Enhancing Value via Cooperation: Firms' Process Benefits From Participation in a Consortium

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**Abstract**

Firms benefit from participating in a consortium in two ways: from the final products and from the cooperation process. We define the latter as process benefits, which include both inter−organizational learning benefits and social capital benefits. This paper examines the drivers of these two types of process benefits. Based on 232 surveys collected from seven e−business standard consortia, our empirical findings show that firms expect more process benefits if they are more technically capable, value the final output higher, and participate in a better−managed consortium. Among the three, standard valuation is the most influential factor, indicating that the output benefits and process benefits are highly correlated. Surprisingly, within standard consortia, we also find that relational risk does not have a statistically significant impact on process benefits.

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**ABSTRACT**

Firms benefit from participating in a consortium in two ways: from the final products and from the cooperation process. We define the latter as process benefits, which include both inter-organizational learning benefits and social capital benefits. This paper examines the drivers of these two types of process benefits. Based on 232 surveys collected from seven e-business standard consortia, our empirical findings show that firms expect more process benefits if they are more technically capable, value the final output higher, and participate in a better-managed consortium. Among the three, standard valuation is the most influential factor, indicating that the output benefits and process benefits are highly correlated. Surprisingly, within standard consortia, we also find that relational risk does not have a statistically significant impact on process benefits.

**Keywords:** standard consortia, output benefits, process benefits, inter-organizational learning, social capital
INTRODUCTION

Consortia, as newly evolving organizational forms, have attracted much research attention within the strategy field in the past decade, following Doz (1996) and Gulati (1998). The extant research literature has examined consortia’s formation (Ring, Doz & Olk, 2005), performance (Ireland, Hitt & Vaidyanath, 2002), and a member firm’s decision to stay or exit (Olk & Young 1997). While some research acknowledges that firms benefit from consortia via learning (Kale & Singh, 2007; Khanna, Gulati & Nohria, 1998) and social capital building (Kale, Singh & Perlmutter, 2000; Koka & Prescott, 2002), it has not been systematically shown how various benefits from the consortia come about, as well as what factors drive their realization.

Based on prior research literature, firms benefit from a consortium in at least two ways: (1) from the output; and (2) from the process. The output can be a product or standard that firms in the consortium jointly develop. Firms also derive value in the development process, from learning via working with other firms, as well as building social capital through interactions. We call the former consortium benefits, output benefits, and the latter process benefits.

The current paper maintains that distinguishing the two types of benefits is important for firms trying to evaluate their participation and resource allocation in consortia. Since the output is common to all firms and is based on the aggregate effort of all participants (Khanna, Gulati & Nohria, 1998), output benefits are difficult for a firm to control, let alone evaluate ex ante, due to the increasingly larger number of firms found in consortia. In contrast, process benefits are earned by firms unilaterally, and thus are private benefits (Khanna, Gulati & Nohria, 1998) that can be better controlled and measured by the firm ex ante. Thus, process benefits are closely related to firms’ incentives to invest in development activities in consortia. From the
consortia’s point of view, understanding how firms can benefit from the process of participation can help better mitigate some firms’ tendencies to free ride, especially when the number of firms is large or the output is a public good. Indeed, recent empirical work shows that process benefits motivate user groups to participate within a consortium (Zhao, Xia & Shaw, 2007).

The current paper considers firms’ process benefits in consortia and what drives such benefits. Our data were collected from consortia that develop e-business standards. Consortium-based e-business standardization is an important phenomenon in many industries (Markus et al., 2006). The standards that these consortia develop are specifications of how information systems communicate with one another. In traditional alliances, because the product is a private good for participating firms, firms’ process and output benefits are integrated and thus are difficult to disentangle. As a result, it is challenging to tease out how firms’ participation is motivated by process benefits alone. In e-business standard consortia, member firms’ process benefits and output benefits are cleanly separated as the standards are open and free to anyone (Zhao, Xia & Shaw, 2005). Moreover, due to the public good feature of the output of such open standard consortia, even non-member firms can access output benefits. In this case, process benefits become a crucial component of consortium’s payoff structures, which makes it ideal for studying firms’ process benefits and their drivers.

We surveyed 232 firms from seven e-business standard consortia, and find that firm technical capability, standard valuation, and consortium governance efficiency drive the level of process benefits that firms can obtain from consortium cooperation. Among these three factors, standard valuation is the most influential factor, indicating that the output benefits and process benefits are highly correlated. Surprisingly, within standard consortia, we also find empirically
that relational risk does not have a statistically significant impact on value via consortium-based cooperation.

This paper’s contributions to the extant research literature are three-fold: First, to the best of our knowledge, we are the first to propose and differentiate output benefits and process benefits in consortia, identify two major types of process benefits, and empirically test their drivers; second, our results will enable firms to better evaluate their potential process gains from joining a consortium; and third, our empirical findings will also enable consortia to show various benefits they can deliver to participants and to better manage the process.

The paper proceeds as follows: Section 2 briefly introduces the research setting of e-business standard consortia. Section 3 presents the developed theoretical framework and presents the hypotheses. Section 4 explains research methods and operationalizations of the variables, followed by the data analysis results in Section 5. Section 6 discusses results, provides conclusions, and offers suggestions for future research.

E-BUSINESS STANDARDS AND STANDARD CONSORTIA

Consortia-based e-business standardization is an emerging phenomenon in many industries (Markus et al., 2006). By providing a common interface for information sharing across trading partners, e-business standards aim to enhance interoperability between firms. With a common interface for information sharing and better interoperability, operations between firms can be more efficient, resulting in cost savings and even further business opportunities. To ensure successful diffusion, most e-business standards are open and free to obtain for firms. Participation in development of standards is voluntary and bottom-up — i.e., interested firms get together to develop standards for their own benefit (Zhao, Xia & Shaw, 2005).
E-business standard consortia are special types of multi-firm alliances (Zeng & Chen, 2003), which provide an ideal setting for studying benefits that firms obtain in the process of collaborating in a consortium for at least two reasons. First, the e-business standards produced by consortia are a public good, since the complete details of the standards are available at their websites and are available for anyone to download and implement (Zhao, Xia & Shaw, 2005). Thus, it is not necessary for firms to participate in the development in order to enjoy the benefit of the output.\(^1\) As a result, their decision to contribute to the development is separate from their decision to adopt a standard, and firms can easily uncouple output benefits from process benefits. Second, firms are able to acquire knowledge and business know-how in the process of contributing to the standard as they interact with companies in the field. Although in general, knowledge is a public good, in this business setting, the acquisition of knowledge can only be accomplished while being part of the development process. The same holds for social capital. To build social capital, firms also must join the consortium in order to interact with their peers. As a result they also effectively contribute to the building of social capital for other firms.

How firms generate economic value through collaborating with their peers requires greater attention in the strategic management field. Prior research studies on consortia mainly focus on those for R&D purposes (Doz, Olk & Ring, 2000; Olk & Young 1997), which are different from e-business standard consortia in several aspects. First, most e-business standard consortia are open for all participants and their output are freely available for both members and non-members. In contrast, in R&D consortia, the output is proprietary and is only available to members of the consortia. The openness of the e-business standard allows us to attribute a large

\(^1\) Although their contribution may improve the amount or quality of the output, due to the large number of firms in a typical standard consortium, such impact on the output by one firm is usually very small.
proportion of members’ incentives to the benefits from the process of collaborating with others. Second, beyond minimum contribution requirements in the form of membership fees and conference attendance, participants’ resource contributions within standard consortia are strictly voluntary and are not bound by any contracts, again providing an ideal research setting to study benefits from the process.

THEORETICAL FRAMEWORK AND HYPOTHESES DEVELOPMENT

Overview

Prior research studies have identified various motives for interfirm technology collaboration (Hagedoorn, 1993; Roethaermel & Boeker, 2008). Of all the motives suggested, two are closely related to the collaboration process. The first motive is interorganizational learning, as firms can enhance their competitive positions through new knowledge and know-how that are acquired from collaboration with other members within the consortia (Quinn, 1992). Simonin (1997) notes important intangible benefits via learning that are derived from consortia collaboration. Furthermore, Arino and de la Torre (1998) find, through analysis of events and dynamics in interfirm relationships, that firms that succeed in relationship building learn in the process and subsequently apply their knowledge to improve their collaboration with consortia partners.

The second motive is social capital that is embedded within the networks of relationships inside the consortium (De Wever, Martens & Vandenbempt, 2005; Moran, 2005). Nahapiet and Ghoshal (1998), building on the literature on social capital as a central organizational advantage, maintain that social capital facilitates the development of firm-level intellectual capital. Consortia,
within which representatives from firms interact on a regular basis, enable social capital building.

Yet how such social capital is built and what drives it has not been thoroughly examined.

Learning and social capital are two process benefits from participating in a consortium, and are therefore the dependent variables of our theoretical model. Next, we identify firm characteristics and consortium conditions that enable firms to acquire these two process benefits within a consortium.

**Firm Characteristics: Technical Capability**

Firms’ technical capability is an important determinant of both how much they can learn and the social capital built while working in a consortium. Consortia offer a natural setting for learning, since to develop technical specifications of e-business standards, firms must work together closely, leading to knowledge spillovers among themselves (Khanna, Gulati & Nohria, 1998; Yoshino & Rangan 1995). Yet even though consortia provide firms an opportunity to internalize the knowledge and know-how of other members, their learning outcome may be asymmetric (Hamel, 1991). Their learning or absorptive capability depends on their in-house knowledge (Cohen & Levinthal 1989). Those firms with more knowledge can better assimilate and utilize knowledge spillovers from other members of the consortium. They have more experience in discovering, internalizing, and organizing knowledge, which can enhance “the effectiveness of imitating, grafting, and searching forms of learning” (Simonin, 1997: 1158). Moreover, a larger knowledge base means more capability of identifying potential learning opportunities when interacting with other firms. Given the typically large number of firms in a consortium, there are many potential opportunities for learning and internalizing knowledge and
know-how, especially for technically savvy firms. Therefore, we expect that a firm’s technical capability, or internal knowledge, facilitates their interorganizational learning within consortia:

**H1a:** Firms with higher technical capability expect more learning benefits from the consortia participation process.

Firm’s technical capability also enhances their social-capital building in a consortium. Consortia are conducive to social capital development, as member-firms work together via general member meetings, work group discussions, and even virtual communities such as online forums (Zhao, Xia & Shaw, 2005), which provide an environment where “social capital is embedded within networks of mutual acquaintance and recognition” (Nahapiet & Ghoshal, 1998: 243).

Firms’ ability to establish relationships with other consortia partners varies depending on their internal technical capability. Because social capital benefits must be acquired through often highly technical interactions with other consortia firms, possessing strong technical capability brings more opportunities for such interactions. Technologically competent firms are more attractive to potential consortia partners who want to obtain knowledge through inter-firm interactions than their less technologically sophisticated counterparts (Ahuja, 2000). Thus, those firms will have more opportunities on the receiving end for interaction and collaboration with their peers, and hence more social capital building. Moreover, internal technical capability enables firms to better analyze the strengths of other consortia members that are most valuable to themselves, as well as better analyzing their needs. Consequently, these firms can better identify networking possibilities and thus take better advantage of the opportunities in the consortium activities. Therefore, we hypothesize that:

**H1b:** Firms with higher technical capability expect more social capital benefits from the consortia participation process.
Firm Characteristics: Standard Valuation

While we differentiate between output benefits and process benefits, these benefits are not completely independent of each other. Firms’ valuation on the output of the consortium also drives their perceived benefits from the process. Consortia output initiates, and continuously drives, the interaction among members, which is essential in shaping firms’ cooperation behavior and the resulting process benefits (Kumar & Nti, 1998). It is the specific output that determines alliance context and institutional arrangements where the focal firm’s interactions, knowledge exchange, and relationship establishment with other firms are embedded (Larsson et al., 1998). The current paper focuses on consortia that develop and promote e-business standards for electronic inter-organizational information sharing.

Knowledge exchanged within a consortium is closely related to the standard it develops. Therefore, the more a firm values the standard, the more importance it attaches to learning related to the standard in the development process. In e-business standard consortia, such learning opportunities abound as firms pool resources together to develop architecture, data model, and technical documents for e-business standards. These firms jointly identify business processes that need to be standardized in digital supply chain networks, and they negotiate with each other in order to reach consensus on such specifications (Zhao, Xia & Shaw, 2005).

Firms have different values concerning e-business standards due to their different business needs (Zhao, Xia & Shaw, 2007). For example, some firms need to share information with a larger number of partners than do others. For them, the common interface provided by e-business standards is more critical than for those firms that only deal with a limited number of partners. The relevance of the knowledge determines firms’ incentives to learn (Lane &
Lubatkin, 1998). When a firm values the standard more, it will also perceive more benefits of knowledge generated from the standard development. This logic leads to the following hypothesis:

**H2a:** Firms with higher standard valuation expect more learning benefits from the consortia participation process.

In addition, a firm’s valuation on the standard also affects its social capital benefits. The goal of the consortium is to provide standards for industry connectivity and interoperability. If a firm values the standard more, its individual goal is then more aligned with the consortium, which is set up to develop the standard. The shared goal leads to a high level of firms’ understanding of consortium tasks and outcomes (Inkpen & Tsang, 2005). Such understanding nurtures social interactions and acquaintance with other consortium members (Nahapiet & Ghoshal, 1998), which provide the foundation for enhanced network relationships. Therefore, we propose:

**H2b:** Firms with higher standard valuation expect more social capital benefits from the consortia participation process.

**Consortium Conditions: Governance Efficiency**

How much benefit a firm can gain through the process of participating in a consortium is also a function of the consortium’s management, especially its governance efficiency. Consortia are a form of interorganizational networks and viewed as an intermediate or hybrid governance structure (Parkhe, 1993). To manage the large number of firms and control alliance coordination costs (Gulati, 1998), consortia typically set a formal governance body, either selected from members or hired as full-time consortium employers, to administer their daily operations. For
example, a standard consortium in the mortgage industry, i.e., MISMO, specifically identifies the responsibility of their governance body as follows:

“The Governance Committee is responsible for administering the day-to-day standards development activities of MISMO and for maintaining the architectural consistency of the MISMO Standards in accordance with MISMO’s Policies and Procedures.”

Researchers note that better consortium governance facilitates interorganizational knowledge creation and learning (Kale, Singh & Perlmutter, 2000) and social capital building (Ireland, Hitt & Vaidyanath, 2002). Within a consortium, a formal governance structure is critical for conflict management (Williamson, 1985), which is essential in eliciting optimal involvement and contribution from member firms. For example, when cooperating with others in the consortium, firms often face conflicts due to potential competition outside the consortium, partnership opportunism, and goal divergence (Doz, 1996), which may thwart their contribution. To address these potential conflicts, the consortium governance body could set up and emphasize the common mission for all consortium participants, monitor and coordinate partner interactions, and resolve conflicts via institutionalized methods such as bylaws and formal procedures (Nelson, Shaw & Qualls, 2005). Such governance structures also help to induce knowledge exchange among representatives as individuals (Kim & Mauborgne, 1998).

In addition to conflict management, a consortium’s strong protection of the competitive advantages and intellectual property rights of its member firms is also crucial in motivating their contributions. Consortium governance can enable firms to alleviate their concerns of controlling

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2 From Mortgage Industry Standard Maintenance Organization’s (MISMO) website: [http://www.mismo.org/AboutMISMO/Leadership/GovernanceCommittee.htm](http://www.mismo.org/AboutMISMO/Leadership/GovernanceCommittee.htm)
the flow of their proprietary knowledge and know-how and preventing unnecessary leakage (Kale, Singh & Perlmutter, 2000), which encourages firms to share knowledge. An efficient consortium governance body should also develop clear and rigorous intellectual property rights (IPR) policies, which simultaneously enable firms to benefit from their commercial products and prevent opportunistic behaviors. One example of such opportunistic behavior is the “submarine patent approach” (Gallini, 2002), in which a company participates in the development of a standard around a technology that it has already patented and later claims royalties on the standard (Markus et al., 2006). Once efficient management is in place in the consortium and firms’ competitive concerns are addressed, we expect firms to receive more learning benefits:

**H3a:** **Consortium governance efficiency positively affects firms’ learning benefits from the consortium participation process.**

A well-managed consortium also enables members to accumulate more social capital, the network of relationships that constitute a valuable organizational resource (Bourdieu, 1986; Madhavan, Koka & Prescott, 2002). Effective consortium governance provides various communication channels, such as regular member meetings and online discussions, for members to interact and get to know one another. Consortium governance serves as an institution to sustain multiparty interactions, conversations, and sociability, which facilitate the development of social capital in many forms (Coleman, 1990; Lin, Cook & Burt, 2001). Further, by emphasizing cooperation over competition, consortium management can create social norms of openness and teamwork, giving firms sufficient motivation to engage in resource exchanges within the consortium (Nahapiet & Ghoshal, 1998; Putnam, 1993). Thus, we hypothesize:

**H3b:** **Consortium governance efficiency positively affects firms’ social capital benefits from the consortium participation process.**
Consortium Conditions: Relational Risk

Interfirm cooperation is highly interdependent and vulnerable to abuse. Consequently, it is subject to high relational risks (Mayer, Davis & Schoorman, 1995), which refer to the probability and consequences of unsatisfactory cooperation (Das & Teng, 1996) caused by members’ opportunistic behaviors. On the one hand, member firms may behave opportunistically to outlearn their exchange partners by internalizing their proprietary capabilities (Kale, Singh & Perlmutter, 2000). On the other hand, to protect themselves, firms may choose to provide distorted information to exchange partners (Das & Teng, 2001).

Relational risk reflects firms’ concern about the lack of genuine cooperation between partners (Ireland, Hitt & Vaidyanath, 2002). Consequently, it will lead to low commitment to collaboration processes within consortia (Das & Teng, 2001). Specifically, when the perceived relational risk is high, firms will be reluctant to share knowledge with each other. The risks of opportunistic exploitation also forces firms to expend more transactional efforts on coordination and monitoring (Williamson, 1985). As a result, fewer resources will be allocated to knowledge sharing and integration. Therefore, we expect:

\[ H4a: \text{Consortium relational risk negatively affects firms’ learning benefits from the consortium participation process.} \]

Meanwhile, firms are less willing to engage in effective social exchange in a highly risky environment (Kramer & Goldman, 1995). The competitive behavior induced by relational risk is destructive and inhibits building effective interorganizational relationships from consortium cooperation (Ireland, Hitt & Vaidyanath, 2002). Therefore, we expect:

\[ H4b: \text{Consortium relational risk negatively affects firms’ social capital benefits from the consortium participation process.} \]
Control Variables

We also included controls for firm experience from other consortia, firm consortium tenure and firm size, as well as consortium size and consortium history:

*Experience from other consortia:* Firms with more consortium-based standardization experience can better handle technical, economic, and social interactions within consortia. Therefore, experience from other consortia may lead to higher levels of benefits (Sakakibara, 2002).

*Tenure:* Long-term commitment may lead to more devotion to the consortium (Olk & Young, 1997), thus we include membership tenure as a control variable. A longer tenure also provides more experience for the firm, which may help enhance their ability to reap the learning and social capital benefits.

*Firm size:* Sakakibara (2002) maintains that firm size affects firms’ capability of consortium participation. Larger firms may be more capable simply because of the superior resources they possess.

*Consortium size:* Consortium size has mixed impacts on members’ process benefits acquisition. Larger size leads to higher resource availability (McPherson, 1983). However, large size also increases coordination and free-riding problems (Marwell & Oliver, 1993). We include consortium size to control for its uncertain impact.

*Consortium history:* We finally control for the maturity of the consortium to explore whether firms’ process benefits will change as the consortium evolves.
METHODS

Research Procedures and Sample

The population for this study consisted of consortia fitting the following criteria. First, the consortium’s main mission is to develop standards for industry-wide information sharing. Second, standards developed by the consortium are public goods, which are freely available for both members and non-members. Third, the consortium is open to all potential participants and reaches consensus via members’ voluntary contribution and coordination. We identified candidate consortia through three sources. The first source is XML.org, a portal for industries to submit e-business standards in order to minimize duplication of effort. The second source is ConsortiumInfo.org, which provides a list, including descriptions and links, for over 400 consortia that develop and promote various types of standards. The third source is the referrals from participating consortia. After several rounds of survey invitations and requests, seven consortia from six industries agreed to participate in our study (Table 1).

Place Table 1 here

We conducted two pretests to ensure the face validity of the research. First, the questionnaire was given to managers from two consortia for comments and suggestions. Second, a pilot survey was administrated to members of OGC and 16 responses were collected. We incorporated their feedback in developing the final version of the questionnaire.

We hosted an Internet-based survey at a secure university website from May 2006 to September 2006. E-mail invitations were distributed to 1,784 consortia members and 247 firm-
level responses were collected, yielding a 13.85% response rate. 232 responses were analyzed due to 15 unusable samples. To test the non-response bias, we compared early and late respondents (Armstrong & Overton, 1977) on demographic information and constructs relevant to this research. The results were not significant (p<0.05, two tailed), suggesting that non-response bias is not a concern.

To reduce the bias caused by reliance on a single informant in each organization (Huber & Power, 1985), we collected multiple responses as often as possible. 39 firms (16.8% of the sample) provided survey responses from more than one informant. We examined the consistency among multiple respondents from the same organization by calculating both Cronbach’s $\alpha$ and the correlation coefficient (Pearson product moment method) (Bowman & Ambrosini, 1997). The majority of the firms (n=33) showed high consistency among multiple respondents with Cronbach’s $\alpha$ above .60 and correlation value of more than .40 (Nunnally & Bernstein, 1994). Therefore, the firm-level responses were generated by the average responses. For the six firms for which the dispersion of responses was wide, we used the answer from the respondent in a more senior level position.³

Measures

We used multi-scale items to collect data for all key constructs. We developed the measures based on literature from the consortia research area, the standardization literature, as well as our fieldwork. We used a 7-point Likert-type scale, ranging from 1 (strongly disagree) to 7 (strongly agree) to assess latent items. The complete list of measurement items is presented in the Appendix.

³ They were the Consortium Relationship Manager, the Primary Consortium Contact, the Enterprise Data Manager, the Marketing Manager, the Manager with extensive experiences in e-business standardization in the real estate industry, and the CTO, respectively.
Learning Benefits

Learning benefits refer to knowledge-based intangible benefits a firm obtains from consortia participation activities (Kogut, 1988; Simonin, 1997). From sharing, exchanging, and acquiring knowledge in the consortium, firms learn specific skills and competencies. We focus on consortia that develop e-business standards, and thus skills and knowledge created through consortia are context specific and closely related to firms’ standard setting and future adoption. Four items were used to capture learning benefits (Kale, Singh & Perlmutter, 2000).

Social Capital Benefits

Based on Burt (1997), Portes (1998), and Inkpen and Tsang (2005), social capital benefits are advantages gained from membership in social networks, which is the consortium in the current paper. Firms access social capital benefits by establishing institutionalized relationships with other consortia members. Social capital benefits were measured by three relational resources inherent in consortia networking, including privileged access to knowledge, partnership opportunities, and potential market access through other members.

Firm Technical Capability

Firm technical capability is a firm’s own internal technological experience, which enables leveraging benefits of the consortium cooperation more effectively (Bayona, Garcia-Marco & Huerta, 2001). Firms need sufficient internal knowledge to get involved in the technically sophisticated standard development process. Three survey measurements were developed, which assessed firms’ understanding of standard technical details, and their experience in standard development as well as prior standard consortia participation (Sakakibara, 2002).
**Standard Valuation**

Standard valuation refers to firms’ perceived benefits of e-business standards. As process benefits from consortia participation is closely related to the output (i.e., the standards), firms who value the standard more might also value the process benefits more. Standard value comes from improved customer satisfaction, partner relationship, and newly created business opportunities (Zhu *et al.*, 2006). In addition, standards can also bring long-term benefits to the entire industry (Wigand, Steinfeld & Markus, 2005). Based on prior IT valuation studies (Iacovou, Benbasat & Dexter, 1995; Zhu *et al.*, 2006), we developed six survey items to measure firms’ standard valuation.

**Consortium Governance Efficiency**

Consortium governance efficiency measures the extent to which consortium management effectively coordinates multi-party cooperation (Gulati, 1998; Ireland, Hitt & Vaidyanath, 2002). Eight items were used to gauge the procedure fairness of the consortium (Luo, 2008), the strength of the consortium leadership, the promotion of trust and coordination among members (Barringer & Harrison, 2000), and the protection of proprietary assets (Kale, Singh & Perlmutter, 2000).

**Relational Risk**

According to Das and Teng (2001: 253), relational risk is defined as the probability and consequences of not having satisfactory cooperation. This risk comes from members’ opportunistic behavior within the consortium. To operationalize this construct, we developed three latent items, which measured the extent of conflicting interests, concern of information leakage, and potential market competition caused by knowledge spillover in the consortium.
Control Variables

We controlled for firm size (i.e., the annual sales in dollar amount), consortium size (number of member firms) and history (number of years since their inception). In addition, we controlled for firms’ participation in other consortia (1: has participated in other standard consortium; 0: has not participated in other standard consortia), and their tenure within the focal consortium. Since consortia in our sample were established in different years, we used the normalize value, Years of Participation in the Consortium/Years since the Consortium’s Inception, to measure firms’ tenure within the consortium.

ANALYSIS AND RESULTS

To examine both the measurement model and the structural model, we chose PLS-Graph version 3.0 for its fit with the research question and data used in this research. First, PLS is appropriate for theory development and exploratory research (Doz, Olk & Ring, 2000). The current paper is a preliminary effort to examine drivers of process benefits from consortia participation. It is also one of only a few research studies focusing on consortia that develop and promote industry-wide open standards. Second, PLS is well-suited for studies that use a small to medium sample size and is insensitive to conditions of non-normality (Barclay, Thompson & Higgins, 1995; Delios & Beamish, 1999).

Measurement Model

Since multiple-item scales were used to measure the latent constructs, we need to first test the validity and reliability of scales used (Gerbing & Anderson, 1988). Due to the new

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4 The software is used with the permission from the developer Prof. W. Chin.
measurements introduced, we first conducted the exploratory factor analysis using Principal Component Analysis in SPSS. Multiple factors, consistent with the later constructs, emerged with no-crossing of items. We then conducted confirmatory factor analysis based on PLS. Item RELRIS01 was dropped due to low and statistically insignificant path loading. As shown in Table 2, the remaining measurement items all have significant path loadings (p<0.001) with acceptable magnitude (Barclay, Thompson & Higgins, 1995). Also, the average variance extracted (AVE) for all constructs exceeded 0.5 (Hulland, 1999). High composite reliability and Cronbach’s α (both>0.7) confirmed the reliability of measurement items. The discriminant validity of the latent constructs was established since all square roots of AVEs were much larger than the construct correlations (Table 3) (Hulland, 1999).

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Place Table 2 and Table 3 here
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Results

Once the measurement model was found to be acceptable, we examined the structural model to test our hypotheses. Table 4 shows the results from PLS-based structural model analysis.

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The empirical results indicate that firm technical capability (β=0.318, p<0.01), standard valuation (β=0.341, p<0.01), and consortium governance efficiency (β=0.224, p<0.01) all have significantly positive effects on learning benefits obtained from consortium participation. These factors also have statistically significant and positive impacts on social capital benefits received
from consortium activities ($\beta=0.144$, $p<0.05$ for technical capability; $\beta=0.382$, $p<0.01$ for standard valuation; $\beta=0.125$, $p<0.1$ for consortium governance efficiency). Thus, Hypotheses H1a&b, H2a&b, and H3a&b are all corroborated.

Relational risk, i.e., concern for opportunistic behaviors, is not statistically significant in determining either learning or social capital benefits. This empirical finding could be due to two reasons. First, the specific output of the consortia in our setting, information sharing standard, is a public good with little competitive implications in its consumption (adoption). Firms develop and implement e-business standards in order to enhance the industry-wide interconnectivity. Thus, competition and opportunistic behaviors, if they exist at all, are not as intense as, say, in a proprietary R&D consortium. Second, and perhaps more importantly, most consortia in our sample did have the foresight to put clearly defined intellectual property right policies and boundaries in place to limit discussion only to standard issues, without getting into areas of competitive nature. We believe this practice, now widely adopted by many consortia, helps mitigate competitive behavior in a consortium setting. Combining these two reasons, firms in our survey expressed little concern for relational risks that they might face within the consortium (mean=4.01).

None of the control variables has any statistically significant impact on social capital benefits derived from the consortium. However, four control variables affect learning benefits received by firms. Firms tend to learn more in larger consortia (Consortium Size), as the number of member firms can increase the availability of knowledge. However, learning benefits provided by the consortium diminish as the consortium evolves (Consortium History). One possible explanation is that the rate of new knowledge generation may decrease the longer the
consortium is in place. Firm size negatively affects firm’s learning benefits. Smaller firms often learn more in a consortium for at least two reasons. First, smaller firms typically have fewer resources, so they can join much fewer consortia than their larger counterparts (the correlation between firm size and other consortium participation is 0.238, p<0.01). Thus, once they make the decision to participate in a consortium, these smaller firms are essentially betting on the consortium to succeed. They are simply more committed than larger firms, which sometimes participate only so as “not to be left behind.” As one large MISMO member indicated in an interview with us, “we are big due to the size, so industry expects us to participate so we participate.” Second, smaller firms, due to their disadvantageous positions in the industry, are more motivated to learn in the consortium. At the same time, because of their smaller knowledge base, they may enjoy more learning opportunities in the consortium than do their larger counterparts. Firms also learn more if they only participate in one consortium, which induces more focused investment than if they are involved in multiple consortia.

**Discussions and Conclusion**

The current paper differentiates output benefits and process benefits from consortium participation, and examines what constitutes process benefits and the drivers of these benefits. E-business standard consortia provide an ideal setting to disentangle those two benefits and enable us to focus on drivers of process benefits. Two major process benefits that firms can obtain through collaborating with others in the consortium are identified: learning and social capital benefits.

By integrating interorganizational learning theory and social capital theory, we identify a common set of factors that drive consortium process benefits. Learning and social capital
benefits co-exist, and their motivating factors are similar to each other. Our analysis suggests that firms can expect more learning as well as social capital benefits if they are more technical capable, value standards more, and work in a better managed consortium.

Standard valuation is the most influential factor, as the output shapes the goal and membership constitution of the consortium. While output benefits and process benefits are two different payoffs that firms receive from consortium participation, process benefits, which are context specific (Larsson et al., 1998), are highly dependent on output benefits. Firms exchange knowledge in developing the output. Thus, learning from the common pool of know-how is domain-specific to the output. Social capital benefits are also closely related to the output, since the networks of relationships are built among firms who share the common interests in the output.

Our study indicates that firm characteristics (Technical Capability and Standard Valuation) dominate consortium conditions (Consortium Governance and Relational Risks) in determining process benefits from consortium activities even when the output is a public good. Compared to output benefits, which are commonly available to all consortium members, process benefits are more private and heterogeneous among firms (Khanna, Gulati & Nohria, 1998). Creating process benefits requires a well-managed consortium that efficiently coordinates multiparty interactions and facilitates the formation of a common knowledge and relationship pool. However, to actually acquire such benefits, firms have to individually learn the knowledge and know-how, and initiate their own inter-firm relationships. Thus, the realization of such benefits is private and constrained by firms’ interests in the outputs and by their individual capabilities (Nelson & Winter, 1982; Teece, Pisano & Shuen, 1997).
The current paper advances our understanding of consortia payoff structures (Khanna, Gulati & Nohria, 1998) by empirically exploring process benefits and their drivers. When a firm needs to determine whether to join a consortium and how to allocate resources for such an endeavor, it needs to simultaneously consider the output generated by the consortium as well as payoffs from the cooperation process alone. While the output may be a public good thus available to all consortium participants, the process benefits are private and favor those with more internal resources. At the same time, managers of consortia need to carefully design their governance mechanism in order to increase firms’ process benefits from the multi-party cooperation (Gottschlag & Zollo, 2007).

This study also has several limitations. First, we focus on standard consortia, which have several unique features as we have discussed in Section 2. Standard consortia provide high common benefit (Agarwal, Croson & Mahoney, 2008) and their output is used for industry-wide cooperation. Whether our findings can be generalized to other types of consortia requires further investigation. We believe that understanding how the goal and scope of consortia affect the formation of process benefits merits further theoretical and empirical attention. Second, we only consider process benefits at the organization level. However, process benefits can also be obtained at the individual level. Firms participate in consortia through individual representatives, who also accrue personal process benefits such as expertise, peer recognition, and personal relationships. It would be useful to investigate how individual-level process benefits can be transferred to organizational-level process benefits (Olk, 1998). Third, we need to strengthen the measurement of the relational risk construct, which is relatively new in empirical studies. Future
research can explore other potential opportunistic behaviors in addition to conflicting interests, information leakage, and competition concerns that have been examined in this paper.

Mahoney (2005) suggests that an integrative research program is a feasible, challenging and rewarding endeavor in pursuing the evolving science of organization. Our hope is that the current paper proves useful for generating further research that joins the extant literatures on alliances (Gulati, 1998), consortia (Ring, Doz & Olk, 2005), capabilities (Makadok, 2001), social capital (Nahapiet & Ghoshal, 1998), and governance (Gottschlag & Zollo, 2007). The current paper empirically corroborates the importance of such a research agenda by showing that a well-managed consortium creates substantial process benefits.
References


Table 1: Participating E-business Standard Consortia

<table>
<thead>
<tr>
<th>Consortia</th>
<th>Industry</th>
<th>N</th>
<th>Consortia</th>
<th>Industry</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACORD</td>
<td>Insurance</td>
<td>113</td>
<td>PISCES &amp;</td>
<td>Real Estate</td>
<td>27</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>OSCRE</td>
<td></td>
<td></td>
</tr>
<tr>
<td>FPL</td>
<td>Securities</td>
<td>22</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Transaction</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MISMO</td>
<td>Mortgage</td>
<td>42</td>
<td>OGC</td>
<td>Geospatial</td>
<td>16</td>
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<tr>
<td>XBRL</td>
<td>Accounting</td>
<td>15</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Although responses from ACORD constitute a large proportion of the entire sample, our statistical analysis of only the ACORD data showed qualitatively similar results.

PISCES and OSCRE are sister consortia, with PISCES located in the U.K. and OSCRE in the U.S. PISCES founded OSCRE.
<table>
<thead>
<tr>
<th>Items</th>
<th>Loading</th>
<th>t-Value</th>
<th>AVE</th>
<th>Composite Reliability</th>
<th>Cronbach’s Alpha</th>
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</thead>
<tbody>
<tr>
<td>LEABEN01</td>
<td>0.790</td>
<td>19.060</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LEABEN02</td>
<td>0.828</td>
<td>28.991</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LEABEN03</td>
<td>0.770</td>
<td>18.411</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LEABEN04</td>
<td>0.703</td>
<td>12.541</td>
<td>0.599</td>
<td>0.856</td>
<td>0.766</td>
</tr>
<tr>
<td>SOCBEN01</td>
<td>0.699</td>
<td>11.083</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SOCBEN02</td>
<td>0.903</td>
<td>58.539</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SOCBEN03</td>
<td>0.864</td>
<td>37.115</td>
<td>0.684</td>
<td>0.865</td>
<td>0.765</td>
</tr>
<tr>
<td>CAPABI01</td>
<td>0.822</td>
<td>15.465</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CAPABI02</td>
<td>0.840</td>
<td>18.525</td>
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<td></td>
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<tr>
<td>CAPABI03</td>
<td>0.757</td>
<td>12.093</td>
<td>0.652</td>
<td>0.849</td>
<td>0.729</td>
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<td>STANVA01</td>
<td>0.716</td>
<td>14.697</td>
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<td>STANVA02</td>
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<tr>
<td>STANVA03</td>
<td>0.751</td>
<td>16.397</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>STANVA04</td>
<td>0.773</td>
<td>21.352</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>STANVA05</td>
<td>0.756</td>
<td>20.747</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>STANVA06</td>
<td>0.762</td>
<td>20.990</td>
<td>0.557</td>
<td>0.883</td>
<td>0.838</td>
</tr>
<tr>
<td>GOVERN01</td>
<td>0.685</td>
<td>12.936</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GOVERN02</td>
<td>0.728</td>
<td>16.622</td>
<td>0.567</td>
<td>0.912</td>
<td>0.888</td>
</tr>
<tr>
<td>Item</td>
<td>Mean(SD)</td>
<td>LEABEN</td>
<td>SOCBEN</td>
<td>CAPABI</td>
<td>STANVA</td>
</tr>
<tr>
<td>---------</td>
<td>----------</td>
<td>--------</td>
<td>--------</td>
<td>--------</td>
<td>--------</td>
</tr>
<tr>
<td>LEABEN</td>
<td>5.40 (1.19)</td>
<td>0.875</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SOCBEN</td>
<td>5.49 (1.20)</td>
<td>0.464**</td>
<td>0.875</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CAPABI</td>
<td>5.56 (1.40)</td>
<td>0.376**</td>
<td>0.255**</td>
<td>0.854</td>
<td></td>
</tr>
<tr>
<td>STANVA</td>
<td>5.86 (1.10)</td>
<td>0.520**</td>
<td>0.485**</td>
<td>0.186**</td>
<td>0.915</td>
</tr>
<tr>
<td>GOVERN</td>
<td>5.38 (1.21)</td>
<td>0.412**</td>
<td>0.326**</td>
<td>0.220**</td>
<td>0.412**</td>
</tr>
<tr>
<td>RELRIS</td>
<td>4.01 (1.58)</td>
<td>-0.116</td>
<td>-0.151*</td>
<td>-0.101</td>
<td>0.128</td>
</tr>
</tbody>
</table>

* p<0.05; ** p<0.01.
<table>
<thead>
<tr>
<th></th>
<th>Learning Benefits</th>
<th>Social Capital Benefits</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>R-Square</strong></td>
<td>0.423</td>
<td>0.298</td>
</tr>
<tr>
<td><strong>Hypotheses</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Firm Technical Capability</td>
<td>0.318*** (H1a supported)</td>
<td>0.144** (H1b supported)</td>
</tr>
<tr>
<td>Standard Valuation</td>
<td>0.341*** (H2a supported)</td>
<td>0.382*** (H2b supported)</td>
</tr>
<tr>
<td>Consortium Governance Efficiency</td>
<td>0.224*** (H3a supported)</td>
<td>0.125* (H3b supported)</td>
</tr>
<tr>
<td>Relational Risk</td>
<td>0.002 (H4a not supported)</td>
<td>-0.061 (H4b not supported)</td>
</tr>
<tr>
<td><strong>Control</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Firm Size</td>
<td>-0.103**</td>
<td>-0.022</td>
</tr>
<tr>
<td>Vscexp</td>
<td>-0.13**</td>
<td>0.066</td>
</tr>
<tr>
<td>Tenure</td>
<td>0.057</td>
<td>0.047</td>
</tr>
<tr>
<td>Consortium Size</td>
<td>0.221*</td>
<td>0.162</td>
</tr>
<tr>
<td>Consortium History</td>
<td>-0.219*</td>
<td>-0.205</td>
</tr>
</tbody>
</table>

n.s.: non-significant; * p<0.1; ** p<0.05; *** p<0.01 (two-tailed).
### APPENDIX: Measurement Items

<table>
<thead>
<tr>
<th>Learning Benefits (LEABEN) (7-point Likert Scale)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Can understand the direction of the standard setting in advance (LEABEN01).</td>
</tr>
<tr>
<td>Can accumulate standard related expertise (LEABEN02).</td>
</tr>
<tr>
<td>Can become industry leaders in Web-based supply chain application and cooperation (LEABEN03).</td>
</tr>
<tr>
<td>Can reduce costs of standard adoption by participating in the VSC (LEABEN04).</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Social Capital Benefits (SOCBEN) (7-point Likert Scale)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Can learn from other VSC participants (SOCBEN01).</td>
</tr>
<tr>
<td>Expects to establish partnerships with other VSC members (SOCBEN02).</td>
</tr>
<tr>
<td>Expects to improve market access through other VSC participants (SOCBEN03).</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Firm Technical Capability (CAPABI) (7-point Likert Scale)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Your firm has employees who understand technical details of the standards (CAPABI01).</td>
</tr>
<tr>
<td>Your firm has experience in developing IT standards (CAPABI02).</td>
</tr>
<tr>
<td>Your firm has gained experience from working in other standards consortia (CAPABI03).</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Standard Valuation (STANVA) (7-point Likert Scale)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Improve customer satisfaction (STANVA01).</td>
</tr>
<tr>
<td>Improve your firm’s relationship with your trading partners (STANVA02).</td>
</tr>
<tr>
<td>To keep your firm’s competitive advantage in the market, it is important for your firm to understand the standards proposed by the VSC (STANVA 03).</td>
</tr>
<tr>
<td>Adopting the standards can bring potential business opportunities to your firm (STANVA 04).</td>
</tr>
<tr>
<td>The standard development is critical to the industry in which this VSC is working (STANVA 05).</td>
</tr>
<tr>
<td>The standard development is critical to the industry in which this VSC is working</td>
</tr>
<tr>
<td><strong>Consortium Governance Efficiency (GOVERN) (7-point Likert Scale)</strong></td>
</tr>
<tr>
<td>---</td>
</tr>
<tr>
<td>The goals and objectives of this VSC are clear and well understood (GOVERN01).</td>
</tr>
<tr>
<td>This VSC is neutral and independent with respect to all firms participating in the consortia (GOVERN02).</td>
</tr>
<tr>
<td>The standard development process in this VSC is open (GOVERN03).</td>
</tr>
<tr>
<td>This VSC disseminates information accurately and responsively (GOVERN04).</td>
</tr>
<tr>
<td>The rules and procedures of this VSC are clear and fair (GOVERN05).</td>
</tr>
<tr>
<td>This VSC has a strong and efficient leadership (GOVERN06).</td>
</tr>
<tr>
<td>This VSC provides sound intellectual property rights policies and protection (GOVERN07).</td>
</tr>
<tr>
<td>This VSC promotes trust and compatibility among members (GOVERN08).</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Relational Risk (RELRIS) (7-point Likert Scale)</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Has conflicting interests with some other participants (RELRIS01).</td>
</tr>
<tr>
<td>Is worried about information leakage (RELRIS02).</td>
</tr>
<tr>
<td>May face increased market competition in the industry, since VSC members share information and learn from each other in the consortium. (RELRIS03).</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Firm Size</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Firm’s annual sale ($)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Consortium Size</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>The number of members in the consortium</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Other Consortium Participation (Yes; No)</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Has your firm participated in other standard consortia addition to the focal one surveyed here?</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Consortium Tenure</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Years of Participation in the Consortium/Years Since the Consortium’s Inception</td>
</tr>
</tbody>
</table>