

NATIONAL E-BUSINESS DIFFUSION

Research-in-Progress

Dipl.-Volkswirt Roman Beck
Institute of Information Systems
Johann Wolfgang Goethe University
Frankfurt am Main, Germany
Phone: +49 69 79828273
Fax: +49 69 79828585
rbeck@wiwi.uni-frankfurt.de

Prof. Dr. Wolfgang König
Institute of Information Systems
Johann Wolfgang Goethe University
Frankfurt am Main, Germany
Phone: +49 69 79828594
Fax: +49 69 79828585
wkoenig@wiwi.uni-frankfurt.de

ABSTRACT

National innovation systems are influencing the path of innovation diffusion like e-business. Important enablers of e-business diffusion are IT mature and innovation friendly enterprises. An indicator of IT maturity is the diffusion of former innovations like electronic data interchange (EDI). The innovation adoption behavior can be described as the adopting date after occurrence of an innovation. The conducted empirical survey analyzed the adoption of EDI as an indicator for innovation friendliness for a better understanding of the diffusion of e-business standards like XML/EDI or m-commerce. The survey detected a time-lag of EDI diffusion which is similar observable with XML/EDI or m-commerce. This research is part of the research project "globalization of e-commerce". The project analyses the impacts of e-business upon the national increase of factor productivity.

1. INTRODUCTION

During the last years an increase of productivity growth rates was observable in developed countries. Accordingly it was declared as the “new economy” effect. In spite of the so-called bubble burst the structural changes of economies and the increase of productivity is still observable. The research project “Globalization of e-commerce” analyzes the contribution of innovations like the Internet. Networked economies and e-business seem to be the main driver of these increases of productivity growth. The research target is the identification of measurable indicators and their contribution to the increase of the gross national productivity.

This paper treated the role of diffusion processes exemplified on EDI and e-business, which diffusion and impacts on business processes are not yet well understood. The empirical research described in this paper is testing a thesis about the German enterprises innovation model:

“German enterprises are fast adopters and acting as early followers after an e-business technology has proven successful.”

In case this thesis proves to be valid a time-lag must be observable between occurrence and adoption of innovation among German enterprises. As an indicator for the adoption behavior of new techniques the empirical survey analyzed the adoption behavior of former innovations such as electronic data interchange (EDI). The empirical survey identified time-lags in the diffusion path of EDI and e-business. An empirical approach was chosen since former analytical frameworks are not sufficient to identify relevant aspects. The research project defined e-business as the usage of innovative technologies in the B2B sector such as XML/EDI and m-commerce. The diffusion of e-business is defined as the adopting date after occurrence of a new technology.

Despite the existence of many different diffusion models for physical and non-physical goods (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 such as e-business and EDI. Schoder 1995 names three areas of deficit (Schoder 1995, 46-50). Firstly, there is a

lack of analysis concerning the phenomenon of critical mass. Secondly, the traditional diffusion models cannot explain the variety of diffusion courses. And lastly, the models do not sufficiently consider the interaction of potential adopters within their socio-economic environment. Based on these findings, this empirical research analyzes the diffusion of EDI, in order to learn more about the character of e-business diffusion.

This research-in-progress paper is based on traditional diffusion theories as well as network models of diffusion (section 2) which are useful to explain the diffusion of e-business and EDI. In section 3 we provide parts of the empirical research. In the conclusion (section 4) we provide an outlook into further research activities inside the research project “Globalization of e-commerce”.

2. DIFFUSION OF INNOVATIONS

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 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 communication. 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.

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 to 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).

Besides the analytical economic research approaches described above, a set of 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 studies are based on the critical mass approaches which analyze the diffusion rate of innovations, collective behavior, and 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. Subsequently, 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., Jansen 1999).

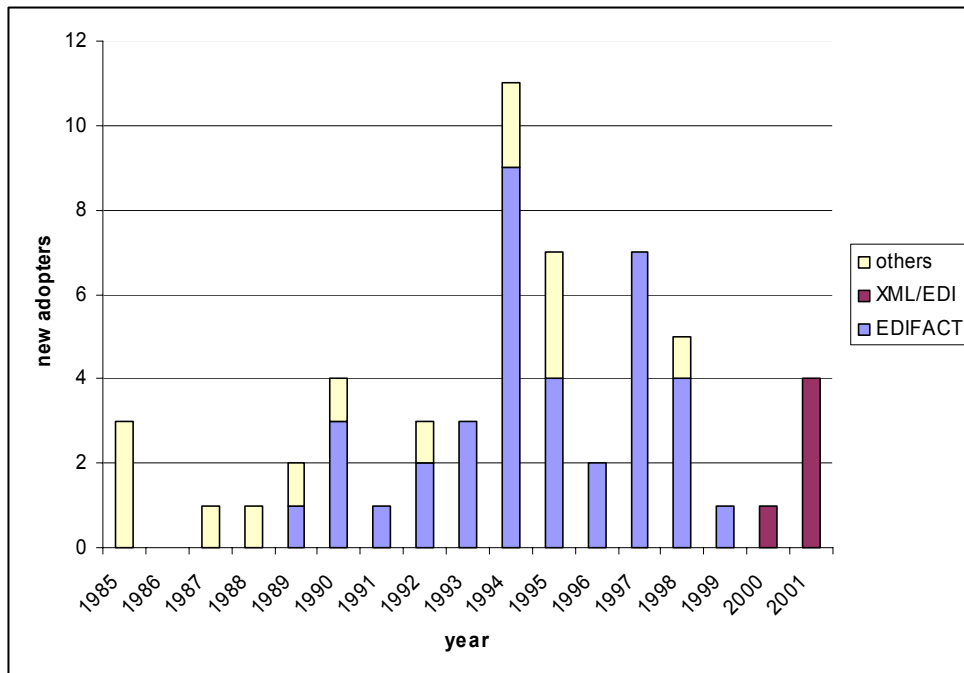
3. EMPIRICAL RESEARCH

The empirical survey was performed in cooperation with the German EDI society among their 450 members. These 450 enterprises include the largest EDI users in each industry, with more than 60 % being enterprises with more than 500 employees. The seven pages extensive questionnaire included e-commerce, EDI, and m-commerce or knowledge management questions. The survey was conducted in December 2001 and January 2002. The respondent ratio was 10.2 %, or 46 questionnaires. The interviewed managers (CIOs) were asked about existing e-business applications and their expectations about the diffusion and adoption of new solutions like m-commerce.

In Germany the diffusion of innovations such as EDI is strongly driven by the occurrence of UN/EDIFACT (electronic data interchange for administration, commerce and transport), introduced as ISO 9735 and ISO 7372 in 1987. Starting with INVOIC as message type, a large variety of message types, directories and subsets were introduced since then. In Germany, the first named EDIFACT imple-

mentation was in 1989 (see FIGURE 1). After a period with rather low adoption rates until 1994 a period with high adoption rates followed between 1994 and 1998. In the years 2000 and 2001 no further EDIFACT implementation were responded. Instead of EDIFACT the adoption of XML/EDI frameworks appeared in 2000 and increased in 2001. Earlier EDI frameworks in the finance (SWIFT) and automotive (VDA) sector were also mentioned. Of especial interest for the adopting behavior of German enterprises is the diffusion of EDIFACT. With a time-lag of two years after introduction the penetration started with low adoption rates until its high-point in 1994 and fall unsteadily until 1999. With the appearance of the first XML/EDI frameworks in 1998 the first implementation in Germany was mentioned two years later in 2000. XML/EDI frameworks are becoming increasingly important to connect business partners with none EDI converter systems over the Internet. Most of these business partners are small or medium-sized enterprises.

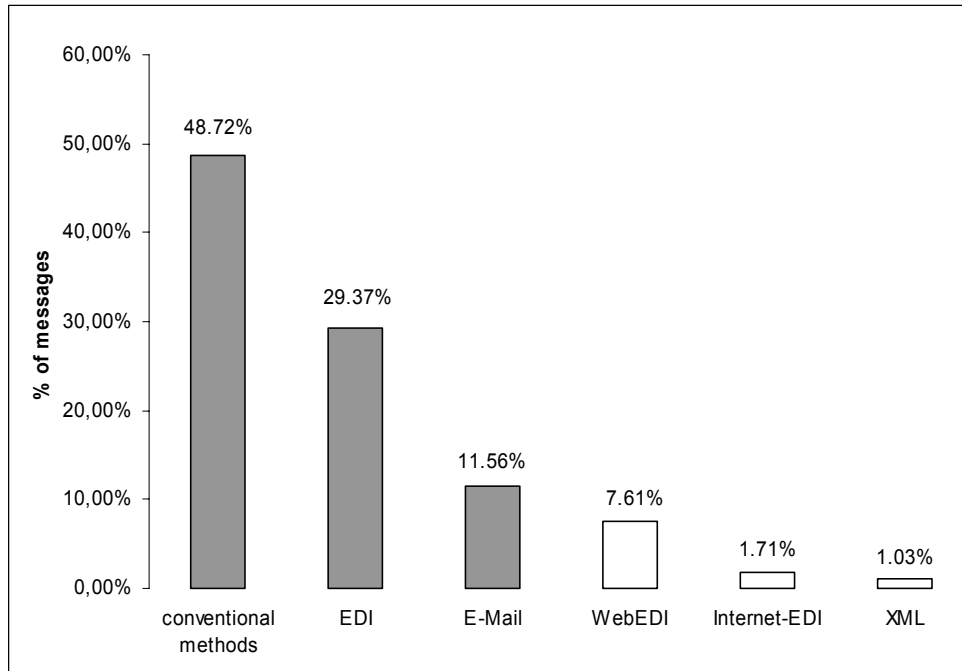
FIGURE 1: Diffusion of EDI standards



Besides traditional EDI new forms of e-business exchange standards such as WebEDI (Beck et al., 2002), XML/EDI (Weitzel et al., 2001) and Internet-EDI have emerged. EDI over the Internet, for example, allows a less expensive transmission of EDI messages over Internet protocols compared with the former

necessary proprietary value added networks (VANs). In spite of the increasing rate of XML/EDI implementations the ratio of sent and received messages is rather low (FIGURE 2). The usage of further e-business innovations like Internet-EDI or WebEDI is slightly higher. The diffusion of these standards are at the very beginning in Germany, nevertheless these technologies are not new.

FIGURE 2: Sent and received messages as ratio of communication channel



To forecast the further development of e-business diffusion the questionnaire asked the managers about their estimations by agreeing or rejecting provided statements. Altogether 36 enterprises participated. Predominant agreement prevailed with the question, of whether the Internet is economical. However, uncertainty prevailed with the question of whether Internet access is abused by employees for private purposes and/or whether there is a meaningful application concerning the Internets for data transmission. 21 enterprises felt 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 been generally accepted. Despite these doubts about safe data transmission, the potentials of the Internet are realized by most enterprises. 25 enterprises use the Internet as information portal for customers with local dealer search func-

tions and services such as the tracking and tracing of packages. Most enterprises are planning further e-business-applications such as on-line financing and logistics tools.

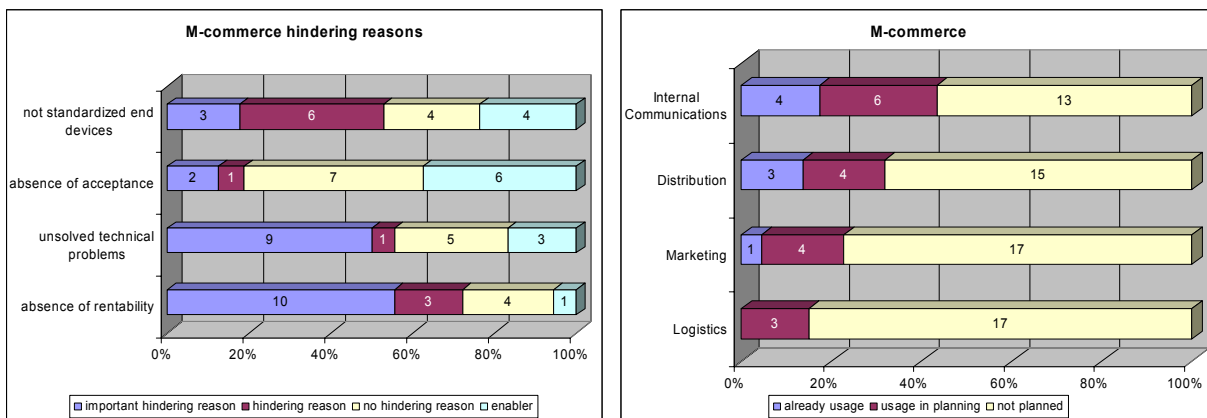
The complete integration and adjustment of all business processes coupled with the increasing possibilities in networked economies, and the globalization of e-business is becoming increasingly important inside enterprises. Unfortunately, the awareness and necessity for a corporate e-business strategy is not yet developed at most enterprises. However, an enterprise-wide e-business-strategy existed only in 34% of the 35 enterprises answering this question. Further 49% answered, that an e-business-strategy existed at least in sub ranges. 17% of those answering could hardly show any e-business strategy. In other words, 66% of the enterprises regard e-business as un-strategic. Due to this, 61% of the enterprises plan e-business investments only up to € 5 million in this area in 2002 and only 8% plan investments amounting to more than € 10 million. 31% of the enterprises plan investments between € 5 and 10 million. 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 manager indicated that a conversion fails because of the missing support by the management.

For example only 18% of respondents had, a company-wide knowledge management solution; a 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 relatively young and 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 with the still-difficult use of the mobile end devices, the field has a promising 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 “conclusive statement” based on only 23 respondents, we provide a few discovered m-commerce results as an early peek at innovation diffusion at its very early beginning.

Four enterprises indicated that they have already begun to use mobile phones for enterprise-internal and verbal communication, six more enterprises plan the application, but still thirteen do not intend to do this. In the sales department three enterprises used non-voice applications (mentioned as mobile data communication). Nevertheless, an enterprise used m-commerce for mobile marketing purposes. In logistics none of the enterprises presently use mobile telematics services. However, three enterprises are planning to do so. The most important hindering reasons for a fast diffusion at the moment are the small mobile phones with their mini keyboards and displays, the lack of m-commerce business models with sufficient profitability (thirteen denominations), as well as unresolved technical problems occurring when converting existing e-commerce applications to the mobile area.

FIGURE 3 Usage and hindering reasons of M-commerce



4. CONCLUSIONS

In this first step the role of e-business innovation diffusion as necessary prerequisite for productivity increases was focused. The survey has not analyzed which transmission processes were responsible for the resulting EDIFCAT adoption. As the empirical survey has shown, it is possible to use the EDI diffusion with it observed adoption lag of two years as an indicator for innovation behavior of German enterprises. A second empirical survey will be conducted in summer 2002 among 13,000 enterprises in the German retail market, based on the experiences of this survey. The planned empirical research should point out the national innovation behavior in the German service sector and sustain the thesis of the importance of e-

business as driver of the increase of productivity growth inside this sector. These empirical as well as analytical research activities should help to solve the research question if e-business as band wagon effect of a networked economy can lead to a higher economic cycle or not...

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