Why Do Firms Participate in e-Business Industry Standard Consortia?

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Abstract

E-Business standards are critical for inter-firm collaboration; and many standard development organizations have been formed to coordinate standard development and adoption efforts in various industries. In this paper, we focus on the research question: what are the factors that drive firms to partake in e-Business standard development in e-Business industry standard consortia? In this work-in-progress, we propose hypotheses that try to identify the common drivers in a cross-industry context.

1. Introduction

Despite the widely known dot-com bust at the beginning of the century, the application of Internet technology in business-to-business transactions and information sharing, also termed e-Business, has quietly taken off (Kharif 2003). Companies are convinced that e-Business can bring significant value in bringing better coordination and interoperability in the supply chain, which leads to lower costs, as well as creating new business opportunities through collaborating with partners. The proliferation of e-Business technologies, especially the eXtended Markup Language (XML), has laid the foundation for firms to share information electronically with partners. However, firms have come to realize that the lack of common standards has become the main spectacle for inter-firm collaboration that is the key to bring out the full potential of e-Business.

Unlike traditional technology standards, which can be developed by one or a few market-leading firms based on their own technology and eventually pushed to other firms, e-Business standards are for inter-firm communication that have little existing practice to build on. This, together with the enormous scope of such standards, makes the costs of development much higher. Furthermore, due to its collaborative nature, the extremely high non-adoption risk of such standards also makes it economically infeasible for any one firm to take on the task by itself. It is thus not surprising that standard development organizations (SDO) have been formed to coordinate standard development and adoption efforts. These SDO’s can be categorized in two camps. The first group aims to develop industry-neutral standards. They include such organizations as the World Wide Web Consortium (W3C), OASIS. The standards they have been developing, such as ebXML by OASIS, are intended to be used across industries. The second group comprises of SDO’s that have a specific industry focus. They are usually founded by firms in a particular industry with a narrower but often more focused objective, i.e. to facilitate e-business in the very industry. Many industries have formed such SDO’s, such as the high-technology industry’s RosettaNet (www.rosettanet.org), the travel industry OpenTravel Alliance (www.opentravel.org), the mortgage’s industry’s MISO (www.mismo.org), among others.

In this paper, we are interested in the second group for a few reasons. First, when the standards are for communication in the supply/value chain, their development and adoption exhibit different characteristics than the more straightforward standard setting process extensively studied by researchers. Second, firms in the same industry often share similar commercial interests to participate in the standardization efforts; whereas in the first group, usually the SDO’s membership is open to any organization or individual interested, thus often resulting in an extremely diversified membership portfolio ranging from socially altruistic individuals to for-profit companies to non-profit organizations that have vastly different incentives and stakes. Lastly, from a more general perspective beyond standards, industry SDO’s provide an ideal setting to study firms’ behavior in industry-wide collaborative efforts, which will help us gain some understanding on why and how firms cooperate despite being competitors in the end product market.

The paper is a work-in-progress and is organized as follows. In Section 2, we review the existing standards literature. In Section 3, we argue why e-Business and its development and adoption are very different from the standards and standardization process that have been extensively studied. Section 4 raises our research questions and lists our hypothesis. The empirical design is presented in Section 5. Section 6 outlines the plan for the remaining work.
2. Standards Literature

Economists have contributed extensively to the study of standards and standardization. They regard standardization as a decentralized decision process on a public good that have positive network externalities (Katz and Shapiro 1985), i.e. the value of a standard increases as the number of adopters grows. The uncertain nature of a standard’s value at the beginning and therefore how one standard is adopted over its competitors were the first issues researchers studied. David’s (1985) widely cited case study recounts the adoption and road to dominance of the QWERTY keyboard, over other technologically superior rivaling keyboard designs. Arthur (1989) studies dynamics of adopting competing technologies that have increasing returns. He argues that insignificant events may give an advantage to a technology competing with others. The technology can, thanks to the random events, eventually achieve sufficient adoption, or lock-in, and dominate the market, even if it is not the most technologically advanced. Besen and Farrell (1994) analyze firms’ compatibility strategies in horizontal standard competition. Besen and Farrell model a two-firm game of compatibility and discuss three scenarios: 1) Both firms fight to become the industry standard, i.e. the inter-standard competition; 2) Both prefer compatibility even though they also have their own preference, i.e. the “Battle of Sexes” game and intra-standard competition; 3) A dominant firm want to be incompatible while the smaller, less established rival prefers compatibility, like a “pesky little brother”.

Another stream of research studies committee-based standard setting. Farrell and Saloner (1988) and Farrell (1996) show that committee-based standard setting, as is the case in these consortia, is more likely to achieve coordination than under a pure market mechanism, yet the process is typically slower.

David and Greenstein (1990) give an excellent review of the standardization literature. They group standardization efforts in four categories and illustrate issues associated with each: market-competition of standards, or de facto standards; sponsored, proprietary standards; standards developed by standard-setting organizations and government regulated standards.

The e-Business standards we study in this paper fall in the second scenario of Besen and Farrell (1994), i.e. all participating firms prefer compatibility to their own preference. This is due to the fact that firms realize the overwhelming benefit of having a common standard, as a prerequisite of conducting e-Business. Moreover, as the e-Business standard involves a lot of new knowledge creation as to when, how and what to share information between business partners, its development also needs to be done in an open, neutral environment that many firms contribute to. This falls into the third category of David and Greenstein (1990). While market forces determine the dynamics of the first two categories, “unsponsored” standards which have no identified originators holding any proprietary preference, and “sponsored” standards that are pushed by firms holding proprietary interest, in the last category the government takes the standard as a public good and intervene the standardization process. It is the third type, which combines both market competitions as well as collaborative learning and public good creation, that has not been extensively studied. Our paper aims to fill this void.

The standard development organization can also be viewed as a strategic alliance. The strategy literature has studied, at length, firms’ characteristics that influence their decision to join strategic alliances. For example, Shan and Hamilton (1991) find that smaller or younger firms have more incentive to join the strategic alliance to access complementary assets than bigger or older firms. Walker et al. (1997) note that firms with higher social capital, technical capital and commercial capital are easier to collaborate with other companies.

Steinfield et al. (2004) study the mortgage industry’s effort in establishing standards for vertical information systems. In contrast to existing research that usually resort to analytical modeling (e.g. Farrell and Saloner 1988, Farrell 1996) or empirical data analysis (Augereau et al. 2004), they use a case study approach to disentangle the intricate factors affecting standard development and adoption. The authors interviewed standardization participants, observed meetings. Admittedly the study has its limitations of a single industry, yet it unveils many issues that are relevant in other industries.

We have also written another paper (Xia et al. 2004), employing a game theory model to study the equilibrium and efficiency of consortium-based open e-Business standard development and adoption. In that paper, we model the development and adoption of a standard as two subsequent stages of a game, thus endogenizing firms’ development decisions.

3. Characteristics of e-Business Standards

While the existing research on general standards apply to e-Business standards, there are a few unique characters of e-Business that present additional challenges to the standard development and adoption process.

3.1. Value Chain Oriented

e-Business standards are aimed to facilitate electronic communications between business partners in the supply chain or value chain. These standards cover business document formats, data definitions and business processes. They are often not about the specifications and
designs of a final product. Therefore, they facilitate cooperation with little negative impact on firms’ product or service offerings directly. By contrast, the standards that are widely studied in the literature are, for the most part, product standards, in which competing firms have a potential conflict. Adopting a standard often implies implementing a vastly different product design that changes the firm’s offering greatly. The stakes are high and the so-called “standard-wars” can make or break a business. Shapiro and Varian (1999) devote an entire chapter of their book to advising firms how to win the standard wars, using the infamous browser war between Microsoft and Netscape and the videotape standard war between Betamax and VHS as examples. The above-mentioned 56K modem standard adoption by Greenstein and Forman and the DVD format war are also typical instances of such competition.

Yet when the standard is for sharing of information and cooperation, the motivations are vastly different. First, firms realize it is important to achieve consensus and build a standard as quickly as possible, so as to reap the benefits e-Business promises as soon as possible. Secondly, since the standards do not affect their final products, firms have few, if any, particular preferences on specific content of the standards, besides the general quality requirement.

3.2. Open, Neutral Standards

Almost all the e-Business standards are open and neutral. Openness of a standard refers to the principle that any interested party, be it a firm or an individual, can obtain the standard specifications freely, usually from the standard organization’s web site. Anyone can also use it free of charge. This is not the case for most product-oriented standards. Usually, the designing firms would claim intellectual property rights and to adopt the standard one has to pay the royalty. In the e-Business context, one of the goals is real-time connectivity, i.e. for any firm to be able to interoperate smoothly with another partner firm. This universal compatibility is the key to fully realize the potential of e-Business. Only by allowing open access and implementation, free of licensing costs, can potential firms be convinced to adopt the standard and join the network of interoperable enterprises.

For similar reasons, e-Business standards also have to be neutral. Standards sponsored and designed by only a few firms are susceptible to perceptions of biases in the standardization, whether there are indeed biases or not. This in turn will hinder the standards’ wide adoption.

3.3. Learning in Standard Development

In developing e-Business standards, some e-Business information shared across firms maybe already shared within firms. Standardization is a matter of reaching consensus on the specifications based on existing practices. The rest needs to be devised from scratch and, just as new product development, requires learning and experiment. For instance, there is little existing knowledge on what, when and how to share process information between two firms. Nevertheless, answers to these questions have to be learned, agreed on and written into the standard. The collaborative learning aspect has not been captured in existing standardization literature, yet it is clearly recognized by many standard organizations especially e-Business SDO’s.

4. Research Question and Conceptual Model

In this paper, we ask and answer the question: what are the factors that drive firms to partake in e-Business standard development? The question is asked in a cross-industry context to identify the common drivers. While we recognize that each industry has its own unique characteristics that affect the firms’ incentives to standardize, we also believe that there exist some common factors that apply to all industries. Our goal is to discover such common factors so as to help firms that are asking themselves the question: Should I join an industry standard development effort? Our result should be able to help these firms evaluate the decision based on the specific industry and firm characteristics. In what follows, we identify the factors in the preliminary analysis and present our hypotheses.

We believe the factors that affect firms’ participation decisions can be classified as external or internal to the firm. External factors include industry-level characteristics such as the intensity of information technology used in the industry and SDO characteristics such as its governance structure. Internal factors refer to firm-specific properties and encompass such items as organizational readiness and IT sophistication level.

4.1 Industry Characteristics

Thanks to its versatility, e-Business is being conducted in very diverse industries ranging from the hi-tech industry to manufacturing industries such as the automobile industry and marine industry. Yet it is not hard to imagine the uniqueness of each industry has an impact on the benefits and costs of e-Business, thus firms’ decisions to join a standardization effort to facilitate e-Business.

The most obvious factor of all that might shape firms’ decision is the IT intensity of the industry. In industries where IT is used extensively, e.g. the hi-tech industry and the financial industry, one would imagine that their value of e-Business should be higher than less IT intensive industries, everything else being equal. Furthermore,
because firms are more IT savvy, the cost of developing a new standard with other firms is lower, so is that of setting up e-Business. Specifically, when a new standard is jointly developed, firms need to identify what types of data and processes are necessary to implement in the standards while leaving others to individual firm’s freedom. They also need to combine their industry-specific knowledge with IT expertise to decompose the entire set of standards into functionally independent components. IT-intensive industries tend to have more experience of utilizing IT to support intra- and inter-firm transactions, and they will have more common languages and understanding to discuss technical issues within the SDO. Based on firm motivation and ability to develop standards, we have the following hypothesis:

**H1:** It is more likely for firms in high IT-intensive industries to join an e-Business SDO than those in low IT-intensive industries.

Besides IT sophistication, industries also differ in consumer expectations including price, product and service offering sophistication. When such demands are high, industries are under great pressure to adopt e-Business so as to lower cost and provide more product and services more efficiently. For example, the mortgage industry’s standardization effort is partly due to consumer’s demand of a real-time mortgage application approval process, which requires instant information sharing among parties involved, including banks, mortgage brokers, credit agencies and credit card companies. So for the industry as a whole, the market demand for delivering products and services faster and cheaper will intensify the pressure to speed up e-Business standardization process. As a result, individual firms in the industry will have more incentive to collaboratively develop e-Business standards to improve value chain efficiency.

**H2:** In an industry, the higher the consumer’s pressure to a more efficient value chain, the more likely a firm is to join a standard development organization.

Market fragmentation may also have a role in shaping firms’ incentive of developing standards in SDO. As we mentioned before, firms have heterogeneous preferences of the standards and they want to influence the future direction of IT standards based on their own interests. However, SDO will achieve the industry-wide compatible standards through multilateral technical discussion and political negotiation (Cargill, 1989). Firms’ bargaining power in SDO will be partly determined by their market share. And with fewer dominant market leaders, firms are more likely to join SDO to express and exchange their points of view of future e-Business standards. So, we obtain the following hypothesis:

**H3:** In an industry, the higher the market fragmentation, the more likely firms participate in standard development organizations.

### 4.2. SDO Characteristics

Among the external factors, the characteristics of SDO may also influence firms’ participation decision in additional to industry-level factors. Previous researches suggested (Axelrod, et al. 1995) that “the utility of a firm for joining a particular standard-setting alliance increases with the size of the alliance”. And firms’ decision as to whether to join SDO, not surprisingly, would be based on how “good” it is, i.e. the management efficiency of SDO.

**H4:** The more efficient the SDO performs, the more likely firms want to join the SDO.

As we mentioned before, we can study SDO from a strategic alliance perspective. Rai (1996) and Whipple (2000) investigated the critical factors of an alliance organization. And based on their studies, we measure the management efficiency of SDO from the following four factors: (1) explicit objectives and goals; (2) effective management teams; (3) efficient communication in SDO; (4) organizational learning facilitated by SDO.

As voluntary organizations, SDO need a clear mission statement so that both current and potential participants can understand the major activities conducted within the organization and assess whether they are aligned with firms’ interests. For instance, CIDX (www.cidx.org) is the e-Business SDO in the chemical industry; and people can easily find its mission statement on the website: “CIDX™ is a robust trade association and standards body whose mission is to improve the ease, speed and cost of conducting business electronically between chemical companies and their trading partners.” An efficient SDO enables firms to have a clear perception of the alliance goals, which will positively influence firms’ willingness to join it.

It is obviously that the capability of the management team will influence the overall management efficiency. Although most e-Business SDO are member driven organizations with dynamic management teams elected from member companies, both top managers and people in charge of daily operations are relatively stable. And an effective management team should be able to coordinate inter-firm collaborations and have both IT and industry-specific knowledge to guide the major activities and future directions of SDO.
SDO represent the committee-based standardization process, and the efficient communication is critical to pool complementary skills and resources from member firms and solve potential conflicts among them. Here, the communication includes both the communication among member companies and the communication between members and SDO. Effective communication is helpful to increase the trust among members, even competing ones, which will reduce the friction costs of existing interactions (Carson, et al. 2003). Thus, efficient communication in SDO is a driver behind the satisfying performance of an SDO, which will lead to firms’ incentive to join it.

Firms join SDO not only to develop e-Business standards, but also to learn experience from other member companies, such as supply chain collaboration and adoption and deployment of e-business standards. Some SDO, such as RosettaNet, collect and summarize standards implementation experience from leading adopters and share them freely with all the other members and public audiences. SDO that facilitate collaborative learning among members will increase members’ satisfaction and improve their overall performance, which will increase firms’ incentive to involve SDO actively.

The management efficiency of SDO will be determined by the above four factors, and the performance of SDO is related to firms’ incentive to participate the SDO.

4.3 Firm Characteristics

As we mentioned before, firms’ need and ability to join SDO are various. First of all, firms need to aware and importance of e-Business standards in order to join SDO. Then firms have to have sufficient internal resources to participate SDO activities since “the active participants are ‘volunteers’ willing to spend substantial time and travel money” (Farrell, 1996, P.2). So the firm-level characteristics will jointly determine firms’ SDO participation decisions.

Firms usually have different valuation of the forthcoming e-Business standards proposed by SDO. And in general, firms with higher valuation have more incentives to participate in an SDO because: (1) they can speed up the development and adoption process of e-business standards; (2) they can become insiders in shaping the standards, which will further increase their business benefits in the future (Xia, et al. 2004). The individual firm’s valuation describes firms’ perception of e-Business standards before any implementation, or “the level of recognition of the relative advantage” (Iacovou, 1995, P.468). There are two dimensions underlying firms’ valuation of e-Business standards: the importance and the usefulness. The importance means the extent the standards will have impacts on a firm’s future competitive advantages. And the usefulness indicates both direct and indirect benefits the firm expects to receive from adopting the standards. Examples of those benefits include reducing operation costs, improving customer satisfaction, lowering switching costs, etc. Firms join SDO because they think the standards developed in SDO will have potential value for them. More importantly, they think some important standards will change the competition and bring drastic changes to the entire industry in the coming future. Therefore, we have the following hypothesis:

H5: A firm is more likely to join a standard development organization if its valuation of the forthcoming e-Business standards is higher.

A special feature of e-Business standards is that they are value chain oriented and they aim at facilitating electronic transactions among supply chain partners. Consequently, the supply-chain structure of a firm will also influence their SDO participation decisions. E-Business standards will lead to non-recurring startup costs, i.e. firms do no need to negotiate how to conduct Web-based business process with each trading partners respectively with standards proposed by SDO. With more supply chain partners the e-Business standards can be used with, a firm can leverage the initial implementation costs. And firms can cumulate experience of information sharing and value chain collaboration from multiple trading partners, so that firms can realize efficiently the advantages of e-business standards. In that case, firms with many trading partners are more willing to join SDO to shape the development of industry-wide IT standards than firms with single or few partners. The number of supply chain partners may also be a factor influence firms’ decisions of joining SDO:

H6: The more supply-chain partners a firm can co-adopt e-Business standards with, the more likely a firm will join the SDO.

Sometimes, the pressure to join SDO may also come from competitors and trading partners a firm has. Firms join SDO so that they can play a role in determining the technical specifications of e-Business process the industry is going to use in the future. With only a single SDO existing in the industry, firms want to join the SDO together with their direct competitors in order to avoid losing competitive advantages during the standardization process. However, if multiple SDOs exist, such as in the financial industry, the situation will be much more complicated. At this stage, we will only consider the
single-SDO-industry cases in our study. Because that e-Business standards are co-adopted between at least two firms, the pressure from trading partner may also be a reason that a firm joins an SDO. Participation in an SDO can help firms better understand the technical and process details of e-Business standards, which is beneficial for future implementation process. In an e-Business standards adoption study, researchers found that SDO had impacts on firms’ adoption and diffusion decisions (Nelson and Shaw, 2003). To achieve a smooth implementation process, trading partners may exert pressure on firms to join SDO. Moreover, firms may gain more support in a SDO when their trading partners also join it. Therefore, we hypothesize that when there are pressures from competitors and value chain partners, firms have more incentive to join the standardization effort.

**H7:** A firm is more likely to join the SDO when there is more pressure from competitors.

**H8:** A firm is more likely to join the SDO when there is more pressure from value chain partners.

The incentive to join the SDO is not sufficient for firms to take the final actions, because their available resources will determine their capability and readiness to become a member of SDO. To involve in SDO activities, firms require both financial and technological capitals. The financial resources will be used to pay for the membership fees, attend the conferences organized by SDO, and support delegates to negotiate with other members in SDO and have a better control of the standardization process. Most SDO charges membership fees to achieve the efficient collective effort. For instance, RosettaNet charges an annual fee of $23,816 for full membership and voting rights. In addition, many SDOs obtain support of human resources from their member companies. The technological resources refer to the level of accumulative IT experience and knowledge of IT standards (Chwelos, et al. 2001). Examples of technological capabilities include expertise and competent project leaders (Pare and Raymond, 1991). Those are important for firms to contribute to collaborative standardization effort in SDO. And technological capital is a key for firms to gain insider information from SDO and speed up the standardization process. Whether a firm can achieve its organizational objectives by joining SDO will depend on the level of its internal resources, both financial and technological ones, a firm has.

**H9:** The more organizational resources a firm has, the more likely a firm will join the SDO.

5. Data Collection

Two types of data will be collected. The first group is secondary data that can be accessed from industry and research databases. These variables include industry fragmentation, switching cost, SDO characteristics such as voting mechanism, etc.

The second group, mostly firm-level properties and dynamics, will be obtained through surveys. For each firm, we will survey an employee who is in charge of the firm’s e-Business standardization efforts. These surveys will be sent to both members and non-members of SDO’s.

6. Research Plan

We will finish the survey design by the middle of July, host it in our web site and solicit response from industry firms. At the same time, secondary data will be collected. By mid-August we expect to have both sets of data available and start to analyze them. Final paper is expected to finish by mid-September.

References


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research”, *Economics of Innovation and New Technology*, 1, 3-41, 1990.


