8-2010

Common Data Exchange Standards: Determinants for Adoption at the Municipal Level

Daniel Veit

University of Mannheim, Business School, veit@bwl.uni-mannheim.de

Nils Parasie

University of Mannheim, Business School, parasie@bwl.uni-mannheim.de

Common Data Exchange Standards:
Determinants for Adoption at the Municipal Level

Daniel Veit
University of Mannheim, Business School
veit AT bwl.uni-mannheim.de

Nils Parasie
University of Mannheim, Business School
parasie AT bwl.uni-mannheim.de

ABSTRACT

Many initiatives have been carried out by governments around the world which have aimed to define common ICT standards for the public sector. However, the majority of data exchange conducted among public administrations is still based on paper or proprietary data formats. Public ICT is therefore lacking integration. The widespread use of common standards is especially hard to achieve in federally organized countries. Determinants for the adoption of common data exchange standards in such countries are identified in this paper. A conceptual model is drawn from a review of the literature and analyzed in a qualitative case study which is carried out in 13 municipalities of the German federal system. Seven determinants for the adoption of data exchange standards are identified. The paper concludes with practical implications on how the adoption of common data exchange standards can be increased.

Keywords

E-Government, Public Sector, Interoperability, Data Exchange, Standards, Technology Adoption.

INTRODUCTION

The public sector has been using Information and Communication Technology (ICT) for several decades (Kraemer and King, 1986; Bhatnagar, 2004; Foley and Alfonso, 2009). But even though inter-organizational dependencies in the public sector have traditionally been greater than in the private sector (Bozeman and Bretschneider, 1986; Bretschneider, 1990), numerous national and international studies demonstrate that ICT systems in the administrations are far from integrated (West, 2005; Capgemini, 2006; Coursey and Norris, 2008; United Nations, 2008). In federally organized countries, like Australia, Germany or the United States, integration is especially hard to achieve as the nature of federalism implies certain degrees of independence among the administrations and thus limits the possibilities to impose binding decisions across the public sector (Scharpf, 2006). The German public sector, for example, is characterized by a rather heterogeneous ICT landscape with little integration between the individual administrations (Kubicek and Wind, 2004). The majority of interactions between public organizations in Germany are not executed in commonly accepted data standards, but either based on paper or unstructured or proprietary data formats (German Federal Ministry of the Interior, 2008). Public ICT is therefore lacking integration. Common data exchange standards can be seen as a necessary condition to improve interoperability and to save costs by enabling an efficient electronic communication between administrations. Previous work on network effects has demonstrated that new standards face a start-up problem, i.e. no actor is willing to invest into a standard, if it is unclear that it will be successful in the future (Shapiro and Varian, 1999). The contribution of this paper is an analysis of determinants that support the adoption of common data exchange standards in the public sector of federally organized countries.

Governments around the world have been engaged in the definition of common ICT standards for the public sector for several years (Guijarro, 2007; Parasie and Veit, 2008; Charalabidis, Lampathaki and Askounis, 2009; Lampathaki, Gionis, Koussouris and Askounis, 2009). Even though many efforts were put into the definition of these standards at the federal level, their adoption rate at the local administrations in Germany has been moderate at best. In a survey by Veit and Parasie (2009) only 56% of the German municipalities stated that they knew the German interoperability standard (SAGA) reasonably well. In the same study just 4% of the participants stated that they knew the European Interoperability Framework, which is the interoperability standard of the European Union.

While the adoption of technologies and more specifically standards has intensely been studied among private organizations (Shapiro and Varian, 1999; Venkatesh, Morris, Davis and Davis, 2003; Jeyaraj, Rottman and Lacity, 2006), less research on these subjects has been done with respect to the public sector (Norris and Lloyd, 2008). The research discussed in this paper

identifies seven determinants for the adoption of common data exchange standards, i.e. structured data formats that can be interpreted by different administrations, in the public sector of federally organized countries.

The next section provides the theoretical foundation for our study. A conceptual model is developed to serve as a basis for the qualitative study in 13 German municipalities. The empirical data is compared to the conceptual model to provide a refined theoretical understanding of the determinants for the adoption of common data exchange standards in the public sector of federally organized countries. Based on the findings, implications for research are given and final conclusions are drawn.

THEORETICAL FOUNDATION

A rich variety of approaches can be identified in the literature, which is related to the adoption of standards, but mainly stems from private sector research. The *theory of network effects* outlines the uncertainties that both individuals and companies have with respect to the adoption of a new standard (Katz and Shapiro, 1985; Farrell and Saloner, 1986; Shapiro and Varian, 1999). The main uncertainty stems from the question of whether the standard is going to be adopted by other agents and thus provides a viable investment for the future. Thus the adoption of a standard always poses the risk of "lock-in" into an unsuccessful standard which could result in high "switching costs" if the standard needs to be replaced at a later stage (Shapiro and Varian, 1999).

Literature on *technology adoption* by individuals and organizations has largely originated from the Technology Acceptance Model (TAM) by Davis (1986) and the Innovation Diffusion Theory (IDT) by Rogers (1962). Both TAM and IDT have resulted in a rich variety of research which originated in the study of the acceptance of technologies in general. The main determinants for the acceptance of technologies are Perceived Usefulness, Perceived Ease of Use, User Support, Social Pressure and Top Management Support (Venkatesh et al., 2003; Jeyaraj et al., 2006). Data exchange standards can be regarded as a technology; therefore the results of this literature are considered to be applicable to our research.

The issue of *data exchange standards* is specifically studied in works on Electronic Data Interchange (EDI) in the private sector which refers to *"the movement of business documents electronically between or within firms [..] in a structured, machine-retrievable, data format that permits data to be transferred, without rekeying, from a business application in one location to a business application in another location" (Hansen and Hill, 1989)*. The proponents of EDI have mostly been large organizations (Barua and Lee, 1997) which tend to have (a) more capacities to compensate the setup costs, (b) a better position to negotiate operating details and (c) more expertise regarding EDI's mode of operation. Based on a review of prior work Chwelos et al. (2001) developed an EDI adoption model for small and medium size enterprises (SMEs), which had been especially reluctant to introduce EDI as a new technology (Banerjee and Golhar, 1994; Barua and Lee, 1997). It posits three main factors that determine the adoption of EDI: *external pressure*, *perceived benefits* and *readiness*. The SME EDI adoption model by Chwelos et al. (2001) is used as the basis for the conceptual model of this study.

Research on the differences between public and private organizations has had a long tradition. A quote which is attributed to the political scientist Wallace S. Sayre states that public and private organizations are *"fundamentally alike in all unimportant respects"* (Allison, 1982). More recent literature holds that differences between public and private sector organizations are not as strong as assumed in earlier works (Rainey and Bozeman, 2000). Public reforms which followed the New Public Management approach of applying private management techniques to public organizations have demonstrated that public and private organizations are not only alike in all unimportant, but also in a number of important aspects (Boyne, 2002). Five key differences which persist between the two sectors have been identified in two reviews of the public and private sector literature and are shown in Table 1.

Table 1   Persistent Public and Private Sector Differences (compiled from: Rainey and Bozeman, 2000; Boyne, 2002)

Difference	Description
Constraints resulting from personnel rules (Rainey and Bozeman, 2000)	There is less flexibility and more formalization in public organizations with respect to personnel administration like hiring or laying off employees.
Constraints resulting from purchasing rules (Rainey and Bozeman, 2000)	Public purchasing and procurement is much more constrained by formalization than in private organizations.
Materialism of public managers (Boyne, 2002)	Public managers are less likely to be motivated by financial rewards than private sector managers.
Organizational commitment of public managers (Boyne, 2002)	Public managers have weaker organizational commitment than their private sector counterparts.
Bureaucracy (Boyne, 2002)	Public sector decision-making structures are more formalized.

Based on this literature five propositions are put forth. Together they make up the conceptual model which is used for the qualitative study and illustrated in Figure 1. Considering the SME EDI adoption model by Chwelos et al. (2001) and taking into account network effect literature, which explains the positive network externalities that arise if a critical number of agents adopt a standard (Shapiro and Varian, 1999), the following proposition may be formulated:

Proposition 1a: Public organizations which perceive pressure by their public and private partners are more likely to adopt a data exchange standard.

Proposition 1b: Public organizations are more likely to adopt a data exchange standard if their public and private partners are technically ready to exchange information using the standard.

The literature on technology adoption by individuals highlights the importance of the perceived benefits that an individual experiences regarding a new technology (Venkatesh et al., 2003; Jeyaraj et al., 2006). But information system implementations can cause high expenses in the short term, while the benefits may only be realized in the long run (Ferguson, Hill and Hansen, 1990; Barua and Lee, 1997). Governmental budgeting and accounting follows different approaches than in the private sector and IS investments cannot easily be accounted for as assets (Jones and Pendlebury, 2000). The linking of IS planning and budgeting is perceived as especially challenging by public IS managers (Caudle, Gorr and Newcomer, 1991). Furthermore political appointees may not benefit from the long term cost savings of an IS implementation due to election cycles and political appointments. Accordingly, the following proposition may be formulated:

Proposition 2a: Public organizations which clearly perceive the long term economic benefits of the implementation of a data exchange standard are more likely to adopt the standard.

Proposition 2b: Public organizations which are able to gain political benefits from the use of a data exchange standard are more likely to adopt.

The literature on the differences between public and private organizations reveals that decision-making in the public sector is more formalized than in the private sector (see Table 1), as processes in public organizations are usually bound by laws and regulations (Rainey and Bozeman, 2000; Boyne, 2002). Accordingly, the following proposition may be formulated:

Proposition 3a: Public organizations which perceive legal pressure to adopt a data exchange standard are more likely to adopt the standard.

Proposition 3b: Public organizations that can draw upon clearly defined legal requirements for the use of a data exchange standard are more likely to adopt the standard.

Based on the SME EDI adoption model by Chwelos et al. (2001) two further propositions are formulated:

Proposition 4:   Lack of financial resources is perceived to be a barrier for the adoption of data exchange standards.

Proposition 5:   Public organizations which have professional IT departments are more likely to adopt a data exchange standard.
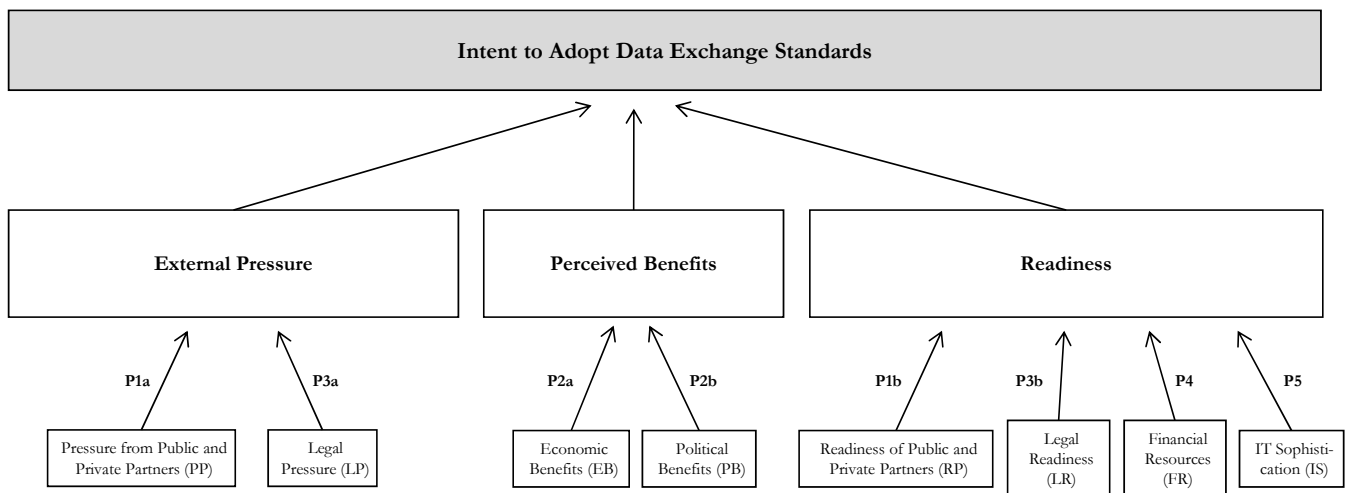

Figure 1   Conceptual Model of Determinants for the Adoption of Data Exchange Standards

ADOPTION OF DATA EXCHANGE STANDARDS – A QUALITATIVE ANALYSIS

In this section the case study about the adoption of common data exchange standards in German municipalities is presented. Below the federal level there are 16 federal states in Germany and within these there exist over 12,000 municipalities which make up the lowest federal level (German Federal Statistical Office, 2008). Due to their right of local self government the municipalities are rather independent, both of each other and of the above federal levels[1]. In order to reduce biases and provide triangulation, i.e. analyze the case from different perspectives, the study is conducted as a multiple site case study as opposed to a single site case study. The goal of the analysis is twofold. First, corroboration of the conceptual model is sought. Second, the relevance of the model should be increased through the incorporation of practitioners' feedback. Thus the approach is explanatory in the sense that the existing model is being tested. And at the same time an exploratory approach is taken which enables the identification of new and not previously considered determinants. This study draws upon the recommendations on case study research by Yin (2009).

Case Study Design

Three of the 16 federal states in Germany are city states (Berlin, Bremen and Hamburg), these states are an exception with respect to municipal responsibilities, as the municipal and the federal state level are fully intertwined. Therefore, these three states are excluded from the study which is conducted in the 13 remaining states. When selecting the appropriate municipalities for the study two factors are taken into account. First, the examined municipality should be big enough to have a significant portfolio of administrative offices and responsibilities. Second, an analysis of the biggest municipality in each state may not yield insights into pressure that is being exercised on it from other municipalities, especially bigger ones. Therefore the 5th largest municipality was contacted in each of the 13 federal states. The sizes of the municipalities range from 110,000 to 430,000 inhabitants. In doing so a literal replication approach is pursued i.e. cases are selected to allow for the analysis of similarities across municipalities, as opposed to theoretical replication where the focus is on the selection of cases with contrasting results for theoretically grounded reasons (Dubé and Paré, 2003; Yin, 2009).

An interview protocol is designed to guide the interviewers in the talks with the municipalities. It consists of semi-structured, open-ended questions, including questions about the general structure of the municipality's ICT. In doing so, it provides reliability and consistency across the individual cases, while at the same time allowing the interviewers to be open for the participants' feedback. A 30 minute interview is sought with the E-Government official of each municipality.

A pilot test was conducted before the data collection phase. The goal was to evaluate and refine the interview protocol. Even though the case study is conducted at the municipal level, officials at the federal state level were contacted for the pilot study. This holds the advantage that officials at the state level typically have got a broad overview and can comment on the overall developments in the state, rather than representing the view of just one municipality. Thus the highest ranking ICT official was contacted in two federal states and a pilot interview was conducted with both officials. The pilot test yielded concise feedback of both officials which led to several refinements of the interview protocol.

Data Collection Procedure

For the collection of the data a case study database was used. In this database all information regarding the individual cases is stored. It contains the interview protocol, audio data, transcripts and contacts of the individual sites. The study was conducted during a five months period from September 2009 to January 2010. For each of the 13 interviews, the website of the municipality was consulted and the main telephone operator was retrieved through the contact section of the site which is mandatory for any non personal website in Germany[2]. In each case the operator was contacted and asked for the highest official who is responsible for ICT in the municipality. The subject of the study was explained in detail and an appointment was made. If the interview partner demanded more information, then the interview protocol with the questions was sent to the interview partner before the interview.

Privacy and confidentiality was guaranteed to all participants of the survey. All participants agreed that their statements may be used in scientific publications, but no details may be given that could lead to the identification of a municipality for specific statements. Such privacy and confidentiality agreements were deemed necessary to win the municipalities' support

---

[1] Article 28, Paragraph 2, Sentence 1 of the Grundgesetz (German Constitution)
http://www.bundestag.de/dokumente/rechtsgrundlagen/grundgesetz/ access date: 02/18/2010

[2] §5 Telemediengesetz (German telecommunications law)
http://www.bgblportal.de/BGBL/bgbl1f/bgbl107s0179.pdf access date: 02/18/2010

for this study in the first place and to enable participants to be more open and thus reduce the likelihood of politically influencing biases.

In some cases the officials either declined to take part in the study straight away or they could not be reached after multiple attempts of contact. In these situations the next bigger municipality was contacted. Using this approach the 5th largest municipality could be interviewed in six cases and in five cases the 4th largest municipality was interviewed. Only in two cases even bigger municipalities had to be interviewed which were the 3rd largest in one case and the largest municipality in the other. All 13 interviews were held on the telephone for an average of 30 minutes each. Prior to the interview each official was asked for his consent to have the interview recorded which helps the interviewer to fully concentrate on the subject of the talk rather than on taking notes. Only two officials declined to have the interview recorded. Personal notes could be made in one of these two cases, in the other case the official declined to hold an interview, but agreed to answer the questions of the interview protocol in writing.

Data Analysis

The transcripts of the 13 interviews are captured in the case study database. Together they make up a total of 21,500 words and 65 pages of text. The interviews were structured and analyzed using the software ATLAS.ti[3]. A coding scheme was devised to study common themes across the individual municipalities and thus support both the explanatory and the exploratory goal of the study based on the recommendations by Boyatzis (1998).

For the explanatory part of the study the goal is to analyze the applicability of the conceptual model. In doing so, a theory-driven approach to the code development is taken (Boyatzis, 1998). For each of the eight determinants which are proposed in the model, one code is developed, which is used for the identification of its occurrence in the interviews. Codes were applied to the transcripts each time that an interview partner stated that he or she perceives one of the eight determinants of the conceptual model as being influential for the adoption of data exchange standards.

In the exploratory part of the study the goal is to identify additional determinants for the adoption of data exchange standards. Therefore a data-driven approach is taken (Boyatzis, 1998). In doing so each of the transcripts was read and scanned for additional themes. The software ATLAS.ti was used to annotate the transcripts with comments each time that a common theme was suspected. Corroboration was sought for such suspected themes in the remaining transcripts. A total of two additional codes could be determined. These are (a) *intelligible communication (IC)*, i.e. clear and understandable information about the reasons for the development and the advantages of the standard and (b) *software readiness (SR)* for data exchange standards, i.e. the degree to which a data exchange standard is supported by the software packages relevant for the municipality.

In order to improve and assess the reliability of the coding scheme four different coders where used. The coders were trained in the use of the coding scheme in a one day workshop which was conducted by the interviewer. The participants were the interviewer, a colleague, a master student and a student assistant. All participants had had prior experience with E-Government topics. The two pilot interviews, which had been conducted upfront, were used for these purposes. All four participants coded the first pilot interview and the results were assessed. The participants discussed the differences in their coding behavior in order to improve their agreement on a common way of coding. Then the second pilot interview was coded by all four participants and the results were discussed again.

All 13 interviews were coded by the interviewer himself. In a second round four interviews were coded by the colleague and the student assistant each, five interviews were coded by the master student. The inter-rater reliability of the four coders was assessed based on the agreement on the presence of the codes between the interviewer's codes of the first round and the results of the three coders in the second round of coding as described in Boyatzis (1998, p. 155). The final coding matrix contains the coding of the first round, i.e. the coding applied by the interviewer himself. Differences in the application of the codes where discussed among the coders. In a small number of cases these had originated from passages that had simply been overlooked as being relevant for the code by one of the coders; in these cases, and only then, was the respective passage added to the coding matrix.

---

[3] The employed version is ATLAS.ti 6.1.9 by ATLAS.ti Scientific Software Development GmbH, Berlin, http://www.atlasti.com/ access date: 01/20/2010

Results

The results of the code analysis are shown in Table 2 and include the total number of occurrences that interview partners mention the determinants as being influential for the adoption of data exchange standards. Determinants were frequently mentioned more than once in an interview. Therefore the *number of interviews* in which determinants were mentioned is also included. Bold figures indicate determinants that are mentioned by more than 50 percent of the participants. Inter-rater reliability ranges from 55 percent to 100 percent agreement among the coders.

Table 2   Total Occurrences of Coded Determinants and Inter-rater Reliability

Measure / Determinant	LP(*)	PP(*)	IC(**)	SR(**)	EB(*)	PB(*)	LR(*)	FR(*)	RP(*)	IS(*)
Total Occurrences	20	13	14	16	12	7	9	9	6	6
Number of Interview Partners who mention Determinant	11	9	9	8	7	7	7	6	5	4
Relative Number of Interview Partners who mention Determinant	**0,85**	**0,69**	**0,69**	**0,62**	**0,54**	**0,54**	**0,54**	0,46	0,38	0,31
Inter-rater Reliability[1]	0,86	0,78	0,89	0,89	1,00	0,92	0,60	0,80	0,55	0,86

(*)   Determinants of the conceptual model   (**)   Additional determinants identified in the study

[1]   Calculated as the percentage of agreement on the presence of the codes of the interviewer's first round coding with that of the second round coders, cp. Boyatzis (1998, p. 155)

For each determinant the most representative citation from the interviews is given in this section. Determinants are ordered by decreasing importance based on the relative number of interview partners who mention the determinant as being influential.

Legal Pressure (LP) is the strongest determinant for the adoption of common data exchange standards. 85 percent of the participants state that they perceive LP as useful and that they even wish that more LP was being exercised.

> *It is important that standards are enforced properly. Data exchange standards have to be made the norm for every software application in the municipality. There is no use in supporting a standard if it is only optional for the other participants. (P1:2)*

Pressure from Public and Private Partners (PP) and Intelligible Communication (IC) about the reasons and the benefits of a standard are the second strongest determinants. They are deemed useful by 69 percent of the participants.

> *Pressure should be exercised in a positive way. Many municipalities do not have big IT departments and they lack the necessary know-how. In these cases it is good if the municipalities' head organizations exercise a bit of pressure, but this has to be done in a supportive way. (P5:2)*

> *The adoption of data exchange standards can be improved through early and transparent communication that is accompanied by trust building measures. The municipalities need to trust the level which is proposing the standards, i.e. the standards must be perceived as an improvement and not as a measure to exercise control in any way. (P3:6)*

Software Readiness (SR) in this study is the third strongest determinant. It was measured as the amount of interview partners who mention that they perceive a lack of software support to be a barrier for the adoption of data exchange standards. A lack of SR was perceived to be a major barrier by 62 percent of the participants.

> *The biggest barrier comes from the software providers. The incorporation of common data exchange standards, e.g. XÖV standards [XML-based data exchange standards for the German public sector], into the relevant software applications happens in a much too slow and incomplete fashion. [..] The motivation of the software providers is important. They should be included into the definition and development of standards early on. After all, they have got a very good notion of the requirements, given their experience with software for the administration. (P6:3-4)*

The forth strongest determinants are Economic Benefits (EB), Political Benefits (PB) and Legal Readiness (LR). These determinants are supported by 54 percent of the participants, among which PB was the most controversially discussed determinant of the study, as 31 percent of the participants explicitly noted that they do not perceive PB to be influential.

> *Increased electronic communication would result in cost savings, especially if the demanding distribution of internal mail is discontinued and through reductions of postage fees for external mail. (P2:4)*

Whether political benefits can be realized depends on the acceptance of the standard in the municipality and on how technically interested the mayor is. A technically interested mayor would point out how much paper can be saved. For example, we do a lot of electronic procurement. Thus we publish numbers on how much ink and paper can be saved this way. But there are other areas where people are more skeptical, especially if data security is concerned. Then it is hard to gain political benefits. Overall, I do believe that savings on resources like paper, time and money are arguments that count on the political level. But these savings have to be quantified in numbers if we want the political level to take notice. (P5:10)

The legal aspect is an important one. And it gets even more significant, the better or worse a data exchange standard is being perceived to be. If a municipality is interested in standardization, then the legal aspect is not predominant. But if it is reluctant to standardize, then the legal aspect will be of especial importance. (P12:6)

Sufficient Financial Resources (FR), Readiness of Public and Private Partners (RP) regarding the support of a standard and IT Sophistication (IS) are the weakest determinants in the study. They were supported by only 46 percent, 38 percent and 31 percent, respectively.

The problem with the standard for the national registration system was that, even though the municipalities were legally bound to use it, they had to pay for the implementation themselves. [..] The introduction of the standard was paid by the federal state. But the required infrastructure had to be paid by ourselves. (P3:3-4)

Standards do exist, e.g. the Online Services Computer Interface (OSCI), but the required infrastructure is missing. A municipality will not be able to build this infrastructure all by itself. [..] Such standards [OSCI] are of increasing importance. But their adoption is rather slow. There is much talk about the OSCI standard, but that's it. (P1:5-6)

IT becomes more and more complex. Data exchange technologies cannot easily be handled. We can invest time into this because we are a big city. But this wouldn't make sense for smaller municipalities. Neighboring cities are increasingly asking us for help, because technology has become so complex. A smaller municipality or a smaller service provider cannot do such tasks. It is definitely a barrier if a municipality is not sufficiently equipped with IT. (P4:7)

DISCUSSION

Determinants for the Adoption of Data Exchange Standards

In qualitative studies there may not be statistical generalizations based on quantitative methods. However, five of the eight determinants of our conceptual model are supported by this study by more than fifty percent of the participants who stated them to be influential (see Table 2). Furthermore, two additional determinants, IC and SR, could be identified which are also supported by more than fifty percent of the participants.

LP turned out to be the strongest supported determinant in the study. While this may not be so surprising at first sight, the more interesting result is that interview partners did not only state that LP helps, but that they wish that more LP was being exercised. The same holds for **PP** of which interview partners equally stated that they wish more pressure was being exercised.

IC was identified as an additional determinant for the adoption of data exchange standards, i.e. early and understandable communication about the need for a standard and about its benefits was perceived to be important by the interview partners. From a theoretical point of view this determinant is supported by the Unified Theory of Acceptance and Use of Technology (UTAUT) which holds that a technology needs to appear beneficial to the intended user in order to increase its acceptance (Venkatesh et al., 2003). **SR** was further determined as an additional influence on adoption behavior, i.e. the adoption of a standard can be improved through the availability of appropriate software packages which support its use. This is also theoretically supported by UTAUT which holds that a technology is more likely to be used if it is easy to use, e.g. if it can easily be integrated into the municipality's software systems.

EB, **PB** and **LR** are supported by just above fifty percent of the participants, with EB and PB being especially controversial. 15 percent of the participants explicitly state that they do not perceive any economic benefits from the use of standards. And 31 percent state they do not perceive any political benefits. However, the results of EB may possibly be skewed a little due to the high setup costs of new technologies which certainly reduce economic benefits in the short term. This may have to be investigated more closely in further studies. Participants indicated that PB depends very much on the overall interests of the political level which may explain the controversial results regarding this determinant. LR was less controversial, only eight

percent of the participants explicitly opposed it as a determinant. The low impact of LR could be explained by the positive attitude towards legal pressure, because a standard which is legally binding must also be legally ready, thus reducing the importance of LR as a determinant.

Just less than fifty percent of the participants state **FR** as a determinant, i.e. financial resources are not perceived to be irrelevant, but they are not the most pressing issue either. **RP** is neither perceived to be a strong determinant nor a strong barrier for the adoption of data exchange standards. This could be explained by the strong support for LP, as readiness of public and private partners would naturally be granted if standards become mandatory by law. The low inter-rater reliability of 55 percent indicates that the associated questions and codes would need to be revised in further investigations to measure this determinant more precisely. **IS** is the weakest determinant in the study, though its occurrence was coded with an inter-rater reliability of 86 percent, it may be hard to capture this determinant in a direct interview with ICT officials.

Limitations of this Study

There are several limitations to take into account. First of all, the study was conducted as a multiple case study in Germany only. Therefore, the results may be most applicable to the German system, but also to countries with a similarly federal government structure. Second, it should be kept in mind that the fifth largest municipality was sought for the interview in each state. Thus the results may be representative for the bigger municipalities only, but would yet have to be confirmed for smaller administrations. A final limitation is potential bias in the answers of the interview participants. One interview partner in particular, was highly diplomatic in his answers and strongly interested in how he compared to other municipalities after the interview. This bias was minimized by granting our participants a maximum amount of anonymity.

CONCLUSION

This study was motivated by the need to improve our understanding of the determinants for the adoption of common data exchange standards in the public sector. A conceptual model of eight theoretical determinants was developed based on a review of the literature and a case study was carried out in 13 German municipalities to analyze the propositions. Five of the theoretical determinants are supported by the study and two additional ones could be identified as part of the analysis. The supported determinants are (1) Legal Pressure, (2) Pressure from Public and Private Partners, (3) Intelligible Communication about the reasons and the benefits of a standard, (4) availability of sufficient software packages supporting the standard, (5) Economic Benefits resulting from the use of the standard, (6) Political Benefits from standardization and (7) clearly defined legal frameworks for each standard.

Clear practical implications can be derived from the first four determinants which have got the strongest impact in our study. These include (1) centrally mandated data exchange standards are welcomed by most municipalities, but they must be made legally binding, (2) the influence of the municipal head organizations should be sought to support a new standard, (3) clear communication about the reasons and benefits of a standard should be provided well in advance, (4) software providers should be encouraged to implement the mandated standards into their products as early as possible.

The results are highly relevant from a theoretical point of view by explaining the behavior of the adoption of data exchange standards in the public sector. Further research needs to clarify the applicability of the findings for smaller municipalities. A refined version of the model should further be tested using quantitative methods. Future investigations have to analyze if we have identified relationships typical for the German public sector only and in how far they can also be generalized to other federal systems.

REFERENCES

1. Allison, G. T. (1982), in: Current Issues in Public Administration, F. Lane (Ed.), St. Martin's Press, New York, 14-29.

2. Banerjee, S., and Golhar, D. Y. (1994) Electronic data interchange: characteristics of users and nonusers, Information and Management, 26, 2, 65-74.

3. Barua, A., and Lee, B. (1997) An Economic Analysis of the Introduction of an Electronic Data Interchange System, Information Systems Research, 8, 4, 398-422.

4. Bhatnagar, S. (2004) E-Government: From Vision to Implementation, SAGE Publications, New Delhi.

5. Boyatzis, R. E. (1998) Transforming Qualitative Information: Thematic Analysis and Code Development, SAGE Publications, Thousand Oaks.

6. Boyne, G. A. (2002) Public and Private Management: What's the Difference?, Journal of Management Studies, 39, 1, 97-122.

7. Bozeman, B., and Bretschneider, S. (1986) Public Management Information Systems: Theory and Prescription, Public Administration Review, 46, Special Issue: Public Management Information Systems, 475-487.

8. Bretschneider, S. (1990) Management Information Systems in Public and Private Organizations: An Empirical Test, Public Administration Review, 50, 5, 536-545.

9. Capgemini (2006) Online Availability of Public Services: How is Europe Progressing?, http://ec.europa.eu/information_society/eeurope/i2010/docs/benchmarking/online_availability_2006.pdf, access date: 01/22/2010.

10. Caudle, S. L., Gorr, W. L., and Newcomer, K. E. (1991) Key Information Systems Management Issues for the Public Sector, MIS Quarterly, 15, 2, 171-188.

11. Charalabidis, Y., Lampathaki, F., and Askounis, D. (2009) A Comparative Analysis of National Interoperability Frameworks, Proceedings of the Fifteenth Americas Conference on Information Systems, August 6 - 9, San Francisco, CA, USA, Paper 694.

12. Chwelos, P., Benbasat, I., and Dexter, A. S. (2001) Research Report: Empirical Test of an EDI Adoption Model, Information Systems Research, 12, 3, 304-321.

13. Coursey, D., and Norris, D. F. (2008) Models of E-Government: Are They Correct? An Empirical Assessment, Public Administration Review, 68, 3, 523-536.

14. Davis, F. D. (1986) A Technology Acceptance Model for Empirically Testing New End-User Information Systems: Theory and Results, Doctoral dissertation, Sloan School of Management, Massachusetts Institute of Technology.

15. Dubé, L., and Paré, G. (2003) Rigor in Information Systems Positivist Case Research: Current Practices, Trends, and Recommendations, MIS Quarterly, 27, 4, 597-636.

16. Farrell, J., and Saloner, G. (1986) Installed Base and Compatibility: Innovation, Product Preannouncements, and Predation, The American Economic Review, 76, 5, 940-955.

17. Ferguson, D. M., Hill, N. C., and Hansen, J. V. (1990) Electronic Data Interchange: Foundations and Survey Evidence on Current Use, Journal of Information Systems, 4, 2, 81-91.

18. Foley, P., and Alfonso, X. (2009) eGovernment and the Transformation Agenda, Public Administration, 87, 2, 371-396.

19. German Federal Ministry of the Interior (2008) Report on the Study 'XÖV-Landkarte' of the Deutschland-Online Project Standardization (in German), http://www.deutschland-online.de/DOL_Internet/binarywriterservlet?imgUid=4f030bab-2552-fe11-d88e-f1ac0c2f214a&uBasVariant=22222222-2222-2222-2222-222222222222, access date: 01/22/2010.

20. German Federal Statistical Office (2008) Gemeindeverzeichnis 2008 - Administrative Gebietsgliederungen, Wiesbaden, http://www.destatis.de/jetspeed/portal/cms/Sites/destatis/Internet/DE/Content/Statistiken/Regionales/Gemeindeverzeichnis/Administrativ/AdministrativeUebersicht, access date: 11/25/2009.

21. Guijarro, L. (2007) Interoperability Frameworks and Enterprise Architectures in E-Government Initiatives in Europe and the United States, Government Information Quarterly, 24, 1, 89-101.

22. Hansen, J. V., and Hill, N. C. (1989) Control and Audit of Electronic Data Interchange, MIS Quarterly, 13, 4, 403-413.

23. Jeyaraj, A., Rottman, J. W., and Lacity, M. C. (2006) A review of the predictors, linkages, and biases in IT innovation adoption research, Journal of Information Technology, 21, 1, 1-23.

24. Jones, R., and Pendlebury, M. (2000) Public sector accounting, Pearson Education Limited, Harlow.

25. Katz, M. L., and Shapiro, C. (1985) Network Externalities, Competition, and Compatibility, The American Economic Review, 75, 3, 424-440.

26. Kraemer, K. L., and King, J. L. (1986) Computing and Public Organizations, Public Administration Review, 46, Special Issue - Public Management Information Systems, 488-496.

27. Kubicek, H., and Wind, M. (2004) Integriertes E-Government auch im föderalen Staat? Herausforderungen auf dem Weg zu effizienten Verwaltungsverfahren (in German), Deutsche Zeitschrift für Kommunalwissenschaften, 43, 2, 48-63.

28. Lampathaki, F., Gionis, G., Koussouris, S., and Askounis, D. (2009) Enabling Semantic Interoperability in e-Government: A System-based Methodological Framework for XML Schema Management at National Level, Proceedings of the Fifteenth Americas Conference on Information Systems, August 6 - 9, San Francisco, CA, USA, Paper 620.

29. Norris, D. F., and Lloyd, B. A. (2008), in: E-government Research: Policy and Management, D. Norris (Ed.), Idea Group Publishing, Hershey, USA, 21-41.

30. Parasie, N., and Veit, D. (2008) Nationale E-Government Standards: Mehr Interoperabilität durch zentrale Richtlinien? (in German), Proceedings of the Multi-Conference Information Systems (Multikonferenz Wirtschaftsinformatik), February 26 - 28, Munich, Germany, 403-417.

31. Rainey, H. G., and Bozeman, B. (2000) Comparing Public and Private Organizations: Empirical Research and the Power of the A Priori, Journal of Public Administration Research and Theory, 10, 2, 447-469.

32. Rogers, E. M. (1962) Diffusion of Innovations, Free Press, New York.

33. Scharpf, F. W. (2006) The Joint-Decision Trap Revisited, Journal of Common Market Studies, 44, 4, 845-864.

34. Shapiro, C., and Varian, H. R. (1999) Information Rules: A Strategic Guide to the Network Economy, Havard Business School Press, Boston.

35. United Nations (2008) UN Government Survey 2008: From E-Government to Connected Governance, http://unpan1.un.org/intradoc/groups/public/documents/un/unpan028607.pdf, access date: 01/22/2010.

36. Veit, D., and Parasie, N. (2009) Can National E-Government Standards find Acceptance?, Proceedings of the 42nd Hawaii International Conference on System Sciences, January 5 - 8, Waikoloa, HI, USA.

37. Venkatesh, V., Morris, M. G., Davis, G. B., and Davis, F. D. (2003) User Acceptance of Information Technology: Toward a Unified View, MIS Quarterly, 27, 3, 425-478.

38. West, D. M. (2005) Digital Government: Technology and Public Sector Performance, Princeton University Press, Princeton, Oxford.

39. Yin, R. K. (2009) Case Study Research: Design and Methods, SAGE Publications, Los Angeles.