
Enhancing value via cooperation: firms' process benefits from participation in a standard consortium

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Firms benefit from participating in a consortium in two ways: from final products and from the cooperation process. Process benefits, including interorganizational learning and social capital benefits, are critical to motivate firms to participate in a consortium. However, there is limited understanding of what factors enable firms to obtain process benefits via consortium activities. Based on 232 member surveys collected from seven e-business standard consortia, we find that firms anticipate more process benefits if they are more technically capable, value the forthcoming standards higher, and participate in a better-managed consortium. Surprisingly, although relational risks exist due to potential competition among consortium members, their impacts on process benefits are insignificant in e-business standard consortia. Furthermore, our empirical analysis suggests that more technically capable firms handle relational risk less effectively when learning within the consortium.

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1. Introduction

Consortia, as a newly evolving organizational form, have attracted much research attention within the management field, following Doz (1996) and Gulati (1998). Extant research has examined consortia's formation (Ring *et al.*, 2005), performance

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(Ireland *et al.*, 2002), and a member firm's decision to stay or exit (Olk and Young, 1997). The goal for such inquiries is to help firms understand how to get the most benefit from participation in a consortium. However, with most research focusing on the benefits obtained from the output (e.g. patents and intellectual property from the R&D consortium), there is little understanding how firms can derive value from the collaboration process. Specifically, while some research acknowledges that firms benefit from consortia via learning (Khanna *et al.*, 1998) and social capital building (Kale *et al.*, 2000), it has not been systematically shown *how* various benefits from consortia come about, as well as what factors affect their realization.

Firms benefit from consortia in at least two ways: (i) from the final products that firms jointly develop (*product benefits*); and (ii) from the development process (*process benefits*). Process benefits refer to those benefits that exist independent of the products. In other words, even when no products are created by the consortium, the participants still gain benefits from the process, which are what we define as process benefits. Process benefits include the value from learning via working with other firms (Simonin, 1997), as well as building social capital through multilateral interactions (Nahapiet and Ghoshal, 1998). The goal of the current article is to establish a theoretical framework for evaluating the process benefits firms can receive through participation in a consortium, and empirically test it.

Process benefits are closely related to firms' incentives to invest in development activities in consortia. While they have been examined in prior alliance literature, there is limited understanding of individual firms' acquisition of process benefits in a consortium-based standardization setting. Standards are specifications for better compatibility and interoperability, and have important implications for market performance and economic welfare (David, 1985; Farrell and Saloner, 1985; Stango, 2004). Many standards are developed via formal negotiation and coordination in industry consortia (David and Greenstein, 1990; Farrell, 1996), in which a large number of firms work together to develop standard based on consensus (Greenstein, 1992; Weiss and Cargill, 1992). Process benefits motivate members to behave more cooperatively. However, it is unclear what factors enable firms to accrue process benefits via consortium activities (Foray, 1994; Cowan and Foray, 1997).

To fill this research gap, we examine firms' process benefits from participating in a standard consortium. Specifically, we focus on consortia that are actively developing e-business standards (Markus *et al.*, 2006). E-business standards, a critical infrastructure of digital supply-chain networks, specify how information systems communicate with one another (Amit and Zott, 2001). In e-business standard consortia, due to the public-good feature of open standards, even nonmember firms can access product benefits (Olson, 1965; Zhao *et al.*, 2005). Thus, product benefits alone may not sufficiently motivate members to contribute to the consortium, and process benefits become a key component of consortia's payoff structures, which makes it ideal for our research.

Firms' process benefits include learning and social capital benefits, which serve as the dependent variable in our specified model. For independent variables, we identify both consortium-level (governance effectiveness and relational risk) and firm-level factors (technical capability and valuation of standard benefit) that can influence the level of process benefits. Identification of independent variables, grounded in Monge *et al.*'s (1998) framework, decomposes consortium participation into value-creation and value-appropriation stages. In the value-creation stage, consortium-level factors, including governance effectiveness and relational risk for firms, can affect the *size of the pie*; while in the value-appropriation stage, firm-level factors, including firms' valuation of the final product and their technical capability, could influence the *share of the pie* that the firm can acquire (Teece, 1986).

We surveyed 232 member firms from seven e-business standard consortia, and found that both firm-level (firm technical capability and valuation of standard benefit), and consortium-level factors (consortium governance effectiveness) influence the level of process benefits that firms can obtain from consortia cooperation. Also, the impact of relational risk is statistically insignificant, and firm-level factors dominate consortium-level factors in determining both learning and social capital benefits. Interestingly, the relationship between relational risks and process benefits are negatively moderated by firm capability.

This article's research contributions are twofold: First, while extant research examined process benefits, factors affecting their realization in the standard setting have been under-emphasized. Based on the value-creation and value-appropriation theoretical underpinning, we propose a framework to identify enablers/barriers of process benefits at the consortium and firm levels. Second, our research provides a deeper understanding of e-business standard consortia. While prior studies on consortia focus on R&D purposes (Aldrich and Sasaki, 1995; Olk and Young, 1997; Doz *et al.*, 2000; Mathews, 2002), comprehensive empirical research of standard consortia is limited. E-business standard consortia are public-good producing consortia and are a type of multi-firm alliance that warrants greater research attention.

The current article proceeds as follows: the next section presents the theoretical framework and hypotheses. The third section explains research methods and operationalizations of the variables, followed by data analysis and results in the next section. The last section discusses results, provides conclusions, and offers suggestions for future research.

2. Theoretical framework and hypotheses development

2.1 Overview

Prior research studies have identified various motives for interfirm technology collaboration (Hagedoorn, 1993), of which two are closely related to the collaboration

process. The first motive is interorganizational learning, as firms can enhance their competitive positions through new knowledge, which is acquired from collaboration with other consortium members (Lim, 2009; Hagedoorn *et al.*, 2010). Simonin (1997) notes important intangible benefits via learning derived from consortia collaboration. Furthermore, Arino and de la Torre (1998) find that firms that succeed in relationship building learn in the process and subsequently apply their knowledge to improve collaboration with consortium partners. In standard consortia, new knowledge is generated while members develop specifications through experimental and learning-by-using processes (Foray, 1994).

The second motive for interfirm technology collaboration is the creation of social capital embedded within networks of relationships inside the consortium. Lin (2001) defines social capital as investment in social relations with expected returns. The central proposition of social capital theory is that networks of relationships constitute an economically valuable resource (Brusoni and Lissoni, 2001; Lin *et al.*, 2001). Nahapiet and Ghoshal (1998) refer to social capital benefits as the sum of actual and potential resources embedded within, available through, and derived from networks of relationships possessed by an individual or social unit. Social capital can facilitate a firm's competition and cooperation with other firms (Adler and Kwon, 2002; Tsai, 2002). Therefore, it is important that firms invest in and manage their social capital properly.

In the context of a firm participating in a consortium, social capital benefits refer to gains for the focal firm through interacting with other participants. Based on a case study of the standard consortium in the mortgage industry, Markus *et al.* (2006) find that social capital benefits include opportunities to learn from other participants, the potential for establishing new exchange relationships with other participants, and improving market access through other participants. Consortia, within which representatives from firms interact on a regular basis, enable social capital building. Yet what drives these social capital benefits has not been fully examined.

Learning and social capital are two process benefits from participating in a consortium, and constitute the dependent variables of our model. Next, we present a theoretical framework that identifies consortium-level and firm-level factors that enable or hinder firms to acquire these two process benefits within consortia.

While resource-based theory emphasizes economic value *appropriation*, a more complete theory of strategy considers both value *creation* (increasing the *size* of the pie) and value *appropriation* (increasing one's *share* of the pie) (Mahoney, 2005). In the current context, to obtain process benefits from the standard consortium, firms must go through a two-stage process: the consortium-level value-creation stage and the firm-level value-appropriation stage (Monge *et al.*, 1998).

In the first stage, to create economic value within the consortium, firms must work together to generate collective benefits (i.e. common-knowledge and social capital pools from which their own related benefits will draw from). Consortium

members' joint-resource contribution determines the collective benefits available to all member firms. Two key consortium-level variables affect this value-creation process. The first key variable is the effectiveness of consortium governance. Many e-business standard consortia choose a nonequity alliance governance form with a neutral and independent management team or committee (Zhao *et al.*, 2007). We use consortium governance effectiveness to measure how well consortium managers coordinate multilateral cooperation among a large number of member firms. Effective consortium governance mitigates opportunistic behavior (Williamson, 1985), motivates firms to contribute resources to the consortium and, encourages overall production of process benefits for all participants. The second key consortium-level variable is relational risk, which refers to potential exposure to losses caused by other firms' opportunistic behaviors and unsatisfactory cooperation. Even with formal control provided by consortium governance, relational risk still exists due to complete contracts being either impossible or prohibitively costly to produce (Williamson, 1996). Relational risk can be counterproductive, as it is caused by interfirm conflicts and firms are reluctant to commit to a conflict-prone alliance. Together, consortium governance effectiveness and relational risk, to the extent that they are observable before firms engage in standardization activities, affect how much firms want to work together to create the pie, as firms plan their contribution *ex ante* in anticipation of the competitive aspect of their consortium work.

In the second value-appropriation stage, firms need to convert the collective resource provision into private benefits, in the form of their own know-how and networks of relationships. The resulting benefits of the private value-realization process depend on two firm-level variables. The first firm-level variable is the firm's technical capability. As a dynamic resource-based approach suggests (Cohen and Levinthal, 1989; Zander and Kogut, 1995), firms' technical capability differentiates their competence to value, absorb, assimilate, and utilize process benefits generated by multi-firm cooperation. The second firm-level variable is how the firm values the forthcoming standard, the final product of the consortium. Alliance research suggests that firms' expectation towards the final product determines the relevance and usefulness of the resulting process benefits (Larsson *et al.*, 1998). If a firm anticipates the future standard to be more valuable, it is more willing to acquire knowledge and social capital generated from the associated development process.

Consortium and firm-level factors have impacts on both value-creation and appropriation stages. Consortium governance effectiveness and relational risk affect the value-appropriation process because they affect the environment where firms appropriate value *ex post*. Firm-level factors affect the value-creation stage, as firms' contribution to the collective-good standard is a function of their technical capability. Their contribution is also a function of their valuation of the standard (Zhao *et al.*, 2007). Next, we focus on these factors and derive our theoretically grounded hypotheses.

2.2 Consortium characteristics: governance effectiveness

How much a firm can benefit through the process of participating in a consortium is a function of the consortium's management, especially its *governance effectiveness* in setting policies and managing the consortium's daily operations. While management research has examined alliances extensively, consortia are somewhat different, because there are usually more firms in a consortium than the small number (often two) typically found in an alliance. Thus, consortia are mostly set up as nonequity alliances that have neutral and independent governance committees, which help establish and enforce policies and governance procedures such as intellectual property rights protection and voting rights. For example, a standard consortium in the mortgage industry, MISMO, identifies the responsibility of their governance body: "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." (MISMO website)

In transaction costs theory, economic agents align transactions with governance structures to reduce costs (Teece, 1986; Williamson, 1996). A standard consortium, consisting of many member firms and a set of policies and procedures for standardization, is characterized by the governance structure, effectiveness, and competitive behavior of member firms (David and Greenstein, 1990; Farrell, 1996). Since the governance structures of such standard consortia are similar (e.g. comprised of independent governance committees and working groups), we focus on how such governance is effectively managed.

Better consortium governance facilitates interorganizational knowledge creation and learning (Kale *et al.*, 2000), as well as social capital building (Ireland *et al.*, 2002). During the process benefits creation stage, consortium governance effectiveness affects members' individual contribution to the collective resource pool within the consortium through conflict management, which is essential in eliciting member firms' contributions. Consortium governance can: set up and emphasize the common mission for all consortium participants; monitor and coordinate exchange partner interactions; and resolve conflicts by institutionalized methods such as bylaws and formal procedures. Those management activities can motivate individual members' contribution via normative conformity (Ouchi, 1980; Ostrom, 2000).

In addition to conflict management, a consortium's strong protection of the competitive advantages of its member firms is also crucial in motivating their contributions. Consortium governance can enable firms to alleviate their concerns of controlling the flow of their proprietary knowledge and know-how and prevent unnecessary leakage (Kale *et al.*, 2000), which encourages firms to share knowledge. Effective consortium governance should also develop clear and rigorous intellectual property rights (IPR) policies, which simultaneously enable firms to benefit from their commercial products and prevent opportunistic behavior such as a "submarine

patent approach” 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 such effective management is in place in the consortium and firms’ competitive concerns are addressed, firms are more likely to exchange private knowledge. Therefore, a larger common-knowledge pool can be created, which can be acquired by firms during the later value-appropriation stage. This logic leads to the following hypothesis:

H1a: Firms perceive more learning benefits from the consortium participation process with better consortium governance effectiveness.

A well-managed consortium also enables members to accumulate more social capital, the networks of relationships that constitute a valuable organizational resource (Madhavan *et al.*, 1998). Transaction costs theory indicates that governance features of interfirm relationships are important in mitigating exchange hazards and opportunistic behaviors (Williamson, 1985). Firms joining the standard consortium typically engage in collaborative exchanges (Dyer, 1997), and rely on effective governance to create relational norms and encourage multilateral interactions, which are conducive in developing social capital. Various communication channels enabled by effective consortium governance, such as regular face-to-face meetings and online discussions, sustain multiparty interactions, conversations, and sociability, which facilitate the development of social capital (Lin *et al.*, 2001). Consortium management can facilitate networking among members while mediating potential conflicts. Furthermore, by emphasizing cooperation over competition, consortium management can create social norms of openness and teamwork, which provide firms sufficient motivation to engage in resource exchanges and relationship building within the consortium. This logic leads to the following hypothesis:

H1b: Firms perceive more social capital benefits from the consortium participation process with better consortium governance effectiveness.

2.3 Consortium characteristics: relational risk

Firms need to consider the difficulties of cooperation in the consortium, which is highly interdependent and vulnerable to high relational risks caused by members’ opportunism (Das and Teng, 1996). Indeed, cooperation and competition coexisting is regarded as likely in the consortium.

Since members are likely to compete with one another outside the standard consortium (Weiss and Sirbu, 1990; Farrell, 1996), some competitive behavior of member firms must be taken as given. The firm must mitigate the negative impact from competition while interacting with other firms to acquire learning and social capital benefits. One of the risks involves leakage of proprietary knowledge to competitors (Teece, 1986) since the protection of unique knowledge is crucial to a

firm's sustained competitive advantage (Barney, 1991; Oxley and Sampson, 2004). Thus, it is warranted to anticipate that competitive behavior may have an impact on the amount of benefits that firms jointly create and then unilaterally acquire, as member firms may try to outlearn their exchange partners by internalizing their proprietary capabilities, and may choose to provide distorted information to exchange partners (Kale *et al.*, 2000).

Relational risk reflects firms' concerns about the lack of genuine cooperation between exchange partners, which will lead to low commitment to collaboration processes within consortia (Das and Teng, 2001). Consequently, the collective resource pool accumulated during the value-creation stage will be lower in a consortium with higher relational risk. In the consortium, firms cannot fully control how other members use the shared knowledge. Therefore, when the perceived relational risk is high, firms will be reluctant to share knowledge with one another. The risk of opportunism also forces firms to expend more transactional efforts on coordination and monitoring (Williamson, 1985). As a result, fewer resources are allocated to knowledge sharing, acquisition, and integration. This logic leads to the following hypothesis:

H2a: Firms perceive less learning benefits from the consortium participation process with higher consortium relational risk.

Relational risk also needs to be included in the analysis of social capital (Nooteboom, 2004). Firms are less willing to engage in effective social exchange in a highly risky environment, since these firms are uncertain about the level of cooperation from their exchange partners (Kramer and Goldman, 1995). Relational risk arises when there are conflicting interests or hidden agendas during interactions among consortium members. Firms are reluctant to establish networks of relationships if they believe themselves to be vulnerable to actions of others. Subsequently, it is difficult to maintain reciprocity and mutual trust between consortium members, the preconditions for social capital building, when the perceived relational risk is high. The competitive behavior and the lack of trust induced by relational risk inhibit building effective interorganizational relationships from consortium cooperation (Ireland *et al.*, 2002). This logic leads to the following hypothesis:

H2b: Firms perceive less social capital benefits from the consortium participation process with higher consortium relational risk.

Effective consortium governance can help mitigate the perception of relational risks, even though it cannot completely prevent firms from acting opportunistically. Formal rules, procedures, and policies can be used to monitor and regulate members' behaviors. Consortium managers can carefully design rules and IPR policies to alleviate concerns of information leakage. They can help settle or even solve firms' conflicts and disagreements and improve trust by promoting shared goals in the consortium.

Effective governance also provides members with necessary security when risk levels are high (Ring and Van De Ven, 1992). Therefore we hypothesize:

H2c: Firms' perception of relational risks is negatively associated with consortium governance effectiveness.

2.4 Firm characteristics: technical capability

By regarding a firm's participating in a consortium as an activity it undertakes to increase its economic rent, and the process benefits as the direct payoffs from conducting this activity, one can better understand how these rents are generated in the process by drawing on the resource-based approach. Heterogeneity in performance is due to ownership of heterogeneous resources, which have differential productivity (Mahoney and Pandian, 1992; Peteraf, 1993). In standard development, because producing specifications is highly technical, such a technical capability differentiates firms and determines their economic payoffs from the process even more than in a nonstandardization consortium (David and Greenstein, 1990).

Specifically, firms' technical capability is an important determinant of both how much they can learn and how much social capital they can build while working in a standard consortium. Consortia offer a natural setting for learning, since to develop technical specifications of e-business standards, firms must work closely together, leading to knowledge spillovers among themselves (Yoshino and Rangan, 1995). During the value-creation stage, resourceful firms can contribute more knowledge to the process to accelerate the standardization process and increase the common-knowledge pool. During the value-appropriation stage, firms' learning outcome may be asymmetric (Hamel, 1991), depending on their in-house knowledge (Cohen and Levinthal, 1989). 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 in-house knowledge base means greater capability in identifying potential learning opportunities when interacting with other firms. Given the typically large number of firms in a standard consortium, there are potential opportunities for learning and internalizing knowledge and know-how, especially for technically capable firms. Therefore, a firm's technical capability, or internal knowledge, facilitates their interorganizational learning within consortia, and this logic leads to the following hypothesis:

H3a: Firms with higher technical capability perceive more learning benefits from the consortia participation process.

Firm's technical capability also enables them to build social capital in a consortium. Standard 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 *et al.*, 2005), which provide an environment where social capital is embedded within networks (Nahapiet and Ghoshal, 1998).

To acquire social capital through the consortium, firms should be able to establish a durable network of interfirm relationships with other consortium participants. Therefore, they can obtain network resources, such as knowledge and market access that reside within the consortium (Gulati, 1999; Koka and Prescott, 2002). Since interactions with other standard consortia firms are often highly technical, possessing strong technical capability brings more opportunities for such interactions. Technologically capable firms are more economically attractive to potential consortia partners wanting to obtain knowledge through interfirm interactions than their less technologically sophisticated counterparts (Ahuja, 2000), and will have more opportunities for interaction and collaboration with their peers, and hence more potential social capital benefits. Moreover, internal technical capability enables firms to better evaluate both their own needs and the strengths of other consortia members to meet such needs. These firms can better identify and take advantage of social capital building opportunities in the standard consortium. Thus, we hypothesize that:

H3b: Firms with higher technical capability perceive more social capital benefits from the consortia participation process.

High technical capability not only helps firms to obtain more process benefits from standard consortia, but also enables them to better manage a dynamic external environment (Teece and Pisano, 1994). Firms with high technical capability are more responsive to market changes (Park *et al.*, 2002). They are also more sensitive to emerging technological opportunities rising from consortium-based standardization, which is part of the product development process (Weiss and Sirbu, 1990). Therefore, more capable firms are better positioned to exploit learning and social capital benefits resulting from the collective value-creation process in consortia, and the positive relationship between consortium governance effectiveness and process benefits can be further enhanced by firm capability. With more in-house knowledge, firms can learn faster than their consortium partners. With competitive advantages enabled by firms' technical capability, potential loss from a risky relationship may be reduced (Das and Teng, 1999). Consequently, the negative relationship between relational risks and process benefits can be weakened by firm capability. Therefore, we hypothesize:

H3c: Firm technical capability enhances the positive relationship between consortium governance effectiveness and process benefits.

H3d: Firm technical capability weakens the negative relationship between relational risks and process benefits.

2.5 Firm characteristics: standard benefit

Standard benefit is defined as how much value the firm perceives the final product of the consortium, in this case the standard, will bring in the future. While the current article focuses on process benefits and distinguishes between the value from the final product and that from the development process, firms' anticipation of the final product affects the relatedness of consortium activities to the firm. Thus, benefits from the standard development *process* are tightly associated with the final *product* of the process—the standard. It is the standard that attracts members to join in the first place, and it is the standard as the consortium's final product that initiates and continuously affects the interaction among members, which shapes firms' cooperation behavior and the resulting process benefits (Kumar and Nti, 1998). It is the final product 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).

Knowledge exchanged within a consortium is closely related to the standard it develops. The more a firm values the forthcoming 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 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 one another in order to reach consensus on such specifications (Zhao *et al.*, 2005).

Different firms benefit from the standards differently (Katz and Shapiro, 1985). In the case of e-business standards, some firms need to share information with a larger number of exchange 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 exchange partners (Zhao *et al.*, 2007). The relevance of the knowledge determines firms' economic incentives to learn (Lane and Lubatkin, 1998). The current article focuses on the ongoing cooperation process within e-business standard consortia, whose final product is still under development. When a firm anticipates that the forthcoming standard will bring it more benefits, it depends more on the consortium and is more likely to appreciate the related knowledge generated from the consortium. Thus, this firm is more willing to learn from the development process. This logic leads to the following hypothesis:

H4a: Firms foreseeing higher standard benefit perceive more learning benefits from the consortia participation process.

A firm's valuation on the forthcoming standard also affects its social capital benefits. Social capital is derived from specific networks, whose institutional settings are critical to its development. In this case, the goal of the consortium is to provide standards for industry-wide connectivity and interoperability. If a firm values the

standard more, its individual goal is then more aligned with the consortium's goal, which is to develop the standard. The shared goal encourages firms to identify with the group, which increases the likelihood that the opportunity for exchange will be recognized (Nahapiet and Ghoshal, 1998). The shared goal also leads to a high level of firms' understanding of consortium tasks and outcomes (Inkpen and Tsang, 2005). Such understanding nurtures social interactions and acquaintance with other consortium members (Nahapiet and Ghoshal, 1998), which provide the foundation for enhanced network relationships. Further, firms valuing the standard more are more likely to get involved in collaborative consortium activities in order to accelerate the standardization process. Therefore, these firms have more opportunities to interact with other consortium members. Such interactions provide a pre-condition to accumulate social capital in the consortium setting. Thus, we propose that:

H4b: Firms foreseeing higher standard benefit perceive more social capital benefits from the consortia participation process.

3. Methods

3.1 Research procedures and sample

The population for the current study consists of consortia fitting the following criteria. First, the consortium's primary 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 nonmembers. 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 the current study (Table 1).

We chose the survey method, a widely-used approach in organizational research (Schwarz and Sudman, 1996; Cycyota and Harrison, 2002), since firms' consortium representatives had reasonable information about the consortium as well as their firms' involvement within the consortium. Subjective measures were used due to the lack of objective measures. For example, process benefits, including inter organizational learning and social capital building, 'are impossible to place a dollar value on' (Barringer and Harrison, 2000: 396).

Table 1 Participating e-business standard consortia

Consortia	Industry	Responses	Number of members ^a	Year of inception
ACORD	Insurance	113 ^b	482	1970
FPL	Securities transaction	22	188	1994
MISMO	Mortgage	42	163	1999
OGC	Geospatial	16	307	1994
OSCRE	Real estate	8	42	2003
PISCES ^c	Real estate	19	152	1997
XBRL	Accounting	15	450	1998

^aThe number of consortium members was based on the data from 2006, when we conducted the survey.

^bAlthough responses from ACORD constitute a large proportion of the entire sample, our statistical analysis of ACORD-only data and non-ACORD data showed qualitatively similar results.

^cPISCES and OSORE are sister consortia, with PISCES located in the U.K. and OSORE in the US. PISCES founded OSORE.

Following Churchill (1979), we designed and pretested the survey. Survey items were developed based on relevant consortia and standardization literature, our field observations, and suggestions from standard experts and consortia managers. We first sent the survey to managers from two consortia for comments and suggestions. Then a pilot survey was distributed 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–September 2006. Email invitations were distributed to 1784 consortia members and 247 firm-level responses were collected, yielding a 13.85% response rate. 232 firm-level responses were analyzed due to 15 unusable samples. To test the nonresponse bias, we compared early and late respondents (Armstrong and Overton, 1977) on demographic information and constructs relevant to this research. The results were not significant ($P < 0.05$), suggesting that nonresponse bias was not a concern.

We conducted two tests to verify the quality of our survey data. First, we examined the effect of common method variance (CMV). Although CMV does not usually lead to bias that invalidates theoretical findings (Doty and Glick, 1998), it is a cause of concern. Using the marker-variable technique (Malhotra *et al.*, 2006), we found that only 3 out of 12 significant correlations (25%) became nonsignificant when adjusted for CMV, which implied that the common method bias in our study was

not sufficient enough to bias our research conclusions. Second, to reduce the bias caused by reliance on a single informant in each organization (Huber and Power, 1985), we collected multiple responses whenever possible. A total of 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 (1951) α and the correlation coefficient (Pearson product moment method) (Bowman and Ambrosini, 1997). The majority of the firms ($n=33$) showed high consistency among multiple respondents with Cronbach's $\alpha >0.60$ and correlation value of >0.40 (Nunnally and Bernstein, 1994). Thus, 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.

3.2 Measures

We used multi-scale items to collect data for all key constructs. A 7-point Likert-type scale, ranging from 1 (strongly disagree) to 7 (strongly agree), was used to assess latent items (Likert, 1932). The complete list of measurement items is presented in Appendix A.

Learning benefits

Learning benefits refer to knowledge-based intangible benefits that a firm obtains from consortia participation activities (Kogut, 1988), and are measured as specific skills, competencies, and advantages firms obtain from sharing, exchanging, and acquiring knowledge in the consortium (Kale *et al.*, 2000). Skills and knowledge created through consortia are context specific. Thus, based on our discussion with standard experts and consortium members, we developed four items to capture firms' learning benefits that are closely related to standard setting and future adoption: understanding the direction of standard setting, accumulating standard-related expertise, reducing costs of future adoption, and becoming leaders in applying e-business standards.

Social capital benefits

Based on Burt (1997), and on Inkpen and Tsang (2005), social capital benefits are advantages gained from membership in social networks, which is the standard consortium in the current article. 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. These relational resources are acquired through other consortium members, including privileged access to knowledge, exchange partnership opportunities, and potential market access.

Consortium-governance effectiveness

Consortium-governance effectiveness measures the extent to which consortium management effectively coordinates multi-party cooperation (Gulati, 1998). Eight items were used to gauge how clear and well understood the goals of the consortium are, the procedure independence and fairness of the consortium (Luo, 2008), strength of consortium leadership, promotion of trust and coordination among members (Barringer and Harrison, 2000), and the protection of proprietary assets (Kale *et al.*, 2000).

Relational risk

Relational risk is defined as the probability and consequences of not having satisfactory cooperation (Das and Teng, 2001). Such relational risk comes from members' opportunism 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.

Firm technical capability.

Firm technical capability is a firm's own internal technological experience that enables leveraging benefits of consortium cooperation effectively (Bayona *et al.*, 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, their experience in standard development, and their experience in other standard consortia participation (Branstetter and Sakakibara, 2002; Sakakibara, 2002).

Standard benefit

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

3.3 Control variables

We controlled for several other firm-level and consortium-level factors that could affect firms' process benefits from consortium activities.

Experience from other consortia

Firms with more consortium-based standardization experience can better handle technical, economic, and social interactions within consortia. Thus, experience from other consortia may lead to higher levels of benefits (Sakakibara, 2002). Firms can also establish a reputation for collaborative behavior via prior participation in other consortia. We asked whether firms had participated in other consortia (1: has participated in other standard consortia; 0: has not participated in other standard consortia).

Tenure

Long-term commitment may lead to more devotion to the consortium (Olk and 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. Since consortia in our sample were established in different years, we used the normalized value, *Years of Participation in the Consortium/Years since the Consortium's Inception*, to measure firms' tenure within the consortium.

Firm size

Sakakibara (2002) maintains that firm size affects firms' capability of consortia participation. Larger firms may be more capable in consortia simply because of the superior quantity of resources that these firms' possess. Firm size was measured by annual sales in dollars.

Consortium size

Consortium size has mixed impacts on members' process benefits acquisition. Larger size leads to higher resource availability. However, large size also increases coordination and free-riding problems (Marwell and Oliver, 1993). We include consortium size, i.e. the number of member firms, to control for its uncertain impact.

Consortium history

We finally control for the maturity of the consortium, i.e. the number of years since its inception, to explore if firms' process benefits change as the consortium evolves.

The means and standard deviations of the firm-level control variables are presented in Appendix B. Consortium size and history data are available in Table 1.

4. 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 *et al.*, 2000). The current article is a preliminary effort to examine the effects 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 empirical studies that have a small- to medium-sample size and is insensitive to conditions of nonnormality (Delios and Beamish, 1999). Our analysis showed that a multi-variable normal data assumption may be violated. Thus, we chose PLS over LISREL since PLS is relatively robust to deviation from a multivariate distribution (Sarkar *et al.*, 2001). Bootstrap was used to conduct the significant tests of the path coefficients.

4.1 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 and Anderson, 1988). Due to the new measurements introduced, we first conducted the exploratory factor analysis using Principal Component Analysis (Jolliffe, 2002) in SPSS. Multiple factors, consistent with the latent constructs, emerged with no-crossing of items. We then conducted confirmatory factor analysis (Thompson, 2007) 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 *et al.*, 1995). The average variance extracted (AVE) for all constructs exceeded 0.5. Also, all latent variables had high composite reliability and Cronbach's α (both > 0.7). Thus, reliability and convergent validity of measurement items were confirmed. The discriminant validity of latent constructs was established since all square roots of the AVEs were much larger than the construct correlations (Table 3), which indicated that all constructs shared more variance with their own measures than they shared with other constructs in the model (Hulland, 1999).

4.2 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. Overall, the reasonable R^2 (0.482 for learning benefits and 0.302 for social capital benefits), strong factor loadings, and significant structural paths indicate a good overall model fit (Hulland, 1999).

The empirical results indicate that firm technical capability ($\beta = 0.318$, $P < 0.01$), standard benefit ($\beta = 0.341$, $P < 0.01$), and consortium-governance effectiveness ($\beta = 0.224$, $P < 0.01$) each have significantly positive effects on learning benefits obtained from consortium participation. These factors also have 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 benefit; $\beta = 0.125$, $P < 0.1$ for consortium-governance effectiveness). Thus, Hypotheses H1a and b, H3a and b, and H4a and b are all corroborated.

Table 2 Confirmatory factor analysis

Items	Loading	t-value	AVE	Composite reliability	Cronbach's alpha
LEABEN01	0.801	19.690	0.599	0.856	0.766
LEABEN02	0.832	26.999			
LEABEN03	0.770	20.304			
LEABEN04	0.685	9.444			
SOCBEN01	0.697	10.534	0.684	0.865	0.765
SOCBEN02	0.904	57.775			
SOCBEN03	0.866	34.278			
CAPABIO1	0.823	17.549	0.652	0.849	0.729
CAPABIO2	0.840	15.611			
CAPABIO3	0.757	14.269			
STANBE01	0.716	16.868	0.557	0.883	0.838
STANBE02	0.720	14.184			
STANBE03	0.751	15.365			
STANBE04	0.772	20.600			
STANBE05	0.756	18.985			
STANBE06	0.762	20.374			
GOVERN01	0.687	14.122	0.566	0.912	0.888
GOVERN02	0.735	17.909			
GOVERN03	0.776	19.207			
GOVERN04	0.763	17.696			
GOVERN05	0.825	23.199			
GOVERN06	0.754	14.920			
GOVERN07	0.621	14.117			
GOVERN08	0.834	28.630			
RELRI02	0.974	21.122	0.823	0.902	0.815
RELRI03	0.835	7.619			

Turning to H2a and b, however, relational risk is not statistically significant in determining either learning or social capital benefits. These empirical findings might be counter-intuitive and indicate that firms can still collaborate and learn despite the relational risk. One explanation is that even though relational risk caused by inter-firm competition outside the consortium is inevitable, firms can carefully evaluate relational risk *ex ante*, and allocate resources in consortium activities when taking into consideration of relational risk they might face. Furthermore, the final product 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 industry-wide interconnectivity

Table 3 Square root AVE values and correlations between the latent constructs^a

Constructs	Mean (SD)	Learning benefits	Social capital benefits	Firm capability	Standard benefit	Governance effectiveness	Relational risk
Learning benefits	5.40 (1.19)	0.774					
Social capital benefits	5.49 (1.20)	0.461**	0.827				
Firm capability	5.56 (1.40)	0.376**	0.255**	0.807			
Standard benefit	5.86 (1.10)	0.515**	0.485**	0.186**	0.746		
Governance effectiveness	5.38 (1.21)	0.412**	0.327**	0.222**	0.412**	0.752	
Relational risk	4.01 (1.58)	-0.095	-0.143**	-0.104	-0.110	-0.207**	0.907

^aThe table shows the square root of AVE on the diagonal, and correlations between the latent constructs on the off-diagonal.

* $P < 0.05$; ** $P < 0.01$;

and supply-chain collaboration. Thus, standard setting consortia provide the most ideal approach among various types of alliances (Arend, 2004). In addition, our results suggest that formal control, such as effective consortium governance, can mitigate relational risks (H2c). Most consortia in our sample had foresight to put clearly defined IPR policies and boundaries in place to limit discussion only to standard issues, without getting into areas of competitive nature. Therefore, firms in our survey expressed little concern for relational risk that they might face within the consortium (mean = 4.01). However, the very low R^2 (0.043) shows that consortium governance effectiveness can only explain a very small portion of the variance of relational risk. One possible explanation is that other contextual factors, such as relational capital and partner asymmetries, may be more influential than formal controls in determining the relational risk perception (Delerue, 2004).

In addition, we find that the moderating effect of technical capability is statistically insignificant for consortium governance effectiveness (H3c). Consortium governance may mainly affect the value creation stage. Since firms face the same collective process benefits, their capability may play a limited role in affecting the relationship between governance effectiveness and process benefits. Surprisingly, firm capability negatively moderates the statistically insignificant but positive relationship between relational risk and learning benefits. This empirical result suggests that more capable firms handle relational risk less effectively when learning from consortium activities. We offer two possible reasons for this seemingly counter-intuitive empirical result. One possible reason is that firms with higher technical capability may have more to lose. The other possibility is that, given their existing in-house knowledge, more capable firms may be less likely to engage in interorganizational learning in a more risky environment. We also find that firm technical capability does not moderate the relationship between relational risk and social capital benefits. Social capital benefits are embedded within networks of relationships. Given perceived high

Table 4 Structural model testing

Dependent variables	Relational risk	Learning benefits	Social capital benefits
R^2	0.043	0.482	0.302
Hypotheses			
Consortium governance effectiveness	-0.207*** (H2c supported)	0.186** (H1a supported)	0.131* (H1b supported)
Relational risk		0.019 (H2a not supported)	-0.070 (H2b not supported)
Firm technical capability		0.269*** (H3a supported)	0.147** (H3b supported)
Standard benefit		0.289*** (H4a supported)	0.385*** (H4b supported)
Technical capability *		-0.178 (H3c not supported)	0.041 (H3c not supported)
Governance effectiveness		-0.188** (H3d not supported)	-0.043 (H3d not supported)
Technical capability *			
Relational risk			
Control			
Firm size		-0.106**	-0.028
Experience from other consortia		-0.096*	0.061
Tenure		0.053	0.046
Consortium size		0.190*	0.172
Consortium history		-0.227**	-0.208

* $P < 0.1$; ** $P < 0.05$; *** $P < 0.01$

relational risks, firms, regardless of their in-house knowledge, may be reluctant to initiate valuable relationships.

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, but 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, due to their disadvantageous positions in the industry, are more motivated to learn in the consortium. At the same time, they may enjoy more learning opportunities in the consortium than do their larger counterparts. Finally, firms also learn more if they only participate in one consortium, which induces more focused investment than if they are involved in multiple consortia.

5. Discussion and conclusion

Firms can obtain both product benefits and process benefits from consortium participation. This article focuses on process benefits and examines what constitutes process benefits and what affects these benefits in a standard consortium. E-business standard consortia provide an ideal setting to disentangle those two benefits and enable us to focus on what affects these process benefits. Two major process benefits that firms can obtain through collaborating with others in the consortium are identified: learning and social capital benefits.

Through a theoretical framework that joins both value-creation and value-appropriation stages in a consortium, we propose two consortium-level factors and two firm-level factors that might affect the process benefits perceived by member firms. Our analysis suggests that firms anticipate more learning as well as social capital benefits if they are more technically capable, value standards higher, and work in a better-managed consortium. While both firm-level and consortium-level factors matter, our analysis indicates that firm-level factors (Technical Capability and Standard Benefit) dominate consortium-level factors (Consortium Governance and Relational Risk) in determining process benefits from consortium activities. The final product of the standard consortium, e-business standards, is a public good and is commonly available to all consortium members. By contrast, process benefits are more private and heterogeneous among firms. Consortium-level factors are important, since they affect the collective creation and distribution of process benefits. For instance, a well-managed consortium can effectively coordinate multilateral interactions and facilitate the formation of a common-knowledge and relationship pool. However, to actually *acquire* such benefits, firms must individually learn the knowledge, and initiate and manage their own interfirm relationships. The realization of such benefits is private and constrained by firms' interests in the final product and by their individual capabilities (Nelson and Winter, 1982; Teece *et al.*, 1997). Thus, compared to consortium factors that are relatively common to all participants, firm-level factors have more profound impacts on differentiating private process benefits available to each consortia participant.

Standard benefit is the most influential factor, as the final product shapes the goal and membership constitution of the consortium. While product 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 product benefits. Firms exchange knowledge in developing the product. Therefore, learning from the common pool of know-how is domain-specific to the product. Social capital benefits are also closely related to the product, since the networks of exchange relationships are built among firms sharing common interests in the product.

Our study shows that, in general, prior alliance studies about interorganizational learning and social capital building can be extended to standard setting. However,

relational risk has an insignificant role in shaping process benefits. This empirical result could be a context-specific finding. We focus on e-business standard consortia that produce standards for better interoperability among heterogeneous information systems. The collaborative nature of the standard may result in less competition in the development process.

Regarding the generalizability of our empirical findings, one might be concerned about their applicability to other types of consortia. Next, we discuss the commonalities and differences between e-business standard consortia and other types of consortia, and issues that might hinder the applicability of our results.

Commonalities between e-business standard consortia and other consortium types are: (i) both are multi-party alliances, which are one form of inter-organizational cooperative arrangement; (ii) in both settings, member firms have shared goals and interests, and they contribute information and resources to the consortia; and (iii) in both settings there is tension between competition and cooperation, which reflects member firms' relationship in the marketplace.

Besides the specific context of the standard consortia (i.e. they are for standard development and promotion), there are two differences between e-business standard consortia and a more general type. First, in the former, participation is purely voluntary and not bounded by contracts. If participation is not fully voluntary, more strategic considerations may be taken by firms when they join. As a result, other factors might exist and take a more important role than the four we identified. Second, and perhaps most important, is the public-good nature of the product of the standard consortia. That is, standards are freely available for both members and nonmembers, which might not be the case for other consortia. However, the public-good dilemma also exists for other alliances, even if the final product can only be enjoyed by members (Zeng and Chen, 2003). Moreover, our empirical findings should be helpful for firms in devising strategies to improve their process benefits in more general settings.

The current article also has several limitations. First, while a focal member's position in the network (e.g. structural hole, integrated player, captain, follower) is important when examining members' contributions to and returns from the organized consortium, we do not have such a measure in our data. Indeed, there are several networks a firm is in: the business relationship network, the network of standard developers in the consortium, and the supply chain network in the product market. To take the network position into account, one must incorporate carefully all such networks as they might affect firms' behavior in the consortium. Second, we focus on standard consortia, which have several unique features. Importantly, standard consortia provide high common benefit (Agarwal *et al.*, 2010) and their product is used for industry-wide cooperation. Whether our empirical findings can be generalized to other types of consortia requires further examination. Understanding how the goal and scope of consortia affect the formation of process benefits merits further theoretical and empirical attention. Third, 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 examine how individual-level process benefits can be transferred to organizational-level process benefits (Olk, 1998). Fourth, 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 the current article. Fifth, we propose the two stage model to examine process benefits in consortia. However, the value-creation stage and value-appropriation stages are tightly intertwined and our empirically data do not allow us to examine them separately.

Another aspect worthy of future examination is the measure of social capital benefits. While our work captures the overall benefits firms perceive from social capital building in standard consortia, future research should include more specific variables to quantify payoffs provided by different dimensions of social capital, such as those suggested by Nahapiet and Ghoshal (1998): structural dimension, which encompasses the network structure of social relationships; cognitive dimension, which includes shared codes, language, and shared narratives; and relational dimension, which incorporates trust, norms, obligations, and identification.

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

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Appendix A

Measurement items

Learning benefits (LEABEN) (7-point Likert scale)

From participating in the VSC, your firm:

- Can understand the direction of the standard setting in advance (LEABEN01).
- Can accumulate standard related expertise (LEABEN02).
- Can become industry leaders in Web-based supply chain application and cooperation (LEABEN03).
- Can reduce costs of standard adoption by participating in the VSC^a (LEABEN04).

Social capital benefits (SOCBEN) (7-point Likert Scale)

From participation in the VSC, your firm:

- Can learn from other VSC participants (SOCBEN01).
- Expects to establish partnerships with other VSC members (SOCBEN02).
- Expects to improve market access through other VSC participants (SOCBEN03).

Consortium governance effectiveness (GOVERN) (7-point Likert Scale)

- The goals and objectives of this VSC are clear and well understood (GOVERN01).
- This VSC is neutral and independent with respect to all firms participating in the consortia (GOVERN02).
- The standard development process in this VSC is open (GOVERN03).
- This VSC disseminates information accurately and responsively (GOVERN04).
- The rules and procedures of this VSC are clear and fair (GOVERN05).
- This VSC has a strong and effective leadership (GOVERN06).
- This VSC provides sound intellectual property rights policies and protection (GOVERN07).
- This VSC promotes trust and compatibility among members (GOVERN08).

Relational risk (REL RIS) (7-point Likert Scale)

- Your firm has conflicting interests with some other participants (REL RIS01).
- Your firm is worried about information leakage (REL RIS02).
- Your firm may face increased market competition in the industry, since VSC members share information and learn from each other in the consortium. (REL RIS03).

Firm technical capability (CAPABI) (7-point Likert Scale)

- Your firm has employees who understand technical details of the standards (CAPABI01).
- Your firm has experience in developing IT standards (CAPABI02).
- Your firm has gained experience from working in other standards consortia (CAPABI03).

Standard benefit (STANBE) (7-point Likert Scale)

- The standards can improve customer satisfaction (STANBE01).
- The standards can improve your firm's relationship with your trading partners (STANBE02).
- To keep your firm's competitive advantage in the market, it is important for your firm to understand the standards proposed by the VSC (STANBE 03).
- Adopting the standards can bring potential business opportunities to your firm (STANBE 04).
- The standard development is critical to the industry in which this VSC is working (STANBE 05).
- The standards are beneficial to the entire community (STANBE 06)

Firm size

Firm's annual sale (\$)

Consortium size

The number of members in the consortium

Other consortium participation (Yes; No)

Has your firm participated in other standard consortia addition to the focal one surveyed here?

Tenure

Years of Participation in the Consortium/Years Since the Consortium's Inception

^aVSC stands for Vertical Standard Consortium, an industry term for a consortium that develops industry-wide information sharing standards.

Appendix B

Control variables

Variables	Mean (SD)
Firm size (Based on the firm's annual sales: 1, Less than \$1 million; 2, \$1 million–\$19 million; 3, \$20 million–\$50 million; 4, \$50 million–\$99 million; 5, \$100 million–\$499 million; 6, \$500 million–\$999 million; 7, \$1 billion–\$50 billion; 8, \$50 billion or greater.)	4.568 (2.252)
Other consortium participation	0.746 (0.436)
Tenure	0.446 (0.276)
