Technology Diffusion in Services: Part II

Electronic Commerce

Industry Canada
Service Industries and Capital Projects Branch
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Electronic commerce in service industries

Background:

In late 1996, Statistics Canada, on behalf of Industry Canada, conducted a survey on technology diffusion in service industries, the results of which were published by Industry Canada in *Survey of Technology Diffusion in Service Industries* in 1997. In the Fall of 1998, the Service Industries and Capital Projects Branch (SICP) of Industry Canada began a thorough review of the survey and published a report on the first part of the survey detailing the use of various electronic technologies and business strategies by service firms in different regions, industries and size groupings. The purpose of this report is to continue the work already completed by reviewing the second part of the survey which focuses on the use of electronic commerce (EC) technologies in service industries and related issues.

Introduction:

"The transition to a digital economy is an important part of the broader move towards a global information society."[1] A key component of this digital economy is EC and its related technologies which offer "... a radically new way of conducting commercial transactions, and (are) potentially a key engine to increase economic growth."[2] For the purposes of the survey, EC was defined as "the innovative application of new computer and telecommunications technologies to achieve efficiencies in terms of cost, time, value and service in business transactions"[3]. These technologies are redefining traditional functional boundaries and customer-supplier relationships, and dramatically changing the way services are delivered. This report, through its in-depth review of EC technology usage in services industries, facilitates the understanding of what impact these technologies have on traditional service sectors and what new developments can be expected in the future.

This report discusses how and where EC technologies are used and what factors are delaying the implementation of additional ones; what government initiatives may promote their use; and a number of other related issues. The report also summarizes the 1996 Statistics Canada survey's findings on how the use of EC technologies has affected customer service and how users of these technologies are satisfied with their use. Lastly, issues related to the usage of four specific EC

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[1] OECD Ministerial Conference "A Borderless World: Realising the Potential of Global EC" Conference Conclusions, p. 5.

[2] OECD Ministerial Conference "A Borderless World: Realising the Potential of Global EC" Conference Conclusions, p. 3.

[3] Statistics Canada, *Survey of Technology Diffusion in Service Industries*, 1986, p. 6.

technologies; bar codes, electronic data interchange (EDI), electronic funds transfer (EFT) and smart cards, are discussed.

The survey:

The technology diffusion survey was sent to 3000 potential respondents in eight broad industrial groups: construction; transportation; communications; wholesale; retail; business services; health and social services; and, accommodation, food and beverage. Potential respondents were selected so that meaningful comparisons could be made among these industries; among five regions: Atlantic Canada, Québec, Ontario, the Prairies and British Columbia (BC); and, among firms of various sizes. For a more detailed explanation of the survey process and its results, see *Survey of Technology Diffusion in Service Industries* which can be found on Industry Canada's Strategis Internet site (http://strategis.ic.gc.ca/SSG/it03471e.html).

The survey was meant to collect data which would help develop a better understanding of electronic technologies usage in service industries. While the sample it was distributed to was quite large, it is very important to interpret the survey's more disaggregated results with caution due to possible sampling errors caused by small sample sizes precipitated by non-responses and iterative questioning techniques.

This report offers comparative statistics for a number of EC technologies and issues related to them. **It is important to note that this is by no means an exhaustive list of technologies nor of issues. Different regions, industries, and firms may not use these EC technologies heavily, but use others intensively. Also, issues related to the implementation, use and impact of the technologies discussed are numerous- this report considers only selected general ones.**

EC strategic factors:

While it is import to obtain an understanding of who is using EC technologies, and how and why they are using them, it is perhaps even more important to investigate the reasons why firms are not implementing EC within their organizations and what can be done to promote its use. The survey attempts to do so by asking respondents to rank the effectiveness of a number of government initiatives in promoting EC; rate the importance of a number of factors in delaying their adoption of EC technologies; and evaluate the importance of an number of issues related to the implementation and use of EC.

Government initiatives:

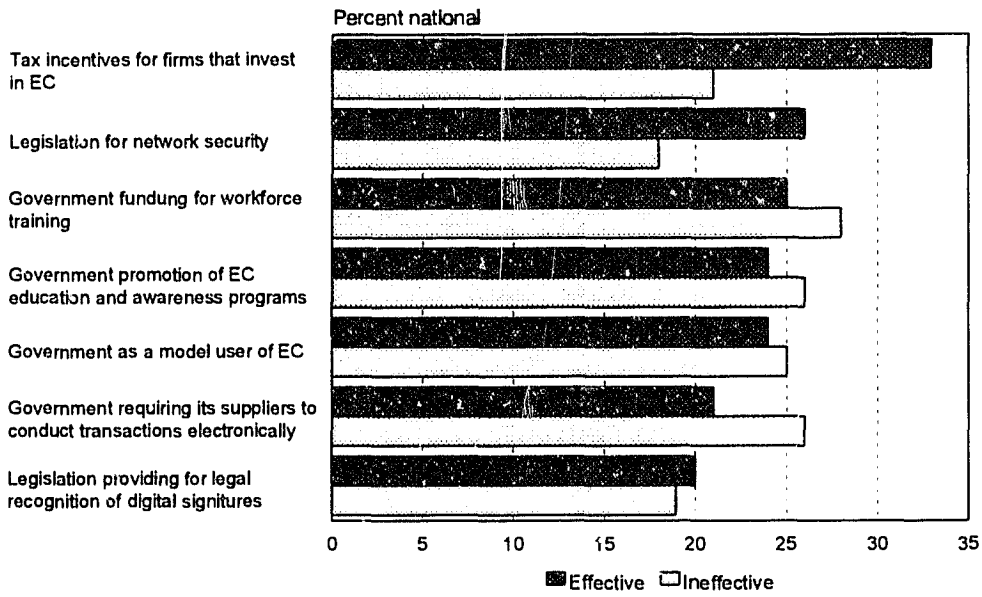
The survey asked respondents to rank seven government (federal, provincial, municipal) initiatives in terms of how effective they would be in persuading them to adopt EC. These seven initiatives are:

- government funding for workforce training;
- legislation providing for legal recognition of digital signatures;
- legislation for network security;
- government as a model user of EC;
- government requiring its suppliers to conduct transactions electronically;
- tax incentives for firms that invest in EC; and,
- government promotion of EC education and awareness programs.

Respondents were given the option to rate each initiative as being not effective at all, ineffective, effective or very effective. They were also given the option to indicate that they did not know. It is worth noting that, at the national level, substantially more respondents felt that legislation for network security and tax incentives for firms that invest in EC were effective rather than ineffective[4] while the opposite was true for government requiring its suppliers to conduct transactions electronically. Furthermore, for each issue, at the national level, no less than 46 percent of respondents indicated that they did not know what these initiatives' ability to persuade them to adopt EC was (Figure 1 present these results graphically below). This, by itself, suggests that knowledge of EC, the issues related to its adoption and or the government initiatives themselves are not well understood or that there is an awareness issue at play.

[4] For the purposes of this paper "not at all effective" and "ineffective" responses are grouped together as "ineffective", and "effective" and "very effective" responses are grouped together as "effective".

Figure 1
Effectiveness rating of government initiatives to promote adoption of EC
Canada, 1996



When grouped by region or by industry, the results were more disparate. For no initiative was there unanimous agreement of its effectiveness or ineffectiveness by any group. Among regions, the greatest degree of consensus was found to be the view that tax incentives for firms that invest in EC and legislation for network security would be effective in persuading respondents to implement EC. Interestingly, in all regions except Québec, more respondents rated government as a model user of EC and government requiring its suppliers to conduct transactions electronically as being ineffective initiatives in persuading them to adopt EC than did not. At the industry level, the results are even more mixed. This can be partly explained by the disparate nature of their business activities.

Firms of different sizes in terms of employment are generally in agreement as to the effectiveness of the various government initiatives listed in persuading them to adopt EC. However, two exceptions exist. First, far more of the smallest firms rated government funding for workforce training as being ineffective in persuading them to adopt EC while the opposite was true among firms with over 20 employees. Alternatively, a greater proportion of the largest firms rated government requiring its suppliers to conduct transactions electronically as being an effective means of persuading them to adopt EC and the opposite was true for firms with less than 200 employees.

It is clear that the larger the firm, the less likely it responded with a "don't know" answer. This

suggests that smaller firms are either less familiar with the concept of EC and its technologies, or with the impact of government initiatives on them. In any case, it is apparent that awareness of both these factors need to be raised in order to effectively promote EC among smaller firms. Table 1 presents the respondents' ratings on each initiative by region, industry and firm size.

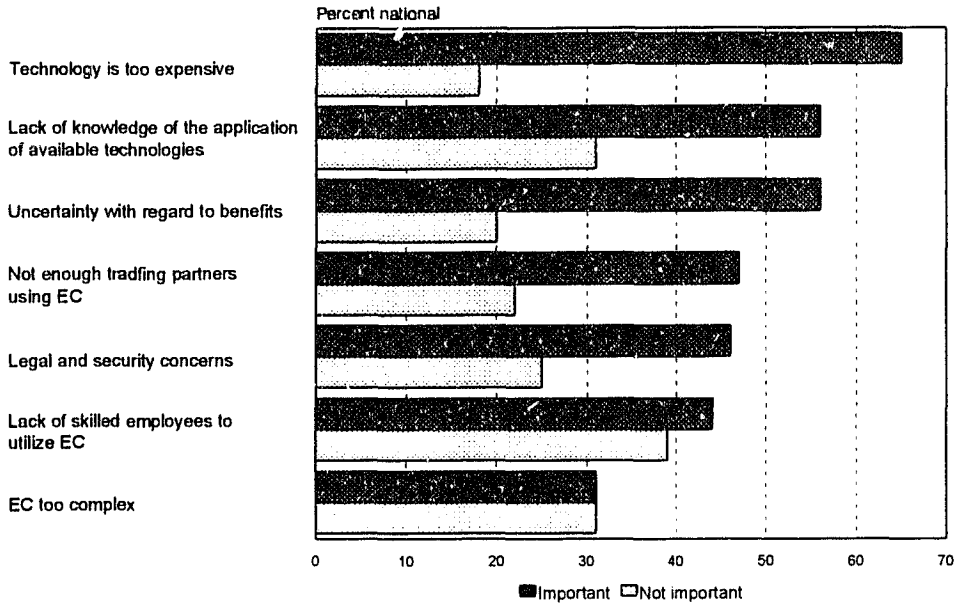
Factors delaying implementation of EC:

The survey asked respondents to rate the importance of a number of factors in delaying their implementation of EC technologies. These factors were:

- techno[illegible]is too expensive;
- lack of knowledge of the application of available technologies;
- not enough trading partners currently practising EC;
- EC technology is too complex;
- legal and security concerns;
- uncertainty with regards to [illegible]enefits; and,
- lack of skilled employees to utilize EC.

Respondents were given the option to rank each initiative as being not important at all, unimportant, important or very important. They were also given the option to indicate that they did not know. Figure 2 shows that the majority of respondents (of those who did not indicate that they did not know) believed that all of the factors listed delayed their implementation of EC technologies. Table 2 presents these data by region, industry and firm size. It shows that regardless of what region, industry or firm size they were from, the majority of respondents (those who did not indicate that they did not know) felt that important factors delaying their implementation of EC technologies were that the technology was too expensive; that there was a lack of knowledge of the application of available technologies; that not enough of their trading partners were practising EC; and, that they had uncertainty as to the benefits of EC. The complexity of EC technologies, however, was not seen as a delaying factor. Furthermore, while the majority of firms of all sizes (of those who did not indicate that they did not know) agreed that the lack of skilled employees to utilize EC was an important factor in delaying their implementation of EC, the results by region and by industry were mixed.

Figure 2
Importance of factors in delaying implementation of EC
Canada, 1996



Issues in use of EC:

The survey also looked at a number of issues relating to the use of EC. Opinions were sought on the importance of a number of issues in the areas of security, speed and efficiency of use, and of the transmission, collection and storage of the data related to EC. More specifically, the issues addressed by the survey were:

- protecting against unauthorized data modification;
- protecting against undetected data loss;
- confidence of sender I.D. validity (authentication of I.D.);
- confidence of receiver I.D. validity (authentication of I.D.);
- speed and efficiency;
- preventing transmission blockage; and,
- protecting against duplication of data.

As Table 3 shows, the vast majority of respondents (excluding those that indicated that they did not know whether an issue was or was not important) from all regions, industries and firm sizes indicated that all of the issues listed, with the exception of protecting against duplication of data, were either important or very important in the use of EC. Protecting against the duplication of data was seen as being not important at all, or unimportant by respondents in all categories except in Québec and the Atlantic regions.

Issues related to willingness to use EC over the Internet:

The Internet is playing an increasingly large role in EC activities as well as the emerging knowledge-based economy. As such, in addition to collecting industry's views on: government initiatives aimed at the promotion of EC use; factors delaying the implementation of EC; and, issues related to EC use, the survey examined the importance of a number of issues concerning a firm's willingness to use EC technologies over the Internet. These issues were:

- transmission of credit card information over the Internet;
- the use of encryption technology and digital signatures;
- the use of smart cards to confirm business partnerships (verification of identity); and,
- the legal aspects of conducting business electronically in Canada.

As Table 4 shows, with few exceptions, the majority of respondents (of those not indicating that they did not know whether an issue was or was not important) felt that all issues were important or very important to their willingness to use EC technologies over the Internet. The transportation industry was the major exception. While the legal aspects of conducting business electronically in Canada were identified as being an important issue impacting on firms' willingness to use EC technologies over the Internet, most of the respondents in the transportation industry (other than those indicating that they did not know) found the transmission of credit card information over the Internet; the use of encryption technology and digital signatures; and, the use of smart cards to confirm business partnerships as being not important at all or unimportant.

EC technology usage:

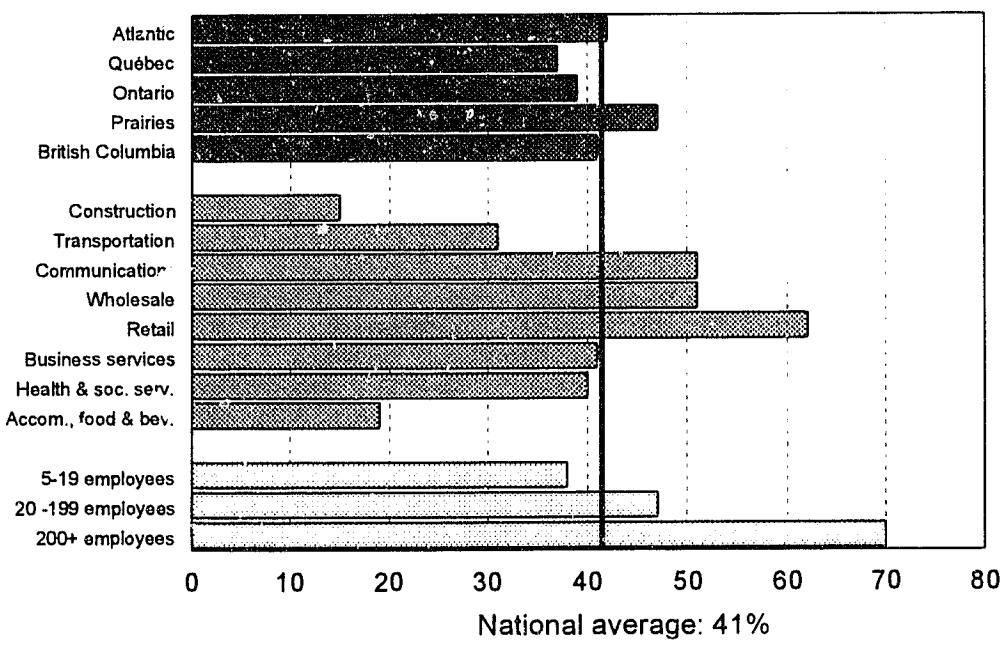
In order to better focus the survey on issues particular to EC technology usage, the survey singled out those firms that used any one of a list of thirteen technologies. These technologies fell into the following three main categories; data capture technologies, data transmission technologies and data storage technologies, and are listed in Figure 3.

Figure 3
EC technologies

Data capture technologies	Data transmission technologies	Data storage technologies
Bar coding	Electronic data interchange (EDI)	CD ROM
Imaging	Electronic forms	Optical cards
Optical character recognition	EDI to FAX	Optical disks
	E-mail	Smart cards
	Electronic funds transfer (EFT)	Electronic information services

The use of EC technologies has been growing quickly across Canada and all indications are that it will continue to grow even more quickly in the future. Survey results suggest that, in 1996, 41 percent of service firms used at least one of the 13 EC technologies listed. Figure 4 presents similar statistics for firms by region, industry and firm size and shows that EC technology use by service firms seems fairly constant across the country with a low of 37 percent of firms using at least one of the 13 technologies in Québec and a high of 47 percent in the Prairies.

Figure 4
EC technologies usage
By region, industry and firm size, 1996



Notable differences exist in EC technology usage between industries and firms of different sizes. The retail industry was the most intensive user of these technologies. Over half of the respondents in the retail (62 percent), wholesale (51 percent) and communications (51 percent) industries indicated using at least one of the technologies listed in 1996. However, less than 20 percent of respondents from the construction (15 percent) and accommodation, food and beverage (19 percent) industries indicated using any of these technologies. These results indicate that the emergence of EC impacts different industries in Canada in various degrees.

The most obvious trend revealed by the survey is that the larger a firm is in terms of employment, the more likely it is to have adopted one or more EC technologies. Thirty-eight percent of firms with 5 to 19 employees indicated using at least one of the thirteen EC technologies listed in the survey while nearly half of firms with 20 to 199 employees and 70 percent of firms with 200 or more employees stated they did so.

The remainder of the survey and of this report focuses on those firms which identified themselves as using one or more of the thirteen EC technologies listed above. More specifically, the following is examined in greater detail: the impact of EC technologies on customer service; satisfaction with the results of these technologies; spending associated with EC technologies; EC technology usage by business function; and, issues related to the use of specific technologies will be examined.

Impact of EC on customer service:

EC is more than a new way of carrying out transactions. It is redefining the buyer-seller relationship as customer service is one of the areas that is affected the most. The survey asked firms whether EC technologies had had a positive or negative impact[5] on a number of different facets of customer service. There are:

- establishing closer ties with business partners;
- increasing the speed of customer payments;
- increasing the speed to market of new products; and,
- reducing errors in information transfer.

The survey results suggest a positive impact of the use of EC technologies on firms' customer service in terms of the factors listed above, regardless of what region or industry they operated in or how many people they employed. Table 5 presents the survey results relating to the impact of EC technologies on customer service.

Satisfaction with the results of EC:

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[5] For the purposes of this paper, very negative impact and negative impact responses are grouped together as "negative impact", and positive and very positive impact responses are grouped together as "positive impact".

Firms tend to introduce new technologies if they believe that they will provide economic benefits. Whether these benefits are derived through increased customer satisfaction or through various other factors, management has expectations as to their results. In order to gain some understanding of how effective EC technologies have been, the survey asked firms to indicate their level of satisfaction with the ability of EC technologies to produce the following positive results:

- reducing inventory levels;
- gaining competitive advantage;
- lowering operating costs;
- gaining on-line access to outside expertise;
- expanding employee skill sets; and,
- increasing sales.

As Table 6 demonstrates, the results of the survey are clear. With one exception, firms (other than those indicating that they did not know the impact the technologies had) were satisfied with the impact of EC technologies on the factors listed. The only exception is the construction industry which is dissatisfied with the ability of EC technologies to increase sales.

Spending on EC:

Firms have been investing substantially in EC technologies. All indications are that this trend will accelerate into the foreseeable future. While the survey did not collect information on how much firms spend on EC in total, it did ask firms to indicate their relative spending on a number of technologies over two years.

As Figure 5 shows, at the national level, the greatest proportion of planned 1997 spending on EC related technologies was on those related to the Internet, followed closely by those related to electronic mail and smart cards. The three together accounted for over 50 percent of the total. Alternatively, EDI to fax/fax to EDI and video conferencing accounted for the smallest proportion of planned 1997 spending. It is interesting to note that the mix of EC technology related spending will have changed somewhat from 1996 to 1997. Spending on Internet and bar coding related technologies will have taken a larger position, while those related to smart cards and EDI to fax/fax to EDI will have lost ground. Table 7 presents data on the spending behaviour of firms in different regions, industries and size categories.

Figure 5
Allocation of EC technologies spending by EC technology using firms
National, 1996 (actual), 1997 (planned)

Technology	Planned 1997 spending (%of total EC spending)	Actual 1996 spending (% of total EC spending)	Increase or decrease, 1996 to 1997
Internet	18	16	+2
E-mail/e-mail to fax	17	16	+1
Smart cards	16	20	-4
Other	12	12	No change
EFT	11	11	No change
EDI	11	11	No change
Bar coding	5	7	+2
Electronic forms	5	5	No change
EDI to fax/fax to EDI	4	2	-2
Video conferencing	1	1	No change

The survey results reveal how relative spending on EC technologies will have changed from 1996 to 1997; however, they give no indication as to why these changes occur. It is unclear whether a change in a technology's relative standing in terms of spending suggests that the technology is outdated or simply that the technology's penetration into a firm's operations is reaching saturation. This issue warrants further investigation.

EC technology usage by business function:

In its general review of electronic technologies and business processes, the Survey of Technology Diffusion in Service Industries examined technology usage by business function. A similar analysis was done for EC technologies as well. In particular, the survey asked firms in which of nine business functions (management, accounting, finance, marketing, personnel, information systems, purchasing, shipping and sales) did they use bar codes, EDI to fax/enhance fax services, electronic forms, smart cards, and debit cards over the Internet. Table 8 presents this information at the national level while Tables 9 through 13 present the information by region, industry and firm size.

The best "fit" seems to be the use of smart cards in the sales functions of firms across Canada. Forty percent of respondents that indicated using one or more EC technologies stated that they used smart cards in their sales functions. Bar coding and debit cards over the Internet were also

most extensively used in firms's sales functions, although not as dominantly as smart cards. EDI to fax/enhanced fax services and electronic forms were used most often in management and accounting functions respectively.

In most cases technology usage by region and by firm size is generally consistent with that recorded at the national level. There is greater diversity in technology usage, however, when the results are compared by industry. The shaded boxes in Tables 9 to 13 indicate in which business function each technology was used most extensively by firms that identified themselves as using one of the thirteen technologies listed earlier.

Specific EC technologies:

The survey attempted to collect data on technology usage by business function, as well it investigated how EC technologies were used in terms of the specific business applications. Data were collected on the use of bar codes, EDI, EFT and smart cards in a number of business applications. Table 14 shows the percentage of firms using these technologies in each region, industry and firm size, thus providing some context as to the extent these technologies were used.

Bar coding:

Four percent of all firms responding to the survey identified themselves as using bar codes. Across the country, bar code use across the country was fairly constant, but there were differences among industries. The communications, wholesale and retail industries were the heaviest users, while the construction industry experienced the least extensive use of bar codes. Furthermore, as a firm grew in size in terms of number of employees, the more likely it was to use bar codes.

The survey reviewed bar code use in a number of business applications: monitoring of work in progress; point of sales debit or credit; shipping and receiving; inventory control; and, point of sales/debit or credit cards. These data are presented in Table 15 which shows that bar codes were most commonly used for point of sale debit or credit transactions followed by inventory control applications. Also, it appears that smaller firms were more likely than larger ones to use bar codes for monitoring work in progress and point of sale debit or credit transactions that the situation was reversed for shipping and receiving, and inventory control applications.

Electronic Data Interchange:

Firms in the Prairies and Québec were more likely to use EDI than in other regions. Eight percent of firms in these regions stated that they used EDI in 1996 while the national average was six percent. Again, wholesale and retail firms, and larger firms in terms of employment were more likely than others to use this EC technology. The survey examines EDI use related to: purchase orders, invoices, advance shipping notices, bills of lading, credit notes/debit notes, functional acknowledgements, inventory levels and product listings.

Nationally, EDI was most commonly used to exchange invoices and purchase orders, while bills of lading and inventory levels were at the other end of the scale. Table 16 demonstrates that the characteristics of EDI use in the transmittal of various documents list varies greatly with the region or industry in which the firm operates and the size of the firm in terms of employees. The results present no identifiable broad trends concerning EDI.

Electronic Funds Transfer:

EFT was the most widely used EC technology listed with 22 percent of firms of all firms using EFT in 1996 nationally. With the exception of firms from Québec, the Prairies, and the construction and wholesale industries (EDI was the popular technology in these categories), EFT was the most widely used EC technology of the four listed in this section. By far, larger firms, and firms from Ontario were most likely to have used EFT in 1996. In terms of business activity, firms in communications and retail were the heaviest users of this technology. The business applications which the survey studied in terms of EFT were:

- regular recurring incoming customer payments;
- variable amount but recurring incoming customer payments;
- regular recurring outgoing company payments;
- large value transfers of corporate funds; and,
- tax payments to various levels of government.

At the national level, EFT was most often used for regular recurring incoming customer payments and large value transfers of corporate funds; however, these applications were the least likely to be considered for future use of EFT by those firms not already active in this regard. It is interesting to note that those business applications where EFT was, at the time of the survey, being least used had the greatest number of non-using firms indicating that they were considering the use of EFT in the future. This suggests perhaps that tax payments to various levels of government and regular recurring outgoing company payments are relatively new applications for EFT but are likely to grow in the future. Table 17 presents similar data by region, industry and firm size.

The survey also asked those respondents who identified themselves as using either EDI or EFT (10.3% of all respondents) whether or not their EDI/EFT technologies were integrated into a company-wide EDI program. Twenty-nine percent of these firms indicated that they did in fact have their EDI/EFT technologies organized in such a manner. For a more thorough review of these figures refer to Table 18.

Smart cards:

Smart card technology was used most extensively by firms in the western provinces and least so

by those in the east. The retail industry, with 40 percent of its firms using smart cards, was the dominant user industry of this technology. The size of a firm had little bearing on whether or not it used smart cards. Table 19 looks at smart card usage for such things as applications in health care, benefit payments, personal security, credit card payments and cybercash..

Smart cards are most heavily used for credit card payments, as seventy-five percent of firms using smart cards used them for this purpose. The same holds true for every region, industry, with the exception of business services, and firm size. Smart card use for credit card payments was more often the case for small and medium sized firms than for the largest firms; however, a greater proportion of the largest firms were considering smart card use for this purpose.

Conclusion:

Electronic technologies have, unquestionably, been changing the face of how business is carried out in today's emerging knowledge-based economy. EC technologies play a leading role in this change. The 1996 Survey of Technology Diffusion studied these technologies and their use in service industries. The summary of its results are presented in Industry Canada's *Survey of Technology Diffusion in Service Industries.* In late 1998, the Service Industries and Capital Projects Branch of Industry Canada published a report titled *Technology Diffusion in Services* which looked at the first half of the survey detailing the use of electronic technologies and business strategies. This report continues the analysis by providing a detailed review of the second half of the survey and focuses on EC technology use in the service sector.

Through its investigation of what industries use which technologies; the impact of using these technologies; and, other related issues, this report introduces industry and policy makers alike to a context in which strategic decisions can be made regarding the role of electronic commerce in service industries.