Abstract

Although there has been a significant amount of research on the adoption of IS standards and consequences, most has tended to focus on traditional EDI standards, paying special attention to factors of individual adopters. However, the current proliferation of new IS standards, based on open technologies, increases the potential for interorganizational collaboration. Research, therefore, needs to raise the level of analysis to that of the constellations of organizations that are part of the industry network. This contribution examines how the structural properties of the network impact on the adoption decision and how the adoption in turn produces changes in the structure of the network. Furthermore, we advocate a multilevel analysis of the consequences of using IS standards and eHubs. We explore and illustrate our theoretical arguments with a case study on the adoption and use of an IS standard and eHub in the chemical industry.

Keywords: IS, industry standards, electronic hub, adoption, network

INTRODUCTION

The emergence of open technologies like XML has resulted in new opportunities for conducting B2B transactions. Nevertheless, the real benefit from the use of these open technologies must come from the integration of intercompany processes and applications (Markus et al. 2002). A prerequisite for this inter-firm integration and interoperability is the existence, particularly at the industry level, of IS standards (Markus et al. 2003, OECD 1996) that define how organizations within that industry can carry out their transactions electronically.

The adoption of these IS industry standards is taking place in networks of organizations, thereby leveraging firms’ network resources. The importance of a firm’s internal resources is widely accepted in the strategy literature in general (Barney 1991) and the competitive dynamics literature in particular (Chen 1996; Grimm and Smith 1997). Following Gnyawali and Madahavan (2001), we consolidate four sets of arguments to establish that resources also reside in the firm’s external network and are important to a firm. First, relationships in a network are potential conduits to internal resources held by connected actors (Nohria 1992). Second, external economies, i.e., ‘capabilities created within a network of competing and cooperating firms’, often complement the internal resources of the firms involved (Langlois 1992). Third, the rate of return on internal resources is determined by how well structured the firm’s network is (Burt 1992) and fourth, a firm’s position in a network contributes to its acquisition of new competitive capabilities (McEvily and Zaheer, 1999), which, in turn, enhances its ability to attract new ties (Powell et al. 1996). We argue that IS standardization initiatives in vertical industries lever network resources impacting on the adoption of the standard and resulting benefits.

Literature supports the existence of standards as an antecedent to the adoption of electronic intermediaries (Chwelos et al. 2001; O’Callaghan et al. 1992). However, those studies focus on EDI standards, which were proprietary and supported dyadic relations, paying special attention to the organizational level and not allowing for the complexity of networks with more than two nodes. New IS industry standards (i.e., CIDX, MISMO) as well as electronic intermediaries like eHubs, make real-time information exchanges easier and emphasize exchanges at the interorganizational level. A first argument here is that the study of IS...
industry standards and eHubs adoption should examine the network structure of industries.

On the other hand the economics literature, focusing on the diffusion and outcomes of network technologies, has shown that there is a positive correlation between the number of firms adopting the standard and its utility (Katz and Shapiro 1985). Other research has investigated the consequences for firms of the use of standards (Mukopadhyay and Kekre 2002). Some of these consequences, however, affect the constellations of organizations and network levels (Christiaanse 2005). The deployment and use of IS industry standards and eHubs is expected to improve information flows among partners and to reduce coordination misalignments across the supply chain (Gosain et al. 2003). A second and related argument here is that the use of eHubs in vertical industries creates some collective benefits that go beyond the organizational or dyadic levels.

This contribution addresses the following research questions: (1) Do industry network properties affect eHub adoption, and how are they affected? and (2) What collective benefits arise from the use of eHubs? To answer these questions, we develop a theoretical model and present a case study of an eHub in the chemical industry that illustrates our theoretical arguments.

The structure of the paper is as follows: The literature review on IS industry standards and eHub adoption and its consequences on network structure is presented in the following section. We then introduce a case study from the chemical industry, which illustrates our main arguments. The final section presents our conclusions and some guidelines for future research.

THEORETICAL ANCHORING

IS industry standards and eHubs

The development of electronic intermediaries to conduct B2B electronically entails first choreographing cross-company business processes and having common data definitions to create the IS industry standard (Rodon et al. 2004). Once the standard has been developed, firms need to develop the technological infrastructure that will support the standard. They may then choose between several alternatives: 1) implementing customized one-to-one integration with partners, or 2) using an electronic intermediary to interact with trading partners (Markus et al. 2002). Within the electronic intermediary alternative we may find: 1) private exchanges developed by a powerful player in the industry (e.g., MyAccount@Dow from Dow Chemical, BayerONE from Bayer); 2) independent exchanges, which are developed by third parties that do not belong to the industry but mediate trading for an industry; or 3) consortia exchanges, or eHubs, in which some firms in an industry support a common technology infrastructure for trading (Damsgaard and Lytyinen 2001). Several examples in different industries (Christiaanse and Damsgaard 2000; Forster and King 1995; Markus et al. 2003; van Baalen et al. 2000) show that results of standard setting efforts are mixed.

We define eHubs as shared and heterogeneous IT infrastructures that act as intermediaries underpinning interfirm relationships and embedding a set of business rules defined by the IS industry standard. eHubs are shared in the sense that they are usually set up, owned and used by firms in the same industry that create a consortium. In these consortia, standards and eHubs emerge through the cooperation of various actors, who simultaneously cooperate to increase the efficiency of the whole industry and who compete for the same customers (de Vries 1999). eHubs are heterogeneous in two senses. First, they encompass multiple technological artefacts as well as non-technological elements (social, organizational, institutional, etc.) that are necessary to sustain and operate the eHub (Kambil and van Heck 2002). Second, eHubs implement multiple versions of the same standard, or embed several standards for the same functionality (Hanseth and Lytyinen 2004).

Adoption and network structure

Research on antecedents to electronic intermediaries adoption has used diffusion of innovations theory (Rogers 1995) to identify factors that predict the adoption (see (Ramanathan and Rose 2003) for a review). These factors span three levels: organization (IT sophistication, financial resources, trading partners’ readiness), environment (competitive pressure, dependency on trading partners, industry pressure, enacted trading-partner power) and technology (perceived benefits of the electronic intermediary) (Chwelos et al. 2001; Iacovou et al. 1995; Premkumar and Ramamurthy 1995).

This paper explores more deeply the impact of the external environment on the adoption by focusing on the industry-level embeddedness. In the context of vertical industries, actions by firms – the decision to adopt a standard or an eHub – may be affected by the network of relationships in which they are embedded (Granovetter 1985). This embeddedness perspective has, to our knowledge, not been included before in the study of standards and eHub adoption. In our view, four elements explain the relevance of the embeddedness perspective to the study of eHub adoption. First, adopters belong to the same industry and, therefore, they do not act in a vacuum, their actions being embedded into the existing network of relationships. Second, the whole industry network has a common interest in a wide adoption of the eHub. Third, firms involved in the adoption know each other and trade with each other, thereby enforcing the concept of
embeddedness. Finally, eHubs have the capability to bind competing and cooperating firms together.

To explore the relationship between the network structure and eHub adoption we will use properties at different levels. The reasons for advocating multilevel analysis are:

1. Just as with EDI, eHub adoption dynamics is a multilayered phenomenon involving organizational, industrial and institutional levels (Damsgaard 1996);
2. Literature on embeddedness has focused on the firm and network levels (Granovetter 1985); and
3. Different properties of the network have different effects on the flow of resources.

As actors want to optimize these flows, attention has to be paid to the network properties (Gnyawali and Madhavan 2001). We use three structural properties of an industry network (Figure 1): centrality, structural equivalence and density.

The influence of network structure on adoption. **Centrality** is a firm-level measure that reflects the extent to which a focal actor occupies a strategic position in the network by virtue of being involved in many significant ties. Centrality can be measured by degree (number of direct links with other firms), or by closeness (extent to which an actor is close to or can easily reach all other members in the network) (Monge and Contractor 2003). High centrality will lead to a higher volume and speed of asset, information and status flows, and generally, central firms will benefit from a positive resource asymmetry (Gnyawali and Madhavan 2001). In the context of industry networks, central actors will have greater access to external resources than non-central ones (Gnyawali and Madhavan 2001), will perceive the cost benefits that may arise from standardizing the exchanges with partners in the network and will have higher power to influence the adoption of the eHub within the network. This last point fits in with the literature on adoption, which recognizes the power – coercive or support strategy – exercised by the initiator of an EDI link (Premkumar and Ramamurthy 1995). Therefore, we argue that a central firm will be the most interested in adopting and promoting the eHub adoption.

**Structural equivalence** is a ‘pair-level measure of how similar the actors’ network patterns are – the greater the similarity in the actors’ network, the greater structural equivalence of these actors’ (Gnyawali and Madhavan 2001: 437). Structurally equivalent firms, although not necessarily connected, can be viewed as having similar asset, information and status flows and somehow being symmetrical in their resource profiles (Gnyawali and Madhavan 2001). In the context of industry networks, structurally equivalent firms, especially central firms, will perceive that they will benefit more from standardizing their similar interaction patterns and will therefore combine their efforts to promote the adoption of the eHub.

**Density** is a network-level measure that refers to the degree of interconnectedness or the number of actual links to the number of possible links in the network (Monge and Contractor 2003). A dense network, meaning a network in which the members have no redundant ties: (1) increases the flow, access and sharing of information; (2) functions as a closed system, and so trust, shared norms and common behavior are developed more easily; and (3) facilitates monitoring and effective sanctioning, making it less risky for members in the network to trust each other (Gnyawali and Madhavan 2001). In dense networks, because of the high interconnectedness, firms clearly perceive the benefits of standardizing interactions, and they will therefore be more willing to adopt an eHub. However, because of the promotional effort that central firms may carry out, it is expected that dense networks without clear central firms will have more difficulties than dense network with central firms.

The influence of adoption on network structure. Literature on the impact of IT on networks or supply chains has assumed that IT deals with the collection, processing and diffusion of information across the network, and has focused on the changes in information flows. Nevertheless, information can be seen as a representation of other network resources – assets and status. IT may therefore have a direct effect on information and an indirect effect on the other resources. We consider that the adoption of eHubs within an industry network will have direct effects on the flows of information between the firms in terms of accessibility, speed, frequency and volume. For instance, the eHub might filter unwanted information or forward some kind of information to network partners that they

![Figure 1. Industry network properties, eHub adoption and usage consequences](image-url)
Consequences of eHub use

The economics literature has shown that the size of the network adopter and the resulting network externalities will determine the value of the electronic intermediary (Katz and Shapiro 1985). Other research has used the industrial organization literature to analyse the adoption of EDI systems as a means of achieving a competitive advantage (Barua and Lee 1997). This literature views the adoption as a way to increase transaction efficiency by reducing coordination costs and increasing the coordination and control capabilities of individual firms (Malone et al. 1987). From a transaction cost perspective, the development of electronic intermediaries based on open technology standards (i.e., XML, web services) is also expected to decrease asset-specific investments for firms that adopt them (Christiaanse et al. 2004). Apart from this asset-specificity argument, this stream of research assumes that the benefits from IT use come from streamlined flows of information. However, effects of usage could also be measured in terms of effects on resources, not only representations of resources, as is the case with information. By filling this gap, the resource-based view of the firm has been used to analyse the impact of IT on organizational performance (Bharadwaj 2000) and to understand how trading-partner resources affect the ability to generate IT business value (Melville et al. 2004).

Other research on the consequences of IS industry standards and electronic intermediary usage has classified the benefits from their use into direct, first-order, operational and indirect, second-order and strategic (Iacovou et al. 1995; Mukopadhay and Kekre 2002; van Baalen et al. 2000). The first type of benefit which usually deals with automation of daily processes and cost reduction, whereas the second type of benefit, which accrue over an extended period of time, is associated with improved partner relations (i.e., customer, supplier, etc.), increased flexibility and responsiveness (Mukopadhay and Kekre 2002; van Baalen et al. 2000). Furthermore, the second type of benefit cannot always be captured unilaterally by one of the firms, or may be captured by the constellations of organizations that are part of the industry network. In the case of IT that spans firms’ boundaries as with eHubs, business processes, IT resources and other trading partner resources play a role in the final impact (Mukopadhay and Kekre 2002). For instance, firms with deeply embedded EDI are supposed to gain more strategic benefits than those with a lesser level of embeddedness (Chatfield and Yetton 2000). Christiaanse (2005) states that research on the consequences of eHub adoption should be orientated towards the network level instead of the dyad or organizational levels. In line with this statement, Straub et al. (2004) develop the network organizational construct, which they define as the aggregated performance of partners in the supply network. Here, we advocate the need for a multilevel exploration of the benefits (organizational, dyadic and network) that arise from the deployment and use of IS industry standards and eHubs. This is relevant, as the level of competition is increasingly moving from the organization to that of the network and integrated business networks compete against other networks (Vervest et al. 2005).

Our conceptualization of eHub adoption as influenced by structural embeddedness provides a new perspective to the research on antecedents and consequences of adoption (Figure 1). This paper complements previous research in three ways: First, through our focus on the impact of the network structure on the adoption decision. Second, by focusing on the changes in the flow of resources and the network structure, as a result of adopting an eHub. Third, since IS industry standards and eHubs embed the interorganizational practices, the analysis of the consequences of using eHubs requires not only focusing on the firm level, but also examining the existing network of relationships. We will now illustrate these arguments with a case study of an eHub in the chemical industry.

Research method

The case material was compiled over a four-year period (2001–5). The data were gathered through 28 in-depth interviews with members of the chemical industry (i.e., Elemica, Dow, Bayer, BASF, Shell, DSM). The interviewees were managers of the participating companies and their clients in addition to interviews with the computer technicians involved. Interviews lasted between one and a half hours and three hours, were semi-structured and dealt with questions on the importance of standardization in the chemical industry, the adoption decision to join Elemica, its implementation process and its impact both on the firm and on the industry as a whole. All interviews were recorded and transcribed. In addition, we attended Elemica world
conferences, where we talked to 20–30 additional Elemica customers and held short 15-minute interviews with stakeholders. Internal documents from these companies, teaching cases and press articles were also gathered and analyzed. Earlier casework was reported in (Christiaanse 2005; Christiaanse and Markus 2003; Christiaanse et al. 2003; van de Ridder 2004). The next section will describe the case study and its context – the chemical industry.

CASE STUDY

IS standards in the chemical industry

The chemical industry is characterized by being fragmented (more than 76,000 companies worldwide and the top ten global companies’ sales represent about 20% of the total), working largely with pre-negotiated contracts (between 80% and 90%) and conducting a considerable amount of intra-industry trading (around 50% of industry’s output is purchased by itself) (Christiaanse 2005; Liveris 2002).

The CIDX (Chemical Industry Data Exchange) is a standards development body in the chemical industry that has focused on improving the ease, speed and cost effectiveness of electronic business transactions among chemical companies and their trading partners. Three principles guide the development of CIDX standards: open (available free of charge to members), neutral (to support current and emerging business models) and platform independent (to prevent restricting the use of any hardware or software platform).

CIDX is in charge of Chem eStandards™, a set of global open XML-based data exchange standards applicable throughout the online chemicals trading network: manufacturers, distributors, logistics providers, financial institutions, electronic marketplaces and other industry consortia. Chem eStandards™ is the result of an effort initiated by BASF, Dow and DuPont in July 2000. Chem eStandards™ covers message formats and business process scenarios; it defines 60 business transactions and encompasses company-to-company, company-to-eHub, and eHub-to-eHub e-commerce activities.

ELEMICA CASE DESCRIPTION

On 17 May 2000, 22 major chemical companies founded Elemica. ‘The idea behind Elemica – a cooperative alliance between competitors – is to create a chemical industry network linking individual information systems and aiming to reduce supply chain inefficiencies, and to strengthen buyer–supplier relationships, those where contracts are in place’ (Elemica 2005). Elemica does not present itself as an electronic marketplace in the sense of a trading platform that openly displays offers or requirements, but as a neutral eHub for the exchange of documents focused on the chemical industry to help members execute their relationships more efficiently. As one of the interviewees from BASF explained:

*the idea behind is really to standardize. And we as BASF, we are with DOX the biggest chemical company in the world, we see the way is to standardize internally and externally. This idea is very good and we have found support very quickly. This was the basic idea when we started it. We supported Elemica with many people from the industry.*

Elemica integrates its systems with participating companies’ ERP systems, and supports Chem eStandards™, but does not require chemical companies to comply with Chem eStandards™. Instead, Elemica uses a hub-and-spoke model in which a message coming from one company, in any format, is translated into Chem eStandards™, and finally if necessary into the recipient’s format. According to Stewart McCutcheon, Elemica’s CTO, (ChemWeek 2002):

*the key to Elemica Connected Solution is interoperability. We ensure that the various protocols (Chem eStandards, xCBL, EDI and SAP IDOCS), business processes and data standards work together.*

For companies that do not have ERP systems in place, Elemica offers web-browser access (i.e., the Buyer Direct solution). By so doing Elemica allows chemical companies to communicate seamlessly with regard to their use of the IS industry standard. An interviewee from Bayer illustrated:

*internally we had to change the way we do business. Not from better to worse, but you have to change it. And we have to explain to people: 'Please, from now on, do this first and not that. Because this is the way Elemica does business and this is the way we standardize it.'*

The goal of this analysis is threefold: First, we show how the structural properties of the industry network (centrality, structural equivalence and density) influence the adoption decision. Second, we want to demonstrate that the adoption of Elemica creates changes to the structure of the network. Third, we conduct a multilevel analysis of the benefits derived from adopting and using Elemica.

The impact of network properties on adoption

Central firms in the chemical industry are more likely to consider CIDX as important and to perceive the benefits, in the form of positive resource asymmetries, of adopting Chem eStandards™ than other non-central
actors in the industry (eyeforchem 2003b). Citing one of the interviewees from one of Elemica’s central initial investors:

*We were looking for the value in a detailed way. One of the promises of Elemica is that they will reduce the costs per order (of order treatment). We had an internal project going on to compare the cost of order process within our different sites in Europe and we expanded this project to Elemica, treating Elemica as a site. Now we can also prove that Elemica is also offering us real value. If Elemica is running it costs less to treat one order than without Elemica.*

On the other hand, partners of those central firms, usually small and medium-sized enterprises (SMEs), do not perceive adopting Chem eStandards™ as so important, because: (1) they have less volume of document exchange; (2) they depend on the dominant partners’ actions; (3) the practices reflected in IS industry standards fit better with those of dominant firms that have previously participated in the standard development committee (CIDX); and (4) they sometimes cannot afford the investment required to implement the technological infrastructure. An interviewee from an SME observed:

*We use some VMI stuff, but it is not widespread. The problem is that until you really do a significant amount in terms of kilos of materials, it is just a cost. That is why, unless we have to do this, we will not work hard in trying to push it. So we only do it when it becomes a business requirement.*

One the other hand, a representative from Bayer commented on this firm’s relationship with small firms:

*In the coatings business we have a number of companies, smaller sized and medium sized, that we have business relationships with that we talk with about Elemica. And many of these companies, even if they are small, do a fair amount of their business with people that are on the Elemica network. We are talking with coatings customers, with distributors, who are also a group of companies that is likely to have many business relationships within the chemical industry. The smaller companies also have the means to connect. Maybe a full connection if they are able to and willing to, but also to connect with us on the basis of a web-based solution. So the size for us is not a criterion, it’s the amount of business we do with them and they will do with the entire Elemica network.*

Elemica, as well as Chem eStandards™, was initially promoted by a group of structurally equivalent firms (Dow Chemical, BASF, DuPont) in the industry, who cooperated because they did not want to put themselves in the hands of a third party that wedged between themselves and their customers, which could have controlled the relationship and captured its value by controlling resource flows (Liveris 2002).

The impact of adoption on network properties

Regarding changes in flows of resources, we observe that Elemica speeds up asset flows (through electronic payment delivery times may be adjusted), and influences the flow of status (we observe that SMEs that line up with Dow Chemical will gain recognition and legitimacy by Dow and other large chemical firms).

Within the Elemica network, some members, usually central actors, might enjoy positive resource asymmetries. For instance, Dow Chemical and BASF might benefit more from ERP-to-ERP connectivity than SMEs who do not have ERP and have opted for a web-browser access. The higher centrality and integration, through ERP-to-ERP connectivity, that some of the members in the Elemica network have reached allows them to improve the flow of assets (lower inventory, higher reliability of raw material availability) and information flows (automatic order response, status messages, inventory management and control), thus somewhat strengthening their centrality.

In addition the adoption of Elemica influences the density of the network by:

1. **Facilitating the flow of information among chemical companies.** Bill Edwards, from Foamex International Inc, observes (Shell 2004): ‘Elemica gives us the opportunity to connect with a larger number of suppliers across a number of chemical product categories. It means we have the same level of automation of order and information exchange each time, and don’t have to make new connections with every new vendor.’

2. **Providing visibility to the supply chain processes and therefore easing monitoring.** Mike McGuigan from BP’s Petrochemicals Business notes (eyeforchem 2003a): ‘[Using Elemica TransLink] not only gives us the capability to connect to our carrier base via B2B or web links, but will allow us to build this foundation to provide greater visibility into our supply chain for both BP’s organization and our customers.’

3. **Strengthening existing ties and developing trust between partners.** In the words of one interviewee talking about the adoption of Elemica to interact with a customer: ‘you analysed the business process from a demand chain perspective …you went deep in the relationship and say: “Okay, what is it exactly what we are doing? Why are you keeping safety stocks and why am I doing that too? Shouldn’t we start trusting each other? Shouldn’t we eliminate part of that stock? Shall I keep stocking and you not? Should we do VMI?” So you end up with a deeper relationship. Especially if you go to VMI [Vendor-Managed Inventory], then there is an enormous trust, because that means that you are a single supplier. You have this tank or this warehouse.
and so, you are the only one that supplies this product and the customers are totally relying on you to make sure that the product is always there.’

4. Increasing the flow of information between chemical companies and others outside the industry (carriers, storage facilities, freight forwarders, contract manufacturers, customs agents, telemetry providers) through hub-to-hub connections. Udo Lindeman, from Bayer Rubber Business Group, comments on the hub-to-hub connection between Elemica and RubberNetwork: ‘the alliance between Elemica and RubberNetwork will enable Bayer to link our supply chain with supply chains of multiple customers in the tyre and rubber industry through one industry connection.’

At the industry level, due to the hub-to-hub connections, the Elemica network is expected to gain more centrality in the industry. This higher centrality could result in an increase of Elemica attractiveness for chemical companies and companies from other industries that have business relations with the chemical industry. This would lead to a growth of critical mass (adopters of Elemica) and the resulting network externalities will then determine the value of Elemica and ensure its survival.

Consequences of eHub use

Next we present the benefits of deploying and using an eHub at the organizational, dyadic and network levels. In addition, we present other consequences of the application and use of eHubs in the chemical industry.

Organizational

At the organizational level we have found two groups of benefits in this case: cost and scale, and internal integration. First, as a result of an increase in information flows, firms can now work with lower inventory (Backhaus 2004). Second, Elemica offers the capability to quickly establish an interorganizational tie within the chemical industry, and cuts down the technological and the syntactical, semantic and pragmatic interconnectivity barriers. Elemica provides tiered integration, which cuts connectivity costs and enables the Elemica network to scale across SMEs. Each network member only needs to incur the cost of connecting to the eHub once, rather than sustaining different links for every partner in the network. By allowing firms to connect only once to interact with other partners in the industry and by connecting to other industries’ eHubs, Elemica could become a ubiquitous platform for the chemical industry.

Finally, when an organization is structurally complex and geographically dispersed, implementing an ERP system to achieve internal integration is sometimes a tough task (Markus et al. 2000). In such cases, eHubs could become a solution for internal integration. Debra Marshall from Shell Chemical observes (Shell 2004): ‘The cost of globalizing and standardizing an ERP system can be prohibitively expensive. In these cases Elemica can be used not only to exchange data with trading partners but also to interconnect business units that may be operating incompatible business processes.’

Dyad. First, at the dyadic level Elemica offers optimization of interfirm processes. eHub adoption has led firms to focus not only on improving internal processes but also on streamlining interfirm processes. An interviewee observed:

The B2B connection with Shell Chemicals Europe [through Elemica] has enabled us to automate a lot of these repetitive routine tasks ...it’s real-time processing, which has made the order creation, processing and completion much faster – now things happen in a matter of seconds. It means our operational supply chain can now focus on exception handling rather than performing the same transaction over and over again.

Second, Elemica does not try to bridge the existing structural holes (Burt 1992) in the chemical industry (as do other electronic intermediaries like ChemConnect) but tries to give support to existing long-term and stable buyer–supplier relationships. Elemica increases the speed and volume of information flows and reinforces existing ties, improving the chance for information sharing and collaboration. As one interviewee observed:

The customer says: ‘This is my inventory and this is my demand forecast.’ Based on this message we, as a supplier, can act in order to make sure their stock level is maintained at the right level. These types of messages are being exchanged through Elemica.

Network. A first example of a network benefit that an eHub can provide can be found in electronic invoicing and payment. Just seeing an electronic invoice versus paper as a cost reduction for firms is not a great gain. As Kent Dolby, CEO of Elemica, observes:

Today, when the companies buy and sell from each other, they then go through an invoice process and there is a payment process. And the payment process may include some review of receipts and some review of either electronic or paper documents, and eventually settlement invoices, cash is transferred. What I see in the future is the ability for Elemica to serve as a clearing house ...where we would actually do cash netting at
the end of the day ... There are no payment terms. There is no delay in the payment process, it is fully automated.

Second, eHubs may provide cross-industry interconnection. For instance, Elemica offers chemical companies hosted supply-chain management applications aimed at collaboration (i.e., VMI and CPFR). The companies using these hosted applications have experienced cost reductions in connecting and licensing the software as well as reductions in inventory and greater efficiency in logistics management (Metcalfe et al. 2004). In 2003, Elemica acquired Optimum Logistics, a global marine logistics solution for the chemical industry, and started offering the TransLink application as a hosted application. As a result, chemical firms could avoid the costs of licensing and implementing the application. Furthermore, Elemica was able to interconnect its customers’ ERP systems with TransLink, thereby integrating logistics process and data and increasing the visibility of information and the agility of asset flows that extend beyond the chemical industry.

eHubs enhancement of IS industry standard adoption. The effort to develop and implement an eHub may be seen as a process of standardization. We can interpret Elemica’s implementation process as a twofold process of standardization: 1) Elemica is based on Chem standards; and 2) the implementation process of Elemica constitutes a standardization process among members of the chemical industry.

eHubs like Elemica facilitate the use of IS industry standards by requiring companies to maintain only one connection to the eHub, and the eHub making the translation of messages into the IS industry standard (Chem eStandards™). As one interviewee observes, even when firms comply with Chem eStandards™ there are incompatibilities:

In spite of the widespread adoption of the Chem eStandard, different versions of these standards are being used, because every organization adopts a new version and at another speed. This is where Elemica offers their translation service to translate to the different versions.

This also confirms the observation that IS industry standards like Chem eStandards™ are enacted in their use, and that they should be used as a frame of reference (Damsgaard and Truex 2000). This is due to: 1) the cost firms have to incur in developing an IT infrastructure that supports an IS industry standard; 2) the complexities in coordinating bilateral relations with partners or upgrading to new versions of standards; and 3) the nature of supply chains which cross several industries (in our case chemical, transport, rubber, automotive), sometimes each having their own IS industry standards.

Impact on software industry. Finally, the pressure towards software application providers (i.e., SAP and Manugistics) to adhere to the Chem eStandards™ is increasing, with Elemica being the industry platform for electronic messaging. Penalties for non-compliance with Chem eStandards™ and with Elemica may be high, because chemical firms will prefer to implement software applications that allow them to seamlessly interact with industry partners.

CONCLUSIONS

This paper contributes to the existing literature on interorganizational systems adoption by raising the level of analysis to that of the network. We call for an exploration of the embeddedness perspective in the research of eHub adoption and its consequences by developing three arguments. First, we considered the structure of an industry network –centrality, structural equivalence and density – as affecting the adoption decision. At the organizational level, central firms are expected to adopt and foster the adoption of eHubs. At the dyadic level, structurally equivalent firms, especially when central, will perceive the standardization of their similar interaction patterns as beneficial and will therefore be more willing to adopt an eHub. At the network level, because of the benefits of standardizing interfirm exchanges, firms in dense networks will be more prone to adopt an eHub. Second, the adoption of an eHub within an industry network may have a direct effect on the flow of network resources – information, assets and status – and these effects, in turn, will produce changes in the structural properties of the network. Similarly, Markus et al. (2003) state that the proliferation of IS industry standards and eHubs is not only changing industries’ working practices, but also their structure. Our final argument is that the adoption and subsequent use of eHubs may create collective benefits for the industry that go beyond the organizational and dyadic levels. We have illustrated these theoretical arguments with a case study of an eHub called Elemica in the chemical industry.

We note several limitations of our embeddedness approach. First, we have used three properties of industry networks, but have not attributed importance to them. Depending on the type of industry, these properties may exert different influences in the adoption decision. Second, examining how the adoption changes the structure of the industry entails doing process analysis, and thus data must be collected using multiple timeframes. Similarly, examining collective benefits requires collecting diverse and complex data.

We expect that more varied forms of IS industry standards and eHubs will emerge in the near future. Research needs to continue in order to understand how the structure of the different constellations of firms that
constitute an industry network shape the adoption of IS industry standards and how these structures evolve. Future research should also examine and measure the value that these constellations of firms get from adopting an eHub.

References


