



The International Diffusion of EDI

By Julio Jimenez and Yolanda Polo

jjimenez@mecon.unizar.es

Julio Jimenez

Profesor de Comercializacion e Investigacion de Mercados

Departamento de Economia y Direccion de Empresas

Facultad de Ciencias Economicas y Empresariales

UNIVERSIDAD de ZARAGOZA

GRAN VIA 2, 50005 ZARAGOZA (SPAIN)

Phone: 34-(9)76-761000/1835/1832 EXT.4695

Fax:34-(9)76-761767/70

Yolanda Polo

Catedratica de Comercializacion e Investigacion de Mercados

Departamento de Economia y Direccion de Empresas

Facultad de Ciencias Economicas y Empresariales

Universidad de Zaragoza

Gran Via 2, 50005 ZARAGOZA (SPAIN)

Phone: 34-76-761834

Fax: 34-76-761767

Introduction

The objective of this article is to study the international diffusion of Electronic Data Interchange (EDI), in order to determine the diffusion of the new technology, as well as international differences at the time of adoption.

The diffusion of a new technology can be defined as the process by which the use of an innovation spreads and grows within a social system. Within the technological change process, diffusion plays an important role: on the one hand, it determines the ratio of technological change, measured as the effect of an innovation on the productivity increase of an industry and, on the other, it plays an important role in the competitive process, eroding the competitive advantage and the monopoly power of any company which successfully introduces an innovation into the market (Parker, 1974).

The diffusion of new technologies has been an object of interest for a sustained period of time. Academics from different disciplines have geared their investigations towards ascertaining the factors that determine the ratio of diffusion of a new technological process. For economists, this ratio is determined at two levels, namely, at company level, where the affecting factors are the risk and the uncertainty that adoption brings with it and, at industry level, where the determinants of the ratio of diffusion are the main market structure of the industry (Romeo, 1975; Scherer, 1980; Benvignati, 1982) and the level of R&D within the industry (Stoneman and Ireland, 1985; Antonelli, 1985).

The investigation described in this article considers different aspects relating to the diffusion of the innovation (EDI) in Europe: the scope and ratio of diffusion, and the lag in the adoption. In order to study these aspects, we have formulated a static study which will collect information about the level of use of the new process among a group of different industrial sectors in different European countries during 1994.

EDI first appeared in Europe in the mid-seventies. Since then, there has been a slow adoption process amongst the

different European countries so that high diffusion levels have not yet been reached.

The interdependence of information technologies and advanced telecommunications systems influences the adoption decision and the speed of diffusion. Therefore, when the new technology becomes incompatible with the old, or when the adoption necessitates important changes within the internal organisation of the business or in its production process, the diffusion will probably be slower. However, when compatibility exists between the new and existing processes, the speed of diffusion will be faster. We also find huge differences at the moment of adoption, according to whether the new technology requires the purchase or the introduction of new equipment or when, by contrast, it can be added to the existing equipment with minimum modification and cost (Rosenberg, 1988).

Diffusion of EDI in Europe

Electronic Data Interchange first appeared in the retail sector in the mid-seventies and now, some 20 years later, it is still in introductory phase in some countries.

Table 1 analyzes several aspects related to the introduction of EDI in the European countries under study. We can draw some conclusions from this.

 [Table 1.](#)

1. The most important distinction is the moment of adoption in every country, coupled with the speed of diffusion. France is a pioneer, as are Germany, Austria, Sweden and the UK, although to a lesser extent. All of them have high levels of use in every sector, save for Germany and Austria (see Figure 1). As for the number of users, this is high, but relative to the population, it is somewhat smaller in France and Germany (see Figure 2).

 [Figure 1.](#)

 [Figure 2.](#)

A second group of countries is characterized by having introduced the innovation in the eighties, such as Belgium and Luxembourg, Finland, Norway, Holland and Spain. Norway and Holland are notable for their widespread use of the innovation in relation to their population. Finland can also be highlighted for its high level of use. The levels of use in Spain are generally average, but the number of users is rather low, given the size of the country.

Switzerland, Ireland and Denmark show a high percentage of users in relation to their population, and this in spite of their late adoption of the innovation. Switzerland, in particular, demonstrates a high level of use. Finally, Portugal and Italy both stand out for their low use and user levels.

2. A second aspect common to all the countries (see Table 1) is related to the most frequently used documents. The sequence of orders (ORDER) and the invoice (INVOIC) are the most commonly used documents. Other documents which are used regularly in the countries studied are: the price catalogue (PRICAT), remittance advice (REMADV), and purchase order response (ORDRSP). The total number of messages used varies greatly and is in direct proportion to the level of diffusion. Therefore, there are countries, such as Spain or Ireland, which use only seven messages, whilst the Finns use fourteen and Norway and Belgium, ten.

3. One distinguishing factor amongst the countries (see Table 1) is the "migration" of the national standard language to EANCOM (a language used in the distribution sector). Some have adopted it completely, while others have just begun the migration from the national standard. Obviously, the former includes those countries which have adopted EDI most recently, e.g. Portugal, Italy, Spain, Switzerland and Denmark (although in Denmark's case, there has been a migration from the national standard HANCOM), but some of the first adopters, like Sweden and Holland, also use EANCOM (Sweden, thanks to a plan which cited 1996 as the final year for migration, and Holland, with a similar plan which migrated from TRASNCOM as the national standard.)

However, apart from these two exceptions, the majority of countries which have widely developed this innovation

show very low rates of use of the EANCOM standard, although many of them have plans to set a time limit to complete the migration in coming years (Austria and Germany plan to employ six - ten years for migration from SEDAS, whilst Norway predicts a minimum of four years to migrate from STANDARD RECORDS).

4. Another relevant aspect in the introduction and subsequent diffusion of Electronic Data Interchange is the role played by the "hubs" in each country. Various studies on the installation of EDI (Bj(rn- Andersen and Krcmar, 1995; Banerjee and Goldhar, 1994; Pfeiffer, 1991; Benjamin, et al, 1990), as well as interviews with experts carried out by ourselves, show that one of the fundamental reasons for the development of EDI in a sector of economic activity is the existence of businesses with sufficient negotiating power to be able to impose the adoption of this type of paper-free relationships on their suppliers, and sometimes even on their clients. These types of companies are known as "hubs".

The role of these companies is fundamental in the diffusion of EDI, since the majority of those who adopt it because of the pressure exerted by the "hubs" would not otherwise do so or, to put it another way, the theoretical benefits of adopting EDI are not sufficient as to entice them to take the step. However, it is hoped (Benjamin, et al, 1990) that, with the passing of time, an integration of EDI will take place within those firms which were not convinced at the time of adoption and, further, that they will take advantage of its benefits and come to consider it as an indispensable tool, in such a way that its use will not only be restricted to the company which incited the adoption (the "hub"), but also to other trade partners. This will mean that the adoption on the part of many companies will be voluntary, without external pressure, due, on the one hand, to the benefits observed in other similar firms and, on the other, because of the difficulties encountered in maintaining commercial relations, not only with large companies who wield power in the market place, but also with smaller firms.

One approximate measure of the importance of these "hub" companies in the diffusion of EDI can be seen by calculating the percentage of EDI users who exchange messages with these companies. Therefore, in the majority of countries where the number of EDI users is low (i.e. Belgium and Luxembourg, Spain, Ireland, Portugal and Switzerland), important levels of interchange can be seen on the part of the "hubs", while in some countries where a large diffusion exists, the weight of the levels of interchange is less (for example, Germany, Austria and France).

This can be interpreted in the following way: initially, all users, are either "hubs" or connected to a "hub", since the reason why the majority of them have adopted the innovation can be attributed to the pressure exerted by these companies. However, as EDI spreads, there are always more companies who adopt on their own initiative.

Furthermore, we know (EAN International, 1995) that the majority of firms are large distributors or produce general mercantile goods, food or DIY products.

Static Analysis

Within this section we will carry out a static analysis of the level of use of Electronic Data Interchange amongst the different sectors of activity and the different European countries that we are studying. The data used has been taken from the EAN report (EAN International, 1995) which analysed this innovation's position in the international community.

The information was collected using a survey, which had previously been sent to the different national EAN organizations. This survey collected information on which sectors of economic activity used EDI, in which sectors did the association have companies which used EDI to interchange documents and, finally, whether the level of activity or use could be classified as "high", "medium", or "low".

[Table 2.](#)

The sectors numbered in Table 2 are very varied, including those which are considered as typical of the retail sector, such as food, general mercantile, goods and textiles. As well as the aforementioned sectors, there are others, less related to the retail sector, such as construction or agriculture. In total, some twenty three sectors were considered, ten of which have a presence in the majority of the countries studied, whilst thirteen appear sporadically in some of the countries which are more advanced in the adoption of the technology, namely Holland, Austria, France and Sweden.

These sectors have been grouped under the heading "others".

From Figure 1, we can appreciate that a certain relationship exists between the level of use of a country and the year when EDI was first introduced. That is to say, those countries which introduced earlier have been able to show potential users the advantages of EDI and this has proved to be advantageous. However, there are important exceptions, such as Switzerland, which saw a late introduction (1990), but which has enjoyed an accelerated rate of use.

In the aforementioned graph, we have introduced lines to separate those countries which have a level of use above that which was anticipated pursuant to the year of introduction, and this is the case both for the total of all sectors, as well as for the retail sector alone. On this basis, we can classify the countries as a function of the relationship between intensity of use and speed of adoption. The results can be seen in Table 3.

 [Table 3.](#)

Conclusions

It has been shown that there is a very significant lag in the adoption in some countries. However, when we compare the number of users to the size of the country, this lag did not influence in a relevant form, since pioneering large countries, like France and Germany, show relatively low levels (Graph 2).

An aspect which is influenced by the lag in adoption is the use of the international standard EANCOM. The pioneer countries with the exception of Switzerland, have a lower percentage of users of EANCOM. It is logical that the better established a language is the harder it is to adapt to a new one.

The opinions proposed by Benjamin et al (1990) regarding the influence of ihubs in the adoption are corroborated by other authors. It can be seen (Table 1) that this type of company exerts more pressure on those countries which are slow to introduce.

Using the statistical analysis, carried out in 1994, it can be deduced that the lag in introduction can negatively influence the level of use (Graph 1), however important exceptions exist such as Switzerland, Finland or Holland.

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