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on the Diffusion of Electronic Data Interchange
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by

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**ABSTRACT**

An information system does not exist in a vacuum. It exists within an organizational and societal context which influences its design, use, management and ultimate acceptance. This paper reports on research into the influence of societal context on the acceptance and use of information systems. It is an examination of the influence of societal factors on the diffusion of electronic data interchange in the Netherlands. Semi-structured interviews with participants and observers of the diffusion process revealed the nature of this societal influence. Technology stimulation programs at the national and European Community levels combined with infrastructure developments have helped to shape the introduction and use of EDI in a fashion that is consistent with economic and cultural factors in the Netherlands.

INTRODUCTION

During the 1970's and 1980's the importance of organizational context was recognized in the information systems field and became a legitimate topic of IS research. During the 1990's we can expect the societal context which incorporates political, cultural and economic factors to become an important aspect of IS research as well. There are several reasons why this should be so. As the world comes closer together through transnational cooperation and political alliances, greater attention is being given to national characteristics which influence the successful development and use of information technology. At the national level, the societal rejection of certain technologies¹ suggest that technical excellence alone will not result in the successful implementation of IT. Finally, the unfulfilled promises of technology and its negative consequences for privacy invasion and laborforce reduction suggest that the larger society beyond the doors of the organization needs to be taken into account in the study of information systems and technology.

There are two aspects to the study of societal context as it relates to information systems. One is the impact of the technology on the society. The other is the influence of the society on the development and use of technology. The research reported in this paper focuses on the latter aspect. It is directed at examining the societal context within which information systems develop by examining aspects of the culture,

public policy, economy and societal infrastructures that exert an influence on the need for, types, and ways in which information systems are used in a given country.

Specifically, this study is concerned with electronic data interchange (EDI) and the role that factors in the societal environment play in its diffusion. The context of this study is the Netherlands, a country which has made the diffusion of IT in general, and EDI in particular a matter of national importance. Though the data from this study is specific to a particular information technology and a certain country, both the country and the technology can be viewed as examples of the issue of societal influence on technology diffusion. The analysis and conclusions are intended to add to our general knowledge about the way in which features of the societal environment help to shape the diffusion of any new information technology. In doing so it will contribute to the development of a research model identifying societal factors to consider when studying the introduction of IT.

PROJECT DESCRIPTION

In order to determine the way in which features of the societal environment influence the diffusion of EDI in The Netherlands a series of semi-structured interviews were conducted during June and July 1992. Those from whom data were sought are members of the following groups:

Providers - those involved with providing technological capability for electronic data interchange, such as representatives from the Dutch PTT, value added network providers, and software vendors.

Policy Makers - representatives from government agencies and standards organizations.

Users - firms currently using EDI or industry organizations established to promote the use of EDI.

Observers - researchers, consultants and others in a position to observe the diffusion of EDI.

Interviews with these individuals lasted approximately one and one half to two hours. At some organizations, more than one individual was interviewed. Items discussed in the interviews were drawn from the results of previous studies which considered societal factors to be taken into account in the development and management of information systems [3,4,8,10] and from related research conducted by one of the authors [15]. The interviews focused on the following aspects of the societal environment: economy, government strategy, technological infrastructure, culture, and the European Community.

RESULTS

Electronic data interchange, in its earliest form began in the late 1960's when companies such as Philips began exchanging electronic data using proprietary standards. By the early 1980's

large firms in the Netherlands were becoming involved in EDI activities. But the majority of the EDI developments have only occurred in the past five years [9]. The progress that has been made is the result of the influence of economic sectors which recognized the benefits of EDI, industry and national EDI user organizations, government stimulation programs, and motivation from international trading partners.

The Economy

In many respects the Dutch economy is well positioned to be receptive to EDI. It is an open economy in which trade is dominant. Thus, the progression to electronic trading is a natural one. Because of its international orientation, key sectors such as trade, transport, distribution and agriculture were sensitive to increased international competition due, in part, to increased use of information technology. Since these sectors are all information intensive, they have been open to improvements in information processing and transmission [13].

An example exists in the flower sector. The Netherlands dominates world trade in both the production and distribution of flowers and is the leading contributor to the Dutch Gross National Product. Not only is it the largest producer of flowers but it also distributes flowers grown elsewhere such as those grown in South America and destined for markets in North America. Time and speed are crucial in an industry in which the freshness of the product is paramount. At present, the entire value chain

of the flower industry is highly automated: from production through auctioning to transportation. Members of the flower industry, themselves, recognized the need to explore the advantages of EDI in advance of any government stimulation programs. In 1988 members of the industry established a flower industry bureau and sought funding from a government program established to support innovative technology projects. From this and subsequent funding and organization called EDIFLOWER was created. A primary focus of EDIFLOWER has been the creation of EDIFACT messages² [1].

Government Stimulation Activities

The government approach to EDI diffusion (and IT in general) is one of indirect stimulation through industry sectors. This occurs when a technology is seen as being central to the enhancement of the Dutch economy. The government strategy is to create the necessary preconditions for the technology to flourish [13]. This is accomplished by directing efforts at awareness, motivation, education and research. The Dutch government hopes to motivate use of EDI by funding concrete projects. These projects serve two purposes. First, as in the case of the flower sector, they enable firms or industries who are already motivated, to experiment with the technology. Second, these projects serve as demonstrations of effective use of EDI so that others may see for themselves its benefits.

The private sector also plays a key role in decisions

regarding project funding. Leaders of industry have participated in setting priorities by targeting industries in which EDI will improve their competitive positioning. From the beginning of EDI stimulation programs, private sector participation has occurred through analysis of issues, assistance in decisions regarding project funding, and sometimes through direct encouragement of firms to get involved with EDI [16].

An important component of the stimulation strategy is that technology push cannot continue indefinitely. At a certain point market pull must take over if the technology is to be successful. EDI, for example, was a high priority for three years (1989-1991). It is now moving into the phase in which market forces will determine its viability [16].

The primary government agency facilitating the diffusion of EDI is the Ministry of Economic Affairs. In the mid-1980's it established the Informatics Stimulation Program which was concerned with stimulating the development of information technology in general along with related education and research. In 1988 the focus was moved to specific applications of IT. It was during this time that the government began to recognize the national strategic advantage of EDI [13]. In 1989 it inaugurated the three year VEDI³ program to provide funding for the development of model EDI projects. Consistent with the economic strengths of the Netherlands, nearly half of the VEDI projects

were in trade and transport, a third were in industry and construction, and the remainder were in service industries [6, p.7].

Other agencies involved with technology stimulation efforts are the Ministry of Telecommunication, Trade and Transport which focuses on EDI in the transport sector, and the Ministry of Agriculture which is involved with EDI activities in that sector. The Netherlands Office of Technology Assessment provides the necessary background research into and evaluation of new technologies.

Facilitating the diffusion of EDI has not ended with the close of the VEDI program. It continues through the activities of EDIFORUM. This organization was established in 1988 as an EDI user organization for the trade and transport sectors. It has since grown to include all sectors. Its overall mission is to promote the use of EDI in the Netherlands. It does this by coordinating the efforts of various sectors and industries, undertaking research and disseminating the results, and serving as the liaison between government efforts and private sector projects. In addition, it is the locus of standards activities in the Netherlands. The example set by EDIFORUM is being followed by other countries which are establishing similar organizations [9].

Information Technology Infrastructure

While informants have observed that it is the perception of mutual benefit that drives EDI, not the network or the

infrastructure[2], these are, nevertheless, necessary factors for the successful diffusion of the technology. The perspective of the Dutch government is that the telecommunications infrastructure should be the engine of economic development. It should be open and standardized and not a barrier to innovative uses. The recent privatization of the Dutch PTT is consistent with this philosophy.

Prior to privatization, the Dutch PTT was a government agency of the Ministry of Telecommunications, Trade and Transport. It retained a monopoly on all telecommunications equipment and service provision except in-house communications systems. Bureaucratic inefficiencies that resulted in nonresponsiveness to customer needs along with the desire to promote technological innovation through greater competition led to the privatization in 1989. The Dutch government originally held all the shares in PTT Telecom but is beginning the process of selling up to forty-nine percent of them.

Under the new structure PTT Telecom is the monopoly provider of the physical infrastructure. Data and international voice transmission is open to other providers. Value added network services are also permitted. This last aspect of the regulatory structure is very important for the diffusion of EDI since most Dutch companies utilize VANs for such transmissions[16]. A state PTT with monopolistic control of value added services can be a barrier to EDI when the absence of competition results in higher costs and services which are not state-of-the-art[2].

Another aspect of the technological infrastructure important to the diffusion of EDI is the installed base of information technology and the level of technological literacy in firms which will be using it. Experience with EDI projects to date has shown that these are indeed influencing factors. While the flower sector is highly automated, it is primarily in the areas of production and distribution; only twenty to thirty percent of the companies have automated management systems. As a result, there has been some difficulty in demonstrating the cost effectiveness of EDI[1]. Since the benefits are based on the use of the information from the EDI transmissions, companies without these management systems need to develop applications in order to benefit from EDI. An early EDI project in the transport sector, INTIS was established to automate some of the activities at the port of Rotterdam. One of the problems it encountered resulted from the fact that many of the small firms had totally manual operations. Resistance resulted from a lack of IT experience which led to the perception that the cost of EDI made it too risky a proposition[11].

A final aspect of the technological infrastructure that has influenced the success of EDI projects is standards. The absence of EDIFACT standards is a definite barrier to EDI diffusion as the INTIS experience showed[11]. A complicating factor is the existence of multiple EDI standards throughout the world. For example, wholesalers in the flower industry who deal with the U.S. have to use as many as eight different standards [1].

Culture

At the heart of societal factors in a nation which can influence the diffusion of EDI is its culture. It pervades all the other factors. Four terms emerged repeatedly during the interviews when the topic of the Dutch culture arose. They are: trading, pragmatic, trust, and consensus. These characteristics help to account for the relatively rapid diffusion of EDI in the Netherlands as well as the particular way in which it has been shaped.

The Dutch describe themselves as a trading people. This term is used explain a tolerance of differences and an openness to new ideas and approaches. But the pragmatic feature requires that sufficient justification also be given. Thus, in order for EDI or any new information technology to be accepted, demonstrated benefits must be in evidence. The Netherlands has also been described as a trust culture in which commitment, discussion and consensus are key elements. These features have a distinctive influence on the implementation of EDI. In many business relationships there is a dominant partner who is in a position to impose EDI on its trading partners. (In the United States this situation has been described as the weaker partners receiving "drop dead" letters informing them that they must use EDI if they want to continue doing business.) In the Netherlands, however, the EDI negotiations are conducted, not using the framework of power but of consensus [5]. There was universal agreement by informants about the following critical success factors for EDI

in the Netherlands.

Trust. Trust is essential. With it a variety of problems can be overcome. Without it, EDI will fail. For example, there are certain legal issues associated with EDI such as the absence of a signature or possible privacy invasion when the systems contain confidential personal information. The response to these issues was that there has to be a trust relationship to begin with. And if there is, then a "gentlemen's agreement" is sufficient and privacy is not a concern [2,11]. This is not to say that everyone automatically trusts each other. In fact, one informant stated that the Dutch start with distrust [20]. Part of the problem with the INTIS project was that not all of the players trusted each other [2,18]. This means that more effort may need to be exerted in establishing an EDI relationship in the beginning but once it is accomplished, subsequent difficulties may be easier to overcome.

Win-Win. What accompanies trust is the perception of mutual benefit. These factors reinforce one another. Trust is needed but it is not sufficient. Both partners must also see the advantages in clear, measurable terms. There must be consensus. The perception of a win-win situation, in turn, provides motivation to trust each other. EDI will only be successful when all parties involved are motivated to engage in it. This cultural trait is clearly present in the approach taken by the government in its stimulation strategy. It takes a proactive role in supporting projects which will demonstrate the benefits and encourage EDI

use rather than allowing a laissez faire situation in which some dominant international players might attempt to impose EDI on Dutch companies.

Work councils. Part of the concept of mutual benefit exists on the part of management and labor as well. Both sides must also see the benefit of EDI for it to be successful. In fact, Dutch law requires the involvement of work councils when jobs are significantly affected by the introduction of technology [7]. Consensus plays an important role here. Just as both trading partners must see the benefits, so too must labor see the benefits to the firm, the country and the economy [2]. Since there is more harmony between labor and management in the Netherlands than in some other countries, this is a reasonable and achievable endeavor.

The European Community

The final societal factor exerting an influence on the diffusion of EDI in the Netherlands is its participation in the European Community. As the Single European Market increases competition, information technology in general and EDI in particular will become more important factors in competitive advantage [13]. In addition, the deemphasis on national borders means that the burden of certain data gathering will fall on firms. For example, since customs data will no longer be collected at national borders, firms in EC countries will need to collect and maintain their own statistics on transport.

This heightened need for information processing on the part of member countries is being accompanied by a strong telematics thrust within the EC. The European Community Green Paper of 1987 [14] expresses the movement towards liberalization of telecommunications markets. The viewpoint is that more competition will improve telecommunications infrastructures and motivate providers to offer value added services. At the same time that it is encouraging diversity through competition, it is emphasizing harmonization through standards. In the case of EDI this means that the European Community is a leading player in the development of EDIFACT standards. To the extent that the absence of standards represents a barrier to the diffusion of EDI, the EC efforts in this regard can be seen as stimulating EDI development.

Further EDI stimulation is occurring through a number of programs directed at technology development in general and EDI development in particular. The TEDIS program is directed at EDI stimulation through promoting projects, creating awareness and developing standards. (The EDIFACT Secretariat for Western Europe is within TEDIS.) The first phase of TEDIS which ended in 1991 was similar to the Dutch VEDI program: stimulation through the funding of model EDI projects. The intent was to heighten awareness and motivation by highlighting successful EDI implementations. The second phase, begun in 1992, is directed at stimulating EDI platforms on a European scale and harmonizing legal rules.

CONCLUSION

"In the 1990's social and cultural factors regarding technology will play a much more important role than in the past," replied Professor Zegveld of the Netherlands Office of Technology Assessment when asked about the relative importance of societal factors in information technology diffusion [20]. The results of this study reinforce this perspective. While examination of the interaction between societal factors and technology as been ongoing in the sociological literature, these authors argue that greater attention to this topic needs to be paid by the information systems community. Just as organizational factors will influence the design and ultimate acceptance of information technology, so too will political, cultural and economic factors help to shape the rate and path of IT diffusion in a nation.

NOTES

1 Examples are videotex and the picturephone in some countries.

2 "Messages" refers to transaction sets defining the content of EDI documents.

3VEDI ("Voorbeeldprojecten Electronic Data Interchange" - Model Projects on Electronic Data Interchange) is a program run by the Directorate-General for Services, Small and Medium-sized Enterprises and Planning, of the Netherlands Ministry of Economic Affairs.

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