



Vertical IS standards deployment and integration: A study of antecedents and benefits



Yun Xu ^{a,1}, Wai Fong Boh ^{b,*}, Christina Soh ^{c,2}

^a Information School, Southwestern University of Finance and Economics, Chengdu 611130, China

^b Nanyang Business School, Nanyang Technological University, S3-B2A-14, Nanyang Avenue, Singapore 639798, Singapore

^c Nanyang Business School, Nanyang Technological University, S3-01B-63, Nanyang Avenue, Singapore 639798, Singapore

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ABSTRACT

We drew on institutional and learning theories to develop a research model assessing how organizations influence standards deployment and integration by creating institutional pressures and learning opportunities. We also examined how standards deployment and integration differentially influenced operational and strategic benefits. Survey data was collected from organizations in China who have implemented RosettaNet. Overall, the study extended research on standards adoption by examining how the learning perspective complemented institutional pressures, generating an integrated view of how pressures and learning from other organizations influence standards deployment and integration as important dimensions of standards use, as well as the benefits arising from their use.

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1. Introduction

The use of inter-organizational systems (IOS) can provide significant operational and strategic benefits to organizations. However, effective deployment of IOS across a global supply chain requires a set of standards that ensure interoperability and integration of both the hardware and software of partner organizations. Hence, companies in some industries have formed consortia to develop industry-specific open IOS standards, which have been termed vertical IS (VIS) standards [11,26]. These are similar to electronic data interchange standards in several ways: they are typically implemented in IOS and facilitate the exchange of structured transaction data by defining elements such as product identification, business document layout, and business process activities. They facilitate inter-organizational business activities and specify transfer, routing and security protocols. However, VIS standards differ in that they are XML-based open standards that were developed and promoted by industry consortia, such as the RosettaNet for high-tech industry, CIDX

for the chemicals industry, MISMO for the mortgage industry, and ACORD for the insurance industry.

The adoption of VIS standards is unlike the adoption of technologies used only within an organization; they cannot be adopted and used unilaterally but require the cooperation of a firm's trading partners. Thus researchers have used a sociopolitical perspective to examine how other organizations influence a firm's VIS standards adoption decisions, focusing on the balance of power among trading partners. Institutional theory argues that organizations adopt practices and innovations, regardless of their technical value [24], in order to achieve greater legitimacy and status. Based on this, studies have found that external pressures on organizations were the major factor influencing IOS adoption.

However, an organization's knowledge and technical capability also influences their adoption decision. In the VIS standards context, where there is an industry consortium that actively promotes knowledge sharing among trading partners and members, the consortium community provides opportunities for all parties to build and retain cooperative relationships and a trusting climate. This encourages the use of softer influence tactics, such as learning opportunities, rather than hard-line tactics such as pressuring organizations to adopt the standards. Such tactics encourage trading partners to obtain and adopt the knowledge and capabilities that allow effective use of the technology.

We therefore extended the prior sociopolitical research on IOS adoption, by complementing the institutional view with the

* Corresponding author. Tel.: +65 6790 6196; fax: +65 6792 2313.

E-mail addresses: xuyun@swufe.edu.cn (Y. Xu), awfboh@ntu.edu.sg (W.F. Boh), acsoh@ntu.edu.sg (C. Soh).

¹ Tel.: +86 28 8709 2220; fax: +86 28 8709 2155.

² Tel.: +65 6790 4858.

learning perspective. We showed that providing learning opportunities for trading partners and consortia members constitutes additional, alternative paths to successfully encouraging partner organizations to implement and use VIS standards.

Furthermore, we believed that institutional pressures and learning not only influence adoption, but also *how* organizations use VIS standards. Organizations have to determine the *extent* to which they will adopt VIS standards, in terms of the number of inter-organizational business processes they will automate [2], and the extent of integration with their backend systems and internal business processes [16,20]. We therefore identify deployment and integration as two distinct dimensions that characterize VIS standards use, allowing us to examine, in an integrated manner, how institutional pressures *and* learning from other organizations influence organizational decisions to deploy more standards, and invest in systems and business integration, as well as how these two dimensions of VIS standards use influence operational and strategic benefits.

2. Literature review of IOS and VIS

IOS are telecommunication-based IS shared by two or more trading partners. Industry-specific IOS standards were collaboratively developed and adopted by all companies in one industry supply chain. Therefore, the company will not have to deal with a different set of proprietary standards in the supply chain.

2.1. Antecedents of VIS standards adoption

O'Callaghan et al. [13] found that the adoption of EDI was related to the perceived relative advantage of the technology and the level of compatibility with existing systems. In addition, the organizational and environmental contexts have been found to be important aspects in determining the effectiveness of the use of the standards. The organizational context (e.g., firm size, organizational readiness, financial resources, IT sophistication, top management support, etc.) reflects the specific characteristics of an organization that constrain or facilitate the adoption of the technology. The environmental context (e.g., business partner power, competitive pressure, government pressure, trust, support from the initiator, etc.) reflects the external influence on adoption that may come from the industry, competitors, trading partners, and the government.

As IOS standards migrated toward more open Internet-based standards, there arose communities of companies that actively share knowledge and gather to collaboratively set VIS standards. This highlighted the importance of emphasizing the social context in which the firm is situated [18]. Prior research on VIS standards recognized this and has emphasized a socio-political view of VIS standards adoption; for example, based on the relational view of the firm and institutional theory, Bala and Venkatesh argued that relational depth, relationship extendibility, and institutional pressure were important for the successful adoption of VIS standards in organizations. The emphasis on standards consortia prompted Markus et al. to argue that the VIS standards development and its adoption/diffusion processes are interrelated problems of collective action. Consequently, a failure in their adoption could be due to insufficient attention having been paid to the negotiation phase in standards development. Likewise, Boh et al. [3] discussed strategies that consortia can adopt in strengthening the connection between standards development and their diffusion.

We therefore argue that this encourages the use of other influence tactics such as sharing knowledge through a variety of learning opportunities, rather than the focusing only on the use of external pressure to adopt the VIS standards.

2.2. Benefits of VIS standards adoption

Prior authors have examined the impacts of VIS standards. Recent literature has suggested that the use of IOS could lead to benefits that include both operational efficiency from reduced inter-enterprise transaction processing times and costs [6], and strategic value from knowledge creation, knowledge assimilation, and flexible supply chain relationship [5,10]. Researchers have also begun to emphasize the relational improvement that can result from IOS implementations. For example, Subramani [22] differentiated two patterns of supply chain management systems use by suppliers (exploitation and exploration), which are associated with different relationship-specific investment in business processes and domain knowledge. These, in turn, enable suppliers to create value and retain a portion of the value created from the use of these systems in inter-firm relationships. VIS standards enable partners to gain insight into their environment, enriching each partner's perspective (enhanced bridging), and creating collective gain. Researchers have also started to examine how organizations can obtain such benefits. Wigand et al. noted that integration of companies' backend systems to the IOS is required to obtain operational benefits that can only be derived from straight-through processing.

With VIS standards defined for a broad range of business processes, organizations now also have to decide on the business processes for which VIS standards should be deployed, in addition to the extent of integration to backend systems and internal business processes. It is thus important to examine both the antecedents and benefits of the extent of deployment as well as the extent of systems and business integration.

Table 1 summarizes what has been found in terms of antecedents and benefits of VIS standards implementation.

As VIS standards are a relatively new phenomenon, we developed our research model by grounding ourselves (through interviews, industry consortia conferences, and industry publications) in the phenomenon, with RosettaNet as our research site. We then tested the research model using a survey.

3. Research context

RosettaNet (<http://www.rosettanet.org/>) is a nonprofit industry consortium that aims to facilitate B2B e-commerce in high-tech industries (e.g., electronic components, semiconductor manufacturing, and telecommunications). Since its founding in 1998, RosettaNet has grown to a membership of nearly 3000 organizations and more than 25,000 Partner Connections. In 2002, RosettaNet merged with the Uniform Code Council (now GS1 US™). Today, it is organized into six industry sectors, each with its own council of key industry players. RosettaNet has one of the largest number of organizational members among all the supply chain standards consortia. Members include customers, suppliers, logistics providers, solution providers, financial institutions, industry associations, and government agencies. Its headquarters are in the United States (RosettaNet Global), and there are affiliate offices in Asia and Europe for standards diffusion.

The corner stone of the RosettaNet standard is the partner interface processes (PIPs). PIPs specify the processes and associated business documents for data exchange. RosettaNet also provides implementation frameworks, which specify both the business meaning behind each data element, and technical details such as the use of certificates for message authentication. All interactions and activities are defined. Many vendors, such as BEA and Microsoft, provide support for the implementation framework of RosettaNet.

Our study builds on a three-year involvement with the RosettaNet consortium. To gain an understanding of RosettaNet,

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