

**INTERNET Y EL COMERCIO INTERNACIONAL DE MANUFACTURAS: UNA APROXIMACIÓN CON DATOS DE SECTORES INDUSTRIALES**

**RESUMEN:** Existen evidencias de que las expectativas generadas en el caso de Internet como elemento capaz de abrir nuevos mercados a las empresas no se están cumpliendo. El propósito de este estudio es analizar la posible relación que existe entre la intensidad con que los sectores industriales de una economía incorporan y aprovechan las TIC y el volumen de negocio que contratan en los mercados internacionales, partiendo de información estadística referida a la industria de España. A partir de la información estadística disponible sobre incorporación y uso comercial de las TIC, comercio exterior y producción de las distintas industrias españolas se definen distintas variables y se somete a contraste la relación lineal entre ellas. Las industrias con mayor actividad exportadora e importadora son, asimismo, las que cada vez contratan más volumen de negocio a través del comercio electrónico, particularmente a través de distintos canales de comunicación, como EDI, Minitel o Internet. Llama la atención, sin embargo, la ausencia de dicha relación cuando se considera el comercio electrónico realizado exclusivamente a través de Internet. Los resultados justifican la necesidad de acciones más intensivas que potencien el uso de los nuevos sistemas electrónicos en la comercialización internacional, especialmente en el ámbito de las pequeñas y medianas empresas.

**PALABRAS CLAVE:** comercio exterior, industria manufacturera, internet, comercio electrónico, España.

**INTERNET ET COMMERCE INTERNATIONAL DE MANUFACTURES: UNE APPROCHE SUR BASE DE DONNÉES DE SECTEURS INDUSTRIELS.**

**RÉSUMÉ:** Il est évident que les attentes concernant Internet, en tant qu'élément pouvant produire une ouverture de nouveaux marchés pour les entreprises, ne donnent pas de résultats. Le but de cette étude est d'analyser la relation existant entre l'intensité selon laquelle les secteurs industriels d'une économie incorporent les TIC et en tirent profit et le volume d'affaires effectués sur les marchés internationaux, à partir de l'information statistique en référence de l'industrie d'Espagne. À partir de cette information statistique disponible concernant l'incorporation et l'utilisation commerciale des TIC, le commerce extérieur et la production de différentes industries espagnoles, différentes variables sont définies dont la relation linéaire est contrastée. Ainsi, les industries démontrant une plus grande activité d'exportation et importation sont celles qui ont un volume d'affaires plus important par le biais du commerce électronique, et plus particulièrement par des chaînes de communication différentes, telles qu'EDI, Minitel ou Internet. Il faut cependant observer l'absence de cette relation si l'on considère le commerce électronique réalisé exclusivement par Internet. Le résultat justifie la nécessité d'actions plus intensives permettant l'utilisation de nouveaux systèmes électroniques dans la commercialisation internationale, et plus spécialement pour les petites et moyennes entreprises.

**MOTS-CLEFS:** commerce extérieur, industrie manufacturière, Internet, commerce électronique, Espagne.

**INTERNET E COMÉRCIO INTERNACIONAL DE MANUFACTURAS: UMA APROXIMAÇÃO COM DADOS DE SETORES INDUSTRIAIS**

**RESUMO:** Existem evidências de que as expectativas geradas no caso da Internet, como elemento capaz de abrir novos mercados às empresas, não estão sendo cumpridas. O propósito deste estudo é analisar a possível relação que existe entre a intensidade com que os setores industriais de uma economia incorporam e aproveitam as TIC e o volume de negócios que contratam nos mercados internacionais, partindo de informação estatística referente à indústria da Espanha. A partir da informação estatística disponível sobre incorporação e uso comercial das TIC, comércio exterior e produção das distintas indústrias espanholas definem-se distintas variáveis, contrastando-se a relação linear entre elas. As indústrias com maior atividade exportadora e importadora são, dessa forma, as que cada vez contratam maior volume de negócios através do comércio eletrônico, particularmente através de distintos canais de comunicação, como EDI, Minitel ou Internet. Sem embargo, chama a atenção a ausência de tal relação, quando se considera o comércio eletrônico realizado exclusivamente através da Internet. Os resultados justificam a necessidade de ações mais intensivas que potencializem o uso dos novos sistemas eletrônicos de comercialização internacional, especialmente no âmbito das pequenas e médias empresas.

**PALAVRAS CHAVE:** comércio exterior, indústria manufatureira, internet, comércio eletrônico, Espanha.

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**CORRESPONDENCIA:** Universidad de Jaén, Campus Las Lagunillas s/n Edif. D-3 23640 Jaén, España.

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# Internet and international trade by manufacturers: An approach using industrial sectors data

**Enrique Bernal-Jurado**

Doctor en Ciencias Económicas y Empresariales por la Universidad de Jaén (España).  
Profesor titular del Departamento de Economía de la Universidad de Jaén,  
Facultad de Ciencias Sociales y Jurídicas.  
Correo electrónico: ebernal@ujaen.es

**Encarnación Moral-Pajares**

Doctora en Ciencias Económicas y Empresariales por la Universidad de Jaén (España).  
Profesora titular del Departamento de Economía de la Universidad de Jaén, Facultad de  
Ciencias Sociales y Jurídicas. Directora de la Cátedra de Internacionalización-EXTENDA.  
Correo electrónico: emoral@ujaen.es

**ABSTRACT:** Some evidences show how the potential generated by using the Internet as a tool able to open new commercial markets is not being fulfilled. The study's purpose is to analyze the possible intensity with which the industrial sectors incorporate and take advantage of the Internet and the volume of business generated in international markets, based on statistical information referring to Spanish industry. Starting from the available statistical information on the incorporation and commercial use of ICT, the foreign trade and production of various Spanish industries are assigned different variables and the lineal relationships among them are contrasted. Those industries with the largest importing and exporting activities are, at the same time, those that get more and more business via electronic commerce, particularly through different communication channels, such as EDI, Minitel or Internet. However, it is interesting to note the absence of this kind of relationship when we look at the e-commerce carried out exclusively through the Internet. The results justify the necessity of taking more intensive actions to improve the use of the new electronic systems in the international commercialization, especially in the environment of the small and medium sized companies.

**KEY WORDS:** e-commerce, electronic commerce, foreign trade, Internet, manufacturing industries, Spain.

## INTRODUCTION

A widespread consensus points out that, close to the growing internationalization underway promoted by the opening and liberalization of markets, the Internet is generating changes on the foundations where the international trade's dynamics are laid (Freund & Weinhold, 2004). The arguments wielded to support that hypothesis could be summarized in the following way: Firstly, the new information development and communication systems are facilitating the waking up of companies of small relative size to the possibilities of external markets, since these new systems now permit them, in a quick and rather inexpensive way –compared to other alternatives–, to meet the demands of potential clients coming from worldwide. Secondly, the growing communication favors us to take tastes, habits and consumption patterns unification, propitiating the markets homogenization and the rising competition development. In this new global marketplace, prices should tend to come down as suppliers compete each other on a world scale to obtain clients, both national as well as foreign ones. Lastly, with the

decreasing costs of communication and data processing, entities can administer the production and globally dispersed distribution systems trying to maximize the comparative advantages offered by different jurisdictions, which have an impact on the flow of external trade where the national economies are involved.

The available statistics suggest that one of the characteristics of the extension and development of *the ICT use* is its unequal level of penetration amongst companies and individuals of different countries. In this context, those countries most permeable to changes, adapting more quickly to the new production, commercialization and distribution conditions with a base in the new technologies, obtain decisive competitive advantages for their future. The competitiveness of their productive system and the growth of economic activity in the national and international environment depend on this permeability (Bane-gas, 2003, p. 54).

The trust put on the ICT potential, and on its principal exponent at the moment, the Internet, as an instigating element of the internationalization process carried out by companies, has made those concerned institutions (both national and international) establish initiatives for ICT installation in the managerial fabric. A good example of this at the international level is the project "*emarketser-vices.com*", whose reference will be made later, or that one developed in the ECLAC's bosom by Ueki et al. (2005): Information and Communication Technologies for the Fomentation of Exporting PYMEs in Latin America and East Asia. In Spain, it is necessary to refer the PIPENET programs, Arte PYME I and Arte PYME II, promoted by the Ministry of Industry, Trade and Tourism, within the framework of The Plan of Measures to Recover the External Competitiveness of the Spanish Economy, and the study financed by the Ministry of Science and Technology in 2002, Adaptation of the Spanish Company to the Information Society, produced within the Program for the Promotion of the Information Society and Electronic Commerce in Spanish PYMEs (Prince XXI), where the advantages derived from the Information Society and from the e-commerce use, are shown by those companies with international commercial relationships.

However, evidence shows that, at the moment, the expectations generated by ICT, and especially the Internet, able to overcome the physical distances that separate markets and promote the opening of other new markets, the national and international environment, are not being met. In fact, some surveys reveal that "the opening of new markets" is among those benefits less frequently obtained by the companies that carry out activities related with the B2B electronic commerce. If we refer to cross border on-line transactions, the data given by the main national

statistical bodies, such as the INE in Spain, shows that they are insignificant compared to the transactions carried out through electronic commerce. Other international studies (we will approach them later in this work) end up questioning the capacity of e-commerce via Internet to permit those less developed world areas to gain access to the large centers of commercial activity, as is frequently pointed out in the literature.

Starting from these premises, this work seeks to determine if, in the Spanish case, there exists any evidence to show that the ICT use is affecting the international commercial relationships where companies from different industrial sectors participate, being able to influence, therefore, the volume of business done with foreign clients/suppliers. Specifically, we are interested in checking whether some relationship exists between the intensity with which companies from various Spanish industrial sectors incorporate and take advantage of ICT and their level in the import/export activity. To determine this, different variables are used to allow us to approximate the degree of the ICT incorporation on those companies from the principal industrial sectors of the Spanish economy (that they together account for more than 90% of the flow of external trade), as well as other variables related to the intensity with which each industry uses said technology in their commercial relationships.

The analysis carried out confirms the existence of a biunivocal relationship between the degree of internationalization of each industrial sector and the ICT use, so the most internationalized industries with the greatest average propensity to import and export apply more intensively the new communication systems for sales through e-commerce in the development of commercial operations with clients. Likewise, the use of more advanced commercialization systems through electronic commerce contributes favorably to the volume of business that the industrial companies reach in the international market. Nevertheless, these results are not expandable for the particular case of the Internet, but rather they are only evidence for traditional forms of electronic commerce (EDI, Minitel) suggesting that, in the Spanish case, the expectations created by the Internet as an energizing element of international transactions are not being realized.

This work is structured in four sections, including this introduction. In the following section, different arguments are put forward to permit the establishment of linkages between ICT and the trade flows among countries. Another section presents the results obtained at the empiric work carried out. The work concludes with an interpretation of the main reflections derived from the study.



## ICT AND INTERNATIONAL COMMERCE

Many literature points out that ICT has the potential to reduce transaction costs and shrink the inherent risk of each operation (Bakos, 1991; Strader & Shaw, 1997; Benjamin & Wigand, 1995 and 1997; Steinfeld et al., 1997), to improve the efficiency in the value chain activities (Rayport & Sviokla, 1995; Evans & Wurster, 1997; Ghosh, 1998; Porter & Thousand, 1985), and to facilitate the organizational knowledge diffusion (Gurteen, 1998; Swan et al., 1999; Bloch & Segev, 1996). In this way, the results of a World Bank report (2006, p. 62) endorses the idea that those companies that use ICT more intensely are more productive, grow quickly, invest more and are more profitable. This wide theoretical base is used to justify the ICT's

potential to alter production and organization model that was effective until the middle eighties, favoring the transition to a new technological paradigm whose space/time relationships are being modified. Likewise, the networks of tangible and intangible flows that interconnect companies and territories are being densified, thereby determining a new spatial division of work (Méndez, 1997, p. 159).

The trade flows among countries—an expression of the productive specialization of each territory—have been affected by the new rules that are imposed by ICT. In fact, there is much literature that has focused on their study in the relationship between technological innovation and the export activity of a national economy. The progressive installation of an information and electronic communication system in

companies is also affecting the intensity of the external trade and the flows origin/destination of them (Canals, 2002). Specifically, we can group into three categories the potential effects of Internet use on operations contracted with international agents and the use of the possibilities presented:

1. ICT facilitates the companies export activity. The new electronic systems allow the information and communication costs to decrease and they make possible for companies to carry out international activities from practically the moment of their creation, thereby facilitating the access to new markets and investors, and the positioning in the market (López, 2004). In the same way, ICT allows entities of smaller relative size, micro-companies with access possibilities to the net, to develop external trade operations that were limited to the big entities environment (Molero, 2005; Plá & Cobos, 2002). Also, they permit small companies that offer specialized products to be able to access to a critical mass of consumers distributed all over the world (Nieto, 2006).
2. The commercial operations development through the Internet affects the competition forces (Porter, 1980, 1985) and contributes to an increase in the national market activity, thereby allowing the entrance of new offerors whose negotiation and contracting activities can be carried out in the net. The Internet, according with Banegas opinion (2003), reduces the purchases costs, facilitates the search of more efficient competitors, and reduces the transaction costs by means of online applications. The market becomes more competitive, with smaller margins, and the client service is improved, which increases their loyalty and helps in the search of other new clients.
3. Lastly, the information and electronic communication systems make a dispersed localization production, distribution and labor possible, favoring a decentralization functions to strategically take advantage of the comparative advantages offered by different territories, which in turn affects the flows of intra-company trade that take place between countries. Technological information, particularly the exchange of electronic information, plays an important role in the inputs administration. The Internet facilitates the optimization in a firm through its production program, makes communication in real time between the different plants of the company possible, and eliminates the flow of paper-based information between them (Hill, 2001). It allows, therefore, the transference –n a quicker and more

efficient way– of all the documentation needed to appropriately coordinate the usual activities.

In accordance with the above, the Internet corporate use has the capacity to speed up the development of each one of the phases that make up a transaction (Schmid, 1995; Zbornik, 1996): the “information phase”, in which the information about the products and services characteristics (prices, offers) is gathered; the “agreement phase”, in which parties negotiate to establish the terms of product acquisition –it usually results in a contract (containing the technical specifications of the product, delivery terms, guarantees...); and, lastly, the “liquidation phase”, where the physical/virtual product delivery takes place (Figure 1). A company can use the Internet to consent to the information, know markets, competitors, and prices, to distribute information, to promote themselves, or to sell their products and services, so the potential client can contact the entity and transmit directly their buy/sell orders.

FIGURE 1. Phases of a transaction.



Source: Schmid (1995) and Zbornik (1996). Self produced.

Regarding the first and second phases, through the new electronic channels such as the Internet, the exporter can have within his reach a source of quicker and cheaper information and, as well, an instrument for the promotion and contact with clients or collaborators in any part of the world (Jiménez et al., 2000; López, 2004). Nowadays, a great variety of public or semi-public websites exist on Internet, created in order to foment and help companies to take advantage of the opportunities offered by the Internet in their internationalization process (Table 1). This aspect is particularly attractive in the international transactions environment since the external market represents for companies a less well-known, more uncertain environment than the national market, with more expensive and less reliable competitors' information, commercial circuits, demand characteristics, trademark regulations or logistics (Alonso, 2005, p. 74). Different studies have shown a more intensive use of e-mail and web pages on the exporting companies than on other kind of companies, independent of the variable of size (World Bank, 2006, p. 60; UNCTAD, 2007, p. 31; European Commission, 2006, p. 64). In this context, the ability that a company could have to take advantage of the possibilities that the new technologies offer and its attitude in face of them become decisive factors in the internationalization strategy.

There exist different questions that affect the commercial use of the new electronic systems as tools facilitating access to new markets. The evidence shows that this application

**TABLE 1. Instruments of help in the process of internationalization for Spanish companies on the Internet.**

Contents	Web site	Sponsoring organization
<b>Instruments of advice, training and information</b>		
These sites deal with the initial difficulties a company faces regarding the activity of exporting. Among them, ignorance regarding the destination markets, their operations, and export requirements are found, as well as the lack of training regarding the norms of international business.	<a href="http://www.plancameral.org">http://www.plancameral.org</a>	Chamber of Commerce
	<a href="http://www.icex.es">http://www.icex.es</a>	Spanish Institute of Foreign Trade
	<a href="http://www.comercio.es">http://www.comercio.es</a>	Secretary of State of Tourism and Trade
	<a href="http://www.aeat.es">http://www.aeat.es</a>	State Agency of Tributary Administration
	<a href="http://enterprise-europe-network.ec.europa.eu">http://enterprise-europe-network.ec.europa.eu</a>	Commission of the USA
	<a href="http://www.cesce.es">http://www.cesce.es</a>	Spanish Credit and Export Company
	<a href="http://europa.eu.int/index_en.htm">http://europa.eu.int/index_en.htm</a>	Commission of the USA
	<a href="http://www.maec.es">http://www.maec.es</a>	Ministry of External Matters and Cooperation
	<a href="http://unstats.un.org/unsd/default.htm">http://unstats.un.org/unsd/default.htm</a>	United Nations
<a href="http://wsie.ipyme.org/autodiagnostico">http://wsie.ipyme.org/autodiagnostico</a>	Institute of Small and Medium Companies	
<b>Instruments promoting external trade</b>		
Dealing with the company's approach to the foreign market and the contact with potential clients.	<a href="http://www.plancameral.org">http://www.plancameral.org</a>	Chamber of Commerce
	<a href="http://www.icex.es">http://www.icex.es</a>	Spanish Institute of Foreign Trade
<b>Instrument of export financing</b>		
Export credits with official concrete support such as, for example, the Agreement of Reciprocal Adjustment of Interest (CARI) and the Credit Fund of Development Assistance (FAD) that insure the financing of foreign sales.	<a href="http://www.ico.es">http://www.ico.es</a>	Institute of Official Credit
<b>Instruments of investment support and corporate cooperation</b>		
These sites facilitate the positioning of Spanish companies in foreign markets through flows of direct investment and/or by entering into agreements of cooperation with managers in the foreign countries.	<a href="http://www.camaras.org">http://www.camaras.org</a>	Chamber of Commerce
	<a href="http://www.icex.es">http://www.icex.es</a>	Spanish Institute of Foreign Trade
	<a href="http://www.cofides.es">http://www.cofides.es</a>	Spanish Society of Development Financing
	<a href="http://www.ico.es">http://www.ico.es</a>	Institute of Official Credit
<b>Instruments of indirect help for exporters (risk coverage, fiscal instruments, etc.)</b>		
Measures of a diverse nature are included, such as credit export insurance that insures the collection of the exported merchandise, the deduction of Society Tax for export activities or systems of normalization of the quality of the product.	<a href="http://www.cesce.es">http://www.cesce.es</a>	Spanish Society of Insurance and Export Credit
	<a href="http://www.comercio.es">http://www.comercio.es</a>	Secretary of State of Tourism and Trade
	<a href="http://www.miga.org">http://www.miga.org</a>	Multilateral Agency of Investment Guarantees
	<a href="http://www.aeat.es">http://www.aeat.es</a>	State Agency of Tributary Administration
	<a href="http://www.camaras.org">http://www.camaras.org</a>	Chamber of Commerce
	<a href="http://www.icex.es">http://www.icex.es</a>	Spanish Institute of Foreign Trade

Source: Self produced.

is not free from problems related to the lack of training of the users or the existence of institutional and cultural factors that affect its use, which is united to a perceived insecurity in the transactions and the fact that access to geographically dispersed markets can cause substantial increases in administrative, marketing, logistical and, on occasion, regulatory costs (OECD, 2003; World Bank, 2006, p. 68)<sup>1</sup>. As a consequence, even among the companies of

the developed countries where the e-commerce is part of an integrated global strategy, most of them are focused on online operations of a preferably local nature. According to the INE (2007), in Spain, in 2007, the 87% of e-commerce transactions were of a local nature. At the European level, a report of the European Commission (2006) clearly showed the rapid growth of electronic commerce among the retailers of the UE, but also the preferably domestic nature of these types of transactions: cross border sales via the Internet only reached 14 percent of the total level of sales carried out by this means<sup>2</sup>. Some of the scarce

<sup>1</sup> The European Commission (2006) has verified that in the retailing sector, the principal barriers for cross border trade are the insecurity of the transactions, the different national fiscal regulations and consumer protection.

<sup>2</sup> It is a significant fact that only one out of every two companies

references existing on the situation in other countries point out the same (OECD, 2004).

**TABLE 2. Percentage of geographic destination in commercial trade transactions (several years).**

Country	Electronic commerce with national destination (%)
Canada (2)	Less than 75
Denmark (1)	82
Finland (1)	87
Germany (1)	90
Iceland (2)	83
Korea (3)	83,5
The Netherlands (2)	70 (95 to the USA)
Norway (1)	97
Sweden (1)	78

(1) Data from 2001; (2) Data from 2002; (3) Data from 2003.  
Source: OECD (2004).

The presence of these barriers and the opportunity to assist in overcoming them justifies the external trade promotion organizations of ten different countries, namely Austrade (Australia), Danish Trade Council (Denmark), EVD (The Netherlands), Trade Council of Iceland (Iceland), ICE (Italy), Trade New Zealand (New Zealand), Norwegian Trade Council (Norway), ICEP (Portugal), ICEX (Spain), and Swedish Trade Council (Sweden), participating in the creation of the project *emarketservices.com* that offers knowledge and information about the electronic markets of diverse sectors in the whole world. Along these lines, the Association of South East Asian Nations (ASEAN) has started a combined project of electronic commerce to help their ten member countries to create and apply a harmonized legal infrastructure of electronic commerce (UNCTAD, 2008).

The work of Humphrey et al. (2003) points out that, in the case of developing countries, the expectations created by the Internet as a tool able to facilitate access to new markets are not being realized. After examining 180 marketplaces based on using the Internet as a platform for the online B2B operations of textile and horticultural products exporters in those countries, it concluded that –although the benefits related to having access to the best information and the reduction of communication– costs were being taking advantage of the generation of new business by using the Internet was practically nonexistent. The main use of this communication channel on the part of the studied

that carried out e-commerce and cross border transactions indicated in this report that the Internet and e-commerce had made such sales to the final customer much more interesting for the company (European Commission, 2006, p. 76).

companies was for sending and receiving electronic mail, used primarily to exchange information with commercial partners already existent prior to the creation of the virtual platform (Humphrey et al., 2003; World Bank, 2006). In this way, far from opening new markets, the Internet was mainly helpful in improving the integration amongst participants in the chain of traditional value. These results do not differ in essence from other OECD studies (Desruelle et al., 2001, p. 6; Moodley, 2002), according to which, in the B2B environment, signs of radical changes do not exist in the ways in which companies develop their commercial transactions and find new business. The report of the United Nations (2003) also reaches similar conclusions, when pointing out the lack of success in most of the marketplaces created between 1990 and 2001 in the coffee and tea sector in underdeveloped countries. In the national environment, the study of the electronic B2B commerce application by Spanish PYMEs, carried out by the Spanish Association of Electronic Commerce (AECE, 2003, p. 69), shows that –among the main benefits found by the companies that carried out B2B transactions online– an increase in clients/markets is listed in last place, being referred to by only 1.4 percent of the companies.

The study of actual cases (Fernández & Nieto, 2006; García-Canal et al., 2007; Ueki et al., 2005) allows us, however, to identify strategic advantages associated with the ICT use, understood as a platform of growth that can permit the company to expand in markets abroad, to contract with new partners and, even, to define new business opportunities. The entity can capture possible clients that before were simply not physically present, and which could not have been found in another way. As well, the prospect of immediate and continuous communication with foreign associates or partners permits the administration and efficient use of information, favoring the elimination of certain barriers, as long as it allows the parties to come closer together, contributing to the solution of problems and the realization of business opportunities in the international market.

## EMPIRICAL ANALYSIS

Starting from what was examined in the previous section, we seek to investigate if some relationship really exists between the external commercial activity of the Spanish companies and their ICT level use in general, and of the Internet in particular, with commercial goals. In short, keeping in mind, firstly, the delay of Spain in the adoption and use of the new technologies (Table 3) and, secondly, the existent differences in relation to the application and commercial employment of ICT among the different Spanish

industries (Table 4), we contrast the existence of a direct relationship between the import/export activity carried out by Spanish companies and their degree of incorporation and use of ICT.

**TABLE 3. Indicators of the incorporation and use of ICT on the part of companies in 2006 (%)**

	Spain	USA-15	USA-25
Companies with Internet access	93	94	93
Companies that maintain their own website	47	65	64
Companies that buy online	15	31	28
Companies that sell online	8	16	15
E-commerce of the companies as a percentage of their sales	7	12	12

Source: Self produced with data from Eurostat (taken from www.ine.es).

The verification of a significant relationship between the use of ICT and the export activity carried out in the industrial activities of the Spanish economy will allow us to interpret appropriately the advantages derived from the new technology, those being greater efficiency and/or effectiveness in the use of the employed resources, and

which should result favorably in the sales of products in foreign markets and, in consequence, in the possibilities of growth for the national economy. In contrast, the lack of a link would substantiate a scarce commercial application and, therefore, the underutilization of the opportunities offered by ICT. On the other hand, a parallel evolution between the importation of industrial products and the incorporation and use of ICT would imply complementarities among these activities and, in a sense, indicate the use of the Internet for contracting with foreign suppliers that offer products at a better price or, perhaps, more adapted to the conditions of the intermediate or final demand.

Table 5 shows the variables used to approximate the incorporation and use of ICT for the sectors of activity, in accordance with the availability of statistical information from the Survey of Use of ICT and Electronic Commerce in the Company offered by the National Institute of Statistical (INE) since 2001, as well as the sectoral aggregation carried out for the different types of industries comes by way of said survey, as seen in Table 4. The statistical information related to industrial production comes from the Industrial Survey of Products of the INE. Additionally, the database on foreign trade of the Chambers of Commerce,

**TABLE 4. Survey of use of ICT (to January 2007) and electronic commerce\* (ec) in 2006 grouped by activity and principal indicators.**

Industrial/Indicator Sectors**	I	BA	WEB	E C i	E V i	E C ec	E V ec	% V I	% C i	% C ec	% V ec
Total companies	94.32	95.23	51.91	18.22	7.83	19.26	8.79	5.20	7.30	11.68	8.70
Industry CNAE 15-41	93.26	93.93	58.75	17.49	8.95	18.21	10.47	8.27	6.45	9.41	12.73
Food, beverages and tobacco; industrial textiles, leather and footwear manufacturing; wood and cork; paper CNAE 15-21	86.93	91.26	51.72	12.83	11.64	13.70	13.53	9.19	2.55	3.53	14.63
Publishing, graphic arts and reproduction of recording supports CNAE 22	97.77	98.36	65.13	28.69	18.17	29.05	19.72	2.81	2.01	2.14	3.88
Coke oven, petroleum refinement; chemicals, rubber and plastic materials CNAE 23-25	97.84	94.16	75.57	22.39	10.43	23.27	12.58	16.41	2.02	2.76	18.19
Non-metallic mineral products; metallurgy and production of metallic products CNAE 26-28	95.69	93.03	54.03	12.55	5.31	13.29	6.36	2.90	2.68	4.18	4.57
Machinery and mechanical equipment; electrical, electronic and optical materials and equipment; transport materials; diverse manufacturing industries CNAE 29-37	95.88	96.87	65.05	24.51	6.85	25.07	8.27	6.00	10.65	18.32	16.94
Production and distribution of electric energy, gas and water CNAE 40-41	99.73	93.50	60.71	20.71	4.30	20.71	4.30	1.60	24.49	29.20	1.60

\* The INE, following a criteria similar to that of the OECD, considers two definitions of electronic transactions: a) a narrow definition according to which electronic transactions are those carried out via the Internet and that consist of the buying or selling of products (goods and services) realized via this channel of communication; b) a wider definition which includes the buying or selling of products via the nets of telematics, including the Internet as well as the EDI (Electronic Data Interchange), Minitel or interactive telephone systems.

\*\* I: % of companies with Internet access. BA: % of companies with broadband Internet access. WEB: % of companies with Internet connection and a webpage/website.

E C ec: % of companies that have made purchases by e-commerce. E C i: % of companies that have made purchases by Internet. E V ec: % of companies that have made sales by e-commerce.

E V i: % of companies that have made sales by Internet. % C ec: % of purchases by e-commerce out of total purchases. % C i: % of purchases by Internet out of total purchases.

% V ec: % of sales by e-commerce out of total sales. % V i: % of sales by Internet out of total sales.

Source: INE (2006).

as well as the registry on said operations maintained by the Spanish State Agency of Tributary Administration (AEAT), allowed collecting data about the volume of exported and imported products by National Classification of Economic Activities (CNAE) sectors.

TABLE 5. Grouping of ICT and foreign trade flow variables.

ICT variables
<b>Variables referring to the incorporation of ICT:</b>
- % of companies with Internet access (I)
- % of companies with broadband Internet access (BA)
- % of companies with Internet access and web site/web page (WEB)
- % of companies that have made purchases by e-commerce (E C ec)
- % of companies that have made purchases by Internet (E C i)
- % of companies that have made sales by e-commerce (E V ec)
- % of companies that have made sales by Internet (E V i)
<b>Variables referring to the intensity of use of ICT:</b>
- % of purchases by e-commerce out of the total purchases (% C ec)
- % of purchases by Internet out of the total purchases (% C i)
- % of sales by e-commerce out of the total sales (% V ec)
- % of sales by Internet out of the total sales (% V i)
<b>Foreign Trade Flow Variables</b>
- % of exports out of the total industrial production (Xp)
- % of imports out of the total industrial production (Mp)

To learn the possible dependence among the referred variables, we will use appropriate statistical techniques<sup>3</sup> that will facilitate a correct evaluation of the base information and of the existent relationships, bearing in mind the impossibility of carrying out a more complex analysis due to the scarce availability of information, which explains the

<sup>3</sup> To check the possible linkage between the application and use of ICTs and the export behavior of the different industries considered between 2001 and 2006 requires contrasting the different relationships. For this, once the values of the variables are known, the correlation coefficients are calculated, as shown in Table 6. In the upper part of the matrix, above the main diagonal, the coefficients of correlation of Pearson are presented and in the lower part, below the main diagonal, those of Spearman or for ranges. Each cell (ij) of the matrix contains two values. The first one is the coefficient of correlation  $r_{ij}$  between the variable  $X_i$  and  $X_j$ , and the second is the p-value from the contrast at 95% whose null hypothesis is  $p=0$ , with  $p$  being the true coefficient of populational correlation, and whose alternative hypothesis is  $p \neq 0$ . Starting from this matrix, one is able to draw conclusions about the dependence or independence of the variables, quantifying the degree of same and its direction.

small sample period (2001, 2003 2004, 2005, 2006<sup>4</sup>) and the annual periodicity of the data.

The data in Table 6 showing the force of the lineal relationship amongst the variables, allow the deduction of some important correlations. We highlight the existent positive linkage between the production volume that the sector dedicates to external markets out of the totality of its production ( $X_p$ ) and the percentage of sales by electronic commerce (% V ec) in a wide sense. A relationship that ratifies the coefficient of correlation of Spearman indicates that when the industry dedicates a larger percentage of its production to the external market, the volume of sale operations that the industry does via electronic increases. The coefficients of Spearman, or for ranges, evidence a positive effect between the propensity of the industry to export and the number of companies with an Internet connection. We must highlight that the positive relationship appears when companies use the Internet to redefine their sale processes using electronic commerce, without a possible association perceived between the export activity of the industry and the simple availability of ICT elements, such as broadband, web pages, electronic systems for purchases and sales, etc. The direct relationship appears when one looks at the forms of e-commerce considered traditional, such as EDI, Minitel or interactive telephone systems, but not when one consider e-commerce developed exclusively through the Internet (% V i).

The existent correspondence between the export activity of the different manufacturing activities considered and the use of the new technologies in their business with foreign clients does not imply a definite causal relationship between them. In fact, a bidirectional relationship among these variables must exist because the companies that operate in international markets are more open to the innovation and assimilation of new technologies to maintain their position in the market, although ICT facilitates the development of commercial operations with very geographically distant clients/suppliers favoring the export activity, as Freund & Weinhold (2004) and Nieto & Zuli-ma (2006) point. According tz Álvarez and Alonso (2003), competition in the international market has a direct influence on the development of innovative activities, favoring the use of sophisticated commercialization systems like the electronic commerce. The relationships maintained with their commercial partners facilitate technological diffusion, while at the same time benefiting from the learning and knowledge developed abroad (Dehesa, 2000, p. 32). Therefore we can onlo presume a relationship feedback

<sup>4</sup> 2002 was not included as the statistical information was not available in the following variables: % C ec, % C i, % V ec and % V i.

**TABLE 6. Matrix of coefficients of correlation.**

	Variables	Xp	I	BA	WEB	EC i	EC ec	EV i	EV ec	% C i	% C ec	% V i	% V ec	
	Xp	-	-0.1728 0.3791	-0.0946 0.6322	0.2273 0.2447	-0.0833 0.6736	-0.0638 0.7471	-0.1519 0.4404	-0.0433 0.8267	-0.1115 0.5721	0.3169 0.1004	0.2285 0.2421	0.6218 0.0004	
C.	I	0.4559 0.0178	-	0.7687 0.0000	0.7232 0.0000	0.6690 0.0001	0.6708 0.0001	0.3451 0.0721	0.2574 0.1860	0.3113 0.1069	0.2513 0.1972	0.1895 0.3341	-0.0339 0.8642	C
S	BA	-0.1270 0.5094	0.7198 0.0002	-	0.8209 0.0000	0.8167 0.0000	0.8280 0.0000	0.6466 0.0002	0.6019 0.0007	0.3488 0.0689	0.2760 0.1551	0.4618 0.0134	0.3387 0.0779	P
P	WEB	0.1730 0.3688	0.6415 0.0009	0.8352 0.0000	-	0.7795 0.0000	0.7802 0.0000	0.4733 0.0110	0.5056 0.0061	0.2721 0.1613	0.3297 0.0867	0.4625 0.0132	0.4295 0.0226	E
E	EC i	-0.1054 0.5840	0.7415 0.0001	0.9230 0.0000	0.7979 0.0000	-	0.9982 0.0000	0.6834 0.0001	0.6002 0.0007	0.4493 0.0165	0.3706 0.0522	0.4421 0.0185	0.3062 0.1130	A
A	EC ec	-0.0662 0.7307	0.7203 0.0002	0.9217 0.0000	0.7964 0.0000	0.9960 0.0000	-	0.6929 0.000	0.6102 0.0006	0.4425 0.0184	0.3747 0.0494	0.4685 0.0119	0.3361 0.0804	R
R	EV i	0.0389 0.8399	0.3123 0.1046	0.7341 0.0001	0.5225 0.0066	0.6927 0.0003	0.6895 0.0003	-	0.9405 0.0000	0.1127 0.5680	-0.0333 0.8663	0.6202 0.0004	0.4035 0.0332	S
M	EV ec	0.1483 0.4409	0.2441 0.2046	0.7099 0.0002	0.6004 0.0018	0.6205 0.0013	0.6196 0.0013	0.9071 0.0000	-	0.0062 0.9750	-0.1385 0.4822	0.6016 0.0007	0.4820 0.0094	O
A	% C i	-0.0512 0.7903	0.4957 0.0100	0.5937 0.0020	0.3610 0.0607	0.7027 0.0003	0.7130 0.0002	0.4514 0.0190	0.3145 0.1022	-	0.8444 0.0000	0.1552 0.4302	0.1182 0.5490	N
N	% C ec	0.3096 0.1077	0.2565 0.1826	0.3780 0.0495	0.3164 0.1002	0.4938 0.0103	0.5162 0.0073	0.1775 0.3563	0.0471 0.8067	0.7991 0.0000	-	0.1070 0.5878	0.2581 0.1848	
	% V i	0.2781 0.1484	0.0605 0.7532	0.6154 0.0014	0.4687 0.0149	0.5046 0.0087	0.5198 0.0069	0.6883 0.0003	0.6236 0.0012	0.4342 0.0241	0.4181 0.0298	-	0.8157 0.0000	
	% V ec	0.7712 0.0001	-0.2315 0.2290	0.2759 0.1517	0.3727 0.0528	0.2472 0.1990	0.2791 0.1469	0.4645 0.0158	0.5506 0.0042	0.2641 0.1699	0.3930 0.0411	0.6822 0.0004	-	

Source: INE, AEAT.

between the export activity in the sector and the use of electronic commerce as an instrument to solidify commercial operations with foreign clients<sup>5</sup>.

From the purchasing side, the correlation coefficients in Table 7 indicate a significant association between the relative value of different industrial sectors imports and the volume of sales via electronic commerce. This responds fundamentally to the linkage that exists between the permanency of Spanish companies in the international markets as offerors and the probability that these same companies import (Lucio et al., p. 183). The accumulation

of capacities and experiences bound to export operations that favor the company to intervene as buyers in the international market. In general, the relationship grows when what is considered is the average propensity to import: A larger percentage of business is carried out by e-commerce when it is done by industries with a high propensity to import. The industry's internationalization level, determined by the volume of purchases reached in the international markets, maintains a high correlation with the use of advanced commercialization systems supported by the new technologies. Apart from this, the differences among industries are significant, as evidenced by the statistical information in Table 4<sup>6</sup>.

<sup>5</sup> In the interpretation of these results, we should also keep in mind that the factor of company size is especially relevant when explaining the export activity of the Spanish economy, because while the big companies send more than 30% of their products to the foreign market, the exports of the PYMEs (see footnote 1) do not reach 10%. This explains why, in the opinion of Melle and Raymon (2001, p. 91), PYMEs are left behind by the entities with a worldwide presence. In 2005, only 10 companies out of 77,300 made up 16.1% of the total amount of exports of the Spanish economy. Therefore, the larger companies that send a higher percentage of their production to the international market would be those that, in addition, better understand how to capitalize on the possibilities offered by ICT in their commercial activities.

<sup>6</sup> While the percentage of purchases by e-commerce surpassed 18% and sales 16% in 2006 in the industry of "Machinery and mechanical equipment, electronic equipment, electronics, optics, transport materials and diverse manufacturing industries", the industry of "Publishing, graphic arts and reproduction of recordings support" only reached 2.14% and 3.88%, respectively, in that year.

TABLE 7. Matrix of coefficients of correlation.

	Variables	Mp	I	BA	WEB	E C i	E C ec	E V i	E V ec	% C i	% C ec	% V i	% V ec	
	Mp	-	-0.1795 0.3607	-0.0786 0.6908	0.2328 0.2331	-0.0674 0.7333	-0.0472 0.8116	-0.1564 0.4267	-0.0432 0.8271	-0.0492 0.8037	0.3521 0.0662	0.2549 0.1905	0.6474 0.0002	
C.	I	-0.4379 0.0229	-	0.7687 0.0000	0.7232 0.0000	0.6690 0.0001	0.6708 0.0001	0.3451 0.0721	0.2574 0.1860	0.3113 0.1069	0.2513 0.1972	0.1895 0.3341	-0.0339 0.8642	C.
S	BA	-0.0799 0.6780	0.7198 0.0002	-	0.8209 0.0000	0.8167 0.0000	0.8280 0.0000	0.6466 0.0002	0.6019 0.0007	0.3488 0.0689	0.2760 0.1551	0.4618 0.0134	0.3387 0.0779	P
P	WEB	0.2124 0.2698	0.6415 0.0009	0.8352 0.0000	-	0.7795 0.0000	0.7802 0.0000	0.4733 0.0110	0.5056 0.0061	0.2721 0.1613	0.3297 0.0867	0.4625 0.0132	0.4295 0.0226	E
E	E C i	-0.0673 0.7264	0.7415 0.0001	0.9230 0.0000	0.7979 0.0000	-	0.9982 0.0000	0.6834 0.0001	0.6002 0.0007	0.4493 0.0165	0.3706 0.0522	0.4421 0.0185	0.3062 0.1130	A
A	E C ec	-0.0290 0.8802	0.7203 0.0002	0.9217 0.0000	0.7964 0.0000	0.9960 0.0000	-	0.6929 0.0000	0.6102 0.0006	0.4425 0.0184	0.3747 0.0494	0.4685 0.0119	0.3361 0.0804	R
R	E V i	0.0446 0.8167	0.3123 0.1046	0.7341 0.0001	0.5225 0.0066	0.6927 0.0003	0.6895 0.0003	-	0.9405 0.0000	0.1127 0.5680	-0.0333 0.8663	0.6202 0.0004	0.4035 0.0332	S
M	E V ec	0.1730 0.3688	0.2441 0.2046	0.7099 0.0002	0.6004 0.0018	0.6205 0.0013	0.6196 0.0013	0.9071 0.0000	-	0.0062 0.9750	-0.1385 0.4822	0.6016 0.0007	0.4820 0.0094	O
A	% C i	-0.0348 0.8567	0.4957 0.0100	0.5937 0.0020	0.3610 0.0607	0.7027 0.0003	0.7130 0.0002	0.4514 0.0190	0.3145 0.1022	-	0.8444 0.0000	0.1552 0.4302	0.1182 0.5490	N
N	% C ec	0.3216 0.0947	0.2565 0.1826	0.3780 0.0495	0.3164 0.1002	0.4938 0.0103	0.5162 0.0073	0.1775 0.3563	0.0471 0.8067	0.7991 0.0000	-	0.1070 0.5875	0.2581 0.1848	
	% V i	0.2899 0.1320	0.0605 0.7532	0.6154 0.0014	0.4687 0.0149	0.5046 0.0087	0.5198 0.0069	0.6883 0.0003	0.6236 0.0012	0.4342 0.0241	0.4181 0.0298	-	0.8157 0.0000	
	% V ec	0.7592 0.0001	-0.2315 0.2290	0.2759 0.1517	0.3727 0.0528	0.2472 0.1990	0.2791 0.1469	0.4645 0.0158	0.5506 0.0042	0.2641 0.1699	0.3930 0.0411	0.6822 0.0004	-	

Source: INE, AEAT.

## CONCLUSIONS

The analysis carried out in the preceding pages allows us to bring to light crucial aspects related to the use of the Internet and electronic commerce by the industrial sectors of the Spanish economy that are involved in most of the real exchanges with the exterior. The main results that come out of this work are the following ones:

The connection/disconnection level of companies and the national productive systems to the global channels of communication and information is indispensable in the face of the new technological paradigm, although it does not determine, according to the analysis carried out in the case of the Spanish industry, whether the opportunities offered by ICT in international operations are being taken advantage of. Spanish industrial companies show, in general, a growing connection to the Internet by means of broadband and, more and more, they value having a presence on the web. However, those that negotiate by electronic means are a small percentage, observing a relationship between the incorporation of the Internet and the average propensity to export. Therefore, as concluded by García-Canal et al. (2007, p. 141), the mere existence of the resource does not imply its efficient employment as an instrument of internationalization. In this sense, one may consider as appropriate the measures taken by different institutions with the

objective of facilitating the extension and a greater application of the ICT use amongst export companies.

Those industries –where a large percentage of their production is dedicated to foreign markets– are also those that do a greater and greater volume of business via electronic commerce, particularly through different communication channels such as EDI, Minitel or the Internet. Of interest, however, is the absence of this relationship when one considers the electronic commerce carried out exclusively through the Internet, in spite of a large majority of companies have this communication channel. Everything points to the broadly extended Internet as not having been even able to displace the other traditional forms of electronic commerce that, although more expensive, still enjoy the trust derived from the possession of restricted access and from the knowledge and familiarity of the parties to said traditional forms. This aspect is especially attractive for companies that operate in foreign markets.

We noted linkages between the average propensity to import of the industry and the volume of operations done via electronic commerce. The most internationalized companies that maintain habitual relationships with foreign clients/suppliers apply more the new technologies to sell.

The biggest difficulty borne by international as opposed to national business results from certain attitudes and

interests and, at the same time, of aptitudes and capacities on the part of the management or the direction of the company (Brouthers & Nakos, 2005), summed up as an appropriate training level, international experience, possibility to assume risks, innovative effort, etc., all of which said factors favor an appropriate exploitation of the opportunities that ICT have as an instrument of internationalization. In fact, the technological effort and the qualification of the personnel are, on one hand, primary conditions for the foreign success of Spanish companies (Donoso y Martín, 2008) and, on the other hand, decisive of the capacity that the entity have to generate competitive advantages associated with the use of the electronic channels of information communication and commercialization.

In any case, we should consider these results as an exploratory analysis of the data. The scarce availability of statistical information, the nonconsideration of those flows of external commerce whose volume does not exceed the statistical threshold established in the USA,<sup>7</sup> and the short sample period analyzed justifies the conclusions being interpreted with caution. Therefore, the statements made about the scarce application of ICT in the commercial activity of Spanish industry should be pondered paying attention to these considerations. In the long term, the virtual mechanisms of trade will be an indispensable complement for the development of the real flows of trade with foreign clients/suppliers and the same dynamics of competition will determine their use and exploitation.

The results given by this work contributes only to constitute indications of what happened in the recent past. Nevertheless, they justify the necessity of more intensive actions that increase the potential that the use of the new electronic systems have in the promotion and international commercialization of Spanish industrial production, especially in the PYMEs' environment, given that their financial and training limitations redound negatively in their capacity as exporters.

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<sup>7</sup> This threshold increased to 200,000 euros in 2007, having increased progressively since 1993 (AEAT).

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