

Micro-Firms Need to be Addressed Differently – an Empirical Investigation of IOS Adoption Among SMEs

Completed Research Paper

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Abstract

Inter-organizational information systems (IOS) play a critical role in today's organizations and their relationships with business partners. While large organizations began utilizing such systems since their dawn in the 1970's, SMEs have largely been reluctant to adopt and use these technologies. Given their relative commonness among enterprises, SMEs and micro-firms are particularly well suited to provide the critical mass of adopters needed to exploit network externalities exhibited by IOS. However, studies on adoption of IOS featuring micro-firms have remained scarce. Hence, a special focus on adoption decisions in micro-firms can be of great value to advance the understanding of IOS adoption. A survey is conducted on the influence of inhibitors on adoption of IOS for electronic invoice exchange among German SMEs and micro-firms. Several inhibitors are identified from extant literature restraining SMEs from adopting. In particular, results show that reasons restraining micro-firms are significantly different from reasons restraining larger SMEs.

Keywords: *inter-organizational information systems, open standards, micro-enterprises, micro-firms, inhibitors of adoption*

Introduction

The adoption and use of inter-organizational information systems (IOS) to conduct electronic business transactions across organizational borders can generate considerable business value for today's organizations (Loukis and Charalabidis 2012). IOS have existed for several decades (Robey et al. 2008) and were successfully utilized in numerous contexts such as electronic integration based on custom proprietary standards for electronic data exchange (EDI) (Masseti and Zmud 1996), electronic business-to-business (B2B) marketplaces such as Covisint for the automotive industry (Howard et al. 2006), or Internet-based ordering platforms such as the PharmX system for the pharmaceutical sector (Reimers et al., 2013). Extant literature defines IOS as information systems shared by two or more companies facilitating the creation, storage, transformation, and transmission of information across organizational boundaries (Johnston and Vitale 1988). Such IOS are characterized by two main parts being the content platform, transforming information between its internal organization-specific representation and a representation understandable by the IOS, and the delivery platform, transferring or delivering the content from one organization to another (Zhu et al. 2006a). In early IOS, the content platform as well as the delivery platform were proprietary (Venkatraman and Zaheer 1990). However, through the emergence of Internet-based content platforms (e.g. the Extensible Markup Language (XML) standard) and delivery platforms (e.g. electronic mail systems or file transfer protocol (FTP) systems) based on open standards (Hovav et al. 2004), IOS began to shift from using fully proprietary content and delivery platforms to the use of newer open and Internet-based platforms (Reimers et al. 2013; Zhu et al. 2006a).

Based on open standards for communication and business interaction, the goals of IOS shifted from reducing transaction costs and minimizing supply uncertainties through lock-in of suppliers with high asset-specific investments towards fostering interoperability between and supporting collaboration among organizations of any size by utilizing open standards to provide systems with low asset specificity (Zhu et al. 2006a). The lower financial entry hurdle made such open-standard IOS especially valuable for small and medium-sized enterprises (SME), which otherwise would not consider adoption of proprietary systems due to an unfavorable cost-benefit ratio (Kauffman and Mohtadi 2004).

Nevertheless, while large organizations already began utilizing IOS since their dawn in the late 1970's, SMEs have largely been reluctant to their use (Chwelos et al. 2001; Iacovou et al. 1995). This is especially troublesome for adoption and diffusion of open standard-based systems, as IOS are subject to high network effects, thus their value largely depends on the total number of adopters using them (Zhu et al. 2006a). More importantly, given their relative commonness among enterprises, with for example approximately 99,8% of all businesses being SMEs in the case of Europe (European Commission 2013), SMEs are particularly well suited to provide the critical mass of adopters needed to exploit network effects exhibited by open-standard IOS and foster their adoption and diffusion (Au and Kauffman 2001; Kauffman and Mohtadi 2004). However, being defined as businesses with less than ten employees and annual turnover of less or equal to 2 million Euro (European Commission 2005), micro-firms account for 92,1% of the total amount of European enterprises (European Commission 2013). This means that approximately nine of ten SMEs are actually micro-firms. Thus, a better understanding of the inhibitors restraining micro-firms from adopting open-standard IOS can be valuable to better explain adoption decisions of SMEs.

Research on the adoption of IOS has extensively investigated various factors influencing organizational adoption decisions, laying great emphasis on enablers of adoption (Robey et al. 2008). Furthermore, numerous studies such as Hong and Zhu (2006), Teo et al. (2006), Zhu et al. (2006b), and Zhu et al. (2006a) have investigated the adoption of open-standard IOS with a focus on SMEs. Recent studies further investigated the specific nature of open-standard IOS, with a respective focus on the growing influence of the business environment, business collaboration, and relational exchange on organizational adoption decisions (Christiaanse et al. 2004; Howard et al. 2006; Zhu et al. 2006a). However, studies explicitly featuring or at least mentioning the smallest of SMEs - the micro-firms - have remained scarce. Not surprisingly, the eight journals from the AIS Senior Scholars' Basket of Journals did not feature a single article in the last decade investigating the adoption of open-standard IOS with at least a partial focus on micro-firms. Nevertheless, studies on the adoption of IT suggest that in micro-firms, IT adoption decisions may significantly differ from those of larger SMEs (Qureshi et al. 2008; Wolcott et al. 2007), making micro-firms a primary target of research with the aim to better explain adoption decisions of SMEs.

Hence, a special focus on adoption decisions in micro-firms can be of great value to advance the understanding of the slow adoption and reluctant use of open-standard IOS by SMEs. Furthermore, while studies on IOS adoption have primarily focused enablers of adoption, studies focusing the inhibitors of adoption have been scarce. While this is in line with findings from general IS adoption literature (Cenfetelli 2004), investigating inhibitors to adoption of IOS, as opposed to the emphasis on enablers in extant literature, can lead to further valuable insights advancing the understanding of the motives for the slow adoption and reluctant use of open-standard IOS by SMEs.

By laying primary focus on open-standard IOS in the following, the goal of this study is to address the deficient focus on micro-firms in extant literature on adoption of open-standard IOS, to empirically investigate the role and unique features of micro-firms by examining inhibitors to adoption of open-standard IOS, and thereby to better understand the inhibiting forces restraining SMEs from adopting such systems. Thus, the main research questions guiding our investigation are:

RQ1: Which inhibitors can influence SMEs' and micro-firms' decisions to adopt open-standard IOS?

RQ2: How do inhibitors to the adoption of open-standard IOS differ in influencing adoption decisions in micro-firms compared to SMEs?

In the last decade, increasing numbers of European initiatives have been started to promote the digitalization of business communication and document exchange through the use of open-standard IOS, with the aim to reap financial benefits on national level and achieve sustainable development (European Commission 2010). One prominent example in this context are open-standard IOS for electronic invoice exchange (e-invoicing IOS), with the invoice being one critical document in business process chains with the highest potential for improvement (European Commission 2009). According to the European Associations of Corporate Treasurers, 243 billion Euro savings could be achieved across Europe by optimizing supply chains through e-invoicing IOS (European Commission 2009). Thus, a better understanding of the inhibitors restraining SMEs and micro-firms from adopting e-invoicing IOS is crucial to achieve these financial benefits.

To this end, a survey is conducted on the influence of inhibitors on the adoption of e-invoicing IOS among German SMEs and micro-firms. By choosing e-invoicing IOS as the research subject for our study, we first are able to further sharpen our approach by including general as well as more specific e-invoicing IOS literature in our research. By identifying inhibitors influencing adoption decisions of micro-firms and SMEs in extant literature, we further are able to identify a set of reasons restraining them from adopting e-invoicing IOS and thus answer **RQ1**. By analyzing the differences in the influence of the identified inhibitors on adoption between micro-firms and SMEs, we are then able to present empirical evidence suggesting that reasons restraining micro-firms from adoption of e-invoicing IOS significantly differ from those of larger SMEs, thus answering **RQ2**.

Identifying inhibitors to the adoption of open-standard IOS from extant literature

Research on adoption of open-standard IOS primarily utilizes the technology-organization-environment framework (TOE) (Tornatzky et al. 1990), which combines the environmental with the organizational and technological contexts into a single model, leading to better explanations of organizational adoption of open-standard IOS as technological innovations in contrast to organizationally or technologically driven models such as transaction-cost theory (TCE) (Williamson 1985), or diffusion of innovations theory (DoI) (Rogers 1962).

Technological context

The main inhibitor in the technological context of open-standard IOS adoption by SMEs relates to a lack of technology readiness, a factor described as encompassing technology infrastructure, relevant systems, as well as technical skills and IT professionals (Venkatesh and Bala 2012; Zhu et al. 2006b). Teo et al. (2006) describe a lack of IT expertise and infrastructure, as well as existing unresolved technical issues as inhibiting IS initiatives in organizations. Similarly, missing technology competence is described as a lack of firm IT infrastructure to support open-standard IOS-related business initiatives (Lin 2006). Several studies furthermore describe missing technology integration, being the extent of open-standard IOS usage and interoperability with other systems, as an important inhibitor to adoption of such systems (Hong and Zhu 2006; Zhu et al. 2006b). Finally, adoption costs of this technology can hinder organizations' intentions to adopt (Hong and Zhu 2006; Soliman and Janz 2004; Zhu et al. 2006b). Thus, we hypothesize that while larger SMEs possess higher amounts of slack resources, technology infrastructure, and IT expertise to achieve a needed level of technology readiness, especially micro-firms will suffer from conditions of resource poverty and missing expertise as a result of the small size and limited workforce (Premkumar and Roberts 1999). This leads to our hypothesis one:

H1: *The inhibiting influence of technology readiness will be significantly higher for micro-firms than for larger SMEs*

Organizational context

In the organizational context, three major inhibitors – managerial complexity, organizational inertia, and organizational uncertainty – can be identified in extant literature.

Managerial complexity is an inhibitor mostly described as a lack of a clear IT strategy towards adoption of open-standard IOS (Teo et al. 2006), as well as a lack of top management support towards the adoption of

such systems (Lin 2006; Soliman and Janz 2004; Teo et al. 2006). Furthermore, Teo et al. (2006) describe problems in project management to be able to inhibit the adoption of open-standard IOS. Similarly, Zhu et al. (2006b; 2006a) describe managerial complexity as the amount of existing managerial obstacles towards adopting such systems. Thus, we hypothesize that while managerial complexity in micro-firms will be minimal as a result of the limited available workforce, it will increase with the size of the organization. This leads to our hypothesis two:

H2: *The inhibiting influence of managerial complexity will be significantly lower for micro-firms than for larger SMEs*

Organizational inertia is an inhibitor related to problems of organizational change. Teo et al. (2006) describe organizational inertia as difficulties in organizational change pertaining to changes in corporate culture, organizational structure or redesigning business processes. As the adoption and integration of open-standard IOS is likely to affect the structure of the organization, it thus can have an influence on an organization's decision to adopt such a system. Similarly, Hong and Zhu (2006) describe organizational inertia as being based on resistance to change and the degree of entrenchment with existing systems and infrastructure. Howard et al. (2006) further portray organizational inertia as being based on internal organizational resistance. Thus, similarly to the inhibiting influence of managerial complexity, we hypothesize that organizational inertia in micro-firms will be minimal as a result of the only limited workforce available, while it will increase with the size of the organization and the amount of employees. This leads to our hypothesis three:

H3: *The inhibiting influence of organizational inertia will be significantly lower for micro-firms than for larger SMEs*

Organizational uncertainty is an inhibitor described by Teo et al. (2006) as being based on fears of opening corporate systems to suppliers and customers, as well as uncertainty about achieving a critical mass of business partners and customers when adopting open-standard IOS. Venkatesh and Bala (2012) further emphasize standards uncertainty in this context as the reluctance to adopt particular systems when the future and pervasiveness of the underlying standards is unclear. Similarly, Zhu et al. (2006a) emphasize concerns about data security and privacy on the Internet as being related to organizational uncertainty. Soliman and Janz (2004) share these concerns on data security and additionally describe concerns about network reliability as related to organizational uncertainty. Thus, we hypothesize that while in larger organizations, more resources can be devoted to manage active information search and processing to address organizational uncertainty, micro-firms can suffer a higher organizational uncertainty as a result of their limited information search and processing capabilities. Furthermore, as a result of only limited financial resources available in micro-firms, they will be more affected by organizational uncertainty about achieving a critical mass of business partners and customers. This leads to our hypothesis four:

H4: *The inhibiting influence of organizational uncertainty will be significantly higher for micro-firms than for larger SMEs*

Environmental context

In the environmental context, major inhibitors of open-standard IOS adoption for SMEs relate to characteristics of the regulatory environment, as well as to characteristics of business partners.

Regulatory environment-specific characteristics are not pertinent to any particular organization. These factors mirror the legal frameworks for economic interaction of all actors alike, irrespective their specific affiliation. Teo et al. (2006) describe the presence of unresolved legal issues such as unclear legal landscapes and differing laws across different countries as a major characteristic hindering organizational open-standard IOS adoption by SMEs. Zhu et al. (2006b) further highlight the importance of the regulatory environment and the degree of its benevolence and support towards the diffusion of these systems within its legal borders as an important characteristic of the regulatory environment influencing adoption. Similarly, Zhu et al. (2006a), describe the presence of legal barriers as a possible inhibitor of open-standard IOS adoption. Thus, we hypothesize that while the regulatory environment they operate in equally affects enterprises of all sizes, micro-firms will be more affected by unclear and complex regulatory framesets as a result of their limited information search and processing capabilities. This leads to our hypothesis five:

H5: *The inhibiting influence of an unclear and complex regulatory environment will be significantly higher for micro-firms than for larger SMEs*

Business partner-specific characteristics encompass factors that characterize business partners of a focal organization according to their technological and organizational contexts. Lin (2006) characterizes business partners according to their IT-readiness, general IT-expertise, and their extent of open-standard IOS use, and analyses the influence of these characteristics on organizational adoption of open-standard IOS by a focal firm. Venkatesh and Bala (2012) lay special focus on business partners of a focal organization and describe business partners' process compatibility, standards uncertainty, and technology readiness as important business partner characteristics having synergistic effects on a focal organization's decision to adopt open-standard IOS. Similarly, Son et al. (2008) investigate suppliers' IT-capability and suppliers' perceived benefits as characteristics influencing a focal organization's decision to adopt such systems. Thus, we hypothesize that while larger SMEs are in general less dependent on their suppliers as a result of their greater market share and higher amounts of available resources, micro-firms will be more affected by the inhibiting influence of their business partners' characteristics such as a lack of business partners' technology or organizational readiness. This leads to our hypothesis six:

H6: *The inhibiting influence of a lacking business partner readiness will be significantly higher for micro-firms than for larger SMEs*

Identifying SME-specific inhibitors to the adoption of open-standard IOS

In general, limited information search and processing capabilities (Thong and Yap 1995), limited financial resources and workforce, as well as missing or inadequate IT expertise (Premkumar and Roberts 1999), together result in a number of challenges which have to be overcome by SMEs in order to successfully adopt and use IT technologies such as open-standard IOS (Wolcott et al. 2007).

In the context of open-standard IOS adoption by SMEs, the lack of awareness of this technology's existence is an often-cited inhibitor. In the case of e-invoicing IOS, Edelmann and Sintonen (2006) describe this as the amount of information that the organization has regarding its external environment, which in turn is able to stimulate a need to adopt the innovation. Similarly, Juntumaa and Oorni (2011) describe a lack of specific information from external sources resulting from only limited information processing capabilities as inhibiting the adoption of e-invoicing IOS by SMEs. Furthermore, Arendsen and van de Wijngaert (2011) take a similar path and describe innovativeness as the extent of the organization's active search for new ideas, with the lack thereof hindering adoption. Thus, we hypothesize that while larger SMEs have access to a larger amount of external sources for searching specific information and increasing their awareness, as well as possess a higher amount of employees to conduct an active search, micro-firms will have a significantly lower awareness of the innovation resulting from the limited resources available to them. This leads to our hypothesis seven:

H7: *The inhibiting influence of a lack of awareness of the technology will be significantly higher for micro-firms than for larger SMEs*

Additionally, while awareness of an innovation is the first step towards the formation of a decision to adopt or reject it, an organization has nevertheless to acquire an adequate amount of domain knowledge and know-how about the innovation to be able to make an informed decision (Edelmann and Sintonen 2006). Arendsen and van de Wijngaert (2011) describe domain knowledge to be an important factor with the ability to influence adoption decisions of SMEs. The lack of know-how and domain knowledge is further described as resulting in difficulties with the selection of a specific solution, as well as with integrating it into existing business processes (Legner and Wende 2006). Thus, we hypothesize that by having access to more resources and external sources, larger SMEs will have fewer problems in acquiring needed domain knowledge, while micro-firms will encounter more difficulties. This leads to our hypothesis eight:

H8: *The inhibiting influence of a lack of domain knowledge and know-how will be significantly higher for micro-firms than for larger SMEs*

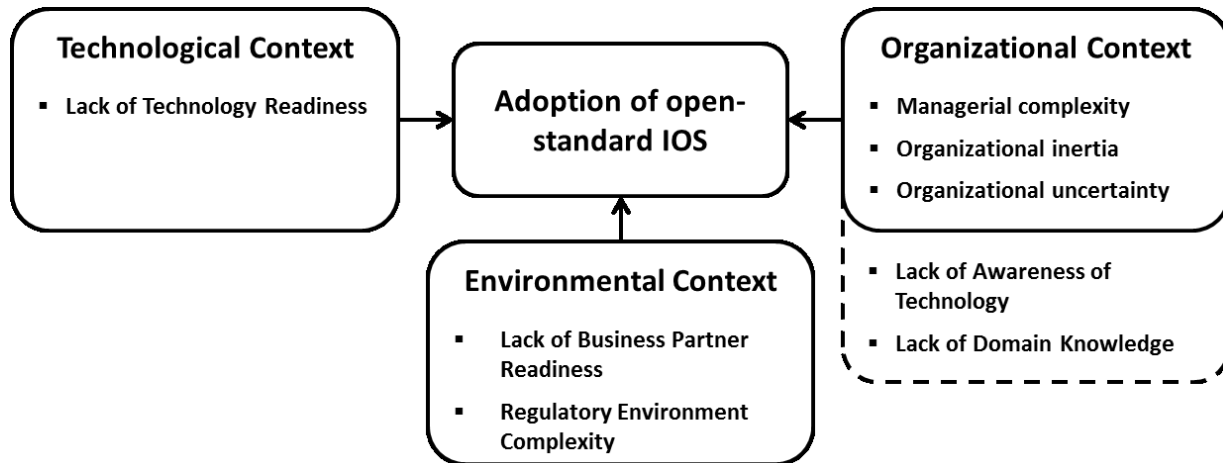


Figure 1: Inhibitors identified in extant literature on adoption of open-standard IOS

In total, eight inhibitors could be identified in extant literature as shown in Figure 1, leading to eight hypotheses towards the adoption of open-standard IOS by SMEs.

While six inhibitors could be derived from extant literature on adoption of open-standard IOS, a specific focus on the adoption of e-invoicing IOS by SMEs helped to identify two additional inhibitors in the organizational context, being a lack of awareness of the technology as well as a lack of domain knowledge and know-how towards the technology.

Methodology

The conducted survey was addressed at organizations as potential recipients of electronic invoices. It was distributed together with actual paper-based invoices. The survey was circulated for a period of four weeks, which resulted in approximately 5000 sent questionnaires. The respondents were asked to return the survey either by mail or by fax, resulting in 735 replies mainly from accountants or financial managers. The language of the questionnaire was German as have been all recipients of the study. The survey was divided into two main parts: control variables and a split ballot. Control variables contained industry type, the number of employees as a measure of firm size, as well as the number of received invoices per year and the percentage of electronically received invoices. While the former part was intended to draw a picture of the given sample, the latter focused on the adoption of e-invoicing IOS. As mentioned above, the second part was a split ballot where the respondents had to decide whether they want to receive electronic invoices in the future or not. In the case of a negative reply, they were further asked to give reasons for their non-adoption. Each of the inhibitors identified from extant literature, corresponding to a specific reason for non-adoption, was coded into one item for measurement. Our eight measurement items with the according references can be seen in Table 1. The survey had to be rather short, as it was distributed as a part of an actual invoice mailing, which restricted our space to one page. On the other hand, the short survey set a low response barrier for the respondents and was perceivably beneficial for the overall response rate.

Results

All of our participants are SMEs and reside within Germany. The vast majority of the firms can be allocated towards the industry type of crafts and trades. The average company in this sample has six employees and receives around 250 invoices per year with only 2% of them by electronic means. The sample profile of the surveyed participants consisted of a randomly chosen subset of the partnering firm's customers with the aim to create a sample closely reflecting the firm's customer structure. Table 2 displays the categorization according to firm size for both sample and subsamples. The total sample includes 735 responses, 436 of them belonging to micro-firms and 299 to SMEs. The median size of the former group is three employees while it is 20 for the latter group.

Inhibitor	Corresponding Measurement Item	Source
I1: Lack of Technology Readiness	Q1: Insufficient IT knowledge	Legner/Wende 2006; Teo et al. 2006; Penttinen/Hyytiäinen 2008
I2: Managerial Complexity	Q2: Reservations from executives	Soliman/Janz 2004; Lin 2006; Teo et al. 2006
I3: Organizational Inertia	Q3: High change management effort	Edelmann/Sintonen 2006; Legner/Wende 2006; Bertelè/Rangone 2008; Penttinen/Hyytiäinen 2008
I4: Organizational Uncertainty	Q4: Security concerns	Soliman/Janz 2004; Teo et al. 2006
I5: Regulatory Environment Complexity	Q5: Legal concerns	Legner/Wende 2006; Bertelè/Rangone 2008; Agostini/Naggi 2010
I6: Lack of Business Partner Readiness	Q6: Reservations from business partners	Teo et al. 2003; Edelmann/Sintonen 2006
I7: Lack of Awareness of Technology	Q7: Theme of e-invoicing not yet tackled	Edelmann/Sintonen 2006; Arendsen/van de Wijngaert 2011; Juntumaa/Oorni 2011
I8: Lack of Domain Knowledge	Q8: Insufficient Know-how of e-invoicing	Edelmann/Sintonen 2006; Arendsen/van de Wijngaert 2011

Table 1: Measurement Items

The sample can be further divided into adopters and non-adopters, as mentioned in the prior section. For both subsamples, the adoption rate is quite similar with 19% for micro firms and 21% for small and medium sized firms, which is reflected by the performed chi-squared test ($X^2 = 0.398$, $p = 0.528$).

	Sample Size	Median Size	Adopters	Non Adopters	Adoption Rate
Micro Firms (<10 Employees)	436	3	81	355	19%
Small and Medium Firms (10 to 250 Employees)	299	20	62	237	21%
Total Sample	735	6	143	592	20%

Table 2: Sample Profile

The investigation of the inhibitors between both subsamples is divided into two parts. First, the relative importance of each inhibitor was measured in a descriptive manner and can be seen in Table 3. For further insight, we utilized a chi-squared test for each of the eight hypotheses **H1-H8** to test for significant differences between the two subsamples.

Hypothesis	Micro Firms	Small/Medium Firms	Total	X ²	p	H-Support
H1: Lack of Technology Readiness	9%	5%	7%	4.475	0.034	★
H2: Managerial Complexity	10%	16%	12%	3.499	0.061	
H3: Organizational Inertia	18%	24%	20%	3.495	0.062	
H4: Organizational Uncertainty	13%	14%	13%	0.115	0.735	
H5: Regulatory Environment Complexity	15%	7%	11%	9.232	0.002	★★
H6: Lack of Business Partner Readiness	3%	4%	3%	0.856	0.355	
H7: Lack of Awareness of Technology	42%	32%	37%	6.107	0.013	★
H8: Lack of Domain Knowledge	19%	11%	15%	5.954	0.015	★

*: $p < 0.05$; **: $p < 0.01$; ***: $p < 0.001$

Table 3: Results

The descriptive results draw a picture of differing relative frequencies across the surveyed items. Some results seem to be pretty similar, like the lack of business partner readiness as well as the degree of organizational uncertainty, which do show almost identical amplitudes for both subsamples. However, the other inhibitors display significant differences among micro-firms and SMEs. While technology readiness is expected to be more of an issue in smaller firms according to extant literature, especially the lack of awareness and domain knowledge and the complexity of the regulatory environment show a significantly higher inhibiting effect on micro firms. Furthermore, according to our results managerial complexity and organizational inertia are more pressing issues for larger firms.

We hypothesized a difference between the subsamples and no difference as the null hypothesis, correspondingly. We applied a chi-squared test for each hypothesis. The null hypothesis could be rejected for **H1**, **H5**, **H7**, and **H8**. The hypothesis tests confirm some of the assumptions from our descriptive results. We found, that technological readiness, environmental complexity, awareness, and domain knowledge differ significantly between both subsamples. Noteworthy, all of these confirmations deal with inhibitors that seem to be more important for micro-firms. However, it was not possible to reject the alternative hypothesis for the remaining inhibitors.

Discussion

The empirical results of our survey lead to several findings. First, while on the surface, both groups look quite similar according to their adoption rate, by analyzing the descriptive importance of the inhibitors in the two subsamples, we find that micro-firms primarily seem to lack awareness of the e-invoicing technologies (**H7**), do not possess needed domain knowledge and expertise in this context (**H8**), and therefore seem to expect a high change management effort in adopting e-invoicing IOS (**H3**). On the contrary, while SMEs also seem to lack awareness of the e-invoicing technologies (**H7**), they are primarily concerned with issues of organizational inertia (**H3**), as well as managerial complexity (**H2**).

By further analyzing differences in the influence of the identified inhibitors on the decision to not adopt e-invoicing IOS between micro-firms and SMEs, we find that particularly lacking awareness of e-invoicing technologies, a lack of domain knowledge in this context, the complexity of the regulatory environment as well as a lack of technology readiness significantly stronger influence non-adoption decisions of micro-firms than decisions of SMEs. On the contrary, decisions of SMEs seem to be influenced more by issues of managerial complexity and organizational inertia than decisions of micro-firms (however, statistical support for hypotheses **H2** and **H3** could only be gained on a $p=0,07\%$ significance level).

These results emphasize the difference in the inhibiting forces, which restrain SMEs and micro-firms from adopting e-invoicing IOS. This is in line with general conceptions on the limitedness of resources in SMEs, and suggests that while micro-firms do not possess the resources and capabilities to search for information and build-up domain knowledge and expertise on e-invoicing technologies, larger SMEs seem to handle this task better, but are caught up in increasingly complex management activities as a result of a bigger organizational size.

Furthermore, the lack of business partner readiness, with network effects being a major driver especially for smaller firms to adopt e-invoicing IOS (Teo et al. 2003), is perceived as an inhibitor of adoption only by a 3-4% minority of respondents, despite the continuing reluctant use of e-invoicing IOS by SMEs. A possible explanation for this finding is that as a result of low awareness of e-invoicing technologies, and lacking domain knowledge and expertise micro-firms are restrained from clearly seeing and realizing benefits connected with adoption of e-invoicing IOS, which ultimately leads them to expect a high change management effort connected with adoption.

Consequently, on national level, it is essential to actively support especially micro-firms in building up awareness of and domain knowledge on e-invoicing technologies by actively informing them and by clarifying the potential benefits that can arise through electronically receiving invoices to increase their awareness of the technology as well as their domain knowledge in this area. Similarly, incentives could be placed to help micro-firms overcome financial constraints and resource limitedness. Simultaneously, SMEs should receive help primarily to overcome issues of managerial complexity and organizational inertia, which could be achieved by informing executives of potential benefits of e-invoicing technologies as well as by promoting e-invoicing solutions, which foster the implementation of clear and transparent business processes.

Limitations and Further Research

As with any study, this research has several limitations. First, as our study focused on the investigation of differences in inhibitors of open-standard IOS adoption by SMEs and did not attempt detailed construct measurements or causal construct inference, the measurement of the identified inhibitors to open-standard IOS adoption was based on single items only. However, while this study can be regarded as a first step towards a better understanding of open-standard IOS adoption by SMEs, further research should investigate the identified constructs with causal models in more detail to further validate these findings. Second, our approach concentrated on a specific set of inhibitors reflecting those discussed in extant literature. However, our investigations show that this list is far from being complete. Thus, future studies may reveal further inhibitors using exploratory analysis techniques. Third, even if we were able to ask a large number of SMEs, our sample focuses on recipients of invoices only, mainly belonging to the manufacturing industry. Future research should therefore investigate inhibitors of e-invoicing senders as well as investigate potential differences across industry sectors.

Conclusion

The adoption of inter-organizational information systems plays a crucial role in today's connected societies; unfortunately many SMEs and especially micro-firms are still reluctant adopters despite the potential benefits by an IOS. While the reluctance of SMEs has been the focal point of several studies, the drivers and inhibitors of micro-firms have not been tackled in the same extent. With our conducted study, we helped to shed some light on the inhibitors of IOS adoption, and particularly emphasized the differences in adoption decision-making between SMEs and micro-firms. To sum up, several inhibitors were identified that restrain SMEs from adopting e-invoicing IOS, but the relative importance of each inhibitor varies with firm size. In particular, the reasons restraining micro-firms from adopting e-invoicing IOS are significantly different from reasons of larger SMEs and therefore micro-firms should be addressed differently.

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