose a theory related to the creation of intellectual capital, which hypothesizes that the network of relationships possessed by a department will enhance intellectual capital. They posit that the co-evolution of intellectual capital and social capital provides a dynamic perspective on the development of organizational advantage, given the close relationship between the two factors. Accordingly, levels of social capital will enhance intellectual capital through discussions and communications among relevant members.

Entrepreneurial orientation reflects the extent to which a firm is able to accept risk and is innovative or competitively aggressive (Lumpkin and Dess, 1996). In terms of the relationship between entrepreneurial orientation and intellectual capital, Wiklund and Shepherd (2003) argue that entrepreneurial orientation can strengthen the advantages of knowledge-based resources.

Thus, if firms are characterized by higher levels of entrepreneurial orientation, they may have more chances to create or extend intellectual capital. Consequently, firms should operate with an emphasis on social capital and entrepreneurial orientation in order to promote the creation of intellectual capital.

Hypothesis 1: *Firms which possess higher levels of social capital and entrepreneurial orientation tend to promote higher levels of intellectual capital.*

## 2.2. Relationships between intellectual capital and innovation

An innovation is defined as an idea, a product or process, or a system that is perceived to be new to an individual (Vakola and Rezgui, 2000). Thus, innovation can occur in domains of product, process and organization. In terms of the relationship between intellectual capital and innovation, firms with strong structural capital will create favorable conditions in which to utilize human capital and allow it to realize its fullest potential, and then to boost the firm's innovation capital and customer capital. Hayton (2005) finds that human capital has a positive influence on innovation among high-technology new ventures. Additionally, Proctor (1998) argues that the cornerstone of successful innovation is understanding the firm's customers and market. It is obvious that market orientation is the nature of customer capital (Bontis et al., 2000), which could be viewed as a form of innovative behavior in response to market conditions (Lee and Tsai, 2005). Therefore,

Hypothesis 2: *Firms which possess higher levels of intellectual capital including human capital, customer capital, and structural capital tend to promote higher levels of innovation.*

## 2.3. Moderating effects of social capital and entrepreneurial orientation

Past research has described the creation of social capital by either 'weak ties' or 'strong ties.' While Burt's (1997) structural hole theory regards the weak tie linking two parties as a bridge that aids in diffusing information, Uzzi (1997) claims that embedded relationships represent strong ties, which breed cohesion. We attempt to explain

the moderating effect of social capital based on these two angles. In terms of structural hole theory, Burt (1997) argues that the brokers can create social capital because of the relationships formed between people otherwise disconnected in the social structure. The disconnected individuals represent a structural hole which is an opportunity to exchange dissimilar information between two parties. The broker can link the disconnected parties and promote the exchange of dissimilar information. This exchange can further facilitate the creation and accumulation of intellectual capital (Nahapiet and Ghoshal, 1998). Thus, social capital can lead to a greater heterogeneity of intellectual capital. Furthermore, heterogeneous resources are of great importance for innovation (Rodan and Galunic, 2004). Accordingly, the beneficial influence of intellectual capital on innovation will be enhanced through diversity. Moreover, Uzzi (1997) concludes that embedded relationships are advantageous for the transfer of fine-grained information, and enable two parties to coordinate for problem solving. The flow of detailed and tacit information and the problem-solving function can further enhance the positive effect of intellectual capital on innovation (Reinmoeller and van Baardwijk, 2005). Consequently, social capital seems to be a catalyst for the influence of intellectual capital on innovation.

Hypothesis 3: *The positive influence of intellectual capital on innovation will increase when firms possess higher levels of social capital.*

Entrepreneurial orientation is the core of resource-based theory (Conner, 1991). This theory posits that discerning which appropriate resources are necessary to compete in the market place is ultimately a matter of entrepreneurial orientation. Because innovation is a process of combining assets (Nahapiet and Ghoshal, 1998), entrepreneurial orientation may facilitate the firm's ability to discern appropriate resources for combination and thus innovate. Entrepreneurial orientation reflects the extent to which a firm engages in product innovation and risky ventures, and is the first to come up with proactive innovations to prevail over competitors (Miller, 1983). It is suggested that entrepreneurial orientation can enhance the relationship between knowledge-based resources and firm performance (Wiklund and Shepherd, 2003). As managers engage in entrepreneurial activities, employees are forced to search for market opportunities and new product designs. Therefore, firms with

intellectual capital will deeply rely on entrepreneurial activities to promote innovation.

Hypothesis 4: *The positive influence of intellectual capital on innovation will increase when firms possess higher levels of entrepreneurial orientation.*

### 3. Methodology

#### 3.1. The research model and construct measurement

The objective of this study is to investigate the interrelationships among intellectual capital, entrepreneurial orientation, social capital, and innovation (see Figure 1). Specifically, this study attempts to explore the influence of entrepreneurial orientation and social capital on intellectual capital, as well as the influence of intellectual capital on innovation. Furthermore, the mediating roles of intellectual capital in the relationships among entrepreneurial orientation, social capital, and innovation are explored. Finally, the moderating effects of social capital and entrepreneurial orientation on the relationship between intellectual capital and innovation are evaluated.

In order to empirically examine the hypothesized relationships, the research constructs were

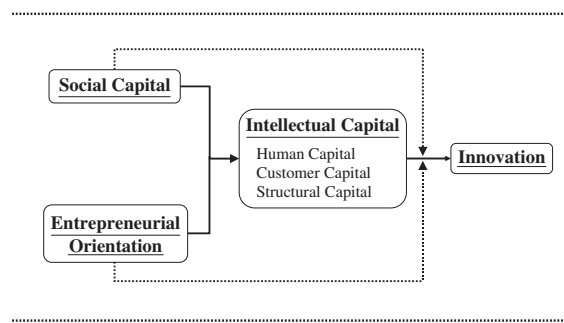


Figure 1. Conceptual model.

operationalized. A preliminary version of this questionnaire was designed for this study. An expert interview was conducted to investigate whether or not the questionnaire items are representative of the actual intellectual capital management of firms. A pilot study was then conducted to ensure the reliability and validity of questionnaire. The final version of the questionnaire items was refined through a process of purification. Eventually 700 Taiwanese firms were selected for this study. The respondents were asked to express their perceptions on intellectual capital, social capital, entrepreneurial orientation, and innovation. Each item is measured on a seven-point Likert scale ranging from 1 = strongly disagree to 7 = strongly agree. The detailed items for research constructs are displayed in Appendix A.

Table 1 displays the results for the dimensionality and reliability of the measures. Among others, there are three factors extracted in terms of social capital, which is consistent with Nahapiet and Ghoshal (1998). Following the criteria suggested by Hair et al. (2006), factor loadings >0.6, item to total correlation coefficients >0.5, and Cronbach's  $\alpha$  >0.6 demonstrate that the dimensionality and reliability of all research constructs are quite reliable and acceptable. Thus, using these constructs, hypotheses testing is undertaken to assess the interrelationships among research variables. These results are given in the following section.

#### 3.2. Sampling plan and data collection procedures

The data was gathered over a 2-month period beginning in mid-February, 2005, and ending in mid-April of 2005. For the survey, a total of 700 survey questionnaires were mailed to the sample firms. Out of 700 sample firms, with follow-up

Table 1. Factor loading and reliability test

Factor	Number of items	Factor loading	Item-to-total correlation	Cronbach's $\alpha$
Human capital	6	0.790–0.837	0.694–0.754	0.899
Customer capital	6	0.782–0.865	0.692–0.815	0.913
Structural capital	7	0.785–0.922	0.712–0.887	0.936
Social capital – structural dimension	2	0.822–0.888	0.619	0.764
Social capital – relational dimension	2	0.844–0.877	0.788	0.881
Social capital – cognitive dimension	3	0.811–0.908	0.809–0.884	0.930
Entrepreneurial orientation	12	0.738–0.861	0.688–0.826	0.949
Innovation	9	0.750–0.874	0.688–0.833	0.940

telephone calls, 170 completed and returned the questionnaires. A total of 159 questionnaires were usable, producing a response rate of 22.71%. The response rate for manufacturing firms was 24.50% and for non-manufacturing firms the response rate was 20.33%. To evaluate the presence of any discrepancies between the opinions of respondents and non-respondents, a split half correlation analysis was conducted using early respondents as the first half-group, and late respondents as the second half-group. None of the *t*-statistics for the means of these two groups was statistically significant ( $P > 0.10$ , two-tail) for any construct. This result seems to suggest that there is no non-response bias.

### 3.3. Descriptive analysis of sample firms

Table 2 shows the basic attributes of the sample firms. These attributes include industry, history,

Table 2. Characteristics of sample firms

	Frequency	Percentage (%)
Industry		
Manufacturing industry	98	61.6
Non-manufacturing industry	61	38.4
History (year)		
< 10 years	38	23.9
11–20 years	51	32.1
21–30 years	29	18.2
More than 30 years	41	25.8
Annual revenue (USD, millions)		
< 0.32	6	3.8
0.32–3.2	14	8.8
3.2–32	51	32.1
> 32	88	55.3
Number of employees (people)		
< 50	20	12.6
51–100	20	12.6
101–500	68	42.8
> 500	51	32.1

annual revenue, and number of employees for the firms. Among others, more than 60% of sample firms belong to manufacturing industry; more than 56% of the firms operate less than 20 years; more than 55% of the firms achieve annual revenue sales of 32 millions dollars or above. More than 32% of the firms have 500 employees or above. In order to explain the differences between manufacturing and non-manufacturing firms and other characteristics, we compared the levels of intellectual capital, social capital, and entrepreneurial orientation among different groups which had different characteristics. The results are shown in Table 3.

Table 3 shows that there are no differences of intellectual capital and entrepreneurial orientation between manufacturing industry and non-manufacturing industry ( $|t| = 0.688-1.389$ ). However, the levels of social capital in non-manufacturing industry are significantly higher than those in manufacturing industry ( $\bar{X} = 5.256$  vs  $\bar{X} = 4.883$ ,  $t = -2.492$ ). Young (2005) surveyed the network ties across different industries in Taiwan and found that electronic and financial service firms in his sample (i.e. non-manufacturing firms) received most ties from diverse industries, and the plastic and textile firms (i.e. manufacturing firms) were main tie-senders. This statement implies that the structures of network ties between manufacturing firms and non-manufacturing firms are unlike due to different industrial features. Although Young's (2005) observation of sample focused on firms' external linkages with others, which is not parallel to our study, his observation implicated that the levels of social capital in manufacturing firms may differentiate from those in non-manufacturing firms.

In terms of our results, non-manufacturing firms have significantly higher levels of social capital than manufacturing firms. This makes sense in that there are more human interactions and connections in non-manufacturing firms. The

Table 3. The differences of intellectual capital, social capital, and entrepreneurial orientation between different industries

	Industry		<i>t</i> -value
	Manufacturing industry ( $n = 98$ )	Non-manufacturing industry ( $n = 61$ )	
Human capital	4.806	4.934	-0.872
Customer capital	5.512	5.604	-0.688
Structural capital	4.906	5.127	-1.389
Social capital	4.883	5.256	-2.492***
Entrepreneurial orientation	4.590	4.734	-.833

\*\*\* $P < 0.001$ .

activities or tasks in manufacturing firms are often standardized, comparing with non-manufacturing firms. The standardized activities may decrease the necessity of interacting with other colleagues. It is not saying that the social capital is not important or will not appear in manufacturing firms. Table 3 just provides a result of comparison between different industries. As to the differences between firms with other characteristics, this study finds that there are no differences of intellectual capital, social capital, and entrepreneurial orientation among firms which have different ages, annual revenue, and numbers of employees. The results implicate that firms' characteristics are not determinant to creation of intellectual capital, social capital, and entrepreneurial orientation.<sup>1</sup>

#### 4. Results of analysis

##### 4.1. Interrelationships among social capital, entrepreneurial orientation, and intellectual capital

Hypothesis 1 predicts that under higher levels of social capital firms tend to promote higher levels of intellectual capital as well as higher levels of entrepreneurial orientation. Table 4 shows that entrepreneurial orientation tends to significantly influence intellectual capital, including human capital ( $\beta = 0.311$ ,  $P < 0.001$ ), customer capital ( $\beta = 0.507$ ,  $P < 0.001$ ), and structural capital ( $\beta = 0.352$ ,  $P < 0.001$ ). The influence of entrepreneurial orientation is observed to be significantly higher for customer capital. Specifically, employ-

Table 4. Regression analysis for the relationships between intellectual capital and entrepreneurial orientation and social capital

Predictive variable <sup>1</sup>	Criterion variable		
	Human capital	Customer capital	Structural capital
Entrepreneurial orientation	.311*** <sup>2</sup>	.507***	.352***
Social capital	.478***	.259**	.551***
$R^2$	0.543	0.517	0.713
Adjusted $R^2$	0.537	0.511	0.709
$F$	92.538	83.574	193.895
$P$ -value	.000	.000	.000
D-W	1.893	1.993	1.877

<sup>1</sup>The values of tolerance and VIF in terms of predictive variables are same with those in model 1 of Table 5.

<sup>2</sup>\* $P < 0.05$ ; \*\* $P < 0.01$ ; \*\*\* $P < 0.001$ .

ees will be encouraged to proactively obtain the knowledge that is embedded in customers, suppliers, and other stakeholders when the environment inside the firm is characterized by higher levels of entrepreneurial orientation.

In addition, the firm's level of social capital tends to influence intellectual capital, including human capital ( $\beta = 0.478$ ,  $P < 0.001$ ), customer capital ( $\beta = 0.259$ ,  $P < 0.01$ ), and structural capital ( $\beta = 0.551$ ,  $P < 0.001$ ). It is interesting to note that social capital has a greater influence on structural capital than on customer capital. Because an internal environment with strong social capital is characterized by a greater frequency of interaction and communication, trust, and commitment (Nahapiet and Ghoshal, 1998), employees who are immersed in such an environment are more willing to exchange their own knowledge with colleagues, resulting in a greater accumulation of human capital. Nevertheless, social capital is even more likely to aid non-human knowledge storing. Therefore, the hypothesis 1 is supported.

##### 4.2. Relationships among intellectual capital and innovation

Hypothesis 2 predicts that firms which possess higher levels of intellectual capital tend to promote higher levels of innovation. Model 2 in Table 5 indicates that intellectual capital, including human capital ( $\beta = 0.597$ ,  $P < 0.001$ ), customer capital ( $\beta = 0.185$ ,  $P < 0.001$ ), and structural capital ( $\beta = 0.204$ ,  $P < 0.001$ ), can enhance the firm's level of innovation. Hence, hypothesis 2 is supported. In order to clarify the mediating role of intellectual capital in the relationships among entrepreneurial orientation, social capital, and innovation, it is necessary to follow a three-step procedure to determine whether or not a variable functions as a mediator, based on Baron and Kenny (1986). In step 1, model 1 in Table 5 reveals that entrepreneurial orientation ( $\beta = 0.371$ ,  $P < 0.001$ ) and social capital ( $\beta = 0.447$ ,  $P < 0.001$ ) are significantly related to innovation. Because the influence of entrepreneurial orientation and social capital on innovation exist at a significant level, it is meaningful to discuss the mediating role of intellectual capital on these relationships.

In step 2, Table 4 indicates that entrepreneurial orientation and social capital are significantly related to a mediating variable, namely, intellectual capital (cf. preceding discussion). In the final step, it is desirable that each predictive variable (i.e. entrepreneurial orientation and

Table 5. Regression analysis for mediators and moderators

Predictive variable	Criterion variable: innovation				
	Model 1	Model 2	Model 3	Model 4	Model 5
Entrepreneurial orientation	0.371***		0.054	0.029	
Social capital	0.447***		0.042		0.028
Human capital		0.597***	0.528***	0.588***	0.573***
Customer capital		0.185***	0.161***	0.196***	0.204***
Structural capital		0.204***	0.155*	0.180**	0.169*
Human capital × entrepreneurial orientation				0.225***	
Customer capital × entrepreneurial orientation				0.193**	
Structural capital × entrepreneurial orientation				0.158*	
Human capital × social capital					0.213***
Customer capital × social capital					0.184**
Structural capital × social capital					0.149*
$R^2$	0.581	0.792	0.794	0.808	0.799
Adjusted $R^2$	0.575	0.788	0.787	0.799	0.789
$F$	107.985	196.651	117.763	90.868	85.600
$P$ -value	0.000	0.000	0.000	0.000	0.000
D-W	2.074	1.870	1.877	1.823	1.869
Tolerance	0.514	0.534–0.543	0.498–0.524	0.503–0.511	0.495–1.523
VIF	1.934	1.843–1.873	1.908–2.008	1.957–1.988	1.913–2.020

\* $P < 0.05$ ; \*\* $P < 0.01$ ; \*\*\* $P < 0.001$ .

This table exhibits the results of alternative regression model based on Cronbach (1987). Specifically, the variables, including innovation, entrepreneurial orientation, social capital, and intellectual capital, were subtracted by their mean.

social capital) have low or no effects on innovation apart from the mediating variable (i.e. intellectual capital). Model 3 in Table 5 shows that entrepreneurial orientation ( $\beta = 0.054$ ,  $P > 0.05$ ) and social capital ( $\beta = 0.042$ ,  $P > 0.05$ ) are not significantly related to innovation when the mediator is controlled. Besides, the effects of intellectual capital, including human capital ( $\beta = 0.528$ ,  $P < 0.001$ ), customer capital ( $\beta = 0.161$ ,  $P < 0.001$ ), and structural capital ( $\beta = 0.155$ ,  $P < 0.05$ ), on innovation still exist at significant levels, suggesting a perfect mediating effect of intellectual capital on innovation.

#### 4.3. Moderating effects of social capital and entrepreneurial orientation on the relationships between intellectual capital and innovation

Hypothesis 3 and 4 predict that social capital and entrepreneurial orientation have moderating effects on the relationship between intellectual capital and innovation. In order to examine the moderating effects, this study employs a hierarchical regression model, that is, the product of the predictive variable and the moderator variable is included in the regression model. Nevertheless, the interaction term may introduce the problem of multicollinearity (Cronbach, 1987; Dunlap and Kemery, 1987). Thus, this study adopts an alter-

native regression model based on Cronbach (1987).<sup>2</sup> Models 4 and 5, Table 5, exhibits the results of the moderating effects. Because of the mediating effects, it is reasonable that entrepreneurial orientation ( $\beta = 0.029$ ,  $P > 0.05$ ) and social capital ( $\beta = 0.028$ ,  $P > 0.05$ ) are not significantly related to innovation. In addition, the multiplication of intellectual capital and entrepreneurial orientation are significantly related to innovation ( $\beta = 0.225$ ,  $P < 0.001$ ;  $\beta = 0.193$ ,  $P < 0.01$ ;  $\beta = 0.158$ ,  $P < 0.05$ ), and the multiplication of intellectual capital and social capital are significantly related to innovation ( $\beta = 0.213$ ,  $P < 0.001$ ;  $\beta = 0.184$ ,  $P < 0.01$ ;  $\beta = 0.149$ ,  $P < 0.05$ ). As a result, hypothesis 3 and 4 are supported.

In order to display a comparison of the moderating effects of social capital and entrepreneurial orientation clearly, this study graphically portrays the moderating effects of entrepreneurial orientation and social capital in Figure 2. The black lines represent high levels for the moderators, whereas the dotted lines represent low levels for the moderators. According to the changes of location and the slope of the lines in Figure 2, it appears that entrepreneurial orientation provides a stronger moderating effect than social capital. Because entrepreneurial orientation reflects the extent to which a firm is innovative or competitively aggressive (Lumpkin and Dess, 1996), it may facilitate organizational members in devoting themselves to innovation more actively and

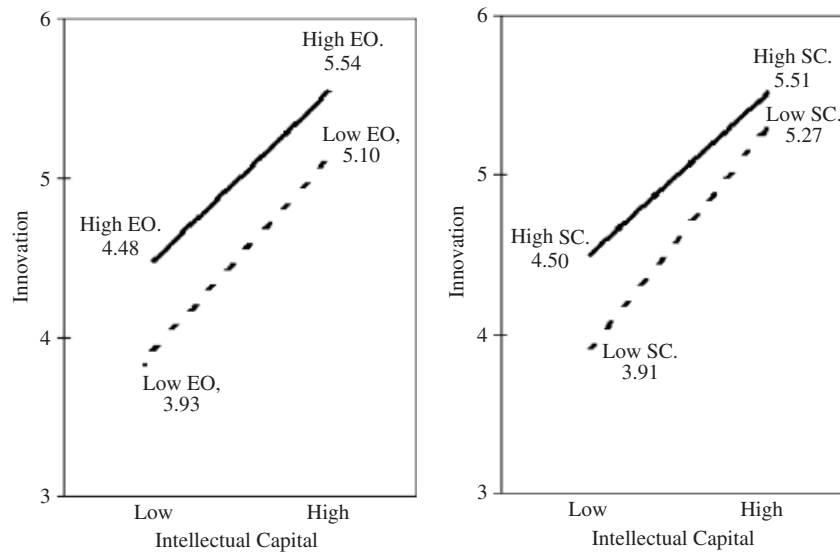


Figure 2. Moderating effects of entrepreneurial orientation and social capital on the relationship between intellectual capital and innovation.

aggressively. This implies that the characteristics of risk-taking, innovativeness, and proactiveness, which constitute entrepreneurial orientation (Miller, 1983), are the key to fully implementing intellectual capital in order to create higher levels of innovation.

## 5. Conclusions and implications

This study attempts to clarify the appropriate inner environment for firms which can reinforce the positive influence of intellectual capital on innovation. The results indicate that intellectual capital is one of the most important sources for firms to acquire competitive advantages. Firms should acquire and manage employees who possess higher degrees of intellectual capital in exchange for better innovation (Shipton et al., 2005). Furthermore, firms operating in an atmosphere of higher entrepreneurial orientation and social capital may also enhance their intellectual capital. Nahapiet and Ghoshal (1998) argue that the network of relationships possessed by a department will enhance its intellectual capital. Firms that operate in highly interactive and coordinative environments will enable employees to create a climate of innovation and information sharing. The results are consistent with the observations and findings of Kohtamäki et al. (2004) and Zakaria et al. (2004) who find that interpersonal trust and mutual respect can encourage the communication of ideas, knowledge sharing, and problem solving. Furthermore, Wiklund and

Shepherd (2003) comment that entrepreneurial orientation can enhance the relationship between knowledge-based resources and firm performance. Thus, in order to promote intellectual capital, firms should emphasize social capital and entrepreneurial orientation in their daily business operations.

In addition, entrepreneurial orientation is more beneficial for the development of customer capital, whereas social capital is more beneficial for the development of structural capital. This result has some managerial implications. First, although abundant valuable knowledge is embedded in the network of relationships including stakeholders such as customers, suppliers, and government, the firm must foster higher levels of entrepreneurial orientation in order to encourage its employees to actively enhance customer capital. Capital cannot be realized without finding and utilizing. Second, social capital is not only advantageous to human capital, but also advantageous to non-human capital. Positive relationships can aid employees in exchanging and storing their own knowledge without suspicion and concealment.

This study also explores the mediating effects of intellectual capital on the relationships between social capital, entrepreneurial orientation, and innovation, as well as the moderating effects of both social capital and entrepreneurial orientation on the relationship between intellectual capital and innovation. The results indicate that the mediating role of intellectual capital and the moderating roles of social capital and entrepreneurial orientation exist. Hence, internal operational modes characterized



by higher levels of social capital and entrepreneurial orientation indeed assist in the full utilization of intellectual capital in order to foster innovation. Previous studies have suggested that intellectual capital should be embedded in a highly social network environment (Uzzi, 1997; Nahapiet and Ghoshal, 1998). Tsai and Ghoshal (1998) argue that social capital facilitates inter-unit resource exchange and the creation of intellectual capital. Therefore, social capital could serve as a catalyst for intellectual capital. The moderating effect of social capital is partially parallel to Reed et al.'s (2006) findings that higher levels of social capital enhance the positive relationship between human capital and performance. Additionally, if entrepreneurs are characterized as risk-taking and proactive, their management styles tend to be active and aggressive. This entrepreneurial management style will force employees to engage in innovation. Therefore, if social capital is a pull force, entrepreneurial orientation will serve as a push force to enhance intellectual capital and innovation.

The final conclusions are related to a comparison of the moderating effects of social capital and entrepreneurial orientation. The results show that the moderating effect of entrepreneurial orientation exceeds that of social capital. Although social capital may also augment the positive influence of intellectual capital on innovation, it is likely to be more effective at actively exploring opportunities than forging a harmonious environment inside the firm. Moreover, this result is consistent with the arguments of Lumpkin and Dess (1996) and Miller (1983) that entrepreneurial orientation reflects the extent to which a firm is able to engage in the pursuit of new ventures or innovation. The firm's intellectual capital can aid in innovation creation; nevertheless, innovation activity also entails actively searching and aggressive exploring opportunities.

Our research findings offer practical implications for firms, especially knowledge-intensive firms. Because the research sample was confined to Taiwanese enterprises, it is necessary to discuss the specificity of our research findings for Taiwanese enterprises. Shiu (2006) indicated that knowledge-intensive companies tended to dominate as in the Taiwan technology sector, and it is necessary to maximize the utilization of intellectual capital. Hence, intellectual capital should receive highly attention from high-tech industries in Taiwan. In fact, high-tech industries gradually become key industry in Taiwan and have continuously enjoyed high growth (Hsieh and Tsai,

2007). Chen et al. (2006) examined the role of intellectual capital in Taiwanese manufacturing companies and found that the intellectual capital had greatly positive effect on new product development performance when the growth rate of the industry was higher. Accordingly, the relationship between intellectual capital and innovation is imperative for high-tech enterprises in Taiwan which have higher growth rate. In this regard, our research findings can provide ideas for enterprises to develop and consolidate the relationship between intellectual capital and innovation.

One of the causes resulting in the core competence of high-tech industry in Taiwan is technology manpower (Hsieh and Tsai, 2007). This phenomenon is parallel to our findings that human capital has most positive influence on innovation. Furthermore, Hsieh and Tsai (2007) indicated that Taiwanese high-tech industries had stable profits because they were closely inter-related with their customers, which generates customer capital. Hsieh and Tsai's (2007) observations on Taiwanese high-tech industries manifest the role of intellectual capital. Shiu (2006) also found that Taiwanese high-tech enterprises were capable of transforming intellectual capital to high value added products or services. It is imperative to identify an optimal management pattern on intellectual capital with particularly emphasis on social capital building for Taiwanese high-tech enterprises. Therefore, as to key industry in Taiwan, our research findings are valuable in that they point to a way to create and utilize the intellectual capital.

There is another trend appearing in Taiwan socioeconomic system. Namely, China has become the factory of world. Because China has been turned into main production location for Taiwanese industries, Taiwanese enterprises need to upgrade from a production orientation to an innovation orientation (Tsan and Chang, 2005). Thus, our research findings can offer very critical references for accommodating this situation. It is imperative to develop an appropriate environment inside organization which is molded by social capital and entrepreneurial orientation in that this environment can be regarded as Petri dish of intellectual capital and innovation.

Social capital is another focus in this study. Note that we place emphasis on internal social capital instead of external social capital. Specifically, we discuss the internal ties among organizational employees rather than external ties with outside firms. This study attempts to investigate how to develop an appropriate environment

wherein the intellectual capital can be created and strengthened by utilizing internal ties among organizational employees. Nevertheless, external social capital is determinant to innovation for Taiwanese high-tech enterprises (Hsieh and Tsai, 2007). Hsieh and Tsai (2007) argued that high percentages of projects were completed by utilizing outsourcing or partners' technologies. This means that innovation also originates from the collaboration between firms. Walter et al. (2007) found many benefits including knowledge transfer accrued to firms from social capital with partners. Many Taiwanese firms have engaged in strategic alliance with the US firms to obtain intellectual capital on the one hand, and transform this intellectual capital (such as patents and know-how) to their subsidiaries in China. In other words, the high-tech enterprises in Taiwan are situated at the pivotal position to build external ties to firms in the US and in China. Accordingly, future research can highlight the influence of external social capital on intellectual capital.

There are other limitations suggest areas and directions for future research. First of all, due to time constraints and data availability, longitudinal research was not viable for this study. Hence, this study adopted a cross-sectional research design and examined firms at one point in time. Another limitation is that the sample firms were drawn from diverse industries in Taiwan. It would be valuable for future studies to concentrate on a comparison of research constructs between specific industries. Furthermore, we only focused on Taiwanese enterprises without regard to international companies or foreign companies in other countries. In terms of international companies, the future research can switch attention on intellectual capital and social capital among organizational members who have diverse culture or nationality. This is particularly imperative for Taiwanese enterprises in that increasing numbers of Taiwanese enterprises invest directly in China. While China became the factory to the world, the Taiwanese enterprises continued migrating production towards China. Many Taiwanese employees have been expatriated to China by parent company. It would be valuable to discuss the intellectual capital and social capital between Taiwanese and Chinese who have diverse culture and value. In terms of foreign companies in other countries, it is interesting to compare intellectual capital inside organization in one country with that in other country. The culture and socio-economic systems may be the causes leading to diverse results for firms in different countries.

Future research can take other factors and various sample into consideration.

## References

- Amabile, T.M. and Kramer, S.J. (2007) Inner work life: understanding the subtext of business performance. *Harvard Business Review*, **85**, 5, 72–83.
- Baron, R.M. and Kenny, D.A. (1986) The moderator-mediator variable distinction in social psychological research: conceptual, strategic, and statistical considerations. *Journal of Personality and Social Psychology*, **51**, 6, 1173–1182.
- Bontis, N. (1998) Intellectual capital: an exploratory study that develops measures and models. *Management Decision*, **36**, 2, 63–76.
- Bontis, N., Keow, W.C. and Richardson, S. (2000) Intellectual capital and business performance in Malaysian industries. *Journal of Intellectual Capital*, **1**, 1, 85–100.
- Bourdieu, P. and Wacquant, L. (1992) *An Invitation to Reflexive Sociology*. Chicago, IL: University of Chicago Press.
- Bueno, E., Salmador, M.P. and Rodríguez, Ó. (2004) The role of social capital in today's economy: empirical evidence and proposal of a new model of intellectual capital. *Journal of Intellectual Capital*, **5**, 4, 556–574.
- Burt, R.S. (1997) The contingent value of social capital. *Administrative Science Quarterly*, **42**, 2, 339–365.
- Chen, Y.S., Lin, M.J.J. and Chang, C.H. (2006) The influence of intellectual capital on new product development performance—the manufacturing companies of Taiwan as an example. *Total Quality Management & Business Excellence*, **17**, 10, 1323–1339.
- Conner, K.R. (1991) A historical comparison of resource-based theory and five schools of thought within industrial organization economics: do we have a new theory of firms? *Journal of Management*, **17**, 1, 121–154.
- Cronbach, L.J. (1987) Statistical tests for moderator variables: flaws in analyses recently proposed. *Psychological Bulletin*, **102**, 3, 414–417.
- Dunlap, W.P. and Kemery, E.R. (1987) Failure to detect moderating effects: is multicollinearity the problem? *Psychological Bulletin*, **102**, 3, 418–420.
- Hair, J.F., Black, B., Babin, B., Anderson, R.E. and Tatham, R.L. (2006) *Multivariate Data Analysis*, 6th edn. Upper Saddle River, N.J.: Pearson Prentice Hall.
- Han, J.K., Kim, N. and Srivastava, R.K. (1998) Market orientation and organizational performance: is innovation a missing link? *Journal of Marketing*, **62**, 4, 30–45.
- Hayton, J.C. (2005) Competing in the new economy: the effect of intellectual capital on corporate entrepreneurship in high-technology new ventures. *R & D Management*, **35**, 2, 137–155.

- Hsieh, M.H. and Tsai, K.H. (2007) Technological capability, social capital and the launch strategy for innovative products. *Industrial Marketing Management*, **36**, 4, 493–502.
- Hurley, R.F. and Hult, G.T.M. (1998) Innovation, market orientation, and organizational learning: an integration and empirical examination. *Journal of Marketing*, **62**, 3, 42–54.
- Kohtamäki, M., Kekäle, T. and Viitala, R. (2004) Trust and innovation: from spin-off idea to stock exchange. *Creativity and Innovation Management*, **13**, 2, 75–88.
- Lee, T.S. and Tsai, H.J. (2005) The effects of business operation mode on market orientation, learning orientation and innovativeness. *Industrial Management and Data Systems*, **105**, 4, 325–348.
- Lumpkin, G.T. and Dess, G.G. (1996) Clarifying entrepreneurial orientation construct and linking it to performance. *Academy of Management Review*, **21**, 1, 135–172.
- Lumpkin, G.T. and Dess, G.G. (2001) Linking two dimensions of entrepreneurial orientation to firm performance. *Journal of Business Venturing*, **16**, 5, 429–451.
- Lynn, B.E. (2000) Intellectual capital: unearthing hidden value by managing intellectual assets. *Ivey Business Journal*, **64**, 3, 48–52.
- Miller, D. (1983) The correlates of entrepreneurship in three types of firms. *Management Science*, **29**, 7, 770–791.
- Nahapiet, J. and Ghoshal, S. (1998) Social capital, intellectual capital, and the organizational advantage. *Academy of Management Review*, **23**, 2, 242–266.
- Proctor, T. (1998) Innovations in time: what can we learn from history? *Creativity and Innovation Management*, **7**, 4, 204–211.
- Reed, K.K., Lubatkin, M. and Srinivasan, N. (2006) Proposing and testing an intellectual capital-based view of the firm. *Journal of Management Studies*, **43**, 4, 867–893.
- Reinmoeller, P. and van Baardwijk, N. (2005) The link between diversity and resilience. *MIT Sloan Management Review*, **46**, 4, 61–65.
- Rodan, M. and Galunic, C. (2004) More than network structure: how knowledge heterogeneity influences managerial performance and innovativeness. *Strategic Management Journal*, **25**, 6, 541–562.
- Shipton, H., Fay, D., West, M., Patterson, M. and Birdi, K. (2005) Managing people to promote innovation. *Creativity and Innovation Management*, **14**, 2, 118–128.
- Shiu, H.J. (2006) The application of the value added intellectual coefficient to measure corporate performance: evidence from technological firms. *International Journal of Management*, **23**, 2, 356–365.
- Subramaniam, M. and Youndt, M.A. (2005) The influence of intellectual capital on the types of innovative capabilities. *Academy of Management Journal*, **48**, 3, 450–463.
- Tsai, W. and Ghoshal, S. (1998) Social capital and value creation: the role of intra-firm networks. *Academy of Management Journal*, **41**, 4, 464–476.
- Tsan, W.N. and Chang, C.C. (2005) Intellectual capital system interaction in Taiwan. *Journal of Intellectual Capital*, **6**, 2, 285–298.
- Uzzi, B. (1997) Social structure and competition in interfirm networks: the paradox of embeddedness. *Administrative Science Quarterly*, **42**, 1, 35–67.
- Vakola, M. and Rezgui, Y. (2000) The role of evaluation in business process re-engineering: two case studies in the construction industry. *Knowledge and Process Management*, **7**, 4, 207–216.
- Walter, J., Lechner, C. and Kellermanns, F.W. (2007) Knowledge transfer between and within alliance partners: private versus collective benefits of social capital. *Journal of Business Research*, **60**, 7, 698–710.
- Wiklund, J. and Shepherd, D. (2003) Knowledge-based resources, entrepreneurial orientation, and the performance of small and medium-sized business. *Strategic Management Journal*, **24**, 13, 1307–1314.
- Young, C.S. (2005) Top management teams' social capital in Taiwan: The impact on firm value in an emerging economy. *Journal of Intellectual Capital*, **6**, 2, 177–190.
- Zakaria, N., Amelinckx, A. and Wilemon, D. (2004) Working together apart? Building a knowledge-sharing culture for global virtual teams. *Creativity and Innovation Management*, **13**, 1, 15–29.

## Notes

1. Since there are no differences of intellectual capital, social capital, and entrepreneurial orientation among firms which have different ages, annual revenue, and numbers of employees, the detailed results of MANOVA are not put into the text for simplicity.
2. Cronbach (1987) suggested an alternative regression model to correct for multicollinearity. First of all, it is necessary to subtract the mean from the criterion variable, predictor and moderator. An alternative method is to regress the deviation of the criterion variable from its mean on the deviation of the predictor and moderator from their mean, as well as the product of the deviation of the predictor and moderator from their mean. In the alternative regression, there is almost no multicollinearity problem. Furthermore, in terms of the mediator, since the predictor causes the mediator, the presence of such correlation also results in multicollinearity (Baron and Kenny, 1986). In order to prevent the problem of multicollinearity, model 1 to model 5 in Table 5 were conducted by Cronbach's (1987) alternative regression model. Concerning Table 4, the results of the original regression model were the same as those using the alternative regression model.

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## Appendix A

Table A1. The detailed items of measurements

Construct	Reference	Items
Human capital	Bontis (1998)	The knowledge and competence of our employees. The average educational level of workforce. The firm supports our employees by constantly upgrading their skills and education whenever each of them feels it is necessary. Instead of doing without thinking, our employees can work brightly. Individuals can share experiences and knowledge with their colleagues.
Customer capital	Bontis (1998)	Employees would share their creativity with their colleagues. A poll of our customers would indicate that they are generally satisfied with our organization Our organization thrives on maintaining the most positive value-added service of any firm in the industry We emphasize on our customers' wants and strive to meet with customers. We get as much feedback out of our customers as we possibly can under the circumstances Our organization prides itself on being market-oriented We are confident of future with customer.
Structural capital	Bontis (1998)	The overall operation procedure is very efficient. Responding to the changes quickly. It is supportive between different departments. Systems allow easy information access. The systems and procedures of our organization is flexible and efficient. Our organization's culture and atmosphere is supportive and comfortable.
Social capital	Nahapiet and Ghoshal (1998) and Tsai and Ghoshal (1998)	Our organization prides itself on being efficient. Employees often exchange information in informal Our company is characterized by personal friendship among the colleagues at multiple levels In this relationship both sides avoid making demands that can seriously damage the interests of the other. Our colleagues always keep their promises to us Our colleagues clearly understand the goal and vision in our company. Our colleagues shares the same ambitions People in our unit are enthusiastic about pursuing the collective goals and missions of the whole organization

Table A1. (Contd.)

Construct	Reference	Items
Entrepreneurial orientation	Lumpkin and Dess (2001)	Owing to the nature of the environment, bold, wide-ranging acts are necessary to achieve the firm's objectives. Employees have the ability of thinking and self-managing. My firm stressed full delegation for employees. A strong proclivity for high risk projects (with chances of very high returns). When confronted with decisions involving uncertainty, my firm typically adopts a bold posture in order to maximize the probability of exploiting opportunities. My firm encouraged individuals or teams to develop new ideas. (In dealing with competitors, my firm) typically initiates actions which competitors then respond to. (In dealing with competitors, my firm) is very often the first business to introduce new products/services, administrative techniques, operating technologies, etc. (In general, the top managers of my firm have) a strong tendency to be ahead of others in introducing novel ideas or products. My firm typically adopts a very competitive 'undo-the-competitors' posture. My firm is very aggressive and intensely competitive. My firm always initiates actions firstly instead of responsiveness.
Innovation	Han et al. (1998) and Hurley and Hult (1998)	The volumes of new products or service that we develop. The speed of new products or service that we develop. The time of new products entering the market. The degree which we improve old products and make it functional. The degree which we develop new technology to improve operating or serving process The degree which we adopt new machines or methods to improving operating or serving process. The degree which we promote brand and corporate image. The degree which we adopt new management practice to improve operating performance. To sum up, our innovation achievement level is high.

Few items were deleted due to poor factor loadings.