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The impact of buyer-supplier relationships' social capital on bi-directional information sharing in the supply chain

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Introduction

The adoption of supply chain management (SCM) initiatives has for more than two decades been considered to be essential for ensuring sustainable performance and cooperation in buyer–supplier relationships. The sharing of information between parties has been examined in many business studies as a key factor in SCM success. However, information is not always shared appropriately in supply chains (e.g., Li *et al.*, 2014; Zhou and Benton, 2007). Earlier research has identified the significant factors that disrupt effective information flows throughout the supply chain. These include: absence of communication standards; lack of trust; weak supply chain relationships; confidentiality concerns; insufficient top management support; unequal distribution of risks/costs/benefits; opportunistic information leakage/misuse, and uncontrollable supply chain dynamism (Fawcett *et al.*, 2006; Zhou and Benton, 2007; Manatsa and McLaren, 2008).

In theory, partner organizations in a supply chain share goals and collaborate while seeking to achieve superior performance for the entire supply chain (Ha *et al.*, 2011). However, in practice, organizations, each existing in a specific business environment, face unique situations, have their own individual motives and tend to be self-interested (e.g., Nyaga *et al.*, 2010). In other words, their intentions and behaviours in collaborative supply chain relationships often vary according to their business environments and roles in that supply chain. Thus, information exchange in a supply chain might also depend on the business conditions faced by the firms in their markets as well as their roles (i.e., whether they are buyer or sellers) in the supply chain (Whipple *et al.*, 2002; Zhou and Benton, 2007; Nyaga *et al.*, 2010). Accordingly, information is not always appropriately shared in supply chains (e.g., Li *et al.*, 2014; Zhou and Benton, 2007).

Information sharing is the exchange of important information between partner organizations in a supply chain (Heide and Miner, 1992; Zhou and Benton, 2007). In this definition, the term ‘exchange’ embraces both the inflow (i.e., receiving/accepting/demanding) and the outflow (i.e., giving/providing/distributing/delivering) phases of information sharing. Firms in upstream and downstream positions in the supply chain receive information from partners as information demanders while giving partners necessary information as information providers. Information inflow/outflow asymmetry on the part of a firm can hinder cooperation with a supply chain partner in that it can ruin mutual trust (Ha *et al.*, 2011). The bi-directionality (receiving and providing) of information flows, notwithstanding its importance or even the considerable research already completed on cooperative information sharing in the supply chain, is often overlooked. Specifically, analysis of the content and extent of bi-directional information sharing and organizations’ relevant perceptions and behaviours is insufficient (e.g., Zhou and Benton, 2007). The present study examines selected dimensions of bi-directional information sharing in supply chains, the difference in buyers’ perceptions when they receive information from suppliers versus when they provide information to suppliers. In this paper, the term ‘bi-directionality’ is defined as the two-way flow (i.e., inflow and outflow) of information between firms and their suppliers.

Social capital is a valuable asset stemming from the assessment of resources made available through social relationships (Nahapiet and Ghoshal, 1998). The concept of social capital has been adopted in several SCM studies (Krause *et al.*, 2007; Lawson *et al.*, 2008; Carey *et al.*, 2011; Villena *et al.*, 2011) because it effectively explains inter-organizational relationships of supply chains in terms of resource sharing, information exchange, and knowledge sharing (Tsai

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8 and Ghoshal, 1998; Inkpen and Tsang, 2005). However, in-depth studies on how these
9 dimensions are developed and how they affect buyer–supplier relationships or collaborative
10 activities – including bi-directional information sharing – are insufficient.

11 Responding to the gaps in the literature, the present study empirically investigated the impact
12 of social capital and its three dimensions (i.e., structural capital, relational capital, and cognitive
13 capital) on balanced bi-directional information sharing. In addition, the present study regards
14 relational capital as a mediator between the other factors of social capital and bi-directional
15 information sharing. Therefore, the objective of the present study is to develop a framework to
16 promote the equivalent perception on bi-directional information. We use inflow and outflow
17 information sharing as a result variable in order to concentrate on the buying firm’s different
18 perceptions of information inflow and outflow. The research questions are as follows:
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- 21 1. Are there perceptual differences between ‘information inflow from supplier’ and
22 ‘information outflow to supplier’ when a buyer exchanges information with a supplier?
 - 23 2. Does the development of social capital and its three sub-dimensions in a supply chain
24 promote buyers’ reciprocal perception with respect to the inflow and outflow of
25 information?
 - 26 3. Among the three dimensions (i.e., structural capital, relational capital, and cognitive
27 capital) of social capital, which are significant to the balancing of perception between
28 information inflow and outflow?
 - 29 4. What type of information is transferred to the supplier and received from the supplier?
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31 To answer the research questions, we first reviewed the literature regarding social capital
32 theory and information sharing in the supply chain in the ‘theoretical foundation’ section. Based
33 on this, we proposed a theoretical framework that explains the relationship between social
34 capital and bi-directional information sharing in the ‘conceptual model and hypotheses’ section.
35 The hypotheses developed to examine the proposed model were tested by the use of structural
36 equation modelling, and the research methodology and data analyses are presented in the
37 ‘methodology’ and ‘analysis and results’ sections. Concluding remarks and suggestions for
38 practitioners and future research are presented in the ‘discussion, implications, limitations and
39 conclusion’ section.
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42 **Theoretical Foundation**

43 *Social capital theory*

44 Social capital theory has often been introduced to explain the benefit of social networks. For
45 example, social capital is regarded as valuable assets or significant resources that are obtained
46 through social relationships (Granovetter, 1992). Social capital theory has been widely applied
47 to many studies in varied business contexts, including supply chain, operations, quality,
48 personnel, and innovation management (Krause *et al.*, 2007; Lawson *et al.*, 2008; Tsai and
49 Ghoshal, 1998). In particular, Nahapiet and Ghoshal (1998) introduce three key dimensions of
50 social capital; namely, structural capital, relational capital, and cognitive capital. Based on their
51 discussion, many other studies have proved that those dimensions can affect collaborative
52 activities and relationships between firms. For example, Li *et al.* (2014) address the fact that
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8 buyer firms may seek suppliers' interest when there is strong social capital in their relationship.
9 Lawson *et al.* (2008) explored the effect of structural and relational capital on the buying firm's
10 performance, and showed that development of social capital is essential in order to obtain access
11 to the resources of a relational network. Krause *et al.* (2007) examined the role of cognitive and
12 structural capital in explaining a firm's performance in terms of flexibility, delivery, and quality.
13 Carey *et al.* (2011) showed that relational capital mediates the effect of cognitive and structural
14 capital on a firm's innovation performance. As many studies have shown, the three sub-
15 dimensions of social capital have different natures and characteristics and, therefore, different
16 effects on network-based mutual relationships (Nahapiet and Ghoshal, 1998). In this respect,
17 rather than seeking an explanation of social capital theory as a whole, attention should be paid
18 to the independent effects of the individual sub-dimensions (Li *et al.*, 2014).

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20 Cognitive capital is represented by the shared representability, interpretation, and systems
21 among members in the network (Nahapiet and Ghoshal, 1998). Cognitive capital enables
22 members in a social network to have shared recognition of certain information or situations
23 (Augoustinos and Walker, 1995), thereby providing shared visions, objectives, and values to
24 network members (Tsai and Ghoshal, 1998). Such shared visions, objectives, and values –
25 which create a collective understanding of cognitive capital – accrue the following benefits:
26 improved cooperative relationships between buyers and suppliers (De Carolis and Saporito,
27 2006); reduced possibility of misunderstanding between parties (Tsai and Ghoshal, 1998); and
28 prevention of information asymmetry problems (Min *et al.*, 2008).

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30 Structural capital traditionally has been explained as the pattern of connections between
31 members or organizations (Nahapiet and Ghoshal, 1998). It is developed based on the simple
32 idea of 'who would be connected to whom or how people can reach each other' (Nahapiet and
33 Ghoshal, 1998). Indeed, it is viewed from diverse perspectives and ranges (Carey *et al.*, 2011)
34 including network characteristics (Burt, 2000), information and knowledge sharing (Koka and
35 Prescott, 2002; Lawson *et al.*, 2008), and the extent of social interactions (Oh *et al.*, 2004; Tsai
36 and Ghoshal, 1998). In recent supply chain studies, structural capital has been related to social
37 interaction or information sharing channels. Social interaction can become the channel for tacit
38 sharing of knowledge and information (Carey *et al.*, 2011; Cousins *et al.*, 2006; Lawson *et al.*,
39 2008; Krause *et al.*, 2007). This type of channel – for instance, a vendor-managed inventory
40 system (Min *et al.*, 2008) – can deliver codified information (Krause *et al.*, 2007; Lawson *et al.*,
41 2008) such as technical communications to support supply chain activities (Min *et al.*, 2008;
42 Lawson *et al.*, 2008). Previous studies, such as that of Tsai and Ghoshal (1998), thus
43 demonstrate that structural capital can make possible superior performance in buyer–supplier
44 relationships. For instance, social interactions based on structural capital enable active
45 exchanges of information or knowledge (Carey *et al.*, 2011; Cousins *et al.*, 2006; Krause *et al.*,
46 2007; Lawson *et al.*, 2008). Structural capital, as the information sharing channel, also
47 integrates supply chains through sharing of information systems (Min *et al.*, 2008).

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49 Relational capital has been the most widely studied among the three dimensions of social
50 capital (Lawson *et al.*, 2008; Min *et al.*, 2008), and refers to interpersonal relationships that
51 develop through a history of interactions with each other (Nahapiet and Ghoshal, 1998; Krause
52 *et al.*, 2007). Relational capital has often been explained in terms of mutual trust, respect,
53 commitment, and obligations between people or organizations (Putman, 1995; Coleman, 1990;
54 Nahapiet and Ghoshal, 1998). The developed relationship based on respect and trust influences
55 the members' behaviour to be more collaborative with each other, and thereby helps them to

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8 exchange valuable resources (Li *et al.*, 2014). In particular, trust, which is viewed as the
9 'goodwill between actors' (Burt, 2000) and regarded as a key dimension of relational capital
10 (Anderson and Narus, 1990; Rousseau *et al.*, 1998), contributes to the development of inter-firm
11 relationships by reducing opportunistic behaviours between firms (Whipple *et al.*, 1999; Tsai
12 and Ghoshal, 1998). Besides, some other characteristics of relational capital, such as
13 commitment and the sense of reciprocal obligations, enable stronger mutual ties, leading to an
14 improvement in relational performance (Nahapiet and Ghoshal, 1998). Carey *et al.* (2011) and
15 Tsai and Ghoshal (1998), in addition, address the fact that relational capital mediates the link
16 between cognitive capital and structural capital, and, consequently, affects relational
17 performance. However, cognitive capital, relational capital, and structural capital, as well as
18 their inter-relationships, have rarely been investigated in the buyer–supplier context (Lawson *et*
19 *al.*, 2008; Carey *et al.*, 2011; Li *et al.*, 2014).

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21 This study adopted social capital theory as a theoretical framework in which to explain the
22 relationship between social capital and information sharing. Several previous studies have
23 suggested that social-relational factors affect information transfer in supply chains (Adler and
24 Kwon, 2002; Fawcett *et al.*, 2006; Li *et al.*, 2014; Jing *et al.*, 2011). For instance, social
25 interactions and shared IT infrastructure (structural capital) provided to members in the network
26 become the channel for information sharing as well as the channel for the exchange of valuable
27 resources (Coleman, 1988; Nahapiet and Ghoshal, 1998). Sharing of goals, culture, and values
28 (cognitive capital) can provide a basis for relationships involving mutually cooperative
29 exchange and sharing of cognitive processes (Coleman, 1988; De Carolis and Saporito, 2006).
30 Relational capital based on trust leads to more open and honest mutual information sharing,
31 consequently preventing the phenomenon of information asymmetry prevalent in inter-firm
32 relationships (Li *et al.*, 2014). The current study therefore adopted social capital theory to
33 discuss the collaborative relationship between buyer and seller firms in supply chains from
34 social-relational perspectives (Adler and Kwon, 2002; Lawson *et al.*, 2008). In addition, based
35 on the previous studies, we viewed that cognitive capital and structural capital can be
36 antecedents to relational capital (Inkpen and Tsang, 2005; Tsai and Ghoshal, 1998; Carey *et al.*,
37 2011). In doing so, it examined the structures of the three dimensions of social capital suggested
38 by Nahapiet and Ghoshal (1998) and their impact on bi-directional information-sharing
39 behaviours (see Figure 1).

40 41 *Bi-directional information sharing in supply chain*

42 Information sharing is defined as the degree to which individual parties mutually provide
43 information (Heide and Miner, 1992, p. 275). In the context of SCM, information sharing refers
44 to knowledge interactions and information exchanges that enable better transactional
45 collaboration. Information sharing, thus, has been considered an essential element for successful
46 SCM and, therefore, a critical element for the maintenance of efficiency, effectiveness, and
47 competitive advantage (Sahin and Robinson, 2002). Some studies have emphasized that
48 effective information sharing in a supply chain can be achieved through the adoption of
49 advanced information technology as well as financial support (Paulraj *et al.*, 2008; Kim *et al.*,
50 2005). The effectiveness of information sharing is not limited simply to the issue of 'whether
51 information is shared or not' but embraces even the issues of 'what types of information are
52 shared' and 'when and how the information is shared' (Li *et al.*, 2014). That is, consideration of
53 the content and quality of information should be accompanied by investigation of effective
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8 modes of information sharing (Zhou and Benton, 2007). In traditional supply chain studies, the
9 'content' of shared information includes market demand, a production plan, and inventory.
10 Meanwhile, the 'quality' of shared information refers to the accuracy, timeliness, adequacy, and
11 credibility of that information (Zhou and Benton, 2007).

12 Many researchers have asserted that many firms do not volunteer to share information and
13 thus have suggested key factors in having them avoid voluntary information sharing (Lie *et al.*,
14 2014; Zhou and Benton, 2007). For example, Fawcett *et al.* (2006) identify confidentiality
15 concerns, a lack of communication standards, a lack of trust, and weak supply chain
16 relationships. Zhou and Benton (2007) indicate that dynamism (i.e., the pace of change of both
17 products and processes), which inevitably exists in supply chains, becomes a significant reason
18 for reluctance to share information. Manatsa and McLaren (2008) posit that poor information
19 sharing might be caused by the fear of an unequal distribution of risks/costs/benefits among the
20 partners and the risk of information being divulged to competitors or used for opportunistic
21 bargaining.

22 In addition, individual information-sharing parties' varying views and incongruent objectives
23 can also obstruct information sharing. Studies have shown that the relationships within supply
24 chains vary in accordance with the given environments, situations, and motives faced by each of
25 the partner firms (e.g., Nyaga *et al.*, 2010). Therefore, individual parties' intentions and
26 resultant behaviours in the supply chain, certainly, can differ. Accordingly, previous studies
27 (e.g., John and Reve, 1982; Nyaga *et al.*, 2010) have found that a firm's perception of and
28 behaviours in information sharing depend on the firm's role (i.e., whether the firm is a buyer or
29 a supplier) in a supply chain. For instance, when assessing the level of relationship satisfaction,
30 suppliers often focus on relational characteristics, whereas buyers focus on performance
31 (Benton and Maloni, 2005). Suppliers think that timeliness of information is important for better
32 operational planning processes, whereas buyers believe that accuracy of information is
33 important for better reaction to problem occurrences (Whipple *et al.*, 2002). Zhou and Benton
34 (2007) argue that, because the information provided by manufacturers to buyers (customers)
35 differs completely in nature from that provided by buyers to manufacturers, it is imperative to
36 identify and adopt variables for two-way information flows.

37 As many studies have defined information sharing in a supply chain as 'exchanges' of
38 important information between partners (Heide and Miner, 1992; Zhou and Benton, 2007),
39 information sharing should embrace both directions of information sharing, receiving as well as
40 giving, at the same time. Thus, firms need to investigate and analyze the differences of shared
41 information between the inflow and outflow phases. That is, it is necessary to understand the
42 directionality of information sharing and to balance the two flows for improved supply chain
43 performance. They also need to assess the levels of quality and quantity of shared information
44 for successful SCM.

45 As bi-directional information sharing is not only essential for supply chain cooperation and
46 integrated performance (Langfield and Greenwood, 1998; Bullington and Bullington, 2005) but
47 also leads to collaborative relationships between buyers and suppliers (Bullington and
48 Bullington, 2005), we presume that a firm having a balanced perception of giving information
49 (information outflow) and receiving information (information inflow) assures successful
50 information sharing. Conversely, we also presume that if a buyer or a supplier does not
51 recognize the importance of bi-directional information sharing or is reluctant to share essential
52 information, the partnership and the performance of the entire supply chain would deteriorate.

Therefore, we assume that firms seeking information sharing in supply chains might show perceptual differences between (1) the receipt of information (information inflow) and (2) its provision (information outflow). Existing studies indicate that, even though information sharing should be beneficial to cooperative relationships, firms providing information might be exposed to their partners' opportunistic behaviours, such as malicious use of the information for negotiations or disclosure to competitors (Zhou and Benton, 2007). Therefore, firms often become reluctant or passive with respect to information provision to their partners. Several previous studies have suggested that social-relational factors affect information transfer in supply chains (Adler and Kwon, 2002; Fawcett *et al.*, 2006; Li *et al.*, 2014; Jing *et al.*, 2011). The current study therefore adopted and modified social capital theory to investigate how such social relational perspectives enable balanced inflows and outflows of information.

Conceptual model and hypotheses

Many studies have introduced key antecedents for the achievement of successful information sharing, including mutual trust, commitment, collaboration, communication, conflict, and relational uncertainty (Sheu *et al.*, 2006; Zhou and Benton, 2007; Paulraj *et al.*, 2008; Ha *et al.*, 2011). These factors are associated with social relationships (Li *et al.*, 2014). Since social capital theory can effectively explain the relationships between firms in terms of social networks as well as social relationships (Lawson *et al.*, 2008), the present study applied the theory to its investigation into bi-directional information sharing between firms in a supply chain.

The goal of this study was to investigate the links of the three sub-dimensions of social capital (i.e., structural, cognitive, and structural capital) with information bi-directional flows (i.e., inflows and outflows). The relevant previous studies have indicated that cognitive capital and structural capital can be antecedents to relational capital (Inkpen and Tsang, 2005; Tsai and Ghoshal, 1998; Carey *et al.*, 2011).

Links among the sub-dimensions of social capital

Structural capital explains the social interaction tie (or connection pattern) among members in a social network (Nahapiet and Ghoshal, 1998). The tie is the degree to which members in a social network are mutually connected or the degree to which they know each other. This social interaction tie becomes the channel through which information and resources flow in network relationships as well as offering a motive to strengthen those relationships (Yu *et al.*, 2006). Social interactions of structural capital enable active information and knowledge exchanges (Carey *et al.*, 2011; Cousins *et al.*, 2006; Krause *et al.*, 2007; Lawson *et al.*, 2008). Structural capital in the forms of information-sharing channels can contribute to the integration of supply chains through shared information systems (Min *et al.*, 2008). The forging and maintenance of links, socialization, and active interactions among members enable buyers to judge suppliers' levels of mutual trust and commitment (Carey *et al.*, 2011). Furthermore, the experience of social relationships between organizations helps them to build mutual trust (Bell *et al.*, 2002). In this respect, the structural capital accumulated through social interactions and shared IT infrastructure enables the development of relational capital. Hence the following hypothesis linking structural capital and relational capital:

Comment [A1]: At the top of page 6 there is a statement that if one relationship in the supply chain suffers because of lack of bi-directional information sharing

the whole supply chain will suffer, more evidence of this assumption needs to be provided.

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9 *H1. Structural capital positively affects relational capital in the relationship with suppliers.*

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11 Cognitive capital emphasizes that the sharing of goals, values, and normative behaviours
12 between partners generates mutual trust (Nahapiet and Ghoshal, 1998). Coleman (1988; 1990)
13 states that normalized sharing decreases the risk of free-riding and increases mutual trust.
14 Barber (1983) and Tsai and Ghoshal (1998) argue that sharing goals and values between
15 partners develops mutual trust. Meanwhile, when there is mutual understanding between buyers
16 and suppliers, relational capital is developed (Adler and Kwon, 2000). That is, relational capital
17 is developed when members share common ideas, experiences, and behavioural patterns
18 (Nahapiet and Ghoshal, 1998; Carey *et al.*, 2011). In this way, they can reduce the possibility of
19 misunderstanding (Inkpen and Tsang, 2005; Krause *et al.*, 2007). Hence the following
20 hypothesis linking cognitive capital and relational capital:
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23 *H2. Cognitive capital positively affects relational capital in the relationship with suppliers.*

24 *Social capital and bi-directional information sharing*

25 Trust is regarded as the most important element in relational capital studies. Since members
26 in a network, though mutually related, are independent entities, they can pursue their own
27 independent gains instead of the entire network's profits. Independence is also applied to
28 limited information sharing (Li *et al.*, 2014). Shared proprietary information can provide the
29 other party with possibilities for opportunistic behaviours such as misuse of information or
30 disclosure. As researchers (Fawcett *et al.*, 2006; Tsai and Ghoshal, 1998) suggest, trust lowers
31 the possibility of opportunistic behaviours and enables effective information flows between
32 members in a social network. Sheu *et al.* (2006) assert that trust leads to favourable attitudes
33 and behaviours that enable the further exchange of information. Correspondingly, Ha *et al.*
34 (2011) argue that supply chain relationships based on mutual trust lead to more open and honest
35 exchanges of valuable data or information, thereby enabling mutually cooperative planning with
36 less worry about the possibility of improper use of information. Therefore, relational capital
37 based on trust leads to more open and honest mutual information sharing, consequently
38 preventing the phenomenon of information asymmetry that is prevalent in inter-firm
39 relationships (Li *et al.*, 2014). In light of the above discussion, the present study assumed that
40 the formation of relational capital in a relationship would enable buyers to share information bi-
41 directionally. Hence the following hypotheses:
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44 *H3-1. Relational capital positively affects information inflow from suppliers.*

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46 *H3-2. Relational capital positively affects information outflow to suppliers.*

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48 Social interactions provide members in the network with opportunities for resource exchange
49 and mutual cooperation (Tsai and Ghoshal, 1998; Li *et al.*, 2014). Structural capital based on
50 social interaction and shared IT infrastructure becomes the channel for information sharing as
51 well as the channel for exchange of valuable resources (Coleman, 1988; Nahapiet and Ghoshal,
52 1998). That is, the adoption and sharing of 'structures' for close interaction between members in
53 the network facilitate information sharing (Villena *et al.*, 2011). In addition to its function in
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activating social interactions, structural capital takes the form of supply-chain-supporting technical communication (Min *et al.*, 2008; Lawson *et al.*, 2008). Therefore, when IT infrastructures are shared between firms, bi-directional information exchanges can be activated (Carey *et al.*, 2011; Cousins *et al.*, 2006; Krause *et al.*, 2007; Lawson *et al.*, 2008). Thus, the present study assumed that IT infrastructure sharing would enable buyers' bi-directional information sharing. Hence the following hypotheses:

H4-1. Structural capital positively affects information inflow from suppliers.

H4-2. Structural capital positively affects information outflow to suppliers.

Cognitive capital in buyer-supplier relationships enables the sharing of goals, visions, and values among network members. In this way, it provides a basis for relationships involving the mutually cooperative exchange and sharing of cognitive processes (De Carolis and Saporito, 2006; Coleman, 1988). Significantly, shared visions, objectives, and values can reduce the possibility of misunderstanding; enable better cooperation; encourage mutual understanding, and facilitate active information sharing (Tsai and Ghoshal, 1998; De Carolis and Saporito, 2006; Whipple *et al.*, 2010). Furthermore, shared values and visions enable members not only to enhance the quality and quantity of information and knowledge sharing but also to prevent problems related to information asymmetry (Min *et al.*, 2008). Therefore, we assumed that cognitive capital in the relationship would induce buyers to appreciate the importance of bi-directional information sharing. Hence the following hypotheses:

H5-1. Cognitive capital positively affects information inflow from suppliers.

H5-2. Cognitive capital positively affects information outflow to suppliers.

Figure 1 provides a schematization of the three social capital sub-dimensions' theoretical links along with the bi-directional information flows (i.e., inflows and outflows).

Insert Figure 1 here

Methodology

Survey and data collection

The data were collected between October 2010 and February 2013 via the postal survey method. Questionnaires were sent to 1,600 medium-to-large South Korea-based manufacturing organizations sampled from a database of the 2011 Business Directory of Korcham (Korea Chamber of Commerce and Industry). To ensure that respondents were knowledgeable on the overall supply chain relationships with suppliers, their managerial responsibilities were limited to the procurement and purchasing areas. The survey instrument was pilot-tested and validated through in-depth interviews with nine purchasing executives and five academic experts. It was then modified and developed further based on their opinions. Subsequently, three waves of

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8 survey research were conducted, as suggested by the total design method (Dillman, 2000). As a
9 result, 221 questionnaires were collected (13.8% response rate), though eleven of them were
10 excluded due to a quality problem in the answers. The response rate seems slightly low, but due
11 to increasing levels of survey fatigue among practitioners (Tan and Wisner, 2003), this response
12 rate is consistent with those of similar supply chain studies in the area (Alreck and Settle, 1995;
13 Carey *et al.*, 2011). A non-response-bias test was conducted through a series of T-tests with key
14 variables as well as demographic variables between the early and late waves of returned
15 samples (Armstrong and Overton, 1977). No significant difference was detected.
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19 Insert Table I here
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21 *Measures*

22 All of the survey items were developed through a review of the extant literature. They were
23 measured on a 1–7 Likert-type scale (see Appendix I). The structural dimension of social capital
24 was measured according to two sub-dimensions: information exchange and social interaction.
25 The items for measurement of information exchange included ‘IT capability for sharing
26 information with partners (SC1),’ ‘IT capability for exchanging standardized information (SC2),’
27 and ‘IT capability for the existence of joint decision making (SC3).’ Meanwhile, the items for
28 social interaction included ‘the existence of joint decision making (SC4),’ ‘the existence of
29 regular communication (SC5),’ and ‘the existence of a joint benefit and risk management
30 system (SC6)’ (Bowersox *et al.*, 1999: 112-113; Whipple *et al.*, 1999; Ellinger, 2000). The
31 cognitive dimension of social capital included four measurement items: ‘levels of agreement on
32 what is in the best interests of the relationship (CC1),’ ‘shared business values (CC2),’ ‘shared
33 goals for the businesses (CC3),’ and ‘shared ambitions and vision (CC4)’ (Griffith *et al.*, 2006;
34 Liu *et al.*, 2012; Carey *et al.*, 2011). Five items were used to measure the relational dimension
35 of social capital, including the levels of ‘mutual trust (RC1),’ ‘friendship (RC2),’ ‘reciprocity
36 (RC3),’ ‘mutual respect (RC4),’ and ‘close interaction (RC5)’ (Carey *et al.*, 2011).
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38 There is little guidance to be had from existing studies on the measurement of bi-directional
39 information sharing from supply chain perspectives. However, Zhou and Benton (2007)
40 examined two-way information sharing in relationships between manufacturers and customers,
41 and Liu *et al.* (2012) investigated information sharing in dyadic relationships. The items for the
42 measurement of bi-directionality of information flows were initially developed based on these
43 studies, and subsequently were further improved via in-depth interviews with several
44 procurement practitioners and researchers. As a result, five items were developed for the
45 measurement of the information inflow part, including: ‘production capacity information (II1),’
46 ‘order status information (II2),’ ‘knowledge about the product and materials (II3),’ ‘changes in
47 delivery schedule (ii4),’ and ‘knowledge about the market (II5).’ Four additional items were
48 developed for the information outflow part, including ‘production planning information (IO1),’
49 ‘future-demand forecasting information (IO2),’ ‘knowledge about the product and materials
50 (IO3),’ and ‘product design specifications (IO4).’
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52 *Test of reliability and validity and verification of common method bias*
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8 The reliability and validity of the constructs were assessed using Cronbach's Coefficient
9 Alpha and Confirmatory Factor Analysis (CFA) with the SPSS and AMOS software packages.
10 Cronbach's Coefficient Alpha values of the latent variables exceeded .70 (see Appendix I), thus
11 showing reliability (Nunnally, 1978; Churchill, 1979). The results indicated a good model (Hair
12 *et al.*, 2010; Byrne, 1998), with $\chi^2=391.9$ (degree of freedom=238), comparative fit index
13 (CFI)=0.946, and root mean square error of approximation (RMSEA)=0.056. In addition, the
14 model's adjusted goodness-of-fit index (AGFI), goodness-of-fit index (GFI), and non-normed
15 fit index (NNFI) were 0.832, 0.867, and 0.876, respectively (Hair *et al.*, 2010).

16 The factor loadings, the composite reliabilities (CR), and the average variance extracted
17 (AVE) estimates were examined to ensure convergent validity of the constructs (Table II). All
18 of the factor loadings were greater than 0.50, ranging between 0.65 and 0.91 (Hair *et al.*, 2010).
19 The CR values identified were between 0.77 and 0.97 (Hair *et al.*, 2010). The AVE values for
20 each construct exceeded the squared correlations of the remaining constructs, as shown in Table
21 III.

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25 Insert Table II here

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28 Insert Table III here

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31 Several steps were taken in the research process to avoid common method bias. First, we
32 prequalified potential respondents to ensure that they were medium-to-senior-level managers
33 with high levels of relevant knowledge (Podsakoff and Organ, 1986). Second, we assured them
34 that the anonymity of their responses would be maintained (Fugate *et al.*, 2009; Podsakoff *et al.*,
35 2003). To further reduce the possibility of common method bias, Harman's one-factor test was
36 performed (Podsakoff *et al.*, 2003), with the results indicating that common method bias was
37 not a significant concern for the purposes of the present study.

38 39 40 **Analysis and results**

41 42 *Tests of hypotheses*

43 We used structural equation modelling to test the hypothesized relationships among the
44 latent variables. Table IV shows the results. The overall model fit was acceptable (NNFI=0.932;
45 CFI=0.941; RMSEA=0.058, AGFI=0.826; and $\chi^2=411.94$ with $df=241$). Then, the hypotheses
46 were tested via structural equation modelling. According to the results (see Table IV), H1 and
47 H2 were significant ($p<0.05$), indicating the significant effect of both structural capital and
48 cognitive capital on relational capital. Relational capital had significant effects on both
49 information inflow and outflow, supporting H3-1 and H3-2. Both structural capital and
50 cognitive capital had significant effects on information inflow (i.e., H4-1 and H5-1 were
51 supported) but not on information outflow (i.e., H4-2 and H5-2 were rejected).

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8 Insert Table IV here
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11 12 *Test of mediation*

13 In addition, to test the mediating effect of relational capital between the other two
14 dimensions of capital and bi-directional information sharing, we used the bootstrapping method.
15 Bootstrapping is a nonparametric statistical procedure in which the dataset is repeatedly
16 sampled and indirect effects are calculated (Preacher and Hayes, 2008). The indirect effects are
17 then tested for significance using confidence intervals. If the indirect effects are significant,
18 mediation is inferred in the model. In the present study, we measured the significance of indirect
19 effects by setting the number of sampling iterations (n=2,000). The direct and indirect effects
20 between structural capital and information inflow (see Table V) were found to be significant
21 (p<0.05), indicating partial mediation. The indirect effect among structural capital, cognitive
22 capital and information outflow was found to be significant and the direct effect was found to be
23 insignificant, indicating full mediation.
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27 Insert Table V here
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30 **Discussion, implications, limitations and conclusion**

31 32 *Discussion*

33 This study examined the impact of social capital on bi-directional information sharing. The
34 impacts of the three dimensions (i.e., structural, cognitive, and relational capital) on bi-
35 directional information sharing (i.e., information inflow and outflow) were mixed. Overall, the
36 findings provide practitioners and academics with important insights into how the dimensions of
37 social capital can be identified, designed and managed for successful bi-directional information
38 sharing with suppliers.

39 Based on the present study's measurement development through to the in-depth interviews
40 and exploratory factor analysis, the contents (i.e., measurements) of information inflow and
41 outflow showed different perspectives (see Appendix, F4 and F5). These respective results
42 reflect the dependence of the nature and quality of information exchange on the role:
43 information provider versus information demander (Whipple *et al.*, 2002; Zhou and Benton,
44 2007; Nyaga *et al.*, 2010).

45 We found that structural capital and cognitive capital positively influence the level of
46 relational capital between buyers and suppliers. This is because the development of structural
47 capital – based on social interactions and shared IT infrastructure – promotes common
48 experience as well as trust-based relationships between buyers and suppliers (Bell *et al.*, 2002).
49 In addition, the development of cognitive capital that facilitates the sharing of goals, visions and
50 values help firms to foster trust, identification, and obligation within the inter-organizational
51 relationship (Nahapiet and Ghoshal, 1998; Carey *et al.*, 2011). Therefore, the development of
52 structural and cognitive capital may be a necessary condition to develop relational capital.
53 However, from the testing of the link between social capital and bi-directional information
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8 sharing, it is indicated that buyer firms may have mixed perceptions of the two different flows
9 in information sharing.

10 The buyer firms recognize that they can receive information effectively from suppliers when
11 they develop structural capital and cognitive capital; this is in line with the findings of previous
12 studies (Coleman, 1988; Nahapiet and Ghoshal, 1998). That is, structural capital can become
13 the channel for the sharing of key resources, and the active interactions between channel
14 partners that result thereby can provide them with opportunities for better information exchange.
15 The findings of this research also imply that cognitive capital can become the basis of mutual
16 cooperation and shared thinking processes (De Carolis and Saporito, 2006) that enable partner
17 firms to better appreciate the advantages of information exchange (Whipple *et al.*, 2010). While
18 both cognitive capital and structural capital have positive effects on information inflow, neither
19 has any significant effect on information outflow. That is, even if the buyer perceives that the
20 supplier will provide information to them as part of their established structural capital (i.e., an
21 IT capability for efficient sharing of information and joint benefit/risk-sharing systems) and
22 cognitive capital (i.e., sharing of goals, visions, and values) in the relationship, still a buyer
23 might be reluctant to provide information to a supplier. This could be because buyers want to
24 avoid the risks of information leakage and their exposure to the opportunistic behaviours of
25 their counterpart, such as harmful misuse of delivered information (Manatsa and McLaren,
26 2008). Moreover, the results indicate that structural and cognitive capital do not embrace that
27 which is essential to participation in mutual exchange relationships: trust and reciprocity
28 (relational capital). This is in line with earlier reports, suggesting that a lack of trust in
29 relationships and weak supply chain relationships lead to a reluctance to share information
30 (Fawcett *et al.*, 2006). Furthermore, such reluctance on the part of buyers might happen due to
31 their own opportunistic, information-asymmetry-inducing behaviours in the relationship (e.g.,
32 Lambert and Pohlen, 2001), which can eventually lead to unfair relationships (Lambert and
33 Pohlen, 2001; Ha *et al.*, 2011). These opportunistic-behaviour problems can be prevented
34 through trust-building efforts, which are a key component of relational capital. Indeed,
35 relational capital fully mediates the relationships between cognitive capital and information
36 inflow, between cognitive capital and information outflow, and between structural capital and
37 information outflow. That is, establishing relational capital in the relationship is the sole factor
38 facilitating buyers' effective information outflows to suppliers, and is essential to the
39 equivalency of bi-directional information sharing.

40 Firms' appreciation of bi-directional information sharing leads to mutually prosperous
41 relationships with suppliers (Bullington and Bullington, 2005). Thus, if a buyer or a supplier
42 does not recognize the need for bi-directional information sharing or is reluctant to share
43 essential information with their counterpart, not only might the partnership be undesirably
44 affected but so also, eventually, might the supply chain performance. As discussed, firms might
45 show differences in their perceptions or behavioural patterns according to whether they are
46 providing information or receiving information, based on the imperative to avoid their
47 counterpart's opportunistic behaviours.

50 *Managerial implications*

51 One of the main managerial implications from our study is to identify that developing social
52 capital in the relationship can contribute to bi-directional information sharing in a supply chain
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8 and, especially, relational capital that is characterized by reciprocity, trust, respect, and close
9 interaction is essential to firms to have a balanced perception on information inflow and outflow.

10 Shared values, missions, and goals (i.e., cognitive capital) between firms are highlighted in
11 this study, as they can be antecedent to trust and reciprocity in the relationship. Through active
12 interactions and communication on both the strategic and operational levels, practitioners can
13 see what is in the best interests of their partners and can build common values and visions. From
14 the investigation on structural traits in the study, companies can benefit from socialization and
15 interactions through information systems (i.e., IT infrastructures) for information sharing. Thus,
16 firms need to pay attention to how and how often they interact socially; fostering social
17 interactions through social events and conferences with suppliers may prove beneficial.

18 Most of all, relational capital was found to be the only factor in the model that facilitates bi-
19 directional information sharing. Therefore, development of mutual trust, respect, and reciprocity
20 (relational capital) is key to avoid the occurrence of information asymmetry in the relationship.
21 These relational characteristics can be developed through continuous exchange, with efforts
22 made to maintain the relationship as collaborative and long-term instead of focusing on short-
23 term competitive relationships. In addition, as the development of relational capital is reliant on
24 social and cognitive capital, the above-mentioned efforts for the development of social and
25 cognitive capital will be the major contribution to fostering mutual trust and reciprocity in the
26 relationship.

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28 Practitioners need to understand that their partner may have different interests and situations,
29 and consequently they may have different perceptions when they give and receive information.
30 Efforts are needed to reduce the chance of such distorted information sharing, as this not only
31 causes information asymmetry but also has a negative impact on partnership performance.
32 When firms make an effort to understand their partners, and are committed to improving the
33 collaborative relationship, this can promote the development of social capital in the relationship.
34 By doing so, concerns about leakage or misuse of information will be lowered so a buyer firm
35 can contribute to having a more balanced perception on the information sharing with the partner.
36 In addition, to achieve successful bi-directional information sharing in the supply chain, buyer
37 firms need to realize that their business's success is dependent on the success of their supply
38 chains. Armed with this collective understanding of SCM, firms can create sound and enduring
39 collaborative relationships with suppliers.

40 41 *Limitations and future study*

42 Even though the current study yielded valuable insights into social capital and bi-directional
43 information sharing, it has limitations in its research methods. First, a cross-sectional survey, by
44 its nature, might limit the depth of understanding of social capital, since relational behaviours
45 between actors might be very complex and vary over time. Second, due to the static nature of
46 the survey method employed, the causal relations therein could not be fully inferred.
47 Longitudinal research settings would allow researchers to further explore the dyadic
48 relationships between buyers and suppliers with regard to how social capital evolves through
49 the relationship phases. Third, the data represent the buyer's side only in the dyadic relationship.
50 Application of both the buyer's and the supplier's dyadic perspectives might provide for a better
51 insight into, and understanding of, social capital and bi-directional information sharing.

52 We also suggest that future research investigates the nature of social capital in the wider
53 context of supply chains. That is, it might extend the view to encompass triadic relationships
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8 among a firm, its supplier, and its buyer, or multiple relationships among a firm and its multiple
9 suppliers, as this would allow for more in-depth investigation of supply chains that are, by their
10 nature, complex (Carey *et al.*, 2011). In future research too, social capital from the supplier's
11 perspective would be more thoroughly examined. Further refinement of the measurement of bi-
12 directional information sharing might also be of interest. Finally, with much of the recent
13 research having focused on the positive effects of social capital, it would be beneficial to
14 examine the degradation of social capital and the associated consequences (e.g., Viella *et al.*,
15 2011).

17 Conclusion

18 The purpose of this paper is to understand how the development of social capital can
19 promote buyer's bi-directional (inflow and outflow) information sharing. We examined buyers'
20 perceptual differences in information sharing: when they receive information from suppliers
21 and when they provide information to suppliers, and how such unequal perception in
22 information sharing can be resolved by the level of social capital and its sub-dimensions.

23 Our findings present an issue of unequal perception in providing and receiving information, and
24 social capital's dimensions have a different effect on bi-directional information sharing. For
25 information inflow, all facets of social capital were significant; for information outflow,
26 however, only relational capital was significant. Given that relational capital is essential for
27 balanced information sharing in buyer-supplier relationships, firms should pay attention to
28 having social interactions and establishing shared goals and values with partners in order to
29 promote trust and reciprocity in the relationship for maximum efficacy in information sharing.
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Appendix I. Measures

Construct and key sources	Measurement	Factor loading	Cronbach's Alpha
Structural Capital (F1) Bowersox <i>et al.</i> , 1999; Whipple <i>et al.</i> , 1999; Ellinger, 2000	• We have IT capability for information sharing with our major supplier (SC1)	0.734	0.831
	• We have IT capability for exchanging standardized information with our major supplier (SC2)	0.811	
	• We have IT capability for exchanging customized information with our major supplier (SC3)	0.814	
	• We promote a joint decision making with our major supplier (SC4)	0.911	
	• We have frequent communication with our major supplier (SC5)	0.800	
	• We promote a joint benefit and risk management system with our major supplier (SC6)	0.838	
Cognitive Capital (F2) Griffith <i>et al.</i> , 2006; Liu <i>et al.</i> , 2012; Carey <i>et al.</i> , 2011	• Both parties often agree on what is in the best interest of the relationship (CC1)	0.771	0.862
	• Both parties share the same business values (CC2)	0.740	
	• Both parties share the goals for this business (CC3)	0.872	
	• Both parties share the same ambitions and vision (CC4)	0.763	
Relational Capital (F3) Carey <i>et al.</i> , 2011	• The relationship is characterized by mutual trust (RC1)	0.723	0.922
	• The relationship is characterized by mutual friendship (RC2)	0.646	
	• The relationship is characterized by high levels of reciprocity (RC3)	0.805	
	• The relationship is characterized by mutual respect (RC4)	0.834	
	• The relationship is characterized by close interaction (RC5)	0.723	
Information Inflow (F4) Zhou and Benton, 2007; Liu <i>et al.</i> , 2012	• Our major supplier shares their production capacity information with us (II1)	0.745	0.748
	• Our major supplier shares their order status information with us (II2)	0.757	
	• Our major supplier shares their knowledge about the product and materials with us (II3)	0.685	
	• Our major supplier shares changes in delivery schedule with us (II4)	0.711	
	• Our major supplier shares their knowledge about the market with us (II5)	0.678	
Information Outflow (F5) Zhou and Benton, 2007;	• We share our production planning information with our major supplier (IO1)	0.664	0.818
	• We share our future-demand forecasting information with our major supplier (IO2)	0.675	

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Liu <i>et al.</i> , 2012	• We share our knowledge about the product and materials with our major supplier (IO3)	0.858
	• We share our product design specifications with our major supplier (IO4)	0.708

Table I. Demographic profile

	Frequency	Percentage (%)
Size (No. of personnel employed)		
Small-sized (<250 employees)	64	30.04%
Medium-sized (between 250 and 500 employees)	66	31.42%
Large-sized (>501 employees)	80	38.81%
Total	210	100%
Total annual sales (US Dollars in Millions)		
>10	62	29.52%
10-29.9	41	20.00%
30-99.9	39	19.05%
100-299	41	19.52%
>300	27	12.86%
Total	210	100%
Industrial sector		
Automotive	88	41.90%
Electronics	77	36.67%
Chemicals/pharmaceuticals	16	7.14%
Food & beverage	11	5.24%
Misc. (paper/textile/consumer goods)	18	8.10%
Total	210	100%
Respondent profile		
CEO/general director	8	3.81%
Supply chain director	60	28.57%
Logistics/purchasing manager	64	30.48%
Operations manager	54	25.71%
Senior buyer	24	11.43%
Total	210	100%

Table II. Construct analysis

Construct	Average variance extracted	Composite reliability	Range of factor loadings
Structural Capital (F1)	0.67	0.88	0.73-0.91
Cognitive Capital (F2)	0.62	0.89	0.74-0.87
Relational Capital (F3)	0.56	0.90	0.65-0.83
Information inflow (F4)	0.51	0.98	0.68-0.76
Information outflow (F5)	0.53	0.77	0.66-0.86

Table III. Construct level correlation analysis

Construct	F1	F2	F3	F4	F5
F1	1.00	-	-	-	-
F2	0.21	1.00	-	-	-
F3	0.27	0.69	1.00	-	-
F4	0.41	0.49	0.52	1.00	-
F5	0.26	0.39	0.42	0.46	1.00

Note: n = 210 observations; all correlations are significant at $p < .01$.

Table IV. Path Analysis results

	Hypothesis	Estimate	Standardized- Estimate	S.E.	C.R.	Results
H1	Structural Capital (F1) → Relational Capital (F3)	0.09*	0.14	0.04	2.26	Support
H2	Cognitive Capital (F2) → Relational Capital (F4)	0.65**	0.68	0.08	7.79	Support
H3	H3-1 Relational Capital (F3) → Information Inflow (F4)	0.37*	0.30	0.14	2.73	Support
	H3-2 Relational Capital (F3) → Information Outflow (F5)	0.29*	0.28	0.12	2.41	Support
H4	H4-1 Structural Capital (F1) → Information Inflow (F4)	0.23**	0.28	0.06	3.90	Support
	H4-2 Structural Capital (F1) → Information Outflow (F5)	0.08	0.12	0.05	1.69	Not support
H5	H5-1 Cognitive Capital (F2) → Information Inflow (F4)	0.29*	0.25	0.13	2.29	Support
	H5-2 Cognitive Capital (F2) → Information Outflow (F5)	0.15	0.15	0.11	1.33	Not support

Note: * $p < .05$; ** $p < .01$.

Table V. Mediation test – bootstrapping results

Hypothesis	Direct effect	Indirect effect	Result
1. Structural Capital → Relational Capital → Information Inflow	0.26 *	0.05 *	Partial mediation
2. Structural Capital → Relational Capital → Information Outflow	0.12	0.04 *	Full mediation
3. Cognitive Capital → Relational Capital → Information Inflow	0.15	0.22 *	Full mediation
4. Cognitive Capital → Relational Capital → Information Outflow	0.22	0.19 *	Full mediation

* $p < .05$; ** $p < .01$; 95% confidence interval for bootstrapping (n = 2000)

Figure I. Theoretical Model

