Electronic Data Interchange: A New Frontier for Global Standards Policy

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Electronic data interchange (EDI) has become an important enabling technology for the creation of a global business environment. It is also raising issues for global standards policy. This article traces the evolution of EDI standards in the United States and in the European Community. It illustrates the fundamentally different perspectives on standards policy by contrasting the approach to EDI standards development each has taken. EDI standards development in the United States, consistent with the American preference for market-based, pluralist policy, is "bottom-up," reflecting a competitive policy perspective. In contrast, the EDI standards development process in the European Community, where standards are viewed as a vehicle for unification is a "top-down," exhibiting a cooperative policy perspective. Given the differences in approach, compromise is required on both sides if the global harmonization of EDI standards is to be achieved.

Electronic data interchange (EDI) is emerging as one of the central enabling technologies for the creation of a global business environment. Throughout the world, firms are increasingly enmeshed in complex networks of transactions and operations. Customers are changing as well, becoming more global, and demanding swifter response and more customized products. Within the global economy, there is increasing need for companies to create linkages across their chain of value-adding activities, to meet the requirements of intensified competition and sophisticated customer demands. The swift, accurate movement of electronic information throughout business processes has become a critical component of strategic advantage, and is driving fundamental developments in the international telecommunications infrastructure. Increasingly, firms are moving towards tighter coupling with their corporate suppliers and customers. In the words of the French political scientist Albert Bressand, the international business environment is "moving from an age of trade-centered interdependence to an age of network-driven interconnection" (Bressand, 1989).

New information technologies such as EDI affect the internal and external activities of firms in several ways. First, the speed of transactions can be greatly increased, which in turn accelerates business processes. Second, since physical distance among firms is largely irrelevant to electronically transmitted information, new opportunities arise for the coordination and integration of spatially distributed operations. Third, new interdependencies among enterprises can be created. In doing so, intermediaries which slow speed and increase the cost of information transmission and access are bypassed. (U.S. Congress, 1990).

The intent of this article is to consider the differences in approaches to EDI standards between the United States and the European Community, and to suggest some implications for global standards policy. We begin by stating the case for EDI. We then describe the development of EDI standards in the United States. In the United States, EDI policy has evolved in a "bottom up" fashion consistent with a decentralized approach to

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other aspects of information and telecommunications policy formulation (Trauth, 1986). That is, standards have developed on an industry sector basis in response to developments in the marketplace. We then show how, in contrast, the European experience with EDI standards has been "top down," in response to leadership and incentive programs in the European Community. In both cases, these differences in EDI policy formulation are shown to be consistent with the overall approaches to standards policy in other areas. We conclude by raising issues which both the United States and the European Community must address if a global EDI policy is to be achieved. The United States and the European Community have been chosen for this comparative study of EDI standards because each represents opposite ends of the standards policy spectrum.

Why EDI?

EDI is the computer-to-computer exchange of structured business information. This information typically takes the form of standardized electronic business documents, such as invoices, purchase orders, bills of lading, and so on. Unlike unstructured computer-based information exchanges such as electronic mail or fax, EDI involves specific documents in standardized formats. EDI exchanges may move within or between firms. (See the Appendix for a glossary of EDI terminology.)

By reducing the cost of, and potential for, error in transmitting and re-keying paper-based transaction information, EDI can offer significant savings in both cost and time. For example, at one of its manufacturing plants, Digital Equipment Corporation lowered the cost of processing purchase orders from $125 to $32, and cut delivery time from five weeks to three days after implementing an EDI system (Korzeniowski, 1989). By using EDI to improve purchasing forecasts, Hewlett-Packard reduced manufacturing lead times from 16-24 weeks to 2-4 weeks (Ioannou, 1990).

Such improvements in efficiency and cost which derive from moving to electronic data exchange indicate the magnitude of documentation generated by cash and information flows within and between firms. Horan has estimated that the average inter-firm transaction generates thirty documents, ranging from pre-order processing (including information exchanges of catalogs, price lists, and requests for quotes), to order processing (purchase orders, acknowledgements, status requests and responses), through production (materials release forms) and transportation (exchanges between shipper, carrier, and receiver) to billing, credit and funds transfer documentation (Horan, 1989). Each of these paper-based documents requires numerous keying and re-keying operations, as well as physical transfer through the mails, with multiple chances for error, delay, and confusion.

Businesses expect a range of benefits to accompany the movement to EDI. Within the firm, these include: reducing time delays; lowering error, labor and clerical costs; improving cash and information management; and gaining competitive advantage through value-added information. Between firms, benefits accrue in relations with both suppliers and customers. Linking with suppliers by EDI can reduce inventory costs and streamline delivery schedules. EDI links to customers can increase responsiveness, enhance customer service, and create new opportunities for personalized products and services.

Driven by increasing awareness of the benefits of EDI, the total level of EDI expenditures by US firms exceeded $250 million in 1990 (Gartner Group, quoted in Ioannou, 1990). Estimates of growth rates vary, but range from 40% to 70% annually, to make EDI a multi-billion dollar market by the end of the decade. By 1991, an estimated 12,000 US firms were using some form of EDI with suppliers and/or customers, and that number is expected to triple by the mid-1990s (Dreyer, 1990:20).

Growth of EDI usage and spending has been much less rapid in Europe. In 1990, European firms spent a total of about $50 million on EDI, only one-fifth the US level. There are between 4,000 and 5,000 EDI sites in Europe (out of some six million organizations), or 22% of the world total. A recent market study by the British firm Ovum predicts a nearly $400 million European EDI market by 1994, and a 12-fold growth in EDI traffic by 1995 (Lawrence, 1990). European EDI usage is strongly concentrated in the United Kingdom. The UK accounted for 90% of EC EDI expenditures, and 70% of the sites ("EDI in Europe," 1991). The unified European market is generating a considerable increase in transborder electronic traffic, leading to at least a 25% reduction in document generation and reproduction costs (Etheridge, 1988).

Although by the early 1990's EDI was growing rapidly in both the United States and the European Community, diffusion of both the technology and the standards setting process took different paths. The following sections examine these differences and the implications for global standards policy.

Diffusion: The Search for EDI Standards in the United States

Pattern of Diffusion

The history of EDI in the US can be divided into three phases. The first phase represents the early efforts by industries and standards bodies to promote the electronic exchange of business documents. During the second phase, American firms experienced significant growth in EDI usage. The third phase, involving participation in the international effort to harmonize different standards in order to achieve global consistency, has just begun. The evolutionary phases of electronic data interchange are consistent with the patterns of technological diffusion examined in other contexts (Rogers, 1983).

EDI was pioneered in the United States by the transportation industry. In 1968, companies in this industry formed the Transportation Data Coordinating Committee (TDCC) to develop a common set of formats for electronic dissemination of transportation documents. The first set of TDCC standards was published in 1975. During this same period other industry-based groups, including the grocery, warehouse, and apparel industries, also developed and promoted their own, industry-specific EDI standards. Thus, the pattern for early EDI standards setting and policy emerged from industry-led, marketplace requirements.

The first American attempt to bring conformity to EDI standards was the establishment in 1979 of the American National Standards Institute (ANSI) X12 Committee on Electronic Data Interchange. ANSI is a private, not for profit federation of United States' standards-setting organizations. It is the national member representative to the International Organization for Standardization (ISO), the major international body concerned with developing and promoting international standards. EDI standards are among the many types of standards developed by ANSI and ISO.[1] ANSI, whose membership includes representatives from technical disciplines as well as trade and commerce, serves as the coordinator and clearinghouse for national and international standards. The X12 Committee was charged with developing uniform standards for cross-industry electronic communication relating to order placement and processing, shipping and receiving, invoicing, payment, and cash applications (ANSI ASC-X12, 1987). Standards originally established by TDCC provided the basis for those to be adopted by the X12 Committee. The formation of this Committee within the national standards setting agency lent legitimacy to EDI, and marked the beginning of its widespread adoption by American businesses.

The diffusion of EDI in the American business environment during the 1980's reflected two distinct patterns of corporate adoption: the proactive and the reactive. A small number of large firms, recognizing the operating efficiencies which could result from streamlining business document exchanges with their trading partners, became proactive users of EDI. These dominant players exerted pressure on their trading partners — suppliers, customers and distributors — to adopt their industry or proprietary EDI format. Those trading partners, placed in a reactive position, would often receive a "drop dead" letter from their large, dominant partners informing them that EDI had become a condition of doing business (EDI Implementation: Steps for Success, 1991). Firms such as Wal-Mart (retailing) and General Motors (automotive) were particularly aggressive in demanding compliance with their proprietary EDI standards. Even large supplier firms, such as Gillette, were quick to convert to the EDI standards of Wal-Mart, a major customer.

However, by the mid-1980's, a proliferation of industry- and firm-specific EDI standards threatened to significantly raise EDI costs since many firms were compelled to support several different EDI formats. These added costs, and the demands that the dominant trading partners often imposed, could have significantly slowed EDI growth in the US. The establishment of a national standard in the form of the ANSI X12 standard, and the coherence it brought to the standards process, encouraged more American firms to adopt EDI. During the second half of the 1980's, several industry specific standards began to migrate towards the X12 standard. Many large firms which had been EDI pioneers recognized that their temporary competitive advantages due to "locking in" trading partners must give way to common, or at least readily translatable, formats, and began to phase out their proprietary protocols in favor of X12.

The early 1990's represents a third phase in the diffusion of EDI. During the next few years, EDI is expected to expand widely in the United States, tripling in volume by mid-decade, involving perhaps 70% of US firms (Dreyer, 1990). EDI, like the telephone, is becoming an indispensable requirement for doing business. EDI is expected to merge with other forms of communications like electronic mail through new telecommunications standards such as X.400. The main challenge of this third phase of EDI diffusion in the 1990's is to link up the US-based X12 standard with EDI standards used in other countries. This is necessary in order for firms to

achieve true global harmonization and integration of electronic document exchanges among international trading partners.

Standard Setting in the United States

The X12 standards provide formatting guidelines for well over 80 business documents or transaction sets. Some of these standards are generic while others are industry-specific. X12 standards establish definitions for several elements of a transaction set, including the kind of document, the data included in the document, the sequence for presenting information, the form in which the information must appear, and the meaning of individual pieces of information. Taken together, these define unambiguously a transaction set which can be read and understood by all senders and receivers. In addition to formatting guidelines, US EDI standards also specify such aspects of the communication process as baud rate, line protocol (asynchronous vs. bisynchronous), and communication links (Emmelhainz, 1990).

The ANSI X12 Committee develops standards on a consensual basis. The Committee's membership consists of volunteers from industry groups. Some of these industry representatives engage in general and administrative work such as serving on the Steering Committee or the Procedures and Review Board. Others serve on industry-specific subcommittees such as government or transportation.

Typically, a request for a new or changed transaction set format is sent to the X12 Secretariat (see Figure 1). Following confirmation that the proposal fits within the scope of X12, it is forwarded to the appropriate subcommittee, which carries out the actual standard development process. The draft proposal is then made available to the entire X12 membership for review, comment, and vote. Once the proposed transaction set clears the X12 hurdles, it is reviewed by ANSI, a process that can take two or three years. Only with the approval of ANSI does the transaction set join the list of approved EDI standards in the United States. Due to the lengthy review process, most EDI "standards" currently in use are actually only draft versions. Since the EDI business user community is impatient for standards it generally considers a standard approved once it passes the X12 review.

Periodic changes to an EDI transaction set are issued by both ANSI and the X12 Committee. ANSI produces updated transaction set versions every two to three years as part of its normal review cycle and the X12 Committee issues new releases of a transaction set annually. At present, over 50 American industries support the X12 group of transaction set standards and the review process.

Standards Policy Perspective: Competition

The approach to EDI standards development in the U.S. is consistent with overall standards policy in this country. According to a recent study by the Office

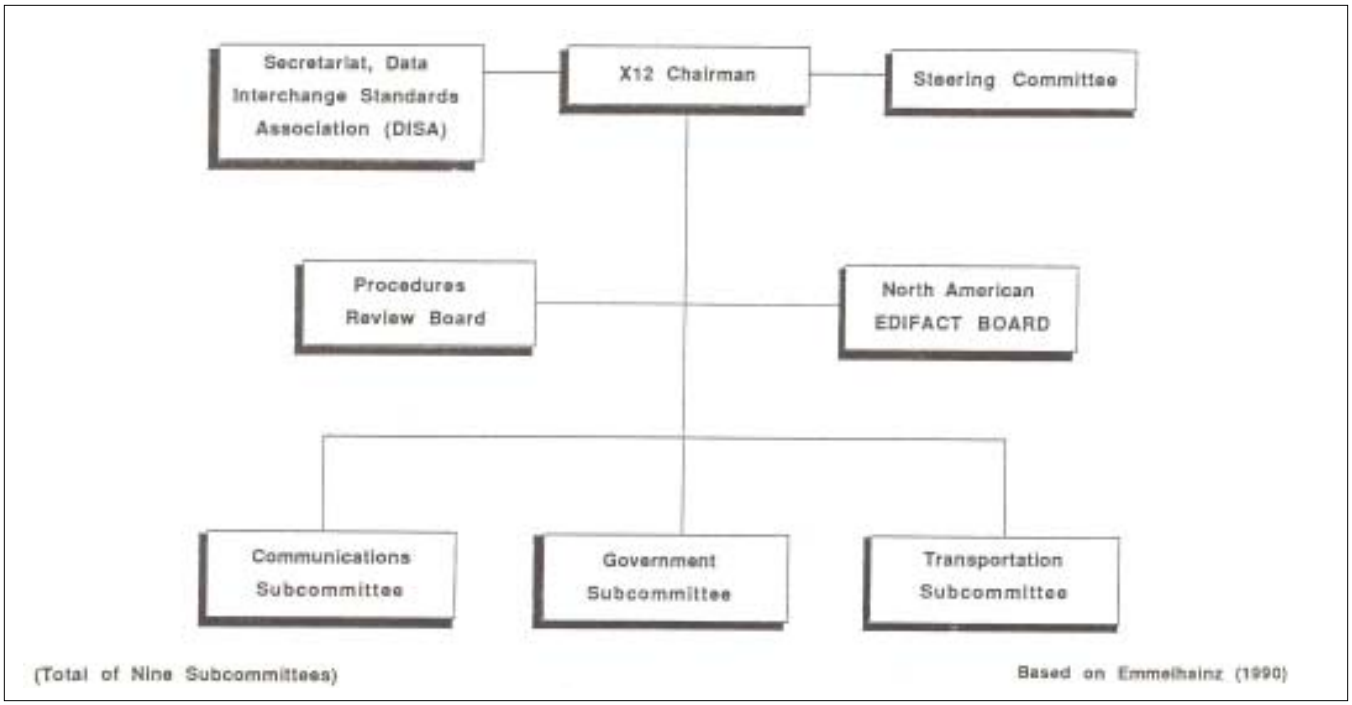

Figure 1: ANSI X12 Structure

of Technology Assessment (OTA), the standards setting process "... reflects American political culture, and the general preference for market-based, pluralist solutions," with the result that over half of the standards in the United States—and all of the EDI standards—are set by the private sector through voluntary participation in the process (US Congress, 1992:3). In all other industrialized countries, governments view the standards process as part of the industry infrastructure and standards policies are set nationally (US Congress, 1992: 17). In contrast, ANSI is purely a coordinating body. The assumption is that the free market will determine the most appropriate standards. But as the OTA study points out, the absence of government leadership has produced a standards setting process which exhibits conflicts over who may participate and what constitutes "due process," Standards setting discussions have often been characterized by struggles over leadership, and by an overall lack of trust among members (US Congress, 1992: 13).

The development of EDI standards from industry-led, marketplace requirements is also consistent with the American approach to telecommunications policy, which is based on competition as the vehicle for improvements in technology and service (Trauth, et al, 1983, and Trauth and Pitt, 1992). The orientation toward competition as a motivating force is evidenced in the the terms used to describe activities associated with EDI: competitive advantage, "locking in" a trading partner, and "locking out" competitors.

The American perspective on EDI standards and their development can be characterized in the following way. Consistent with Americal political culture, there is a fundamental commitment to competition as the vehicle for quality products and services, and lower prices. In the case of EDI this commitment to competition is manifested both in the use of EDI to achieve competitive advantage over others, and by the evolution of standards through an inherently free market process. EDI standards used currently in the US have resulted from: (1) pressures exerted by dominant trading partners to use proprietary standards; (2) industry-wide efforts at standardization; and (3) voluntary participation in the ANSI standards process. Table 1 summarizes the American standards policy perspective.

We turn now to a consideration of the different path by which EDI is evolving in the European Community, and the contrasting approach taken by the European Commission in the standards-setting process.

1970s:
- Industry specific standards:
  Examples: TDCC (Transportation); VICS (Retail); UCS (Grocery)
- Proprietary Standards
  Examples: Wal-Mart, General Motors

1980s:
- American National Standards Institute (ANSI) X12 Committee begins activities (founded 1979)
- 1985: ANSI Series 1 published
- Proprietary standards become less important as EDI usage expands
- Industry-specific standards begin to migrate to X12 by end of decade

Early 1990s:
- ANSI X12 standards dominate in U.S.
- Discussions begin for migration of ANSI X12 future versions to EDIFACT
- U.S. Customs announced intent to implement EDIFACT for U.S. imports

United States: Competition Perspective
- Commitment to competition as vehicle for quality products and services, and lower prices
- EDI originally used for competitive advantage achieved through technologically "locking out" potential competitor trading partners
- EDI has existed for over 20 years without complete acceptance of a common standard

Table 1: Evolution of EDI Standards in the United States—Bottom Up

Harmonization: EDI Standards Creation in the European Community

Societal Context

The first effort to promote standards for electronic documents was a set of guidelines developed under the auspices of the United Nations Economic Commission for Europe in the mid-1950's, known as the Guidelines for Trade Data Interchange (UN/ECE GTDI). However, technological limitations inhibited further development of EDI until the 1970's, when some large international firms began to experiment with EDI (deJong, 1992).

It is not surprising that substantial EDI use in Europe began later than in the United States. A variety of features in the societal environment contributed to a setting that was not conducive to EDI (Trauth, et.al., 1993). These factors are technological, political and cultural. A lag in applications of computer and telecommunications technologies combined with inadequate telecommunications infrastructures hindered EDI development. Slow transmission speeds and network breakdowns made businesses reluctant to place vital corporate documentation on the public networks. In the political realm, telecommunications policies also dis-

couraged EDI. A single national PTT (Post, Telephone and Telegraph) controlled the telecommunications infrastructure in each country. Third party carriers were prohibited by law in most countries. Since resale of circuits leased from the PTT was not permitted, value-added network providers (VANS) ,the main vehicle for EDI transmissions, were not able to operate.

There have also been difficulties in sharing electronic information across borders due to differences in culture, language, distribution systems and business environments. In the words of one European EDI consultant, "the biggest challenge is to understand the business practices of your foreign trading partners, and to agree on how they should be harmonized" (LaPlante, 1991).

One interesting departure from this history is the United Kingdom where EDI has experienced a significantly faster diffusion rate than in the rest of the EC. Just as certain societal features help account for the slow pace of EDI diffusion during the 1980's in many European Community countries, societal features played a role in accelerating the pace in the UK. Liberalization of telecommunications in 1981 allowed for the open market entry of VANs while the British PTT remained a government agency. A subsequent act in 1984 resulted in the privatization of British Telecom. These policy changes led to a rapid development of third party carriers and VANs. These VANs, in turn, enabled the growth of EDI by providing the technical infrastructure which potential EDI users required.

If the policy realm offered the necessary technological context within which EDI could flourish, members of industry provided the sufficient business conditions. The U.K. Article Numbering Association was created in 1977 to facilitate uniform product codes. At this time some retailers and their suppliers were already exchanging magnetic tapes to avoid rekeying costs and errors. In 1979 the TRADACOMS Working Party of the Article Numbering Association began to produce standards for data exchange. While TRADACOMS was initially intended for standardizing magnetic tape exchanges, the introduction of competition into British telecommunications meant that data could now be exchanged via value-added networks. Consequently, the TRADANET service started in April 1985 (Goodwin, 1992).

The Development of EDIFACT

Although a framework for European EDI standards can be traced to the UN guidelines of the 1950's mentioned earlier, significant EDI standards development did not begin to occur until the end of the 1980's. In contrast to the American, market-driven approach, the UN guidelines served as the basis upon which a fundamentally different process of developing EDI standards took place. In Europe standards are viewed as a tool for unification and the approach to EDI standards from the beginning has been consistent with that philosophy (Commission on the European Communities, 1992).

At the initiative of the UN/ECE, representatives from the North American (i.e. the ANSI X12 Committee) and European EDI communities began the process of developing international EDI standards in 1985 and approved the EDIFACT acronym (Electronic Data Interchange for Administration, Commerce and Transport) in 1986. But EDIFACT did not become a true international standard until 1987 when the International Organization for Standardization (ISO) adopted the EDIFACT syntax, thereby recognizing it as the official international standard for electronic data interchange.[2]

EDIFACT creates a common electronic document syntax for all major business functions. While the approval process for new EDIFACT messages has historically been very slow, the pace has been stepped up to meet the harmonization goals of the 1992 integration timetable. In 1991, the European Commission mandated European trading partners to adhere to the EDIFACT standard (Emmett, 1991). By 1992, approximately 100 transaction sets were in various stages of the approval process (de Jong, 1992).

The 1987 endorsement of EDIFACT by ISO has had the effect of initiating a slow but steady migration of other standards toward EDIFACT. In the U.K. there was a brief period of competition between TRADACOMS, the entrenched "national standard," and EDIFACT (Euromatica, 1988). Today, however, the British Article Numbering Association has accepted that TRADACOMS will migrate to EDIFACT in the 1990's (Goodwin, 1992). EDIFACT is also being promoted by several pan-European EDI user communities, including CEFIC (chemicals), EDIFICE (electronics and semiconductors) and ODETTE (vehicle manufacturers). In 1991, the six nations of the European Free Trade Association (EFTA)—Sweden, Norway, Finland, Austria, Switzerland and Iceland—announced plans to use EDIFACT (Heywood, 1991).[3]

Standards Policy Perspective: Cooperation

In contrast to the market-based, pluralist approach to standards development evidenced in the

American process, the approach taken in the European Community has been to view the EDI standards development process as part of the Single European policy. This "top-down" approach to EDI standards is reflected in the 1987 European Commission Green Paper on telecommunications (Commission of the European Communities, 1987). The themes of the Green Paper most directly relevant to EDI standards policy concern the development of open standards, the creation of advanced telecommunications projects in less developed regions of the EC, and the establishment of common member state positions on international telecommunications standards. In the Green Paper, the European Commission commits itself to the creation of open and common international standards and to the construction of a "level playing field" in telecommunications. It establishes as a basic principle that EC citizens must have access to a broad range of telecommunications services which must be provided efficiently and coherently in open competitive environments.

The philosophy expressed in this EC Green Paper also represents a shift in telecommunications policy orientation. Consistent with what appears to be global paradigm shift toward greater competition in the telecommunications industry, the EC is committed to an open and competitive environment (Trauth and Pitt, 1992). However, unlike the United States in which the convergence of information technologies resulted in the complete privatization of telecommunications carriers, the EC perspective accepts the continued special position of national PTTs in the overall provision of a national telecommunications infrastructure. It directs national PTTs to open their networks to permit rapid movement towards unrestricted, competitively provided value-added data services. In so doing, the EC is helping to create the technological infrastructure needed for EDI to flourish.

Unlike the United States which remains at arm's length from the standards development process, the European Community is actively engaged in promoting standards development. This occurs primarily through the TEDIS (Trade EDI Systems) program administered by Directorate General XIII , the European Commission Directorate for Telecommunication, Information Industries and Innovation. In 1988 the European Community inaugurated this program to stimulate EDI use, construct technological platforms, and develop EDI standards (Council Decision 87/499). The intent of TEDIS I (1988-91) was to promote EDI use among European trading partners, and work to prevent the proliferation of closed or proprietary EDI standards in Europe. TEDIS II, initiated in July, 1991 (Council Decision 91/335), focuses on increasing adoption of EDI by European businesses, the development of EDI platforms on a European scale, and the socio-economic impact of EDI on business and the public (Claveloux, 1991). Through the TEDIS program, the European Commission contributes coherence to the standards process by providing financial support for the development of new EDI transaction sets, and by serving as the focal point for European standards development efforts. One way it does this is by providing the Secretariat to the Western European EDIFACT Board.

The European Commission is motivated to bring countries together in a cooperative effort to work on the development of EDIFACT as the international standard because it is concerned about the danger of nationally-developed standards functioning as a technical barrier to the free cross-border flow of goods, services, information, and people. Used as a form of non-tariff barrier, technical standards, such as divergent EDI formats, can contribute to distorted production patterns and increased inventory costs, and can discourage cooperation among firms. Well before the creation of EDIFACT, the Commission issued a "standstill directive" (Directive 83/189), under which member states must notify the Commission of all draft regulations on standards to be introduced in their states. The Commission has occasionally enforced a halt to proposed national standards that might create new barriers (Macpherson, 1990).

The EC perspective on EDI standards policy is consistent with the view of standards as a vehicle for unification and as a component of industrial policy. As such, the promotion of EDI and facilitation of EDIFACT standards development is woven into the fabric of EC policy. This has been accomplished by making telecommunications policy changes in order to provide the necessary technological infrastructure. Programs for cooperative transaction set developmenthave been established, and financial support for representation at EDIFACT meetings has been provided. Table 2. summarizes this overview of the development of EDI and EDIFACT in the European Community.

Achieving Global EDI Policy

US Issues

A major issue confronting the United States with regard to EDI standards is conformance with

1950s:
- United Nations Guidelines on Trade Data Interchange

1980s:
- Industry specific standards, primarily in U.K.
  Examples: Tradacoms (Retail, U.K.); Odette (Automative, Europe)
- Very limited use of EDI except in U.K.
- 1987-Electronic Data Interchange for Administration, Commerce and Transport (EDIFACT) standard endorsed by International Standards Organization (ISO)
- 1987-"Green Paper" on telecommunications issued by European Commission

Early 1990s:
- EDIFACT standard becomes basis for United Nations electronic messaging
- "Harmonization" efforts by X12 with EDIFACT

European Community: Cooperation Perspective
- Commitment to creation of open and common international standards and the construction of "level playing field" in telecommunications
- Efforts to remove barriers to free flow of goods, services, information and people. Measures to prevent proliferation of proprietary standards.
- Move to create common standard (EDIFACT) in early stage of EDI diffusion in Europe.

Table 2: Evolution of EDI Standards in the European Community—Top Down

EDIFACT. At present, the major barrier to global acceptance of EDIFACT is coming from North America. In the United States there is both apathy and resistance to EDIFACT. Many firms, especially smaller ones, do not see the need to become compatible with international standards. They are resistant to the added costs associated with conversion from X12 to EDIFACT. The ANSI X12 Committee is considering a motion to migrate to the EDIFACT syntax in the next major revision, the version 5 series. The motion proposes that the next series of X12 standards will be developed in conformance with EDIFACT. However, even if this motion passes, its effect will not be felt until the turn of the century, since version 4 of the X12 standards is currently under discussion. Discussion about version 5 is not expected to begin until 1995 or 1996, and the process of version revision generally takes two to five years. Moreover, many U.S. firms are still using transactions sets in the earlier, version 2 series, and can be expected only to migrate slowly to newer versions. (Barber, 1992). If the motion fails, it will be up to domestic and international marketplace forces to determine whether the United States joins the EDIFACT "bandwagon."

A second issue confronting the United States is the absence of a national EDI standards policy emanating from the federal government. Instead, as we have seen, standards evolved "bottom-up," from industry groups and leading edge companies who were able for a time to compel adoption and conformity to proprietary standards by their less powerful trading partners. Different "policies," or de facto practices, existed on an industry-specific basis, through such standards as WINS (warehousing), TDCC (transportation), UCS (grocery and retail) and VICS (apparel and general merchandise). Only after more than a decade of experience with EDI in these industries did there develop, again from the bottom up, pressures for more open standards, which led to ever-widening acceptance of the ANSI X12 Committee's transaction set standards.

The absence of a national standards policy can also affect America's competitiveness in a global economy which the US no longer dominates. Several years ago, a study by the National Telecommunications and Information Administration (NTIA) suggested the need for greater U.S. government participation in international commuication areas such as standards development (NTIA, 1988:116). However, NTIA noted that this would represent a shift in U.S. telecommunications policy, which NTIA characterized as ad hoc, reactive, and skewed toward short term objectives (NTIA, 1988:165). A 1992 study by the Office of Technology Assessment expresses similar concerns:

> Some people ... are concerned ... that other countries are better organized and better able to influence the international standards setting process, to the detriment of US trade. In particular, they fear that the harmonization of European trade laws, scheduled for completion in 1992, will not only make it harder for US companies to trade in Europe, but will also allow the Europeans to take the lead in setting international standards. Pointing to the active role that foreign governments play in the international standard setting process, some have called on the US Government to assume greater responsibility in protecting US interests (US Congress, 1992:3-4).

But developments in EDI diffusion are decidedly dynamic. Despite the entrenched use of X12 in the United States, and the active resistance on the part of many major EDI users to even consider migrating to EDIFACT as a genuine international standard (Barber, 1992), several trends in the United States point to change. The United States Customs Service has been a major backer of EDIFACT for several years, and in 1991, began to conduct pilot tests with large import companies like ICI Americas to use EDIFACT sets. This

United States	European Community
Apathy and resistance toward conformance with EDIFACT	Responding to predominance of non-EDIFACT standards among current EDI users worldwide.
Conflicts in standards process resulting from lack of government leadership	Increasing the pace of EDIFACT transaction set approvals
Insufficient participation in ISO EDI standards process	

Table 3: Issues for Global Harmonization of EDI Standards

decision, not surprisingly, angered ANSI which wanted Customs to continue to endorse X12 (Emmett, 1991). Although top Customs officials have criticized the "foot-dragging" of the EDIFACT process of transaction set approvals, it nevertheless announced in 1991 the intent to implement EDIFACT for U.S. imports. U.S. Customs sees this decision as a "key force in creating a global standards-based customs clearance system" (Messmer, 1991). This is the first example of a US governmental agency taking active steps to pressure domestic firms to migrate to EDIFACT. Despite resistance, it is becoming clearer to many American firms that global competitiveness will not be enhanced by clinging to an EDI standard that limits their interaction with foreign, especially European Community, trading partners. American organizations are learning that they must play on a global field.

EC Issues

In distinct contrast to the American situation, the motivation for a single European EDI standard is both political and social. The political dimension derives from the need to harmonize key standards and policies that affect the creation of a unified European economic zone. Through Council Directives, the Green Paper, and the TEDIS project, the European Commission has taken an active and directive role in promoting, and recently mandating, EDIFACT for all European trading partners. It has recently aimed at extending the range of EDIFACT use by encouraging EFTA nations and others (in particular, the Far East), to adopt EDIFACT as the standard. The social dimension has also played a crucial part in the activism of the Commission, since the barriers of language, custom and business practices can readily be exacerbated by different national-based standards.

But there are also issues for the European Community that must be addressed. Key among them is coping with the prevalence of non-EDIFACT standards among current EDI users. Despite the dominance of EDIFACT within the EC, European companies doing business with American firms must still accomodate to X12 and proprietary standards in use. In addition to the use of X12 in America, EC-based firms must also cope with different standards in the U.K.,the largest EDI user in Europe. Even though members of the UK EDI community have agreed to the migration of TRADACOMS to EDIFACT, that has not fully occurred. It is in the EC's interest to encourage participation by the US and the UK EDI communities in order to speed up the process of migration to a single global EDI standard. Table 3 notes some of the issues for the United States and the European Community concerning global harmonization of EDI standards.

Achieving the goal of a true global EDI standard requires cooperation and compromise. A starting point is recognizing the existence of different traditions of standards policy development, neither of which is inherently better than the other. Table 4 summarizes key differences between the EDI standards process in the United States and the European Community. It is in America's best interest to accede to the long term benefits of a global EDI policy despite the short term costs of technical conversion. The EC, for its part, needs to take into account the existing installed base of EDI users as it moves toward a post-1992 world of standards harmonization.

Conclusion

Given the present situation and the trend toward greater global integration of businesses through telecommunications, there are issues to be addressed by both the United States and the EC. Clearly there will be increased pressure on both ANSI and American firms to adopt the EDIFACT standard, and certain large multinational firms have already done so for some of their EDI activities. However, there is also considerable resistance from US firms. Due to the large number of EDI users in America who currently use X12, there will be resistance

United States	European Community
Distributed	Centralized
Pragmatic	Systematic
Reactive	Anticipatory
Entrepreneurial and individualistic	Tools of industrial policy
Maximize role of private sector	Responsive to government direction and national policy
International Standards often only a guide	Direct adoption of international standard

Table 4: United States-European Community—Key Differences in EDI Standards Process

from firms who currently have only domestic trading partners. This resistance stems from the cost of new software to convert business documents to EDIFACT.

The twenty-first century will not be the "American Century" that the twentieth has been. American organizations are learning that they must interact in a global business community as an equal player. As this article has pointed out, this change has serious implications for EDI standards policy. Given the differences in policy perspective and process exhibited by the US and the EC, compromise is required on both parts. In Europe, the standards setting process must acknowledge the marketplace dominance of the ANSI X12 standards as EDIFACT standards are being developed. Despite the fact that America has been a leader in introducing EDI and is currently the dominant user, it is not in a position to dominate the content or structure of EDI standards in the future. As American firms become more global and as domestic firms enter into partnerships with foreign companies, the issue of evolution towards international EDI standards will move to the top of the standards setting agenda in America.

Notes

1 For further information about the ISO standards setting process, see (U.S. Congress 1992).

2 The International Organization for Standardization, created in 1947, consists of the national standards groups of 88 countries. The ISO's purpose is to further the development of international standards in a wide range of areas in order to improve cross-border trade and to promote cooperation in scientific and technological activities. Through the activities of many working groups and technical committees, ISO publishes standards with the aim of achieving worldwide harmonization. Member organizations, only one from each nation, are admitted to ISO on the basis of their being the most representative of the standardization process in their country. (Macpherson 1990). ANSI is the member body to ISO from the United States.

3 Although the focus of this article is the US and the EC, it is worth noting that there is support for EDIFACT in Asia as well. Korea, Taiwan and Singapore are committed to using EDIFACT. Japan has its own national standard which is different from EDIFACT, but the Japanese government is supporting migration toward EDIFACT.

Appendix: EDI Terminology

The following are terms commonly used in discussions of EDI applications and standards.

ANSI - the American National Standards Institute which facilitates the development of standards on a voluntary, consensus basis in the United States.

ISO - the International Organization for Standardization, which sets world wide standards for science and industry.

Rapporteur - a person nominated by his or her government and appointed by the UN Economic Commission for Europe Working Party 4 to initiate and coordinate UN/EDIFACT development work in a designated geographical area of jurisdiction.

Standard - the rules governing the arrangement of data in an electronic document, that is, for converting the information in a firm's business document (such as a purchase order) into a commonly agreed upon format. There are four categories of standards. EDIFACT is the accepted *international standard.* X12 is an example of a *national standard.* TDCC is an example of an *industry standard* (in this case, transportation industry). Finally, some firms develop their own, *proprietary standards.*

Syntax - a part of the standard which defines the format of the transaction set. This would include which pieces of data appear on the electronic document and the sequence in which they do so.

Transaction set - a structured business document associated with a specific transaction in a specific industry. An example is an invoice in the distribution industry. In Europe, transaction sets are referred to as *messages.*

Value Added Network Service - a third party telecommunications service provider which leases lines from the common carrier and provides enhanced data communication services. In the case of EDI, the services provided by the VAN include: 1) translation between the format of the firm's computerized applications and the "standard" format; and 2) an electronic mailbox facility where a firm can place electronic documents for pick up by its trading partners.

WP.4 - UN/ECE Working Party on facilitation of international trade procedures. This working party is re-

sponsible for various initiatives regarding EDI.

X.400 - this ANSI standard governs the electronic "envelope" by means of which messages are communicated. X.400 standards were originally developed to apply to free-formatted electronic transmissions such as electronic mail. Increasingly, however the X.400 standard is being viewed by many as the appropriate standard format for all electronic transmissions, including structured electronic documents such as EDI messages.

References

ANSI ASC-X12 (1987). *An Introduction to Electronic Data Interchange.* American National Standards Institute, July.

Barber, N. (1992). EDI Consultant. *Personal communication, August 25.*

Bressand, A. (1989). The Think-Net Program. Unpublished ms.

Claveloux, D. (1991). EC Renews Research Efforts on Global Info Services. *Network World*, August 12, p. 29.

Commission on the European Communities (1990). *Commission Green Paper on the Development of European Standardaiztion: Action for Faster Technological Integration in Europe* COM(90) 456 final. Commission on the European Communities.

Commission on the European Communities (1987). *Towards a Dynamic European Economy: Green Paper on the Development of the Common Market for Telecommunications Services and Equipment* COM(87) 290 final. Commission on the European Communities.

Dreyer, J. (1990). Signs of Strong EDI Growth. *Global Trade*, November, p. 20.

EDI in Europe: Great Potential for Continental Growth. (1991). *Data Channels.* April 15.

EDI Implementation: Steps for Success. (1991). Panel presentation at New England EDI Users Group Meeting, Marlboro, MA, June 13.

Emmelhainz, M. (1990). *Electronic Data Interchange: A Total Management Guide.* New York: Van Nostrand Reinhold.

Emmett, A. (1991). Breaking Barriers to EDI. *Datamation,* April 1, p. 64.

Etheridge, J. (1988). EDI in Europe. *Datamation (International Edition)*, October 1, p. 15-18.

Euromatica (1988). *A Review of Electronic Data Interchange (EDI) Developments in Europe* . Brussels: Euromatica, S.A.

Goodwin, G. (1992). Information Manager, Wavin Building Products. Personal communication. Amstelveen, the Netherlands, June 30 and August 13.

Horan, T. (1989). EDI Outlook and Opportunities. *EDI Forum.* Volume 1, Number 1.

Heywood, P. (1991). European EDI: Business as Unusual. Data Communications, March,p. 95.

Introduction to UN/EDIFACT. (1991). UN/EDIFACT Rapporteurs' Team. April.

Ioannou, L. (1990). EDI: Sharpening the Competitive Edge. *Euromoney,* March, p. 59.

de Jong, W.J. (1992). Senior Advisor, EDIFORUM and Dutch representative to Western European EDIFACT Board. Personal communication. Leidschendam, the Netherlands, July 22.

Korzeniowski, P. (1989). International Software Trends: EDI, Overseas Signals Making More Sense. Software Magazine (International Edition), March, p. 15.

LaPlante, A. (1991). EDI Booms as Global Outlook Blooms. *Computerworld*, February 18, p. 55.

Lawrence, A. (1990). Using Computers in Business 5: Business Slow on the Uptake—EDI. Financial Times, October 16, p. 5 (S45 Survey).

Macpherson, A. (1990). *International Telecommunications Standards Organizations.* Norwood, MA: Artech.

Messmer, E. (1991). Customs Moves Ahead Despite EDIFACT Delays. *Network World,* August 19, p. 6.

National Telecommunications and Information Administration (1988). *NTIA Telecom 2000: Charting the Course for a New Century.* Washington, D.C.: US Department of Commerce.

Rogers, E. (1983). *Diffusion of Innovations.* Third Edition. New York: The Free Press.

Trauth, E.M. (1986). An Integrative Approach to Information Policy Research. *Telecommunications Policy*, Volume 10, Number 1: 41-50.

Trauth, E.M., Derksen, F.E.J.M. and Mevissen, H.M.J. (1993). The Influence of Societal Factors and the Diffusion of Electronic Data Interchange in the Netherlands. In *Human, Organizational and Social Dimensions of Information Systems Development.* D. Avison, J.E. Kendall, and J.I. DeGross (eds). Amsterdam: North Holland:323-335.

Trauth, E.M. and Pitt, D.C. (1992). Competition in the Telecommunications Industry: A New Global Paradigm and Its Limits. *Journal of Information Technology*, Volume 7 , Number 1: 3-11.

Trauth, E.M., Trauth, D.M. and Huffman, J.H. (1983). Impact of Deregulation on Marketplace Diversity in the USA. *Telecommunications Policy,* Volume 7, Number 2:111-117.

U.S. Congress, Office of Technology Assessment (1990). *Critical Connections: Communication for the Future (OTA-CIT-407).* Washington, D.C.: U.S. Government Printing Office.

U.S. Congress, Office of Technology Assessment (1992). *Global Standards: Building Blocks for the Future.* TCT-512. Washington, D.C.: U.S. Government Printing Office.

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