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# Adoption Factors of Electronic Data Exchanges and Technologies to Improve Data Synchronization in BtoB Relationships: Are they similar?

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## ABSTRACT

Because of the emergence of technologies that allow more flexible interconnections, we propose to divide Interorganizational Information Systems (IOSs) adoption into two decision processes: electronic data exchanges adoption and technological choices. Indeed they are sequentially and in extreme case simultaneously related but independent since electronic data exchanges decision rarely imposes a technological choice. In this context, the research aims at distinguishing factors influencing the decision for a company to adopt electronic data exchanges with its partners and factors influencing the decision to adopt technologies supporting these electronic data exchanges. We investigate product information exchanges in the French consumer goods and retail industry through external catalogue, internal catalogue and Extranets. Analysis of 25 case studies allows us to conclude that it is relevant to distinguish these two decisions and the factors influencing each one.

## Keywords

Adoption factors, interorganizational information systems, data synchronization, electronic data exchanges, technological choices.

## INTRODUCTION

Interorganizational Information Systems (IOSs) are needed to support interorganizational processes and used to perform electronic data exchanges among businesses (Steinfeld et al., 2005). They were defined in a seminal article as “automated information systems shared by two or more companies” (Barrett and Konsynski, 1982) and are recognized to be an important area of MIS research. Literature has identified numerous factors that influence IOS adoption to support data exchanges among organizations. However, most of these researches discuss about EDI (Electronic Data Interchange) adoption or use models of EDI adoption to explain other types of IOSs adoption, such as Electronic Marketplaces for instance. Following Robey, Im and Wareham (2008), we consider that the theoretical implications of EDI research are limited for theory building since EDI refers to a specific type of IOS and narrows researchers’ perspectives. Concerning IOS adoption, these considerations seem to be particularly valuable since EDI adoption meant for a company to combine the decision to adopt electronic data exchanges with its trading partners and the adoption of a given technology, which is similar as the one of its trading partners. Now, given that new technologies provide more flexible opportunities for electronic interconnection (de Corbière and Rowe, 2010), it is relevant to analyze different phases in adoption. Therefore we think researches on IOS adoption need first to understand why companies decide to adopt electronic data exchanges with their partners and then why they adopt a given technology to exchange these data. Naturally, these two decisions are somehow intertwined and develop during the same process. But logically the first one occurs prior to the second one. It is only in extreme case that they are simultaneous, when a solely technology can support electronic data exchanges. Moreover, despite their interdependence in terms of decision process, we suggest on the basis of empirical evidence that the main technological choices are not made when the decision to adopt electronic data exchanges is taken in the principles. Consequently, this research aims at

understanding which factors influence the decision for a company to adopt electronic data exchanges with its partners and which factors influence the decision to adopt new technologies supporting these electronic data exchanges.

The paper is constructed as following. In a first part, we perform a literature review on IOS adoption to classify adoption factors into main categories. In the second part, we explain the type of data - product information exchanged between the consumer goods and retail industries - we have investigated, and the qualitative methodology we have build. In the third part, results extracted from the case studies are presented before discussion and conclusion.

## LITERATURE REVIEW ON FACTORS INFLUENCING IOS ADOPTION

The literature on IOS adoption and implementation has a long tradition. However it does not distinguish the sequence of the two different decisions related to IOS adoption, because, when most of these works were conducted, this distinction was not as relevant as today. Therefore, at this stage, we will use the literature review only to identify factors that are important for IOS adoption in general.

### Technological factors influencing adoption

Factors that have positive or negative influence on technology adoption are from different nature. A company generally adopts a technology when it perceives benefits from its adoption and use. However, these anticipated benefits have to be balanced with perceived costs (Barrett and Konsynski, 1982) and perceived risks (Kumar et al., 1998). Therefore, technological factors refer to the perceived benefits, costs and risks of the technology (Iacovou et al., 1995; Subramani, 2004).

Past empirical researches have studied reasons that explain IOSs development, use and success (Grover, 1993) and benefits that can be issued from their use (Subramani, 2004). IOSs expand automation of data exchanges between companies (Suomi, 1992) and are referred as systems that enhance productivity, flexibility and competitiveness for their users (Cash and Konsynski, 1985). Moreover, IOSs are all the more valuable when data integration, both external and internal, is achieved (Truman, 2000; Zhu et al., 2006). Data integration with business partners helps firms to enhance interorganizational efficiency (Bakos, 1991). However, at the industry level, automation and integration cannot be achieved without standardization (Markus et al., 2006), which is a prerequisite for operational benefits. In addition to operational benefits issued from automation, standardization and faster communication, IOSs can also provide strategic benefits, that refer to potential, long-term benefits (Suomi, 1992). One can find similarities with the two distinct categories of benefits proposed by Iacovou, Benbasat and Dexter (1995):

- Direct benefits, such as transaction costs reduction, inventory levels reduction, data quality improvement.
- Indirect benefits, as opportunities, such as operational efficiency improvement, better customer service, interorganizational relationships improvement or strategic competitive advantages.

Therefore, direct benefits refer to technological and informational level of integration. Indirect benefits refer to strategic benefits that can emerge when business partners develop integration at the organizational level. Indeed, as argued by Bensaou (1997), companies can use interorganizational technology adoption to transform business relationships with some of their partners. Yi, Soh and Huang (2005) discuss about IOSs effects on operational and strategic performance. Their results emphasize that both system and business integration lead to operational benefits whereas only business integration leads to strategic benefits. These results are concordant with those of Markus, Steinfield, Wigand and Minton (2006) on interorganizational processes standardization. They underline that strategic performance is issued from business relationships integration and not from information systems integration.

To conclude, perceived benefits can be both operational and strategic, and are issued from different levels of integration realization between partners. However, perceived benefits have to be balanced with perceived costs and risks. Migration from proprietary systems to open standards based systems is supposed to help firms to adopt new IOSs since they are less costly (Zhu et al., 2006). However, costs generated by project management have still a negative influence on adoption. Similarly, perceived risks have negative influence on intent to adopt (Kumar et al., 1998). Perceived risks mainly referred to return on investments (ROI). Especially, External integration consists in extending the solutions to a set of partners that can implement and use such a system (Iacovou et al., 1995). Therefore, external integration success is dependent upon the number of partners involved to maximize ROI and critical mass (Markus, 1987) of partners emerges as a risk.

### Organizational and interorganizational factors

Organizational factors represent firm's capabilities to adopt and implement the technology (Iacovou et al., 1995). Organizational factors are for instance company size, top management support, financial and technological capabilities of the firm. Adoption decision is influenced by financial resources available to pay for system installation, implementation and use costs (Iacovou et al., 1995; Zhu et al., 2006). Decision is also influenced by technological considerations about "*the level of sophistication of IT usage and IT management in an organization*" (Iacovou et al., 1995).

Interorganizational factors represent environmental characteristics that influence technology adoption, such as power of or trust over a partner (Hart et Saunders, 1997) or external pressure from competitors (Grover, 1993). Concerning technologies, to develop or maintain legitimacy in the institutional environment, "*organizations imitate early adopters to replicate their success or to avoid being perceived as laggards*" (Teo et al., 2003). Teo, Wei and Benbasat (2003) use institutional theory to identify the factors that enable the adoption of interorganizational systems. Coercive pressures occur in a dyadic relationship when a dependent firm is pressed or feels to be pressed by its dominant partner to adopt IOS. Numerous research works have shown that pressures exercised by a powerful firm influence its partners decision to adopt IOS (Grover, 1993; Iacovou et al., 1995; Premkumar and Ramamurthy, 1995; ). A firm faces mimetic pressures when IOS diffusion is quite important among its competitors or when it perceives success of a competitor that have adopted IOS (Premkumar and Ramamurthy, 1995). Normative pressures arise when IOS diffusion is quite important among the firm's customers or suppliers or when the firm participates in associations promoting the IOS. Firms promoting technology and standards influence IOS adoption (Grover, 1993).

Thanks to the literature review, we select four main categories of adoption factors: (1) Perceived benefits; (2) Perceived costs and risks; (3) Organizational capabilities; (4) Interorganizational pressures and supports. In the next section, we explain the field of application and the methodology in order to analyze, among these main categories which factors influence the decision to develop electronic data exchanges, and which factors influence the choice of a technology among others.

### FIELD OF APPLICATION AND METHODOLOGY

In this part, we present and justify the choice of studying product information exchanges between manufacturers and retailers, and the qualitative methodology we conducted.

#### Product information exchanges between consumer goods and retail industries

Product information is defined as a set of data that represents the identifying, technical, logistical and marketing characteristics of a product. Over the last ten years, the retail and consumer goods industries have developed technologies to improve integration of product information through data synchronization (Nakatani et al., 2006; Legner and Schemm, 2008). Data Synchronization (Legner and Schemm, 2008; de Corbière and Rowe, 2010) is a concept representing the process allowing trading partners to have always data with the same values, both in their own internal information systems. So any change of a product information in the internal information system of a manufacturer induces a real-time modification of this product information in all the internal information systems of its clients that retail this product. To achieve such a goal, Global Data Synchronization Network (GDSN) has been proposed. GDSN is based on a network of data pools, or external electronic catalogues, defined as repositories of standardized product information (Nakatani et al., 2006). With such a network, a company needs to build a solely connection to its data pool in order to communicate with all its trading partners (Legner and Schemm, 2008). However, GDSN is not the only way to exchange product information (Nakatani et al., 2006; de Corbière and Rowe, 2010). Indeed, in the French retail industry, retailers can adopt from one to three different ways to receive product information electronically:

- Through an external electronic catalogue, belonging to GDSN or not.
- Through a "Direct link" from its internal system by the implementation of an internal electronic catalogue.
- Via an Extranet where suppliers can enter manually the data required.

Similarly, the manufacturer can adopt from one to three solutions to send product information:

- Through an external electronic catalogue, belonging to GDSN or not.
- Through a “Direct link” from its internal system by the implementation of an internal electronic catalogue.
- Via the Retailer Extranet in which it enters manually the data required

Consequently, several types of IOSs are emerging to improve data synchronization between manufacturers and retailers and this field is therefore relevant to understand (1) the reasons that justify for a company the adoption of electronic data exchanges and (2) the reasons that justify technological choices of this company to better synchronize its data with its partners. The following subsection explains the qualitative research we have conducted to investigate adoption by manufacturers and retailers of electronic data exchanges and related technologies for their product information exchanges.

### **A qualitative research**

Since the research is mainly inductive, qualitative methods have been selected. They are more appropriate methods than quantitative ones to analyze and distinguish adoption factors of two decisions that are somehow intertwined. The research design is a multiple case studies design (Yin, 2003), in which the cases are the individual manufacturers and retailers. In a vertical market, the literature distinguishes firms that initiate an IOS adoption, often buyers, from their business partners, often suppliers, that are considered to be followers since they adopt an IOS due to pressure from initiators (Riggins et Mukhopadhyay, 1994). Concerning product information exchanges, retailers act as initiators since they can take more advantages from IOS use than their suppliers. Indeed, they have more products for which they would have no more to re enter the data in their own systems. The first category of firms we analyzed is constituted by retailers: All the seven major French retailers (Carrefour, Auchan, Casino, Système U, Leclerc, Intermarché, Provera) were included in our sample. Because of their number, we were limited to a sample of the Manufacturers. To benefit from the use of an IOS initiated by their powerful partners, suppliers may implement their technological choices in order to better integrate their systems and businesses (Subramani, 2004). However, all the manufacturers are not sufficiently sophisticated or powerful to design the IOS as they want. The more a manufacturer has numerous and powerful brands, the more he can design the IOS. At the opposite, SMEs generally act as followers (Riggins and Mukhopadhyay, 1994). Therefore, we decided to distinguish two extreme types of manufacturers, thanks to their power and their size. At the end of data collection, 10 global manufacturers and 8 SMEs were included in our sample.

Data from companies were collected through a variety of methods: semi-structured interviews, reviews of company and project documentation (Yin, 2003). The primary source of data is semi-structured interviews conducted between 2005 and 2007 in the 25 firms included in our sample. Because we focused on building technologies, we interviewed managers that were responsible for B2B data exchanges or for the development of electronic product information exchanges. Considering the research objectives, we focused on external validity of the findings, through intercases analysis, rather than internal validity with numerous data per case. Therefore, a second or a third interview was only conducted when several managers of the firm shared the responsibility for electronic development of product information exchanges. 40 interviews were tape-recorded and transcribed for data analysis.

Concerning data analysis, we focused on the 18 firms that had already adopted an IOS to realize a thematic qualitative analysis of the interviews (Miles and Huberman, 1994). In a first step, data are extracted to identify factors influencing the adoption of electronic data exchanges, to describe the technological choices of the company and to identify factors that have motivated these choices. Then, through intercases analysis, we generalized cases results in order to show: 1) the influence of the main adoption factors on the decision to adopt electronic data exchanges; 2) the influence of the main adoption factors on the technological choices.

### **CASE STUDIES RESULTS**

For each case in each category of firms analyzed, a table summarizes factors that motivate or inhibit the decision to adopt electronic data exchanges and main reasons that explain these choices. For each argument, we indicate in parentheses the weight of its influence on the decision. After tables, main insights are presented for each of the four main categories of adoption factors (Perceived benefits; Perceived costs and risks; organizational capabilities; Interorganizational pressures and supports) considering both the decision to adopt electronic data exchanges and the technological choices.

### Adoption factors for Retailers

Table 1 presents results for the 5 retailers that have already adopted technologies to improve data synchronization concerning product information exchanges. That for all retailers, some perceived benefits are found whatever the technological choices, we can conclude that the decision to adopt the principle of electronic data exchanges and the decision to adopt a technological support are not simultaneous.

Retailer	Factors influencing electronic data exchanges adoption	Technological choices: reception through	Factors influencing technological choices
A	Data quality improvement (++) Productivity improvement (++) Buyer supplier efficiency improvement (+) Change management (-)	Internal catalogue	Suppliers involvement (++) Maturity of GDSN standard (-)
B	Data quality improvement (++) Productivity improvement (++) Buyer supplier efficiency improvement (+)	External catalogue, Internal catalogue, Extranet	Suppliers involvement (++) Interoperability (++)
C	Data quality improvement (++) Productivity improvement (+) Critical mass of manufacturers (-) Buyer supplier efficiency improvement (+)	External catalogue, Extranet	Stakeholder of an EMP proposing an external catalogue (++) SMEs involvement through GDSN (-) Outsourcing of technological complexity (++)
D	Data quality improvement (++) Productivity improvement (++) Buyer supplier efficiency improvement (+) Change management (-)	Internal catalogue	Perceived costs of external catalogues and Extranets (-) Supplier involvement (+) Proprietary standard development (++)
E	Data quality improvement (++) Productivity improvement (++) Project costs (-) Change management (-)	External catalogue	Stakeholder of an EMP proposing an external catalogue (++) Perceived costs of Extranets (-) Outsourcing of technological complexity (++) Industry standard as a guarantee of benefits for all (+)

**Table 1. Adoption factors for retailers.**

#### *Factors influencing the decision to adopt electronic data exchanges*

Concerning perceived benefits, all the retailers share two motivations that influence electronic data exchanges adoption: data quality improvement and productivity improvement. Productivity improvement is issued from automation whatever technological choices. From the retailer point of view, data receptions through electronic catalogues, both internal and external, or Extranet are all solutions that allow to realize internal data integration since product information from manufacturers are no more re entered by retailer employees. Since data are no more re entered in the retailer own IS, human errors that previously occurred with traditional methods are suppressed. For most retailers, data quality improvement is the main factor of electronic data exchanges adoption. Moreover, another perceived benefit, more strategic, emerged. It concerns buyer/supplier relationships efficiency that can be improved thanks to product information integration at the interorganizational level. Indeed, for some retailers, thanks to data quality improvement, there will be fewer disputes and more cooperative opportunities.

Perceived risks and costs presented by retailers are about project and use costs of the future IOS and ROI. Retailers underline that project costs are important for these types of project, especially to realize systems integration between their own information systems and the future IOS. For the retailer C, the main risk associated to electronic data exchanges adoption is the critical mass of manufacturers, since ROI can be positive if and only if a enough partners exchange their data through the system. The only organizational consideration quoted by retailers does not concern their financial or technical capabilities. Indeed, it is more about change management that can be risky, and so they have to involve buyers in the project.

Finally, we found in retailers arguments that perceived benefits issued from data integration, such as productivity enhancement and data quality improvement, are the factors that have the highest influence on decision to adopt electronic data exchanges.

### Factors influencing technological choices

Concerning technological choices, perceived benefits of the technology are less relevant than in the decision to adopt electronic exchanges. Indeed, choices are more driven by risks considerations, organizational capabilities and interorganizational context.

Retailer A has chosen to adopt an internal catalogue since it finds immature the GDSN standard and risky to spend money for external catalogue implementation in this context. Retailer D prefers to adopt an internal catalogue since it offers greater flexibility to exchange complementary data outside the global standard. An external catalogue and the GDSN risk not to support the exchange of these data and retailer D estimates that costs induced by the implementation of such a catalogue will not have a sufficient ROI. Moreover, in their point of view, supplier involvement, which is a necessary condition for ROI, is easier with internal catalogue.

Retailer B, C and E had chosen external catalogues to reduce technological complexity issued from standard evolution and interoperability. However, retailers C and E constrained themselves with organizational capabilities. Indeed, since they are stakeholders of an electronic marketplace that has developed an electronic catalogue, they have to connect to this catalogue in order to maintain their marketplace ROI. Retailer B has a singular strategy since it proposes the three types of data reception. It considers that, whatever costs derived from all these solutions, ROI will mainly be guaranteed by the maximization of supplier involvement. With all the three types of data reception, interoperability problems (technical and/or organizational) with suppliers choices are suppressed. Retailer B and C had implemented an Extranet for SMEs involvement, whereas retailer A and D find Extranet too expensive.

### Adoption factors for global manufacturers

Table 2 presents main results issued from the 8 global manufacturers' case studies that have already adopted technologies to improve data synchronization concerning product information exchanges.

Global Manuf	Factors influencing electronic data exchanges adoption	Technological choices	Factors influencing technological choices
A	Data quality improvement (++) Productivity improvement (++) Buyer supplier efficiency improvement (++) Change management (-) Project costs (-) Pressures from retailers (+)	External catalogue	Stakeholder of an EMP proposing an external catalogue (++) Product information standardization (++) Manufacturers consortium to resist pressures (++) Outsourcing of technological complexity (++)
B	Data quality improvement (++) Productivity improvement (++) Buyer supplier efficiency improvement (++) ROI (--)	External catalogue, Extranet	Stakeholder of an EMP proposing an external catalogue (++) Product information standardization (+) Outsourcing of technological complexity (++)
C	Data quality improvement (++) Productivity improvement (+) Pressures from retailers and competitors (+)	Internal catalogue	Maturity of GDSN standard (--) Keep control on data (++)
D	Data quality improvement (++) Productivity improvement (+)	Internal catalogue	External catalogue costs (--) Maturity of GDSN standard (--) Keep control on data (++)
E	Data quality improvement (++) Productivity improvement (+) Pressures from retailers (+) Project costs (--)	External catalogue	Stakeholder of an EMP proposing an external catalogue (++) Product information standardization (+) Outsourcing of technological complexity (++) Connection with internal systems (--)
F	Data quality improvement (++) Productivity improvement (+) Buyer supplier efficiency improvement (+) Pressures from retailers (++) Project costs (--)	External catalogue	Manufacturers consortium to resist pressures (++) Product information standardization (+)
G	Data quality improvement (++) Productivity improvement (++) Buyer supplier efficiency improvement (+)	External catalogue	Stakeholder of an EMP proposing an external catalogue (++) Product information standardization (+)

	ROI (--) Change management (-) Pressures from retailers (+)		Outsourcing of technological complexity (++)
H	Data quality improvement (++) Pressures from retailers (++)	Internal catalogue	Internal data centralization (++) Keep control on data (+)

**Table 2. Adoption factors for global manufacturers.**

*Factors influencing the decision to adopt electronic data exchanges*

When we compare results of global manufacturers with those of retailers, we find several common points. Once again, perceived benefits issued from data integration are important factors influencing decision to adopt electronic exchanges of product information: Data quality improvement and productivity enhancement, and strategic benefits associated to a better efficiency of buyer/supplier relationships.

Similar perceived costs and risks are also considered in the decision process: project costs and ROI, dependent upon the critical mass of partners. Considerations about change management, with sales manager, are also taken into account. However, contrary to retailers, external pressures constitute a powerful determinant of electronic exchanges adoption. One manufacturer perceives pressures from its competitors, but main pressures are coming from retailers. These pressures are sometimes presented as direct demands from retailers, ut in most cases, indirect pressures from retailers, as anticipated pressures that will occur, have pushed manufacturers to adopt electronic data exchanges.

To summarize, “we face pressures from retailers, but if there were no benefits for the company, we are powerful enough to resist” (Manu A). Finally, similarly to retailers, perceived benefits issued from data integration are the factors that have the most influence on decision to adopt electronic data exchanges, and pressures from retailers accelerate decision making.

*Factors influencing technological choices*

Concerning technological choices, perceived benefits of the chosen technology are generally amplified with perceived risks and costs of non chosen technologies. For instance, external catalogues are chosen by manufacturers that consider internal catalogue do not allow to outsource technological complexity issued from standard evolution and interoperability. For some manufacturer, adopting an external catalogue is also a solution to create a consortium of manufacturers which will be powerful enough to refuse the development of one standard per retailer. On the opposite, internal catalogues are chosen by manufacturers who consider external catalogue as risky. Similarly to retailers, we find again organizational considerations that influence adoption of given technologies, such as being stakeholder of an electronic marketplace that has developed an electronic catalogue, or not being ready for interconnecting internal IS with external catalogue. However, new factors emerged. For instance, internal catalogue adoption is also driven by data control considerations or by developing technological capabilities that can be use both for external and internal data transactions.

**Adoption factors for SMEs**

Table 3 presents main results issued from the 8 global manufacturers’ case studies that have already adopted technologies to improve data synchronization concerning product information exchanges.

SME	Factors influencing electronic data exchanges adoption	Technological choices	Factors influencing technological choices
I	Pressures from retailers (++) Buyer/supplier efficiency improvement (+)	External catalogue	Only one data re-entering for all the retailers in the external catalogue (++)
J	Pressures from retailers (++) Data quality improvement (+)	External catalogue	Only one data re-entering for all the retailers in the external catalogue (++)
K	Pressures from retailers (++)	Extranet	Costs minimization (++)
L	Pressures from retailers (++)	Extranet	Costs minimization (++)
M	Pressures from retailers (++)	Extranet	Costs minimization (++)



**Table 3. Adoption factors for SMEs.**

Concerning SMEs, results are significantly different from global manufacturers. Most of them do not find perceived benefits in electronic data exchanges adoption and external pressure extremely constrains adoption of electronic data exchanges. Only two of the five SMEs perceive benefits (data quality improvement and better relationships efficiency) in electronic exchanges adoption. Logically, these SMEs decided to adopt an external catalogue, in order to realize external data integration, without internal data integration. Other SMEs have adopted Extranet, because it is the less expensive solution.

## DISCUSSION AND CONCLUSION

Concerning powerful firms, whatever they are initiators or not (Riggins and Mukhopadhyay, 1994), the results show that the decision to adopt electronic data exchanges is mainly driven by the perceived benefits of electronic data exchanges, and especially by the operational, direct benefits (Suomi, 1992; Iacovou et al., 1995). These benefits are issued from data integration (Zhu et al., 2006) and lead to productivity improvement (Cash and Konsynski, 1985) and data quality improvement (Iacovou et al., 1995). Moreover, they are all the more important when both internal and external integration (Truman, 2000) are realized and data integration can lead to strategic benefits such as buyer/supplier relationship efficiency improvement (Iacovou et al., 1995). Moreover, organizational and interorganizational considerations have not a strong influence on the decision to adopt electronic data exchanges. Even for manufacturers that act as followers, the results show that interorganizational pressures from initiators accelerate decision making but that perceived benefits are the key factors for electronic data exchanges adoption. Consequently, we can conclude that powerful firms adopt electronic data exchanges when perceived benefits are greater than perceived risks and costs. Concerning perceived costs and risks, main considerations are about project costs and ROI that are dependent upon the critical mass of partners with which integration can be realized (Iacovou et al., 1995).

P1: For firms that have market power, perceived benefits issued from data integration are the key factors that influence the decision to adopt electronic data exchanges.

Concerning their technological choices, it appears that powerful partners adopt a technology among those that promise to achieve the perceived benefits issued from data integration and that fits better to their organizational constraints. Indeed, as argued in the literature, perceived benefits have to be balanced with perceived costs and risks. Technological choices are influenced by the relative advantage of a technology compared to others, each of them having their own perceived benefits, costs and risks. In product information exchanges, relative advantages of Extranet, internal catalogue and external catalogue are compared in terms of critical mass of partners and value (research of complexity outsourcing, data standardization, data control keeping, internal data centralization). Moreover, organizational factors (Iacovou et al., 1995), such as financial capabilities to support technology implementation costs or technological capabilities available (re-use of an existing technology), generally reduce the set of technologies that allows to develop data integration. Indeed, organizational capabilities generally conduct to eliminate some technologies among the set of possibilities. Finally, external pressures are not so important for technological choices thanks to interconnections possibilities between different technologies (de Corbière and Rowe, 2010). Consequently, external pressures influence the decision to adopt electronic data exchanges rather than technological choices.

P2: For firms that have market power, relative advantage of technologies under organizational constraints drives technological choice.

Concerning SMEs, in accordance with extant literature, the coercive pressure from retailers has a strong positive influence on electronic data exchanges adoption. This is not an innovative result since literature has long emphasized that pressures from initiators with market power constitute a powerful determinant of IOS adoption for their business partners (Grover, 1993; Premkumar and Ramamurthy, 1995; Subramani, 2004). As argued by Iacovou, Benbasat and Dexter (1995), coercive pressures are sometimes the main IOS adoption factor, especially for SMEs.

P3: The smaller the firms, the more external pressures from business partners become the main factor that influence electronic data exchanges adoption.

Consequently, the two decisions are more intertwined than for powerful firms. Indeed, under network externalities issued from their business partners technological choices, organizational capabilities, and especially financial ones (Iacovou et al., 1995), conduct to adopt the technology. Indeed, if organizational capabilities are limited, SMEs select the less expensive technology, Extranet for product information exchanges. If their financial capabilities are sufficient enough, they can adopt a more sophisticated and expensive technology. For product information exchanges, they adopt external catalogues since these

ones lead to external data integration achievement thanks to their interoperability with all the technologies of retailers, even if they do not perform internal data integration from their internal systems.

P4: Under their business partners' pressures to develop their electronic data exchanges, technological choices of SMEs are mainly issued from financial capabilities considerations.

Whereas past literature considered IOS adoption as a whole, we can distinguish two phases in IOS adoption: electronic data exchanges adoption and technology adoption. The distinction is all the more important at the time of open standards based systems (Zhu et al., 2006) and intermediaries (O'Reilly and Finnegan, 2010) which provide more flexible opportunities for technology interconnections (de Corbière and Rowe, 2010). We have provided empirical evidence that factors influencing the two phases of adoption are different in magnitude but also in nature. Especially, external pressures have greater influence on electronic data exchanges adoption while organizational capabilities are more focused on the choice of a technology among a set of possibilities. Following our results, a powerful firm can exercise power, in a coercive or persuasive way (Hart and Saunders, 1997), to influence adoption of electronic data exchanges by its partners, without influencing their technological choices. Therefore, these partners can adopt the technology that better corresponds to their organizational capabilities and constraints and their perceived benefits. Contrary to previous IOSs, such as EDI, for which electronic data exchanges adoption meant that technological choices were made by the powerful firm, this one is less intrusive in its partners' choices.

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