Study Knowledge Flows Moving in Business Groups with the Perspectives of Organizational Learning

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ABSTRACT

Business groups are commonly regarded as important organizational structures in today’s modern economies. Headquarters play the main role of coordinating all subsidiaries’ knowledge, and subsidiaries are both knowledge providers and knowledge demanders. If all the parties in business groups accomplish their functions well, every unit enjoys the fruits of synergy. However, knowledge is often not easy to spread. This knowledge represents a subsidiaries competitive advantage. If subsidiaries shared knowledge with each other, they would dilute their own competitive advantages. Hence, properly managing the knowledge held in subsidiaries is very important for headquarters. This study attempts to link social capital and organizational learning concepts in exploring the driving force behind knowledge outflows of subsidiaries.

Keywords: knowledge flows, organizational learning, social capitals

INTRODUCTION

Business groups are commonly regarded as important organizational structures in today’s modern economies, and they can freely share tangible and intangible resources with all business units and exhibit excellent performance (Chang & Hong, 2000; Khanna & Rivkin, 2001; Lincoln, Gerlach & Ahmadjian, 1996). These results correspond to the knowledge-based theory concept. That central concept considers firms as not only substitutional mechanisms, but also institution which integrate knowledge (Grant, 1996). Similarly, business groups can be viewed as higher-level coordinating mechanisms for integrating all the knowledge and resources contained in all business units. General speaking, headquarters plays the main role of coordinating all subsidiaries’ knowledge, and subsidiaries are both knowledge providers and knowledge demanders. If all the parties in business groups accomplish their functions well, every unit enjoys the fruits of synergy.

In reality, however, knowledge is often not easy to spread. Knowing the driving force of subsidiary knowledge outflows helps clarify this conflicting phenomenon within business groups. Each business group subsidiary has many special situations to confront and incidents to overcome; these experiences continuously accumulate in each subsidiary and are transformed into valuable knowledge. This knowledge represents a subsidiaries competitive advantage. If subsidiaries share knowledge with each other, they would dilute their own competitive advantages. This leads to many real examples of the conflict between headquarter and subsidiaries concerning knowledge sharing.

Knowledge outflows in business groups mean knowledge transfers from one unit to other business units (Schulz, 2001). There are two types of knowledge outflows, according to Schulz (2001). Vertical outflow refers to knowledge transfers from a subsidiary into headquarter; horizontal outflow refers to
knowledge transfers from a subsidiary into peer units. In previous studies, organizational learning is a proper starting point for observing the relationships between the types of subsidiary knowledge acquisition and the tendency of knowledge outflows to other units.

When subsidiaries acquire knowledge from other units within a business group or outflow knowledge to other units, some social capital factors, like interaction, trust or trustworthiness, and shared vision are formed gradually. Social capital is usually cited for explaining the relationship between actors within a relational network. A business group comprises many subsidiaries, just like a relational network. However, few empirical studies have analyzed the links between organizational learning and social capital to explore knowledge outflows. This study attempts to combine the social capital view with the organizational learning perspective to further clarify the driving force of subsidiary knowledge outflows within a business group.

According to these intentions, the two major purposes of this study are as follows: First, exploring the subsidiary relationships between knowledge acquisition inside and outside the business group and knowledge outflows. Secondly, exploring whether or not social capital influences the relationships between knowledge acquisition and knowledge outflows.

LITERATURE REVIEW AND RESEARCH MODEL

Knowledge flows

Knowledge flows could be seen the transference of competences or else external market data with strategic value, such as important information about customer, competitors or dealers (Gupta & Govindarajan, 1991; Ordóñez, 2004). Like the patterns of communication, knowledge flow is a concept of transference; it occurs between a source and a target along a channel (Gupta & Govindarajan, 2000). Including at least two players, a knowledge provider and a knowledge receiver, could be operated.

Most of these studies suggested that business groups offer efficient forms of governance in some circumstances, showing that firms affiliated with business groups usually tended to present higher profitability and performance than independent firms (Chang & Hong, 2000; Khanna & Rivkin, 2001; Lincoln, Gerlach & Ahmadjian, 1996). This is because of business groups are as a platform that all subsidiaries could exchange knowledge or resources upon it easily. By contrast, independent firms must spend both time and cost to acquire knowledge through various methods.

The power viewpoint is another angle to observe the behaviors of knowledge exchange within business groups. Mudambi & Navarra (2004) argued knowledge flow is a key determinant of subsidiary bargaining power. If subsidiary possesses valuable knowledge, it means directly strong bargaining power is holding by the subsidiary, and further, subsidiary owns high level of decision-making autonomy to resist headquarters’ command and have high level of power of allocating resource within business groups.

Schulz (2001 & 2003) adopted Gupta & Govindarajan’s (2000) types and added the concept of horizontal and vertical into knowledge flows. (1)horizontal outflows: carrying knowledge to peer units, (2)vertical outflows: carrying knowledge to supervising units, (3)horizontal inflows: acquiring knowledge from peer units, (4)vertical inflows: acquiring knowledge from supervising units.

The relationship between knowledge outflows and organizational learning review

Organizational learning is a process that could be viewed as a cyclical in which individuals actions lead to organizational interactions with the environment or environment responds (Sinkula, 1994). Besides, several scholars stressed organizational learning as a process of improving performance through
experience and understanding (e.g., Fiol & Lyles, 1985; Nevis, DiBella & Gould, 1995). Hence, undergoing continuous learning processes, organization could develop exclusive competitive advantage.

However, organizational learning is a multilevel phenomenon, including individual, group, and organization (Crossan, Lane & White, 1999; Huber, 1991; Schulz, 2001). Learning in each level may occur by different motivators. In this study, we focus on the level of subsidiary. Subsidiary-level learning occurs if any of its units acquires knowledge that it recognizes as potentially useful to the subsidiary (Huber, 1991). March (1991) cited the concept of organizational learning and suggested that exploitation and exploration were two ways for subsidiaries to acquire knowledge effectively.

Exploitation and exploration represent two sources, inside and outside the organization, of acquiring knowledge of organization respectively. Both exploitation and exploration are essential for organizations, but they compete to scarce resources (March, 1991). Exploitation could achieve purposes rapidly, but may not be sufficient in the long run to maintain a competitive advantage over time, in that the environment was changeable and unpredictable; on the other side, focusing on exploration must burden with higher costs in experimentation that may not have been necessary or beneficial (March, 1991; Van Deusen & Mueller, 1999). Consequently, in order to obtain the optimum performance of acquiring knowledge, organization must keep an appropriate balance between these two processes. However, these two processes do not have the trade-off relationship only. Holmqvist (2004) argue exploitation and exploration could be viewed as cause and effect relationship. Exploitation can become a cause of exploration, and vise versa.

The research model is modified from Schulz’s (2001) framework. This study attempts to understand the relationship between knowledge acquisition and knowledge outflows among business group units. Exploration and exploitation are twin processes for subsidiaries to acquire knowledge from organizational learning. Exploitation is a process that subsidiaries acquire knowledge from headquarter (vertical inflows) or peer units (horizontal inflows). Several studies address the positive relationships between knowledge inflows and knowledge outflows (e.g., Gupta & Govindarajan, 2000; Mudambi & Navarra, 2004). Exploration refers to independent new knowledge development by subsidiaries without resources from other units within business group. A subsidiary that transfers knowledge to other units, earns strong bargaining power within business group (Mudambi & Navarra, 2004). Hence, exploration is related to knowledge outflows.

The relationship between exploitation and knowledge outflows

Companies affiliated with business groups tend to exhibit higher performance than independent companies in the same country (Chang & Hong, 2000). One of the most important reasons is because of group-affiliated companies can make use of tangible and intangible resources within whole business groups. And exploitation is such an inflow process for subsidiaries to collect or integrate existent knowledge that was stocked in headquarters or peer units, hence those units can save significant costs in researching needed knowledge. However, knowledge is a valuable asset to every company. It is not easily for a company to outflow its knowledge; even it plays the roles of headquarters or subsidiary within business groups.

Reciprocation is a proper view, the angle of procedural justice, to explain the fairness of knowledge exchange (Kim & Mauborgne, 1991; Schulz, 2001). For example, a subsidiary willingly transfers helpful knowledge to another subsidiary because of expected reciprocation from the receiving subsidiary (Schulz, 2001, 2003). The concept can be seen as a cause and effect cyclic phenomenon. In such a reciprocating process, the providing subsidiary expects to obtain desirable knowledge by sharing knowledge; it is a comparatively efficient method than explores knowledge by itself. On the other side, the receiving
subsidiary returns knowledge to the providing one can earn a next chance of knowledge inflow. Similarly, the reciprocating process happens to the situations of knowledge exchange between subsidiary and headquarters. These arguments lead to the two following hypotheses:

**H₁:** The higher the level of vertical knowledge inflows, the stronger are the vertical knowledge outflows.

**H₂:** The higher the level of horizontal knowledge inflows, the stronger are the horizontal knowledge outflows.

Different to reciprocation, broker is another knowledge exchange concept, coordinating resources between two groups. Davenport & Prusak (1998) addressed the ideas of knowledge market, who seen knowledge exchange as a types of transaction in the market. However, economic theories confirm market mechanism is imperfectly, as well as knowledge market. It needs brokers to coordinate the gap between supply actors and demand actors in the knowledge market. Hargadon & Sutton’s (1997) observation in the innovation processes of Thomas Edison’s laboratory find that good innovation performance is due to numerous collected and combined ideas from other companies in different industries. Business groups usually diversify in business and construct many subsidiaries in different industries. A subsidiary acting as a business group broker finds more opportunities and knowledge through processes of importing knowledge, combining it, and providing it to other business units. Brokering implies a positive effect related to inflows from one group and outflows to another group (Schulz, 2001). Two following hypotheses relate to the above argument:

**H₃:** the higher the level of vertical knowledge inflows, the stronger are the horizontal knowledge outflows.

**H₄:** the higher the level of horizontal knowledge inflows, the stronger are the vertical knowledge outflows.

*The relationship between exploration and knowledge outflows*

The exploration process occurs more frequently than the exploitation process for a company. Although business groups abound in resources, each subsidiary faces diverse competition and environment in most conditions. Therefore, much unique and valuable knowledge is developed and transferred into competitive advantage in every subsidiary. This research divides the arguments according to views of power and cause-and-effect, for convenient inference clarification.

Mudambi & Navarra (2004) argue that subsidiary bargaining power is the prime determinant of knowledge outflow intention. As a subsidiary’s valuable knowledge are widely used by (and create a lot of value for) headquarters and peer units within business groups has a strong bargaining power, because of the opportunity costs in that receiving units are very high (Forsgren & Pedersen, 2000; Mudambi & Navarra, 2004). Otherwise, headquarters frequently establish formal knowledge exchange requirements to exploit knowledge from all units (Schulz, 2001).

Exploration and exploitation can also be viewed as a cause and effect relationship (Holmqvist, 2004). As a subsidiary transfers unique knowledge to needed units and headquarters, receiving subsidiaries will share their knowledge with the provider, resulting in another beneficial exploration process. Two hypotheses are formulated according to the above argument, as follows:

**H₅:** The higher the level of new knowledge exploration, the stronger are the vertical knowledge outflows.

**H₆:** The higher the level of new knowledge exploration, the stronger are the horizontal knowledge outflows.
Social capital between exploitation, exploration and knowledge outflows

A business group can be regarded as a network which is composed of numerous units. The social capital viewpoint for observing the social relationship network is incorporated into this framework for clarifying the knowledge exchange relationships.

The concept of social capital has since been applied in a wide range of intra- and inter-firm studies (Burt, 1992; Nahapiet & Ghoshal, 1998; Walker, Kogut & Shan, 1997). Social capital is the sum of the actual and potential resources embedded within, available through, and derived from the network of relationships possessed by an individual or social unit (Nahapiet & Ghoshal, 1998). Unlike other forms of capitals, social capital is owned jointly by the parties in a relationship, and no one player has, or is capable of having, exclusive ownership rights (Burt, 1992). Undoubtedly, a network of relationship is the most crucial foundation of forming social capital. As Coleman (1988) stated, a network tends toward the reproduction of an inherited pattern of relationship due to the value to the individual in preserving social capital. Similarly, business group is a typical of network composed of numerous subsidiaries. Such a network of links enables business-units to gain the resources they wanted, and further contribute to their competitiveness (Tsai, 2001). Therefore, social capital is a suitable view to observe the situations of knowledge flows among all units within a business group.

Social capital is more than just a structure or network but that it also including many aspects of social context (Liao & Welsch, 2005; Nahapiet & Ghoshal, 1998). In order to present a theoretical model of how social capital may creative intellectual capital within organizations, Nahapiet & Ghoshal (1998) firstly clarified many different attributes into three clusters: the structural, the relational and the cognitive dimensions of social capital. Many scholars developed relative researches were founded upon this classification later (Liao & Welsch, 2005; Tsai & Ghoshal, 1998; Yli-Renko, Autio & Sapienza, 2001).

Exploitation, exploration, and knowledge outflows in this study belong to subsidiary-level relationships. following Tsai & Ghoshal’s (1998) study and dividing the argument into three parts, firstly, social interaction belongs to the structural dimension of social capital (Tsai & Ghoshal, 1998); subsidiaries can earn resources through better interaction. Subsidiary transfers knowledge to other units or acquire knowledge from other units, both can be seen as interaction behaviors. The second, trustworthiness, belongs to the relational dimension of social capital; a subsidiary’s trustworthy reputation is a referable signal for other units that is beneficial for exchanging knowledge. Szulanski, Cappetta and Jensen (2004) argue that trustworthiness has positive influence in knowledge transfer. The third, shared vision, belongs to the cognitive dimension of social capital; all business group units have identical goals and shared language. A shared vision embedded in all units will benefit communication and further knowledge exchange between different units (Nahapiet & Ghoshal, 1998; Tsai & Ghoshal, 1998). Four hypotheses relate to the above argument as follows:

H7a: The social capital between subsidiaries and headquarters strengthens the relationship between exploitation and vertical knowledge outflows.

H7b: The social capital between subsidiaries and headquarters strengthens the relationship between exploration and vertical knowledge outflows.

H8a: The social capital between subsidiaries and peer units strengthens the relationship between exploitation and horizontal knowledge outflows.

H8b: The social capital between subsidiaries and peer units strengthens the relationship between exploitation and horizontal knowledge outflows.
METHODOLOGY

Research variables

All variables in the questionnaire are measured according to the six-point Likert scale ranging from 1 “agree very little” to 6 “agree very much”.

Knowledge outflow refers to subsidiary transfers knowledge to other units within the same business group (Gupta & Govindarajan, 1991; Schulz, 2001). According to Schulz (2001, 2003), vertical outflow refers to carrying knowledge from a subsidiary to headquarter and horizontal outflow refers to carrying knowledge from a subsidiary to peer units on the same hierarchical level.

Exploitation represents that a learning process for a subsidiary to combine existing knowledge from whole business group. The current work follows Schulz’s (2001, 2003) methods and cites the inflow concept to measure exploitation. Exploitation can be divided into vertical inflow and horizontal inflow (Schulz, 2001, 2003). Vertical inflow means that subsidiaries acquire knowledge from headquarter. Horizontal inflow means that subsidiaries acquire knowledge from peer units on the same hierarchical level.

Exploration, in contrast to exploitation, refers to a learning process for a subsidiary to acquire new knowledge outside the business group. The exploration process occurs more frequently than the exploitation process because subsidiaries usually face diverse environments.

Social capital refers to sum of the actual and potential resources embedded within, available through, and derived from the network of relationships possessed by whole business units within a business group (Nahapiet & Ghoshal, 1998). Following Tsai and Ghoshal’s (1998) study, social capital was measured by social interaction, trustworthiness and shared vision. Social interaction refers to the extent of social relationships between other units within business groups. Trustworthiness refer to an exchange business unit is worthy when it is worthy of the trust of other units within business groups. Shared vision refers to a bonding mechanism that helps all units to integrate or to combine resources.

In order to control for additional factors related to this study, six variables were included in the model: Industry, subsidiary age, relative size of subsidiary compared to other units of the business groups, relative sales of subsidiary compared to other units of the business groups, knowledge coding, department

Data collection and analysis

This study mainly researches the behaviors of knowledge outflow of subsidiaries affiliated to business groups. The source of sample is according to the database of business groups in Taiwan 2006 of China Credit Information service, Ltd. The target subsidiaries are chose from the lists of top 100 business groups in Taiwan. In order to avoid bias, questionnaires are provided to every business groups as dispersedly as possible.

Considering of collecting the results correspond to actuality in practice. This study picks these leaders of marketing department and R&D department of target subsidiaries for respondents. These leaders would actually understand the situations of exchange knowledge with other units within business groups than these chiefs of subsidiaries.
RESULTS

Response rate and reliability analysis

A total of 410 questionnaires are mailed to the suitable marketing departments and R&D departments which are selected from 274 subsidiaries within business groups. Two sets of questions are designed in each questionnaire. A response rate of 11.22% percent corresponded to 46 questionnaires returned. Among these, there are 67 validity samples, of which 32 belonged to marketing and 35 belonged to R&D. All the test results of these variables are over than 0.7 and reach to reliable consistence.

Both Information & Electronics industry and Manufacture industry are in the majority, occupying an equal percentage, 35.8%. A similar respondent amount returns from both departments. Most subsidiaries’ age fall into two intervals, 6~10 and 15~20 years. Statistics about relative size and relative sales are in a normal condition. The ratios related to whole business groups or headquarters have significant differences in it, but peer unit is not. Most of these subsidiaries are in a high degree of coding knowledge.

Hypotheses Results

All variables in this study are listed in Table 1 for a correlation analysis. The correlative degree between per pair variables is observed by the coefficients of correlation in that Table.

Table 2 lists the parameter estimates of regression models of vertical / horizontal outflows of knowledge. A total of six regression models are contained. Model 1 includes only the control variables. Relative size (W) has a positive and significant effect in this model, corresponding to Gupta & Govindarajan’s (2000) study. It implies when a subsidiary owns a high ratio of staffs compared to whole business groups’, it has more intention to outflow knowledge to headquarters. But other variables, including industry, department, age, relative size and sales compared to headquarter, and the degree of coding knowledge are not significant here.

In model 2, the improvement of fit is highly significant (p < 0.001) and R^2 rises from 0.22 to 0.71. Vertical outflows has a positive and highly significant (p < 0.001). Therefore, hypothesis 1 gets a strong support. Obviously, horizontal inflows is not a significant factor for vertical knowledge outflows, and even subsequent models are presented the same condition. So hypothesis 4 is rejected. Exploration shows a positive and significant effect here. Hypothesis 5 gets a strong support.

Model 3 adds social capitals to examine simultaneously. The improvement of fit is significant (p < 0.001), and R^2 is just a slight raise, from 0.71 to 0.72. Social capitals are not significant here. But specially, exploration converts into insignificant due to the influence of combining with social capitals. In fact, social capitals are arranged for a moderating variable in this study. Hence, result of model 3 corresponds to expectation.

At last, three interactive variables related respectively to vertical inflows, horizontal inflows, and exploration are added in model 4. The improvement of fit is significant (p < 0.001), and R^2 rises from 0.72 to 0.77. Because of adding interactive variables, exploration changes into significant again. Therefore, hypothesis 5 is indeed supported by this result. Otherwise, the interactive effect between exploration and social capitals shows a positive and significant in this model as well. It confirms that social capitals can strengthen the relationship between exploration and vertical outflows (hypothesis 7b). The rest of two interactive variables which related to vertical inflows and horizontal inflows are insignificant, so hypothesis 7a is rejected.
Model 5 gives the parameter estimates of the control variables. Having a similar result with vertical outflows, only relative size (W) has a highly significant effect in this model, but whole is significant (p < 0.05).

In model 6, The improvement of fit is significant (p < 0.001), and R² rises from 0.25 to 0.64. Vertical inflows was significant here and even in subsequent models. Horizontal inflows is the significant variable. Thus, hypothesis 2 is supported and hypothesis 3 is rejected. By observing subsequent models, exploration shows no significant as well. The inference of hypothesis 6 does not occur.

Model 7 explores the result after combining social capitals. The improvement of fit is significant (p < 0.001), and R² rises from 0.64 to 0.69. Social capitals have a positive and significant effect in this model. However, the performance of horizontal inflows suffers slight decrease from joining social capitals.

Three interactive variables, related to vertical inflows, horizontal inflows, and exploration are examined concurrently in model 8. The improvement of fit is significant (p < 0.001), and R² has a more raise, from 0.69 to 0.75. Both horizontal inflows and social capitals are still significant in this model. In addition, the interactive variable concerning to exploration and social capitals shows a positive and significant effect. Therefore, the relationships among exploration, social capitals, and horizontal outflows are confirmed successfully (hypothesis 8b). The other two interactive variables, here, represent the same and insignificant results with vertical outflows. So hypothesis 8a does not get verification in this study.

Besides, an interesting discovery is that financial industry converts into significant in model 8. Due to the quantities of respondent samples of financial industry is less, only 11. It still needs more samples to explore if the interactive effects will strengthen horizontal knowledge outflows in financial industry.

CONCLUSIONS

Research discussion

This study explores the driving force behind knowledge outflows within business groups, combining organizational learning and social capital concepts. Questionnaires were sent to business group subsidiaries. Partial hypotheses, although not finally verified, still correspond to previous studies and offer many new indications for further clarifying knowledge flow conditions within business groups. Both vertical inflows and exploration promote vertical outflows; horizontal inflows and social capital are two essential forces that drive horizontal outflows. Obviously, vertical outflows and horizontal outflows are drove by different incentives. Otherwise, the interactive effect between exploration and social capital significantly influences both vertical and horizontal outflows.

This study attempts to link social capital and organizational learning concepts in exploring knowledge outflows within business groups. Findings indicate that different types of acquired knowledge indeed affect knowledge outflows in Taiwan’s business groups, and correspond with prior studies that usually focused on multinational corporations. However, social capital representing excellent effect in promoting knowledge outflows within business groups is the most important finding.

This investigation finds two major stimulants in driving vertical outflows, the knowledge acquired from headquarters and the knowledge were developed by subsidiaries themselves, subsidiaries are willing to transfer their knowledge. This result also supports Schulz’s (2001) study. Social capitals incorporated into the models reveals that social capitals do not directly influence knowledge sharing with headquarters, but some strengthen the tendency of transferring knowledge to headquarter with that knowledge were developed by subsidiaries themselves.
Therefore, this study considers bargaining power and governance as the main driving forces of vertical knowledge outflows. Subsidiaries transfer knowledge to headquarters, expecting to gain greater bargaining power, and headquarters usually establishes formal requirements for obtaining subsidiary knowledge. Previous studies also confirm that motivation factors do not stimulate subsidiary to outflow knowledge into headquarters (Gupta & Govindarajan, 2000), as it could increase the above inference possibility. Nevertheless, social capital still aids in promoting vertical outflows, though the influence is less.

Horizontal inflows are the only effective incentive in horizontal outflows before adding social capital. Reciprocation effect displays strong performance in both vertical outflows and horizontal outflows. As long as a subsidiary acquires knowledge form headquarters or specific subsidiary, then the subsidiary willingly gives feedback knowledge to that unit. To business groups, If headquarters and subsidiaries keep the open mind to share knowledge to other units within business groups actively, these knowledge receivers will return their knowledge equally. Depending on the continuous share-return circle, all the units within business groups will gain excellent synergy.

On the contrary, social capitals possess comparative ability of explanation in horizontal knowledge outflows. Social capital not only directly influences horizontal outflows, but also indirectly effects exploration. Exploration knowledge originally is only transferred to headquarters, not to other subsidiaries. Although headquarters plays a role of coordinating resource, it is too slow to some changeable and uncertain industry, like Information Technology industry. However, if subsidiaries have better social interaction, or build up trustworthiness through cooperation, or have identical share vision, subsidiaries are willing to share their specific knowledge to the other peer subsidiaries. It is unnecessary to waste cost and time to exchange knowledge via the transmitting of headquarters.

This study confirms the effect of social capitals in knowledge outflows successfully and offers an alternative to headquarters for effectively managing knowledge flows within business groups.

Future research and research limitation

This study chooses business groups for the observation object since business groups are a combination of many subsidiaries. Taiwan business groups usually serve as vertical integration patterns, with highly different subsidiary affairs. Multinational corporations may be another suitable object, and horizontal integration more occurs in that organization. That research results maybe generate an interesting comparison to this study.

Social capitals have significant effect in this study. A future study could focus in depth on social capitals. Previous studies classify social capitals into three types, which may have different degrees of influence with other variables.

The regression analysis results of horizontal knowledge outflows represent the financial industry is significant when interactive variables are added. Financial industry samples however, are too few to confirm the result. Maybe that industry includes certain characteristics diverse to other industries, and interactive effects easily occurring in the financial industry.

The greatest research limitation of this study is that questionnaires are not easy to collect. This difficulty is due to limited sample quantity and the fact that questionnaire respondents are marketing department and R&D department leaders who are too busy to fill out the questionnaires. Therefore, in order to collect more samples, the design of questionnaire was able to fill two samples. Business groups are usually composed of many subsidiaries, so it is convenient to choose two peer units as questionnaire objects. Some returned questionnaires may have high similarity, generating influence on inference. The
possibility of expansion of results is raised. Hence, the common method variance might occur in this study.

REFERENCES


### Table 1 Descriptive statistics and correlations

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<th>4</th>
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<td>2. Horizontal outflows</td>
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<td>3. Vertical inflows</td>
<td>4.21</td>
<td>0.99</td>
<td>0.77**</td>
<td>0.63**</td>
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<td>4. Horizontal inflows</td>
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<td>5. Exploration</td>
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<td>6. Social capitals (V)</td>
<td>4.70</td>
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<td>7. Social capitals (H)</td>
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<td>0.60**</td>
<td>0.41**</td>
<td>0.53**</td>
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</table>

a. (V): question items were related to “vertical relationship”.
   (H): question items were related to “horizontal relationship”.
   (W): question items were related to “whole business groups”.

b. *: P < 0.05 ;  **: P < 0.01
Table 2 Results of regression analysis of vertical /horizontal knowledge outflows

<table>
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<tr>
<th>Variables</th>
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<td></td>
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<td>(0.11)</td>
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<td>Exploration</td>
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<td></td>
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<td>(0.12)</td>
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<td>Social capitals</td>
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<td></td>
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<td>(0.22)</td>
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<td>0.15</td>
</tr>
<tr>
<td></td>
<td>(0.74)</td>
<td>(0.47)</td>
</tr>
<tr>
<td>Financial-Other</td>
<td>-0.15</td>
<td>0.23</td>
</tr>
<tr>
<td></td>
<td>(0.65)</td>
<td>(0.43)</td>
</tr>
<tr>
<td>Manufacture-Other</td>
<td>-0.03</td>
<td>0.19</td>
</tr>
<tr>
<td></td>
<td>(0.65)</td>
<td>(0.41)</td>
</tr>
<tr>
<td>Department</td>
<td>0.54</td>
<td>-0.09</td>
</tr>
<tr>
<td></td>
<td>(0.31)</td>
<td>(0.20)</td>
</tr>
<tr>
<td>Age</td>
<td>-0.10</td>
<td>-0.09</td>
</tr>
<tr>
<td></td>
<td>(0.11)</td>
<td>(0.07)</td>
</tr>
<tr>
<td>Relative size (W)</td>
<td>0.36*</td>
<td>0.03</td>
</tr>
<tr>
<td></td>
<td>(0.10)</td>
<td>(0.07)</td>
</tr>
<tr>
<td>Relative size (scale 4)</td>
<td>0.12</td>
<td>0.14</td>
</tr>
<tr>
<td></td>
<td>(0.19)</td>
<td>(0.12)</td>
</tr>
<tr>
<td>Relative sales</td>
<td>0.07</td>
<td>0.07</td>
</tr>
<tr>
<td></td>
<td>(0.23)</td>
<td>(0.15)</td>
</tr>
<tr>
<td>Codification</td>
<td>-0.19</td>
<td>-0.14</td>
</tr>
<tr>
<td></td>
<td>(0.20)</td>
<td>(0.14)</td>
</tr>
<tr>
<td>R²</td>
<td>0.22</td>
<td>0.71</td>
</tr>
<tr>
<td>Adjusted R²</td>
<td>0.08</td>
<td>0.64</td>
</tr>
<tr>
<td>F</td>
<td>1.54</td>
<td>9.89**</td>
</tr>
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</table>

a. Standard errors are in parentheses.  
b. *: P < 0.05; **: P < 0.01; ***: P < 0.001  
1: refers to the interactive effect between vertical inflows and social capitals  
2: refers to the interactive effect between horizontal inflows and social capitals  
3: refers to the interactive effect between exploration and social capitals  
4: a new named variable in this model (results of regression analysis of vertical /horizontal knowledge outflows) extracted form both relative size and relative sales