

INNOVATION SYSTEMS AND IMPACTS OF E-COMMERCE AND EDI ON GERMAN SME

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ABSTRACT

The diffusion of innovation in the field of e-commerce is often seen as a global effect. Nevertheless national innovation systems are also of importance to understand the path of diffusion and to learn more about e-commerce enablers and inhibitors. This paper is part of the research project “globalization of e-commerce” and presents the results of an empirical research among German enterprises which are known as innovation friendly. The project is targeting on the identification of indicators for innovation adoption, based on the adoption of former innovations like EDI for a better understanding of the diffusion and transmission process of new standards like m-commerce. Due to this an empirical approach was chosen since former analytical frameworks are not sufficient to identify all relevant aspects.

2497 Words

1. INTRODUCTION

The diffusion of e-commerce and its impacts on business processes is not yet well understood, the fundamental changes and improvements together with possible increases of productivity are not yet metered in a methodological and theoretical way. This research in progress project is targeting on the identification of indicators for innovation adoption, based on the adoption behavior of former innovations like electronic data interchange (EDI) for a better understanding of the diffusion of new standards like m-commerce. Due to this an empirical approach was chosen since former analytical frameworks are not sufficient to identify relevant aspects. E-commerce is defined in the research project in a broad sense as the integration of external information exchanges between firms and customers with the assistance of telecommunications and telecommunications-based tools together with new internal co-operation mechanisms. Searching for appropriate instruments to model the diffusion of e-commerce, two areas of research seem to be promising. On one hand, analytic models of the diffusion of innovations focus on explaining and forecasting the process of the adoption of innovations over time. On the other hand, theory of positive network effects analyzes the specific characteristics of markets for net effects goods (such as e-commerce applications). Based on these frameworks the empirical survey should identify the innovators and the enabling factors to provide answers about the optimal setting for a successful e-commerce adoption.

1.1. RESEARCH FRAMEWORK AND STRUCTURE OF THE PAPER

Despite the existence of many different diffusion models (for a comprehensive overview of the traditional diffusion models refer to Gierl 1987, Mahajan/Muller/Bass 1990), the approaches are not sufficient to model the diffusion of innovations with net effect characters. Schoder 1995 names three areas of deficit (Schoder 1995, 46-50). First of all, there is a lack of analysis concerning the phenomenon of critical mass. Furthermore, the traditional diffusion models cannot explain the variety of diffusion courses. Third, the models do not sufficiently consider the interaction of potential adopters within their socio-economic environment. Therefore, it is not surprising that the broad acceptance of logistic and semilogistic approaches

is found in areas where innovations have only small consumer interdependencies and where the diffusion function is similar to distribution of physical goods (Schoder 1995, 48-49). All of these assumptions are rather unrealistic for the diffusion of something inhomogeneous like e-commerce. Due to this, this empirical research tries to identify the diffusion drivers of EDI, to learn more about the character of e-commerce diffusion.

This research-in-progress paper describes possible theories to explain both, the diffusion of e-commerce depending on national enablers and inhibitors and the impacts of e-commerce itself on enterprises. After an introduction into the framework of social or national innovation systems determining the diffusion of e-commerce (section 2) we provide in section 3 an empirical research to evaluate first the state-of-the-art e-commerce techniques and second new IT-standards like knowledge management (section 3.3) or m-commerce (section 3.4). In the conclusions (section 4) we provide an outlook of further research in this area inside the research project “Globalization of e-commerce”.

2. DIFFUSION OF INNOVATIONS

2.1. DIFFUSION MODELS

The term diffusion is generally defined as “the process by which an innovation is communicated through certain channels over time among the members of a social system” (Rogers 1983, 5). The traditional economic analysis of diffusion focuses on describing and forecasting the adoption of products in markets. In particular, the question of which factors influence the speed and specific course of diffusion processes arises (Weiber 1993). Traditional diffusion models are based on similar assumptions: Generally, the number of new adopters in a certain period of time is modeled as the proportion of the group of market participants that have not yet adopted the innovation. Based on this fundamental structure, three different types of diffusion models are most common (Lilien/Kotler 1983, 706-740, Mahajan/Peterson 1985, 12-26): The exponential diffusion model (also external influence model or pure innovative model) assumes that the number of new adopters is determined by influences from outside the system, e.g. mass commu-

nication. The logistic diffusion model (also internal influence model or pure imitative model) assumes that the decision to become a new adopter is determined solely by the positive influence of existing adopters (e.g. word of mouth). The semi logistic diffusion model (also mixed influence model) considers both internal and external influences.

2.2. NETWORK MODELS OF DIFFUSION

Besides the economic research approaches described above, many (mostly empirical) studies of diffusion processes can be found in various research areas (for an early overview of existing empirical studies refer to Rogers/Shoemaker 1971, 44-96). Most of the models are based on the threshold and critical mass approaches which analyze the diffusion rate of innovations, collective behavior, or public opinion (e.g. Granovetter 1978, Marwell/Oliver/Prahl 1988). A long research tradition exists in the area of network models of diffusion of innovations. Complementing the analysis of diffusion of innovations, network analysis in this context is an instrument for analyzing the pattern of interpersonal communication in a social network (for concepts of sociological network analysis e.g. refer to Jansen 1999).

In general, network diffusion models can be divided into relational models and structural models. Relational models analyze how direct contacts between participants in networks influence the decision to adopt or not adopt an innovation. In contrast, structural models focus on the pattern of all relationships and show how the structural characteristics of a social system determine the diffusion process (Valente 1995, 31-61).

3. EMPIRICAL RESEARCH

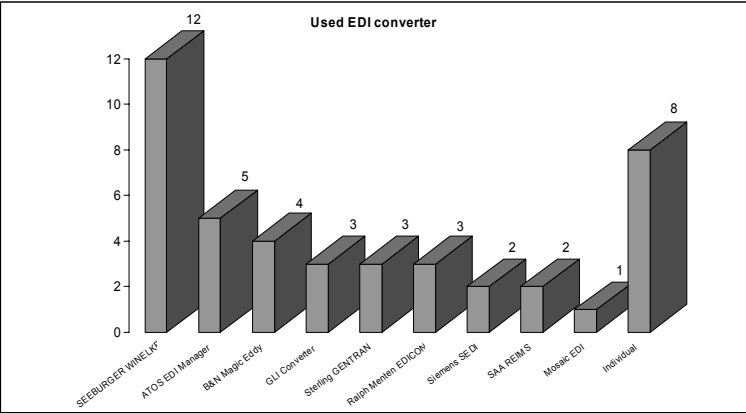
Due to the large variety of different e-commerce applications and their impacts on the business processes of German enterprises, we performed an empirical survey in cooperation with the German EDI society among their 450 members. These 450 enterprises include the largest EDI users in each industry sectors; more than 60 % are large enterprises with more than 500 employees. The seven pages extensive questionnaire included e-commerce, EDI as well as m-commerce or knowledge management questions. The re-

spondent German enterprises came from different industry sectors which explain the large variety of different used applications and IT-standards. The survey was conducted in December 2001 and January 2002. The respondent ratio was 10.2 % or 46 questionnaires. The interviewed managers or CIOs were asked about existing e-commerce applications and their expectations about the diffusion and adoption of new solutions like m-commerce.

3.1. USE OF EDI STANDARDS

In the following we provide some selected data from our survey. Most enterprises are using EDI for a couple of years. Most of them were using traditional EDI converter applications to handle the incoming and outgoing EDI messages. As shown in FIGURE 1 the diffusion of converter software has not led to a homogenous standard solution in the past. The question was responded from 38 enterprises and multiple answers were allowed.

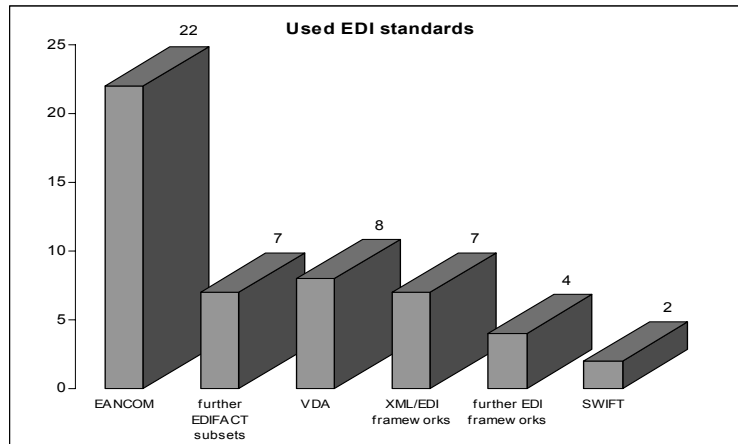
FIGURE 1: Use of EDI converter software



Only the WINELKE converter solution of Seeburger could be seen as quasi-standard with twelve responses, aside a large variety of other systems. With eight responses the use of individual software solutions is quite high and far away from standardization. Most of these EDI converter systems can also be used as interface for further e-commerce solutions, e.g. WINELKE. In average, 116 employees are responsible for these systems, working at the IT department. The variety of used EDI solutions and the

large number of skilled employees is an important enabler for implementing new e-commerce solutions in different fields. On the information exchange level a more harmonized scenario is observable.

FIGURE 2: Used EDI messaging standards



EANCOM as an EDIFACT subset is one of the most famous EDI standards, followed by further EDIFACT subsets. In average EANCOM was used since 1995, the other EDIFACT subsets since 1994. The adoption of EDI standards seem to be completed at most industries, nevertheless, the use of EDI is still more or less restricted to large enterprises.

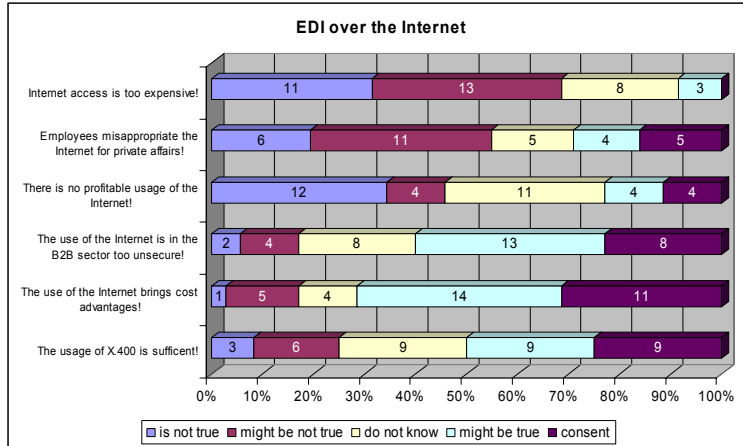
Besides VDA, the most common EDI standard in the German automotive industry (eight responses, in average use since 1991) and SWIFT, the EDI inter-bank exchange standard (two responses, in average used since 1996) a relatively astonishing high number of existing XML/EDI frameworks were used at the same time together with traditional EDI standards. EDI transmission standards like XML are becoming more and more important for Internet based transactions. Therefore they are an indicator for e-commerce orientated enterprises.

3.2. USE OF INNOVATIVE E-BUSINESS STANDARDS

Besides traditional EDI as process innovation which was introduced mainly ten years ago new forms of e-commerce methods like WebEDI (Beck et al., 2002), XML/EDI (Weitzel et al., 2001) or Internet EDI appeared. EDI over the Internet, e.g., allows a less expensive transmission of EDI messages over Internet protocols in contrast to the former necessary proprietary value added networks (VANs). In spite of these

potential cost savings the Internet is not as save as VANs and therefore not as widespread as it was expected (FIGURE 3).

FIGURE 3: EDI over the Internet



In the questionnaire the managers were asked about their estimations by agreeing or rejecting provided statements. Altogether 36 enterprises answered this question. Predominant agreement prevailed with the question whether the Internet is economical. However, uncertainty prevailed with the questions whether the Internet access is abused by the employees for private purposes and/or whether there is a meaningful application concerning the Internets for data transmission. 21 enterprises answered that the Internet is unsafe or rather unsafe for data transmission. Due to this the improvement of traditional EDI transmission by using the Internet has not yet generally accepted.

Despite these doubts about safe data transmission the potentials of the Internet are yet realized by most enterprises. Apart from the mandatory Internet homepage and the use of the Internet as a further vendor outlet, it serves 25 enterprises beyond that as information portal for customers with local dealer search functions as well as service like tracking and tracing of packages. Most enterprises were planning further e-business-applications such as on-line financing and logistics tools.

3.3. E-BUSINESS AND KNOWLEDGEMANAGEMENT

The complete integration and adjustment of all business processes together with the increasing possibilities due to the occurring network effects in networked economies as well as the globalization of e-

commerce is becoming more and more important and presuppose a strategic planning in the enterprises. Unfortunately, the awareness and necessity for such a strategy is yet underdeveloped at most enterprises. An enterprise-wide e-business-strategy existed however only in 34% of the 35 enterprises answering to this question, in further 49% existed at least in sub ranges an appropriate strategy. 17% of the answering could hardly show any e-business strategy. In other words: 66% of the enterprises regard e-business not as strategic. Due to this, 61% plan e-business investments only up to € 5 millions in this area in 2002 and only 8% more than € 10 millions. 31% of the enterprises plan investments between 5 and 10 millions. The largest difficulties occurring by implementing an e-business strategy are seen in the difficulties of a company-wide conversion, together with the execution of such a strategy (each with 35%). One answering indicated that a conversion fails because of the missing support by the management.

Only 18% of respondents had, e.g., a company-wide knowledge management solution, further 40% possess an application in sub-ranges. Most enterprises were relatively reluctant to use such innovations in spite of a long tradition as EDI using enterprise. The maturity in using IT technologies like this can therefore not be seen as an indicator for an innovation friendly enterprise.

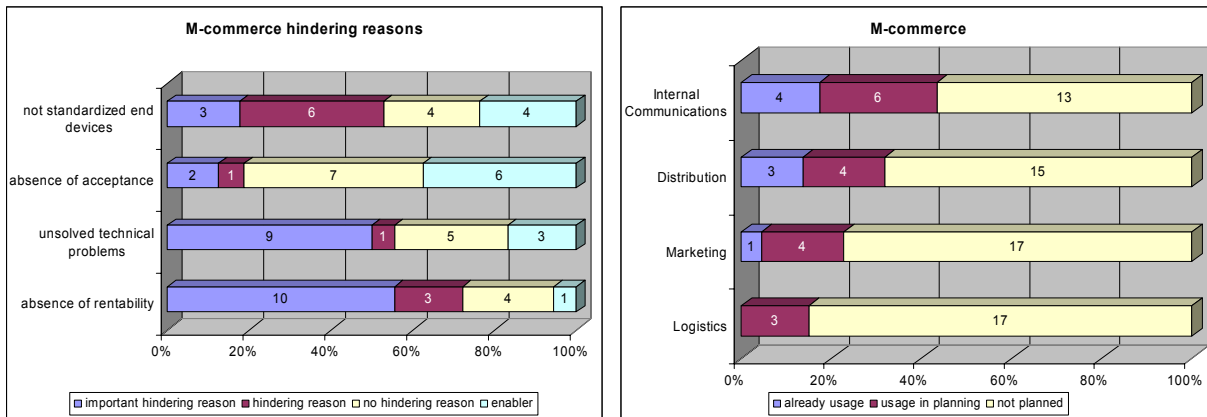
3.4. M-COMMERCE

The relative young and also controversial area of m-commerce as a mobile version of e-commerce is heavily disputed in its applicability and usefulness. In spite of the fact that until now hardly any mobile applications are offered together with the still difficult use of the mobile end devices, the field promises a fabulous future. Until now, the use of m-commerce is still restricted on WAP or i-mode sides or the forwarding of short messages. After a fast adoption of mobile phones, the so called non-voice services or m-commerce diffusion is in a very early stage. Although it might be too early for a significant statement based on only 23 respondents, we provide a few discovered m-commerce results as an early screen shot of innovation diffusion at its very early beginning.

Four enterprises indicated that they already begin to use mobile phones for enterprise-internal, verbal communication, further six enterprises plan the application, but still thirteen do not intend to do this. In

the sales department three enterprises used non-voice applications as mentioned as mobile data communication, nevertheless an enterprise used m-commerce for mobile marketing purposes. In logistics at present none of the enterprises uses mobile telematics services, three enterprises plans however a use. The most important hindering reason for a fast diffusion are at the moment the small mobile phones with their mini keyboards and displays together with the lack of m-commerce business models with sufficient profitability (thirteen denominations), followed by unresolved technical problems when converting existing e-commerce applications to the mobile area.

FIGURE 4 Usage and hindering reasons of M-commerce



4. CONCLUSIONS

As the empirical survey had shown it is not possible to use the EDI readiness of ICT mature enterprises as indicator for an innovation friendly company. It might be also possible that the use of knowledge management and especially m-commerce are at a very early stadium of diffusion, even in innovative enterprises. Further research will be conducted for a better understanding of the transmission process of IT standard diffusions together with a simulative method to explain fast diffusions based on networked technologies.

The camera ready paper will include the research results of an empirical survey among 13,000 SME in the German food and consumption industry. The findings will provide a better understanding of SME innovation behavior and the impacts of globalization on the e-business adoption decision. The provided data in

this paper was used as a pre-survey to formulate both quantitative as well as qualitative questions for the planned survey project.

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