

Adoption Determinants of Xml-Based Invoices: an Exploratory Investigation

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Abstract

The digitalization of all business processes along the supply chain is a crucial method for cutting down administrative costs, improve productivity, and achieving transparency. One major business document being exchanged in almost any business transaction in the invoice. Electronic invoices are of great potential especially when automatically processing structured data (e.g., XML data). We conducted a qualitative study to understand the adoption determinants of XML-based invoice standards. Therefore, we analyzed interview material and organized the results in the technological, organizational, and environmental (TOE) framework. Within the technological element the simple XML special characteristics play a crucial role for its adoption. The organizational element is characterized by internal aspects like monetary and technical resources as well as available knowledge and expertise. Network effects and competitive pressure are adoption determinants set exogenous and are depicted in the external task environmental element.

Keywords: Electronic invoice, XML-based invoice standard adoption, critical success factor, qualitative study, expert interview

1 Introduction

The automated creation and procedure of electronic invoices (e-invoices) increase the efficiency of invoice business processes and is seen as a key factor for an economic growth for large as well as for small and medium sized organizations (Cuylen et al. 2012). An e-invoice can be received, transmitted and processed digitally which leads to no media discontinuity and thus optimizes and streamlines the business process. Legal requirements and the lack of knowledge how to deal with e-invoices were only some challenges to initiate the e-invoice process.

In Germany, the law of Simplifying Tax in 2011 with the objective of equal treatment of paper and e-invoices and a lot of effort and enlightenment of the government, the European Union (EU) as well as independent organizations are reasons for the debate about e-invoices and their acceptance. Many transmission protocol, structure data formats and standards are used for the data exchange (Kuehne et al., 2015). This involves many challenges for the adoption and acceptance since the effort is high to unify the business processes of invoice procedure.

E-invoices do not only save time and money but also protect the environment by using less paper and avoiding the actual transportation. Organizations rethink their behavior on the environment and owning therefore a positive aspect at the side of the employees (Base ware, 2012). The key advantages can be realized when the e-invoice is not only an electronic document, like a PDF file sent via e-mail but rather when structured data sets, e.g., EDIFACT (Electronic Data Interchange for Administration, Commerce and Transport) or XML (Extensible Markup Language) are used.

Larger organizations are more likely to adopt e-invoices and play a pioneering role in initially persuading their large business partners and thereafter also their smaller business partners follow suit (Koch, 2016). Nevertheless, the expected market penetration for 2017 in the B2B sector differs from country to country with the highest rates of more than 40% in Denmark, Finland, Norway, Sweden, Estonia, Brazil, Chile and Mexico (Koch, 2017). In Germany, 46% of the organizations prefer to send e-invoices and even 53% of the organizations prefer to receive invoices in an electronic format (Seidenschwarz et al., 2017). This implies much room for improvement since the majority of organizations have not adopted e-invoices.

The vision of the German Federal Ministry for Economic Affairs and Energy is that the market provides software and information systems to support e-invoices like the already established electronic banking transactions. However, a uniform standard is a key requirement for adoption of e-invoices (Haug, 2016). An XML-based standard, developed in Germany of the organization FeRD (Forum fuer elektronische Rechnung Deutschland "Forum for electronic invoicing Germany") is the "ZUGFeRD" (Zentraler User Guide des Forums elektronische Rechnung Deutschland) standard. The forum has the task and target to support the acceptance and adoption of e-invoices. For that reason they have elaborated one standard which can be used easily by any organization (FeRD, 2017). Another example is "Finvoice" (also XML-based), which is a frequently used standard in Finland for B2B, B2C and B2G transactions related to bank transactions (Finvoice, 2015). Another format is EDIFACT, which is part of the well-established EDI (Electronic Data Interchange). It includes not only invoices but also orders and other business documents along the entire supply chain. EDI is especially prevalent within value added networks because the data is only machine-readable and can therefore be processed at high speed. Thus, EDI is not affordable for every organization and not worthwhile for every business relationship due to high implementation and transmission costs (Balsmeier & Borne, 1995; Kabak & Dogac, 2010). To involve any company, an easier standard with fewer contractual agreements and lower investment is necessary. Therefore, an XML-based invoice might be suitable for business transactions and shows frequently application for example ebInterface (national standard in Austria) or UBL (universal business language developed for and with participants of various types of industries and businesses). From this background, the following central research question of this paper is derived:

What are the adoption determinants of XML-based invoice standards?

2 Literature Review

Much discussed in scientific literature is the adoption of e-invoices in general. Many challenges and barriers are identified to be factors for the non-adoption of e-invoices in Germany (Mai & Meyer, 2010). Often the advantages like cost saving, more accurately procedure, higher transparency, cutting lead times and efficient business processes are not evaluated very high so that many organizations are not willing to modify their invoicing processes (Haag et al., 2013; European Commission, 2010). In addition, the adoption is associated with costs, especially with creation and procedure of structured data like XML. Software and IT systems are required, which is not available in any organization (Koch, 2016; Bernius et al., 2013).

Research in the field of e-invoices or EDI in general has been carried out for several decades. Most research studies address e-invoice performance and national diffusion (Edelmann & Sintonen, 2006; Hernandez-Ortega & Jimenez-Martinez 2013), influence factors (Penttinen et al. 2009; Haag et al. 2013), or EDI adoption (Iacovou et al., 1995; Chau & Hui, 2001). For example, in 1995 Delhaye & Lobet-Maris focused on EDI and open standard adoptions as well as standard message choice pointing out that coordination and cooperation structure are the most relevant factors for EDI adoption.

Iacovou et al. (1995) considered small and medium sized enterprises and studied their EDI adoption behavior. Organizational readiness, external pressure and perceived benefits are identified adoption determinants. In 2003 Zhu et al. developed a conceptual model to study the adoption of electronic business in general. Edelmann & Sintonen (2006) have studied the reasons for the slow adoption rate of general e-invoices by small and medium sized organization in Finland. Their identified reasons are, e.g., perceived uncertainty or business partner using no e-invoices. A further study but focusing on open standard adoption is the paper of Zhu et al. (2006). They developed a conceptual model and showed that network effects, expected benefits and adoption costs are the main reasons for a standard diffusion. A further study in Finland is published by Penttinen & Hyytiäinen (2008). They studied factors which affect the adoption rate using a qualitative research method. In the Netherlands, Arendsen & Wijngaert (2011) have studied the impact of the government as a launching customer on e-invoice adoption and showed that organizations doing business with governmental organizations are more likely to adopt e-invoices.

Juntumaa & Öörni (2011) showed with their study that a positive attitude towards adoption and an intention to adopt e-invoices are not sufficient for an overall adoption. Hernandez-Ortega (2012) has studied the Spanish market and came to the conclusion that organizations working already with IT and digital business documents will adopt e-invoices faster. However, the highest rated key factors are perceived usefulness and compatibility. Hernandez-Ortega & Jimenez-Martinez (2013) concentrated on performance of organizations which regularly use e-invoices. They explained a successful use of e-invoices by a general IT affinity of organizations and resulting habits to work with digital business processes. One explorative study concentrating on XML-based standard succeed is published by Kuehne et al. (2015). They addressed internal as well as external adoption determinants like for instance the available portfolio of documents in the format or the current market situation. Kreuzer (2017) studied the German market using empirical data of 126 business small and medium sized organizations. He pointed out that coercive pressure and degree of technology readiness are the most important influence factors of e-invoice inter-organizational information systems adoption.

3 Research Design and Data Collection

Since little research has been carried out on XML-based invoice standards, we undertook a qualitative exploration to identify influence factors of an adoption in this field. As qualitative methods are able to provide deep insights into organizational contexts and especially for new or unknown areas (Palvia et al., 2003), they are also useful for analyzing the adoption of XML-based invoice standards. Interviews with every age and social group are a typical instrument of data collection in empirically-oriented business sciences. Such interviews are widespread and mostly modelled as guided interviews. Preparation of guided interviews requires time, quality and a certain knowledge level of the interviewer. We developed a structured list of questions to study critical factors of XML-based invoice standard adoption. The experts were from diverse organizations and had a wide knowledge of the adoption of XML-based invoices. The experts were contacted by visiting the large computer fair CEBIT 2016 in Hannover, thereby permitting personal interviews. With the permission of the expert in question, each interview was recorded and the recorded file was used for transcription. These were assessed in accordance with the structured content analysis of Mayring (2014). Table 1 presents an overview of the participants.

The Technology – Organization – External Task Environment (TOE) frame work developed by Tornatzky & Fleischer (1990) serves as deductive categories for the interview analysis and interpretation. We decided to use this model due to its frequently application in empirical research of business process standard adoption (e.g., Kreuzer et al., 2014), EDI standard adoption (e.g., Premkumar et al., 1997), and e-business adoption (Zhu et al., 2006). It is useful to cluster and organize factors influencing the adoption of an innovative technology (in our case XML-based invoice standards). The technology element contains the relevant technologies of an organization (internal as well as external) to adopt an innovation. The organizational element, however, describes the internal situation and characteristics of an organization. The last element (external task environment) cannot be influenced by the organization and is set exogenous. All three elements together describe the restrictions and chances of a technological innovation, such as an XML-based invoice standard.

For the tool-based content analysis, the MAXQDA software was applied. The uploaded text material provided an opportunity to define the deductive categories accurately in accordance to the TOE-model and add a category description. Through the appropriated coding of the deductive categories, a paraphrase and a generalization for every code was formulated. The paraphrases structured the code by shortening and reforming the quotations of the experts. The generalization formulated a general statement for every paraphrase.

In some cases it was possible to summarize two or more paraphrases to one generalization and thus to form the adoption determinant. Table 2 provides an extract of the definition, code, paraphrase and generalization.

4 Discussion of Results

We enhanced the traditional TOE-model with our specific adoption determinants of XML-based invoice standard. Since we use the TOE-model for our empirical investigation, the results of the expert interviews are organized according to the same pattern.

4.1 Technology

The technology element of the model describes the characteristics of an innovation, which in our case represent the characteristics of an XML-based invoice standard. For instance, the German-designed ZUGFeRD standard is one hybrid standard, which integrates XML data based on UN/CEFACT CII into a PDF (FeRD, 2017).

By way of a combination organizations are able to conduct transactions with both business partners who implemented IT-systems to process the XML data as well as business partners who are unable to process the structured data and just use the invoice image (the PDF file). This approach unifies the process and increases productivity as well as raises the rate of adoption by business partners as a whole (Experts 1; 2; 5). Furthermore, an XML-based standard is simply applicable and transferable to further business documents (e.g., order confirmation or delivery notification) due to its clear syntax and interchangeability of elements. This allows setting this format as a standard. The XML code is machine-readable and is also easily comprehensible for humans due to the text format, even though this is not necessary when it comes to an automated process. The creation as well as the interpretation of XML files are basic functions of current software and are very common among employees in IT departments and is a well-known language (Bohannon et al. 2002), as also confirmed by the majority of our experts. One specific characteristic of XML-based invoice standards is the possibility to develop interfaces to others systems and standard software. Since the complexity of an invoice standard in general is a critical factor for its adoption (Chen et al. 2003; Jeyaraj et al. 2006; Penttinen & Hyytiäinen 2008), the simplicity of an XML-based standard permits an easy integration into current systems. All of our six experts have mentioned the simplified manageability of XML files and thus its suitability to use this format for an invoice exchange.

4.2 Organization

An XML-based invoice standard provides the opportunity of a simple solution of an invoice exchange. However, organizations must invest effort and money to implement and realize the electronic processing. The four experts from organization using already XML-based invoices explain that they have the technical expertise and knowledge in IT so that a successful adoption was possible (Experts 1; 2; 4; 6). But they also point out that some organizations have no IT in use and thus show now willingness to adopt XML-based invoices since they need interfaces to process the data automatically. The experts all agree that in times of digitalization more IT landscape and diverse systems become available and affordable to all kind of organizations (in terms of size and industry) which leads to a simple integration possibility of XML-based invoices. Some experts (2; 4; 6) mentioned that much monetary effort is necessary especially when the entire business process has to be modified and new IT architecture has to be implemented. Working already in digital environment and with IT systems reduces the monetary necessary resources and is therefore a significant adoption determinant for an XML-based invoice exchange. It thereby promotes the adoption rate of XML-based invoice standards. One additional aspect in this respect is that some organizations do not handle enough invoices and therefore avoid an electronic procedure. The effort is evaluated as too high in comparison to the processed low number of invoices (Experts 1; 2; 4; 6). Sufficient high volumes of invoices thus increase the adoption rate of XML-based invoices.

4.3 External Task Environment

Every organization also has external circumstances which may determine the adoption of XML-based invoice standards. Much discussed in studies on innovation adoption (e.g., EDI adoption) are the network effects. If enough business partners use one specific standard, the organization is more likely to follow and adopt the same standard (Zhu et al., 2003; Zhu et al., 2006; Haag et al., 2013). Our experts agree to this statement. They all pointed out that many organizations are skeptical as long as they have not many business partners who use the same XML-based invoice standard. The more user an XML-based standard has, the more organizations are likely to adopt it, too. This represents one of the largest adoption determinants of an XML-based invoice standard. A standard always needs pioneers who start to dispatch or even send requests for the invoice receive.

This can not only occur by organizations but rather public authorities should also be involved and implement processes for an XML-based invoice exchange for a successful adoption.

5 Limitations and Outlook

Reflecting the preliminary nature of our exploratory study, our investigation has some limitations that offer interesting future research directions. A desirable benefit of the chosen design of our study is the ability to isolate particular factors of interest, however, a weakness of the research design is its inability to truly capture other dynamic processes concerning the adoption of XML-based invoice standards within a complex organizational environment and its interfaces with the external environment. Future research should employ other research methods (e.g., a quantitative investigation) in order to provide a triangulation with the presented findings.

Furthermore, the study was only conducted with German experts; for that reason cross-national studies to achieve higher level of the generalizability of the results are recommended. Such studies may provide new insights into the diffusion, adoption, and use of XML-based invoice standards.

6 Conclusions

Although recent studies mentioned standard adoption in general, academic research do not properly consider XML-based invoice standard adoption and their determinants. To shed light on this issue, we set forth to answer the question: What are the adoption determinants of XML-based invoice standards? In this context, we have conducted a qualitative study to identify factors that are relevant not only from the perspective of current research but also from practice. We depicted our results in the TOE framework. Within the technological element the simple XML specific characteristics play a crucial role for the adoption of XML-based invoice standards. The organizational element is characterized by internal aspects like monetary and technical resources as well as available knowledge and expertise. Network effects and competitive pressure are adoption determinates set exogenous and are displayed in the external task environmental element. By identifying the underlying mechanism and boundary conditions of XML-based invoice standard adoption, our study serves as a basis for future research in this important and growing area of research. Our study demonstrates a well-founded framework for a successful adoption of XML-based invoices in organizations and additionally provides a basis for future research.

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Tables and Figures

Table 1: Overview of the interviewed experts and relevant data

Expert	Organization size	XML-based standard in use	Experts position	Industry	# codes ¹
1	SME	yes	CEO	Software Provider	18
2	SME	yes	CEO	Management Consulting	20
3	SME	n/a	Member of Standardization council	Public Organization	15
4	SME	yes	Head of research & development	Software/Service provider	11
5	SME	n/a	Advisor	Government Institution	10
6	SME	yes	Consultant	Software/Service provider	9

Table 2: Overview of the interviewed experts and relevant data

Category	Definition	Code	Paraphrase	Generalization
Technology	current situation of IT systems, standardization, XML characteristics	XML is a long established and well know language. It is future-oriented and can be used for any business document exchange, like PDF. Combining both is also an opportunity.	XML is a suitable technology for business document exchange	XML is an easy language to exchange structured business documents.
Organization	Internal factors such as monetary and technical resources, number of processed invoices, internal knowledge	The organization which is sending XML-based invoices has to make sure that the standard requirements are fulfilled and that is a lot of work and effort. It always sounds easy but in reality there is much technical effort to realize it.	Sending XML-based standards requires technical knowledge and needs effort in preparation phase.	Technical knowledge and expertise is a prerequisite for XML-based invoice standard exchange.
External Task Environment	External factors such as legal requirements, business partner etc.	If you want to become successful in electronic procedure then you always need business partners supporting you how to send XML-based invoices in the preferred standard.	Business partner who support and provide opportunities to create and send XML-based invoices is useful.	Business partners' support increases the adoption of XML-based invoice standards.

¹ Codes can be understood as statements or interpretations of segments of the interview

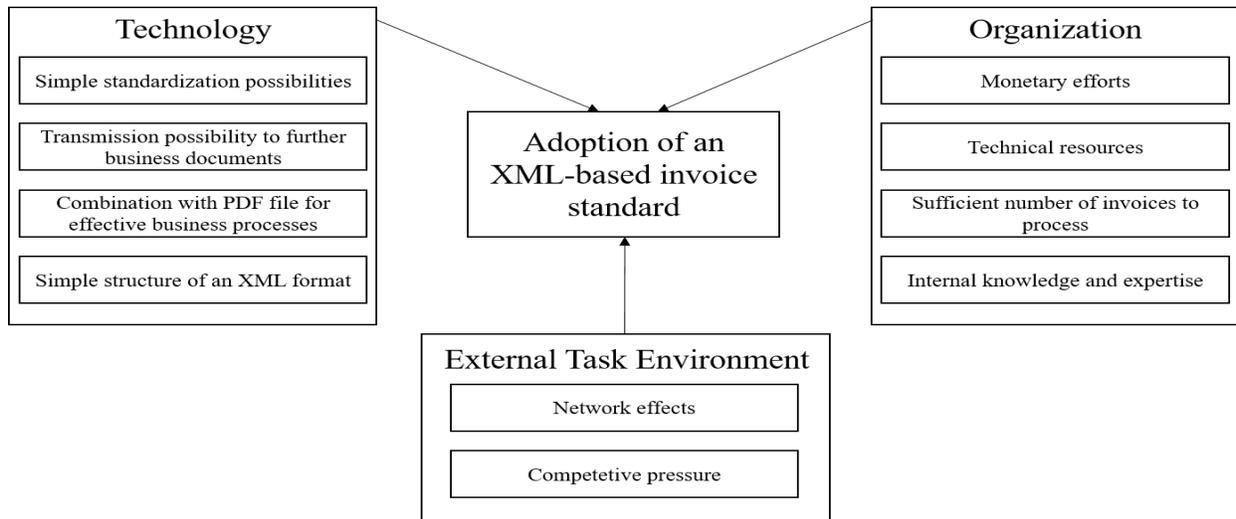


Figure 1: TOE-model for XML-based invoice standard adoption