

ICT Adoption and Use in Costa Rican Export Companiesⁱ

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Abstract

We study the ICT adoption and use in Costa Rican export companies based on the results of a field survey. The e-commerce readiness/intensity/impact model, developed by the Organisation for Economic Cooperation and Development (OECD), was adapted for this research. The results obtained show that, in general, the surveyed companies present low ICT readiness and intensity, with the exception of service companies and microenterprises. Furthermore, there is no evidence of a clear perceived positive ICT impact on the exports taking into account all companies, neither considering their sector or size. Nevertheless, large companies perceive a positive effect, which is consistent with a sustained increase in their export value. Based on the previous results, we discuss factors that might influence the adoption and use of ICT in the export companies and present recommendations to increase its use. In addition, suggestions for further research are presented.

1. Introduction

The objective of this study was to analyze ICT adoption and use, particularly related to e-marketing, in Costa Rican export companies.

This research was carried out as part of the project "ICT and Global Value Chains: Web 2.0 Technologies and their Impact on Sales, Productivity and Competitiveness for Costa Rican Export SMEs", undertaken by the Graduate Program in Management of Information and Communication Technology of the School of Informatics of the Universidad Nacional de Costa Rica and funded by the International Development Research Centre (IDRC) of Canada.

This paper is divided in five sections. Section 2 presents the methodology used. The results obtained in the field survey are discussed in section 3. Section 4 introduces factors that might influence ICT adoption and use in Costa Rican export companies based on the previous results. Finally, conclusions and recommendations are presented in section 5.

2. Methodology

This study was conducted through a field survey using an electronic questionnaire, which was sent to the General Managers of the export companies in the population thereafter defined.

2.1. Questionnaire design

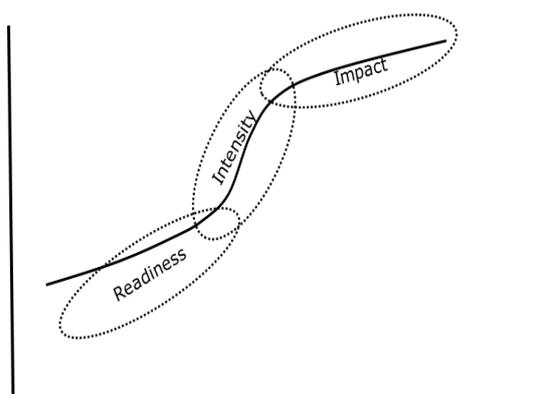
To assess ICT adoption and use, we adapted the e-commerce maturity model proposed by the Organisation for Economic Cooperation and Development (OECD) [1] (see Figure 1). This model assumes that ICT adoption and use follows three stages through an s-shaped curve, popularized by Rogers in his work *Diffusion of Innovations* [2]. Implicit in this type of models is the fact that the stages succeed across time.

The OECD framework considers three stages for the diffusion of ICT: readiness, intensity and impact. Readiness can be defined as "the ability to use ... ICT ... to develop one's economy and to foster one's welfare" [3]. Intensity measures the state of specific ICT applications and identifies who are exploiting better such applications [1]. Given the fact that this research focuses on e-marketing, intensity was referred to the use of websites, e-commerce, and Web 2.0 sites and tools. Finally, impact relates to ICT effects, both additive and multiplicative, on firm's performance and society's welfare.

In the previous model, readiness is a requirement for intensity, and intensity for impact.

Recommendations from international organizations regarding ICT indicators and ICT field studies [4,5,6,7,8] were taken into consideration for selecting indicators for each of the stages in the proposed framework.

The questionnaire was organized in five chapters. The first one was aimed at gathering relevant information about the organizations, such as its economic sector and size, the beginning date of its operations and exports, the degree of participation of foreign capital, the type and level of exports, and the educational level of the employees. Indicators for this chapter were based on the Costa Rican innovation survey 2006-2007 [6].



Source: Adapted from OECD [1]

Figure 1. Readiness/intensity/impact model

Information on the ICT readiness for the companies was collected in the second chapter. Indicators in this chapter were selected from the previous survey [6], the Manual for the Production of Statistics on the Information Economy 2009, published by UNCTAD [8], and the recommendations for building indicators from UNECLAC [5] and RICYT [7]. This chapter considered indicators related to computer use, ICT equipment, Internet connection and use, ICT applications used, and data/information exchange with customers and suppliers.

The third chapter considered the intensity of websites and e-commerce in the export companies. Such intensity was gathered through the following indicators: i) existence of a website, ii) intention of having a website in the future, iii) characteristics of the website, and iv) utilization of electronic markets. These indicators were selected based on the work carried out by UNCTAD [4,8].

The fourth chapter focused on the intensity of Web 2.0 sites and tools. Due to the novelty of this topic, the indicators used in this part were elaborated by the authors, considering aspects such as use of Web 2.0 sites and tools, intention of using such sites and tools in the future, main Web 2.0 sites used, and reasons for not using Web 2.0 sites and tools.

The fifth and last chapter, of the questionnaire measured the ICT impact on the companies' exports. Although in the case of e-commerce, UNCTAD [4] used perceived impact, no intensity indicators were found for Web 2.0, possibly because of its novelty. Furthermore, impact indicators are not well treated in the literature. Since ICT impact is reflected as additive and multiplicative effects, as already mentioned, it is difficult to assess such effects without controlling for other variables. Furthermore, "[a]lthough there is ample evidence that IT is the main driving force behind the globalization of capital ... the contribution of IT to export performance remains underinvestigated, especially in SMEs." [9]. Taking all these into account, we decided to use the

perception of the respondents as indicator for ICT impact, as proposed in the E-Commerce and Development Report 2004 [4].

The questionnaire was tested in two ways. First, the items selected were sent to a panel of six experts to test their relevance and completeness. The revised items were then included in an electronic questionnaire created using LimeSurvey.ⁱⁱ

Second, the electronic questionnaire was applied to four companies. General Managers from such companies were asked to fill electronically the questionnaire in the presence of one of the researchers. Based on this last test, modifications were made to several questions, and two new questions were included, for a total of 35 items.

2.2. Population and Sample

A census was conducted for the field survey using the companies included in a contact databaseⁱⁱⁱ provided by the Costa Rican Export Promoting Agency (PROCOMER). At the time of the study, the contact database contained information for 1,999 organizations, mainly export companies or companies indicating interest in exporting. Prior to the survey, the contact database was reviewed primarily to check the e-mail address, required to send the electronic questionnaire. This process allowed eliminating duplicated e-mail addresses, belonging to the same business group, yet associated to different company names. Furthermore, records from organizations not suitable for the study, such as banks and universities, were deleted. Once this cleaning process was conducted, the electronic questionnaire was sent to the remaining 1,827 organizations.

The questionnaire was available on-line from August to December 2010. During that period of time, electronic reminders were sent to companies and phone calls were made to improve the response rate. At the end of this period, 385 questionnaires were received, giving a response rate of 21% which is considered acceptable for a study of this nature.

Due to the fact that the study focused on export companies, a filter was included as the first item in the questionnaire to limit the response only to those firms that exported at the time of the survey. From the 385 questionnaires received, 201 (52%) corresponded to export companies, and were considered in the analyses.

3. Results

The results presented in this section are organized according to the chapters of the questionnaire presented in the previous section.

3.1. Profile of the Information on the Export Companies

As Figure 2 shows, the majority of the export companies that completed the survey belonged to the industrial sector (54%), followed by the agricultural sector (33%), the service sector^{iv} (9%), the cattle-raising and fishing sector (2%), and companies that did not indicate their sector (2%). These two last groups were excluded from the subsequent analyses, due to their small number of companies.

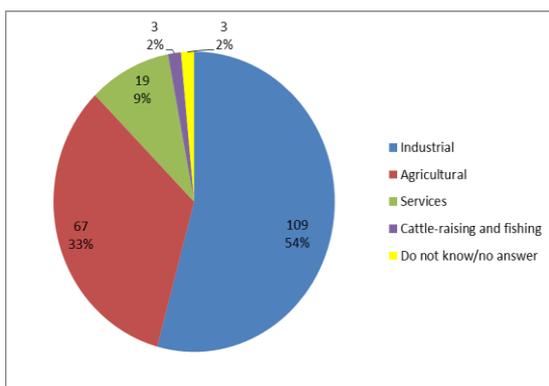


Figure 2. Economic sector of the companies participating in the survey

In terms of the number of employees, most companies in the sample were small (36%), having 6 to 30 employees. They are seconded by medium companies (28%), with 31 to 100 employees, microenterprises (19%), having at most 5 employees, and large companies (17%), with more than 100 employees.^v However large companies concentrated the majority of the direct employment (74%). This result is similar to the one obtained in the 2009 Export Census of PROCOMER [10], which shows that large companies generated 81% of the direct employment and SMEs only 19%.

If size and sector are considered jointly, the largest concentration of companies was found in small enterprises in the agricultural sector (46%), followed by medium companies in the industrial sector (34%), microenterprises in the service sector (32%) and large companies in the industrial and service sectors (21% respectively), as depicted in Figure 3.

The majority of companies participating in the survey initiated operations in the last decennium (2000-2009), therefore they have been created very recently. This is consistent with the research conducted by Rivera [11] for the State of the Nation, which indicates that that export SMEs in Costa Rica have a life span of 10 years.

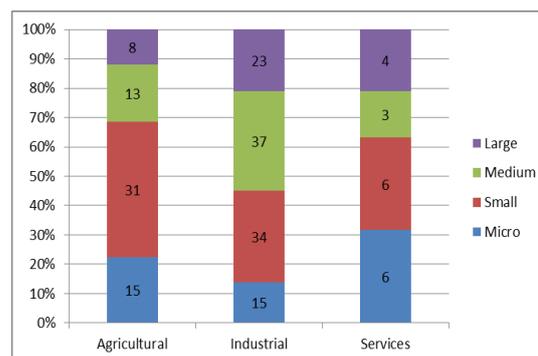


Figure 3. Size by economic sector of the export companies

The industrial sector separated from the previous pattern with a major number of companies initiating operations in the period 1990-1999. Similarly, medium and large companies mainly initiated operations in this same decennium. This last fact coincides with the observation made by Rivera [11] that large export companies have a lower mortality rate.

Furthermore, companies in the sample predominantly began to export in the period 2000-2009. The distribution of companies by sectors was similar to the total sample; however, the agricultural and industrial sector presented companies with a longer export trajectory. In the case of the size of the company, it can be observed that the larger the company, the longest they have been exporting. In the case of microenterprises, 18% initiated exports in the 1990-1999 decennium, compared to 31%, 41% and 56%, in the case of small, medium, and large companies, respectively. This situation is consistent with the conclusion obtained by Rivera [11] that large companies in Costa Rica are better able to maintain themselves in the export market.

It took on average five years for the companies surveyed to start exporting. However, companies in the agricultural and service sectors, as well as microenterprises and small companies, presented lower averages (approximately three years).

Regarding the participation of foreign capital in the surveyed export companies, Figure 4 shows that most of them (53%) had 0% foreign capital, that is, they possessed only Costa Rican capital. In contrast 47% of these companies had some participation of foreign capital, being the largest part of them (24%) those corresponding to having exclusively foreign capital. These two groups of companies were followed by a low number of companies (4 to 8%) with participation of foreign capital ranging from 1% to 99%.

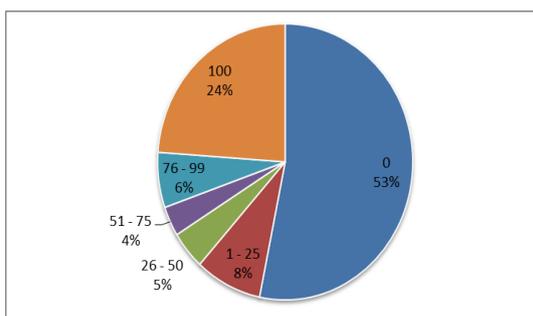


Figure 4. Participation of foreign capital in export companies

A similar pattern can be observed regarding the participation of foreign capital considering the economic sectors. However, the percentage of companies with some foreign capital participation varies among sectors: 37% in the agricultural sector, 47% in the industrial sector, and 63% in the service sector.

On the other hand, the participation of foreign capital^{vi} increases with the size of the companies: 39% in microenterprises, 44% in small, 48% in medium, and 57% in large companies.

Furthermore, wholesale exports^{vii} predominated for all the companies surveyed (48%). This same pattern is also observed when the sample is divided by sector or company size.

The majority of the companies in the sample (34%) exported from 1% to 25% of their total sales in 2009, followed by 29% of them exporting 100% of their sales. This situation shows a great variability in exports.

The agricultural sector showed a greater tendency towards exporting, whereas service companies presented a larger orientation towards the national market. A fairly equal distribution between the international and national market is observed when the size of the companies is considered, with the exception of the microenterprises which showed a larger orientation towards exports. Sixty-one percent of these companies exported more than 75% of their sales.

Although the number of countries to which the companies trade was very broad (1 to 38 countries), the majority of these companies exported in a range from one to five countries, being four the average. This result could be taken as an indication of a small export diversification.

Agricultural companies showed less diversification in their exports, trading to three countries on average, and companies in the service sector reflected more diversification, exporting to six countries on average; whereas industrial companies shipped on average to four countries, similar to the sample.

On the other hand, microenterprises traded on average to three countries, small and medium

companies to four and large to six, showing these last ones the largest export diversification.

The major destinations for exports in 2009 were the U.S. (49%) and Central America (47%).^{viii} This result coincides with the 2009 International Trade Statistics published by PROCOMER [12]. In the agricultural sector, the U.S. was the first destination (79%), followed by Europe (58%). In contrast, Central America was the first destination for exports from industrial and service companies (66% and 68%, respectively). Furthermore, the U.S. was the main destination for all size strata (45% for microenterprises, 49% for small companies, 50% for medium companies and 54% for large companies), yet Europe held a similar position in the case of microenterprises (45%), and Central America in the case of small, medium and large companies (49%, 52% and 54%, respectively).

As Table 1 indicates, most companies reported increases in the monetary value of the exports for the three periods considered (2006-2007, 2007-2008, and 2008-2009), although the percentage of companies reporting such growth also decreased. This fact reveals a slowdown in export growth, which coincides with the results of the International Trade Statistics from PROCOMER [12] and is a consequence of the situation in the global economy. A similar pattern is found in the industrial and service sector, and in medium and large companies. On the other hand, the agricultural sector and micro and small companies reported periods in which the export variation either was constant or decreased.

Table 1. Variation in the Value of Exports^a

Monetary Value of Exports	Period		
	2006-2007 ^a	2007-2008 ^a	2008-2009 ^a
Decrease	8.5%	15.9%	35.3%
Constant	35.3%	37.8%	26.4%
Increase	56.2%	46.3%	38.3%

a. Percentage of companies in each category

Lastly, the level of education for the employees in the companies surveyed was very basic (see Table 2). These data are similar to the results obtained in the 2006-2007 Costa Rican Innovation Survey [6]. This pattern was alike for the agricultural and industrial sectors and the small, medium and large companies; however, employees in the service sector and microenterprises predominantly had university education (40% and 52%, respectively).

Table 2. Educational Level of Employees

Educational level	Number of employees	
	Absolute	Relative
Primary school or lower	7,517	42.67%
Secondary school	5,061	28.73%
Technical	2,381	13.52%
University	2,657	15.08%
Total	17,616	100.00%

3.2. ICT Readiness

Computer use in the export companies surveyed was generally low. Only 16% of these companies reported that all its employees used regularly a computer at work, whereas 40% answered that at least half to all of their workers did so. Most companies in the sectors and size strata considered also showed a similar behavior, with the notable exception of the service sector and microenterprises. These two groups presented a larger proportion of companies in which all its employees normally used a computer at work (32% and 50%, respectively), and in which at least half of them did so (74% and 82%, respectively).

In terms of equipment owned by the companies, the average number of computers and servers was 25.33 and 1.55, respectively.

Furthermore, all companies had at least one computer. Although we might expect this result to hold true *a priori* in this survey, given the fact that companies should have an e-mail address to participate in the electronic survey, other studies [6,13] show that more than 90% of the Costa Rican companies have computers. Therefore, computer ownership is quite generalized in the country, and there is no evidence that a bias had been introduced in this study due to the population used.

Companies in the service sector presented larger averages of equipment ownership, as compared to the other sectors as well as to the sample. Furthermore, a direct relationship between the number of equipment possessed and the size of the company can be observed. As a result of this, large companies showed greater averages of computers and servers compared not only to the other size strata but also to the sectors and the total sample.

The companies in the survey had generalized access to Internet; only one company in the sample indicated not having such access.

The proportion of employees using a computer connected to Internet normally at work was low, similarly to the case of the employees using a standalone computer, except in the case of the service sector and the microenterprises.

As Figure 5 shows, the ICT applications most commonly used by the companies surveyed were: e-mail (100%), Internet browsers (97%), office tools (96%) and accounting and finance systems (84%). These applications are somehow unsophisticated, since they are horizontal applications, i.e. common to all the sectors, rather than vertical, that is, specific to a sector.

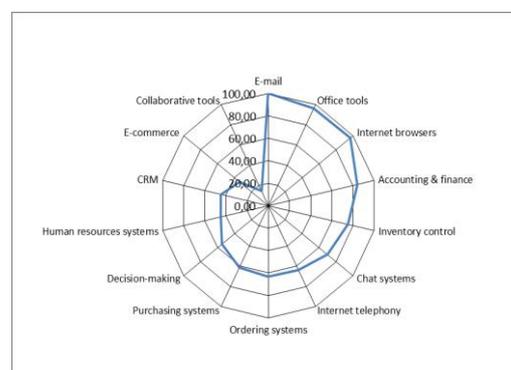


Figure 5. ICT applications in the surveyed companies

Considering the sectors, agricultural companies showed a lower use of the ICT applications included in the survey in comparison to the other sectors. On the other hand, the industrial sector presented a greater use of systems supporting production (inventory control systems, ordering systems and purchase and supply systems), and the service sector exhibited a larger usage of Web 2.0 applications, such as chat and Internet phone systems. Furthermore, the use of ICT applications increased along with the size of the companies, with the exception of e-commerce, whose use was larger in the case of microenterprises (50%).

In terms of data/information exchange with customers, the predominant mechanisms were e-mail and telephone (4.73 and 4.05, respectively, using a five-point Likert scale). To a lesser extent, Internet telephony, fax, chat and e-commerce were used (2.79, 2.70, 2.40, and 2.40, respectively). In particular, it is noteworthy the low use of e-commerce, already mentioned, and Web 2.0 applications: Internet telephony and chat, previously discussed, social networks (1.57), blogs (1.21), discussion forums (1.14) and wikis (1.12).

The data/information exchange with customers by economic sector followed a similar pattern. However, the service sector dominated the use of practically all categories of communication mechanisms, mainly Internet telephony, e-commerce and social networks. Exchange mechanisms with clients exhibited an analogous behavior for the different size strata; although the greater use of e-commerce and chat systems by microenterprises was

notorious, as well as of fax and postal mail by large companies.

Data/information exchange with suppliers also showed a leading use of e-mail and phone (4.44 and 4.03, respectively also using a five-point Likert scale), similar to the case with customers. Yet contrary to the previous case, fax was more often used than Internet telephony (2.74 vs. 2.28). Similarly, to the situation with customers, little usage of e-commerce and Web 2.0 applications was reported in the communication with suppliers.

Nevertheless, once the sample is divided, a greater use of Internet telephony, chat, and e-commerce was found with suppliers in the service sector. A larger use of e-commerce with suppliers was also observed in the case of the microenterprises, which additionally presented greater chat usage. Lastly, and similar to the case with customers, large companies exhibited more use of fax and postal mail.

The previous results point out to a low ICT readiness in the companies surveyed; although service companies and microenterprises appeared to be ahead of the rest in this regard.

3.3. Intensity of Websites and E-Commerce

More than half of the companies surveyed (69%) had a website. When the sample is divided by economic sector, around half of the agricultural companies (53%) indicated having a website, whereas three quarters of the industrial and service companies claimed to have one (77% and 74%, respectively). Furthermore, website ownership increased with the size of the company: microenterprises had the least proportion of websites (55%) and large companies the greatest (80%), with small and medium companies in between (72% and 75%, respectively).

In addition, only 40% of companies without a website expressed interest in having one in the future. Not much difference was found in such interest among the sectors: industrial companies (44%), service companies (40%), and agricultural companies (39%). On the other hand, small companies presented the greatest interest in having a website (58%) and large firms the smallest (0%).

As Table 3 demonstrates, only a handful of the companies surveyed indicated that their websites allowed the execution of commercial transactions (11%), being such websites simply a commercial showcase for the majority of the firms (84%).^{ix} Therefore, we can conclude that few of the existing websites were truly e-commerce sites.^x

The previous situation also holds when the sample is divided. However, a larger proportion of service companies and microenterprises indicated that their websites allowed commercial transactions (21% and 24%, respectively). This result is

consistent with the analysis of applications presented in the previous subsection; however, larger percentages for e-commerce use appeared in the previous analysis. This is probably due to a definition problem, since it is likely that companies tended to associate e-commerce with a website, even though this site did not allow execution of commercial transactions.

Table 3. Characteristics of the Websites in the Companies Surveyed

Characteristic	Responses	Percentage
A commercial display of products or services	117	58.21%
A place where customers can interact with the company (download of forms or catalogs, tracking purchases, etc.)	19	9.45%
A site where customers can execute commercial transactions	15	7.46%
A site integrated with other functions (inventory, accounting, production, etc.)	6	2.99%

Furthermore, there was a low utilization of electronic markets, such as Amazon Marketplace or Alibaba, for the entire sample and its divisions by economic sector and size.

The previous results clearly demonstrate that the intensity of websites, in general, and of e-commerce sites, in particular, was low in the companies surveyed. Nevertheless, service companies and microenterprises relatively showed a greater e-commerce use.

3.4. Intensity of the Web 2.0 Sites and Tools

Similarly, to the case of websites and e-commerce sites, the intensity of Web 2.0 sites and tools was low. Only 11% of the companies studied used such sites and tools. This is consistent with the low utilization of these sites and tools previously identified in the case of data/information exchange with customers and suppliers.

Companies in the service sector used more Web 2.0 sites and tools (16%), followed by firms in the industrial (12%) and the agricultural (6%) sectors. Interestingly, the usage of Web 2.0 sites and tools seems to decrease along with the size of the company, showing microenterprises the highest (21%) and large companies the smallest (6%), with small and medium companies in between (8% and 11%, respectively). This result contrasts with the case of the websites, previously discussed.

Only 27% of the companies surveyed not using Web 2.0 site and tools were interested in doing so in the future, lower than in the case of websites. This fact reinforces the apparent lack of interest in such type of applications by export companies. Industrial and medium companies indicated the most interest in using Web 2.0 applications in the future (32% and 36%, respectively).

The main Web 2.0 sites used by the export companies were: Microsoft Live Messenger (chat), Skype (Internet telephony and chat), and Facebook (social network). This pattern was also reflected in the other sectors and size strata. However, companies in the service sector and microenterprises showed a greater use of such sites.

Finally, the lack of knowledge about Web 2.0 use or its effective application was the first reason (49%) indicated by the companies surveyed for not using such type of applications. This was followed in importance by the opinion that Web 2.0 is not a viable option for business purposes (46%).^{xi} These two reasons also ranked first in importance when the sample is divided by sector and size.

Therefore, similarly to the case of e-commerce, use of Web 2.0 sites and tools was usually low for all the companies, yet service companies and microenterprises showed more use of such applications.

3.5. ICT Impact

As Table 4 shows, there was not a clear evidence of a perceived ICT impact on the value of the exports for the whole sample, since the difference for constant and increase was not substantial. Additionally, these perceptions did not go hand-in-hand with the sustained increase in exports reported by the companies for these three periods and presented in section 3.1. A similar situation existed in the case of the sectors.

On the contrary, microenterprises perceived a constant ICT effect on export value for the three periods considered, which goes along with a stabilization of the value of the exports reported by the same companies. Although small companies also claimed a constant ICT effect on exports, they reported increases in export values for 2006-2007 and 2007-2008 and a decrease for 2008-2009. In the case of medium companies, the perceived ICT effect was not clear either, except for the period 2008-2009 for which it was considered as increasing the value of exports. Finally, large companies perceived an increasing ICT effect on the export values, which is also consistent with an increase in such values accounted for the three periods in these same companies. Consequently, only in the case of large companies there was a perceived positive effect of ICT on exports.

Table 4. ICT Impact on the Value of Exports^a

Perceived ICT Impact on the Value of Exports	Period		
	2006-2007 ^a	2007-2008 ^a	2008-2009 ^a
Decrease	1.8%	5.1%	15.2%
Constant	52.7%	50.3%	41.3%
Increase	45.5%	44.6%	43.5%

a. Percentage of companies in each category

4. Factors Influencing the Adoption and Use of ICT in Export Companies

Based on the results presented in the previous section and on the literature, we discuss in this section potential factors that might influence the adoption and use of ICT in the Costa Rican export companies.

4.1. ICT Readiness

As explained previously, ICT readiness in the surveyed companies was low considering the proportion of employees which regularly use a standalone computer or a computer connected to the Internet in their work. Both indicators are considered important for ICT adoption and use [5,8]. These two indicators are very much related, due to the fact that the great majority of the companies surveyed had access to the Internet.

Furthermore, ICT readiness can also be considered low, taking into account that e-mail and telephone were the most pervasive communication methods with customers and suppliers and there was a low use of e-commerce and Web 2.0 sites and tools for such types of communication.

Additionally, the most common applications used in the export companies (e-mail, office, Internet browsers and accounting and finance systems) were relatively unsophisticated, as previously explained.

However, when the sample is divided by economic sector, service companies showed a greater readiness, in relation to the previous indicators, as well as a greater use of e-marketing applications (e-commerce and Web 2.0 applications for communication with customers and suppliers). *Economic sector* is considered an important factor in ICT adoption [5,7,8,9]. The relationship between industry types and ICT use has been reported in the literature for a long time and was popularized by McFarland et al. [14] by means of the strategic grid, which relates ICT dependency and strategic impact with industry types. In particular, service companies can be classified in the delivery sector proposed by Earl [15]. In such a sector, ICT is extremely important for the companies and it is the mechanism for delivering products and services; information

systems are also fundamental for operations in such firms.

Although ICT ownership could also be taken as another indicator of readiness, this is clearly affected by ICT use. In this regard, service companies, as opposed to large firms --which have the largest quantity of equipment--, seem to make better use of ICT, arguably due to the fact that they belong to the delivery sector proposed by Earl [15].

Size is another factor deemed important for ICT adoption [5,7,8,9]. According to the Oslo Manual for Collecting and Interpreting Innovation Data [16], marketing is a source of innovation. Furthermore, following Schumpeter [17] large firms in highly concentrated market structures are more likely to innovate. If all the previous were true, we would expect large export companies to have the largest ICT readiness and intensity; nevertheless, this is not the case. Rather microenterprises outperformed large companies in this realm. This is consistent with the fact that there is little empirical evidence that size and concentration are conducive factors to innovation [18].

Lefebvre and Lefebvre [9] indicate that although ICT applications are most often found in large firms, SMEs are increasingly adopting such applications due to improvements in hardware and software along with falling prices. As explained in the previous section, the use of ICT applications increased with the size of the surveyed companies, with the exception of e-commerce, which presented a larger usage in the case of the microenterprises.

Particularly, microenterprises showed more readiness in terms of proportion of employees using a standalone computer or a computer connected to Internet regularly at work, and of the use of e-commerce and Web 2.0 applications for communication with customers and suppliers. This situation might be attributable to the increase in productivity by ICT in such companies, which by definition have the smallest number of employees. Therefore, although size seems to affect adoption and use, an inverse relationship between them appears to exist, according to this study.

The greater ICT readiness for service companies and microenterprises can in turn be explained by the greater educational level of their employees. As presented in the previous section, these types of companies had the largest number of workers with university education. *Technocratization* is an important internal factor for ICT adoption, according to Lefebvre and Lefebvre [9].

4.2. ICT Intensity

ICT intensity was also low for the export companies surveyed, as evidenced in the low use of e-commerce sites and Web 2.0 sites and tools.

According to the model adopted in this research, a low readiness explains a low intensity.

When the sample is divided, the service companies and microenterprises showed more use of the previously mentioned sites and tools. This is consistent with the larger use of e-commerce and Web 2.0 applications for communication with customers and suppliers in these companies, already discussed. This situation could be explained by the better ICT readiness exhibited by the service companies and microenterprises.

Although microenterprises possessed less websites, they reported their sites had more e-commerce functionality. Service companies also had more e-commerce sites. Similarly, these two types of companies used more Web 2.0 sites and tools than other types of companies. This situation is reinforced by the fact that these companies also showed a greater use of e-commerce and Web 2.0 applications for communication with customers and suppliers. All these could be attributed to a greater preparation by such companies.

Another possible explanation for the greater use of e-commerce sites and Web 2.0 applications could be found in the prompt decision to export by service companies and microenterprises. As explained in the previous section, these two types of companies along with agricultural and small companies showed the smallest difference in time between exporting and initiating operations. The decision to export can be considered as an internal factor that affects ICT adoption and is reflected in the factor of *firm's pursued strategy* included in the framework proposed by Lefebvre and Lefebvre [9].

Furthermore, the use of Web 2.0 applications could be influenced by the use of websites, particularly e-commerce sites, which are predecessors. *The current level of assimilation and integration of technologies* is presented by Lefebvre and Lefebvre [9] as another internal factor of ICT adoption. Furthermore, as part of another study conducted for this project [20], we conclude that e-commerce and Web 2.0 are complementary, rather than substitute, technologies to promote sales and exports. Nevertheless, integration between websites and Web 2.0 sites and tools did not hold true when size is considered, since website use increased with the size of the company, yet Web 2.0 use decreased, as explained before.

Finally, it is important to note that most of the exports for the companies surveyed correspond to wholesales, instead of retail sales, as mentioned in the previous section. Therefore, e-commerce systems for such companies should be primarily B2B, which are more complex than B2C systems [19]. This situation might affect e-commerce usage in the export companies.

Consequently, ICT intensity can be influenced by ICT readiness and/or firm characteristics, as previously discussed.

4.3. ICT Impact

As explained before, there was no evidence of a positive perceived ICT impact on the export value for all the companies surveyed. Furthermore, no relationship was found regarding this perceived impact and the reported value of exports for the periods 2006-2007, 2007-2008 and 2008-2009. This could be explained by the low ICT intensity observed for the whole sample.

A similar situation exists in the case of the economic sectors, also explained in the previous section. However, it is interesting to note that large companies claimed a positive ICT impact on export values, which is consistent with a sustained increase in the export value reported by these same companies. Although this last result contrasts with the expected low ICT impact on exports for these companies, due to their low readiness and intensity, this perception might come from the difficulty to isolate export performance from export factors. As presented in section 3.1, large companies were more consolidated, since they had predominantly initiated operations in the 1990-1999 decennium. Also export diversification increased with the size of the company. Furthermore, the survey showed that the larger the size of the company, the longest they had been exporting. This is consistent with the fact that large companies in Costa Rica are better able to remain in the export market [11], presumably since they are more successful.

Finally, in spite of their greater ICT readiness and intensity, service companies and microenterprises reported a low ICT impact on exports, similar to the case of the whole sample. This situation might be due to the need of increasing even more the ICT readiness and intensity in such companies or to the lack of knowledge on how to use more effectively ICT for exports.

5. Conclusions and Recommendations

This study shows a low ICT readiness of the export companies surveyed. This in turn could explain the low ICT intensity found in the same companies, which also might contribute to the perceived low ICT impact on export values. Although, the ICT cause-effect on exports could be affected by other factors, as already discussed, the adaptation of the OECD readiness/intensity/impact model [1] seems to be a good framework to explain the low perceived impact of ICT on exports.

Even though service companies and microenterprises showed more ICT readiness and intensity, the perceived ICT impact on export values

was not as high as expected. This might be due to the need of improving readiness and/or increasing ICT intensity in these types of companies, and thus making better use of ICT for exports.

On the other hand, large companies claimed a higher perceived impact of ICT on exports than expected, in spite of their lower level of readiness and intensity. This apparent discrepancy with the model used might be explained by the difficulty in isolating cause from effect, since larger companies tend to be more successful at exporting. For this reason, it is necessary to develop better impact indicators.

This study demonstrates that the baseline for adoption and use of ICT in Costa Rican export companies is low and efforts should be taken to improve the situation.

An awareness and training program is without doubt an important component in a strategy towards improving ICT impact on exports in the country. Based on the results of this survey, such a program should consider in first place service companies and microenterprises, which appear to have a more fertile ground: better ICT readiness and intensity. This program should also contemplate the factors for influencing ICT adoption and use presented in this study, which could explain why these two types of companies excel in ICT readiness and intensity.

The emphasis in the case of service companies and microenterprises should be on raising awareness on the potential impact of ICT on exports and training them on how to use more effectively e-marketing applications, particularly e-commerce and Web 2.0 applications. It also should focus on turning these applications into viable options to achieve export strategies.

Afterwards, the emphasis of the program should shift to the agricultural and industrial sectors. Agricultural companies showed a greater orientation towards the international market and decided sooner to start exporting, yet presented the lowest ICT readiness and intensity. Although industrial companies presented more readiness and intensity than agricultural firms, they showed less orientation towards the international market.

Finally, awareness raising and training should focus on large companies, which due to the fact of being more successful exporting, might be less aware of the need of obtaining real ICT impacts, due to the fact that are more capable of surviving in the international market [11], account the largest proportion of direct employment, show the largest diversification of exports, and have the largest quantity of ICT equipment.

Due to the exploratory nature of this study, the same cannot be used to confirm the factors presented which might influence the adoption and use of ICT in the Costa Rican export companies. Additional studies would be required for this purpose.

Furthermore, case studies would be useful to complement this research. Such cases would contribute to obtaining more information on how companies can use ICT more effectively in support of their export activities.

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8. Endnotes

ⁱ A previous version of this research was presented at the *International Conference on Information Society (i-Society 2012)*, held in London, United Kingdom, 25-28 June 2012.

ⁱⁱ <http://www.limesurvey.org>

ⁱⁱⁱ This database is not the same used for the Export Census of PROCOMER, later mentioned. Access to such database was not possible due to confidentiality issues.

^{iv} It is important to note that the database used did not contain ICT companies, most of them belonging to the service sector, which are abundant in the country. The inclusion of such companies would have biased the results of the survey due to their predominant use of ICT.

^v We use the criteria adopted in Costa Rica for classifying companies according to size based on their number of employees.

^{vi} This refers to 1% to 100% of foreign capital.

^{vii} Other options for this question were 1) retail sales and 2) both whole and retail sales.

^{viii} A company can export simultaneously to several destinations.

^{ix} This is a multiple answer question.

^x We adopted the definition of e-commerce as commercial transactions made through a website, proposed by the OECD [1].

^{xi} This is a multiple answer question.