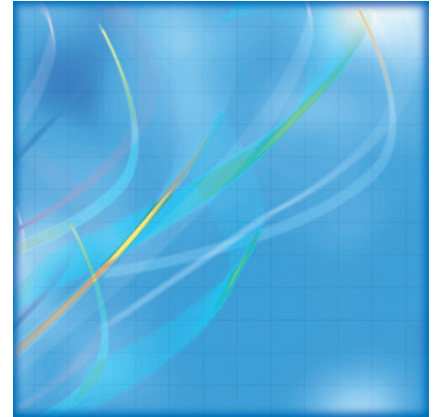## Research Paper

Analytical Paper Series — Service Industries Division

Building the perfect system: An analysis of the computer systems design and related services industry

by Moreno Da Pont

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Abstract

The need for Information Technology (IT) support has never been greater than it is today. Businesses, institutions, government and individuals all rely heavily on IT networks to convey information, process data, and provide or access services.

This paper focuses on describing how a leading IT industry, Computer Systems Design and Related Services, has responded to the mounting demand for IT services in Canada. Structural differences between small and large system design firms are explored and data describing industry growth rates, export markets, and employment characteristics are examined.

Building the perfect system: An analysis of the computer systems design and related services industry

By Moreno Da Pont

Moreno Da Pont is with Service Industries Division

Introduction

During the past quarter-century, the Computer Systems Design and Related Services Industry has enjoyed tremendous growth. The widespread adoption of computers in business, government and households has created strong demand for information technology (IT) services. In today's knowledge-based economy, using computers as a means for storing, processing and transmitting data is pervasive. It would be difficult, if not impossible, for a business or government department to conduct its affairs without a sound IT system. However, the ability to store information, access it quickly and transmit it from one user to another does not come without a cost.

Businesses have poured large amounts of capital and human resources into developing the underpinnings of IT systems, as well as additional resources into

maintaining them. Some firms have been successful at developing in-house IT systems, while others have not. But in attempting to meet their IT needs, many firms determined it would be more productive to focus efforts on their core business activities and to engage IT specialists for expert advice or to manage their entire IT systems. This ever increasing reliance by business and government on outside support has played an important role in shaping the extensive market for IT services in Canada and helps explain why the Computer Systems Design and Related Services Industry has achieved strong growth over time.

Firms in this industry offer an array of services, including computer systems consulting, customization of packaged software, network design and development and IT infrastructure management

This bulletin is one of a series produced by Statistics Canada's Service Industries Division. Its goal is to increase awareness of how service industries operate in the Canadian economy.

This issue provides a snapshot of the Computer Systems Design and Related Services Industry. It describes the industry's recent financial performance and provides information on market share, revenues by type of service, employment characteristics and revenues earned from foreign markets.

Throughout, the emphasis will be on comparing large, medium-sized and small firms. Data come primarily from the Annual Survey of Software Development and Computer Services, and are meant to supplement previously released survey data.

services. They are information technology experts who develop and implement computer environment solutions for business and government.

The types of contracts obtained by systems design firms are diverse. Some call for specialized work in areas such as customizing prepackaged software to better fit clients needs. Other contracts are multifaceted and touch on all aspects of clients' IT systems. For these, systems design firms may provide a host of services. These range from determining clients' IT requirements to designing appropriate systems and procuring the requisite hardware and software for building these systems. In addition, systems design firms may supply staff to set up and maintain newly developed systems, or provide training that allows clients to manage their own systems.

Industry enjoyed solid growth before slowdown in 2001

The computer systems design industry posted stong growth rates from 1998 to 2000 before hitting a slowdown in 2001. From 1998 to 2000, the number of firms increased 39%; revenues climbed 50%; and the number of employees[1] jumped by 61% (Table 1).

In 2001, the boom years for high technology halted abruptly. Revenues grew just 2.8% to $18.6 billion, while some of the employment gains from previous years were wiped out.

Despite the slowdown, the strong growth rates posted as the 1990s wound down allowed the industry to outperform most others in the Canadian economy from 1998-2001.

Amongst industries in the Information and Communications Technology (ICT) sector,[2] it ranked third in revenues generated for 2001 and accounted for about 14% of total revenues earned.

This bulletin describes firms classified to NAICS 541510: the Computer Systems Design and Related Services Industry.

This industry is defined in the North American Industrial Classification (NAICS), adopted as the standard for producing business statistics in 1997.

Prior to 1997, the computer services industry was broader in scope. It included software publishing firms, data processing firms and computer systems design firms, and formed the basis for three NAICS industries.

Statistics in this bulletin cover the most recent four-year period where NAICS data are available for the Computer Systems Design and Related Services Industry.

Table 1.
Major variables

	1998	1999	2000	2001
Number of firms	31,651	41,597	43,874	43,440
Number of paid employees	82,478	109,681	132,705	128,005
Total revenues (millions)	12,033	15,533	18,048	18,562
Total expenses (millions)	11,253	15,237	17,433	17,682
Profit margin	6.5%	1.9%	3.4%	4.7%

1 -- Employees are defined as people for whom salaries or wages were paid and tax T4 slips were issued. Working owners and workers employed on a contract basis are not included in this definition of employment.

2 -- The ICT sector includes numerous NAICS industries as defined by the OECD (Appendix 2).

Large firms generate majority of revenues but small firms maintain a strong presence

The vast majority of computer systems firms (96%) were small in 2001 in terms of numbers of employees. Just over one-half of these small firms were, in fact, non-employers. In contrast, medium-sized firms accounted for about 3.5% of the industry total, while large firms made up less than 1%.

Even though large firms accounted for just a small proportion of the industry's firms, they generated the bulk of revenues. In 2001, the largest firms accounted for almost one-half (48%) of revenues, compared with 29% for small firms, and 24% for medium-sized firms (Table 2).

Small firms, which have a strong presence, gained market share in 1999 when work was abundant as a result of concerns over 'Year 2000' (Y2K). That year the number of firms in the industry increased by 31%. Many of the entrants were likely small start-ups specializing in providing specific Y2K system solutions. After establishing a presence, the majority were able to continue operating, even after Y2K work subsided. According to an independent study of survival rates for new entrants into business service industries, 83% of entrants will survive their first year of operation and 68% will survive beyond two years.[3]

How are small, medium-sized and large firms defined?

Firms are categorized into one of three size classes: small firms, including non-employer firms, have fewer than 10 employees; medium-sized firms have between 10 and 99 employees; and large firms have 100 or more employees.

Table 2.
Total revenues (millions)

	1998	1999	2000	2001
Small (less than 10 employees)	3,333	5,051	4,982	5,312
Medium (10 to 99 employees)	2,831	3,447	5,345	4,380
Large (100 or more employees)	5,870	7,035	7,722	8,870

Economic slowdown hit medium-sized firms

In 2001, revenues for the computer systems design industry flattened, mirroring an economy-wide slowdown. That year, gross domestic product grew at a rate of only 1.5%, down sharply from 4.5%[4] the previous year. As the rate of growth in corporate revenue slowed, many businesses

sought to curb discretionary spending to maintain profitability and protect cash reserves. Unfortunately for firms in computer systems design, this cost-cutting exercise resulted in a deceleration of IT spending after years of strong growth.

3 -- Source: Failure Rates for New Canadian Firms: New Perspectives on Entry and Exit (catalogue number 61-526-XPE), Statistics Canada.

4 -- Source: Expenditure based estimates of gross domestic product, National income and expenditure accounts. Statistics Canada.

With the sluggish economy and fallout from the events of September 11, 2001, businesses delayed orders for new computers and software, and put systems redevelopment plans on hold. This was a first step in cost-cutting exercises that later resulted in corporate restructuring and staff reductions. The dot-com sector was at the eye of the storm, suffering staggering losses.

In the computer systems design and related services industry, medium-sized firms were hit particularly hard. Their revenues dropped 18%. In contrast, revenues for large firms rose 15%, while small firms also fared well, posting a 7% year-over-year gain. The solid performance of large and small firms kept overall industry revenues from declining.

One explanation for the exceptional performance of large firms during the 2001 slowdown was the presence of long-term contracts on their books. Contractual commitments that run over a period of years act as a buffer against a worsening economic climate, at least in the short term.

The structure of certain contracts also benefited larger computer systems firms. During difficult economic times, some companies find that outsourcing IT work is a good mechanism for infusing cash into their businesses. This is accomplished by selling their in-house IT infrastructure to a service provider, and entering into a long-term service provision contract. The business that contracts out can put cash from the sale of its infrastructure into core activities that will help sustain it until economic conditions improve.

The service provider will incur the expense of purchasing their client's IT infrastructure, but will also gain the benefit of increased business and a steady revenue stream. Large computer systems firms are better situated to enter into such contracts because they have more sizable pools of capital on which to draw. This allows them to incur the up-front capital expenditure required to purchase clients' infrastructure.

Small firms recorded higher profit margins but this was mostly attributable to their structure

Even though large firms generated the bulk of revenues, small firms recorded higher profits. In 2001, small firms recorded a 14% profit margin, compared with margins of less than 2% for both large and medium-sized firms.

The structure of small firms is an important factor contributing to their high profit margins. In computer systems design, a large proportion (51%) of the smallest firms did not have salaried employees in 2001. For these non-employer firms, the income of owners or working proprietors is recorded as profit on their income statements. Since working proprietors provide many of the same capacities to their companies as would employees in other companies, a somewhat artificial difference is created when comparing profit margins.

Non-employer firms record higher margins when compared with firms whose employee salaries are expensed. But if working proprietors of non-employer firms expensed their time spent providing IT services to clients, the difference would be far smaller.

Large firms led the way in economic value added

In 2001, the computer systems design and related services industry contributed just over $9.1 billion in value added to the Canadian economy. Firms of all size made significant contributions, but large firms led the way. They amassed about $4.3 billion in value added, compared with $2.3 billion for medium-sized firms and $2.5 billion for small firms. Large firms had by far the highest value added per firm. However, value added per employee was similar, regardless of firm size (Table 3).

The bulk of economic value added for most service industries can be attributed to workers' salaries. For the computer systems design industry, salaries

were the single largest expense incurred by firms, accounting for 43% of operating expenses. If fees paid to contract workers, 9.5% of operating expenses, are added to the salary expense, then over half of the industry's operating expenses go towards paying for knowledge from human capital.
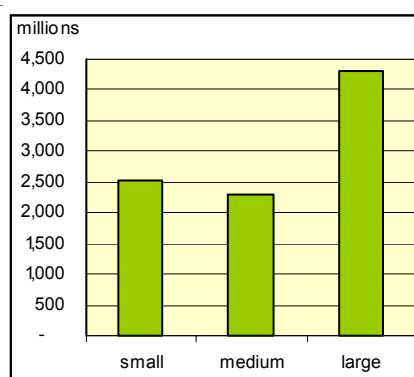
A useful concept for assessing economic performance is 'value added'. It is a standard measure of the economic value that is created by businesses as a direct result of the activities they conduct. The net sum of value added across all industries in the economy is known as gross domestic product (GDP), a key barometer for assessing a nation's economic performance.

Chart 1.
Value added by firm size for year 2001

Table 3.
Value added for year 2001

	Value added per firm	Value added per employee
Small (less than 10 employees)	60,520	69,905 *
Medium (10 to 99 employees)	1,514,906	66,620
Large (100 or more employees)	11,797,246	75,066

*   *Working proprietors are not counted as employees*

IT technical consulting is the main source of revenue

The largest source of revenue for firms in computer systems design was IT technical consulting services (Appendix 1). This was especially true of the smallest firms, for which IT consulting

accounted for 35 cents of every dollar in earned income. That compares to about 23 cents for medium-sized firms, and 21 cents for large firms.

Other key sources of revenue included the design and development of computer systems, the development of customized applications and the customization of software.

Large firms generate significant revenues from services not primarily associated with the industry

Small firms generated 84% of their revenues from services primarily associated with the industry, that is, the eight services under the mantra of computer systems design and related services (Appendix 1).

In contrast, large firms earn just 61% of their revenues from computer systems design and related services. They also earned a significant proportion (10%) from the sale of purchased hardware and from IT infrastructure and network management services (11%).

Most firms are specialized but it is diversified firms that earn higher revenues

A comparison of firms by size and degree of specialization reveals that the majority are 'specialized' (Chart 2). This was particularly true for the smallest firms, among which six out of 10 generated all their revenues by providing either one or, at most, two different services.

This high degree of specialization for small firms is not unexpected. Small firms have fewer employees, and are less likely to have the resources required to obtain contracts where a broad range of IT services is mandated. Instead, they will bid on projects in selective areas where they can achieve a competitive advantage.

However, being specialized was not just a small-firm phenomenon. Many medium-sized and large firms also derived their entire revenues from just

one or two services. In 2001, about 43% of medium-sized firms and 48% of large firms were specialized (Chart 2).

Despite the fact that the majority of firms are specialized, it is diversified firms that earned the highest share of revenues (Chart 3). In total, these diversified firms generated 68% of industry revenues in 2001. In the case of large firms, nearly 80% of revenues went to diversified firms.

But it was not just large firms that benefited from offering a range of services to their clients. Diversified small and medium-sized firms also had much larger revenue shares than might be expected, given their numbers. Only four in 10 small firms were diversified, yet they earned 54% of revenues among such firms.

Degree of specialization measure

The annual Survey of Software Development and Computer Services includes an extensive section for revenues earned by type of service provided. Survey respondents can choose to report revenues for up to 31 different services (Appendix 1).

To facilitate analysis, this extensive list of revenue cells was utilized to construct a measure of the degree of specialization found in the industry. Firms were assigned to one of two categories based on the number of services for which they reported revenues. The categories are 'specialized' service providers and 'diversified' service providers.

Firms who derived all their operating revenues from a maximum of two different services are defined as 'specialized' service providers. Firms who generated revenues from the provision of more than two services are defined as 'diversified' service providers.

Data on degree of specialization do not include information for firms which were too small to be sent a questionnaire. These firms accounted for 52% of the firms in the industry, but just 6% of industry revenues.

For medium-sized firms, 57% were diversified, and they earned over 60% of revenues for the size class. It would appear, at least for this industry, that being able to offer clients a range of services plays an important role in a firm's ability to obtain additional business.

Data showing average and median revenues support the finding that diversified firms earn higher revenues (Tables 4 and 5). For example, in 2001, the median revenue for small firms that were diversified was $139,190, compared with a median revenue of $114,297 among small firms that were specialized. Revenues earned per employee were also higher for diversified firms (Table 6).

Not surprisingly, diversified firms tend to have more employees. There is obviously a relationship between the number of services a firm can provide to the market and the number of persons required to offer them. This is especially the case in service-oriented industries, where the knowledge of workers is the most
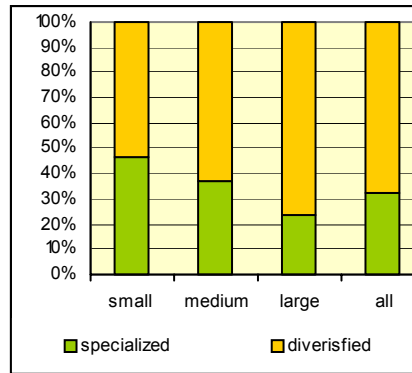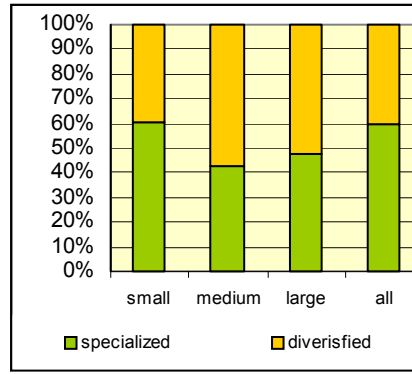
important input in the production process.

While specialized small and medium-sized firms focused primarily on IT consulting, the large specialists were more likely to design and develop either applications or systems. In the case of diversified firms, the large ones accounted for almost all of the IT infrastructure and network management service revenues generated by the industry.

Chart 2.
Percentage of firms by degree of specialization and firm size

Chart 3.
Percentage of revenues by degree of specialization and firm size

A useful statistic for analyzing revenues earned is the median. For purposes of this study, the median is the revenue value where half the firms earned more than the value, while the other half earned less.

One of the benefits of median statistics is that they will not be influenced by extreme values or outliers, as may be the case for averages.

Table 4.
Average revenues earned by degree of specialization and firm size

	Small	Medium	Large	All
Specialized	166,100	2,678,200	31,223,700	458,100
Diversified	299,200	3,467,100	94,571,300	1,415,900

Table 5.
Median revenues earned by degree of specialization and firm size

	Small	Medium	Large	All
Specialized	114,297	1,000,000	16,127,786	120,000
Diversified	139,190	2,385,595	21,943,866	153,914

Table 6.
Revenues earned per employee by degree of specialization and firm size

	Small	Medium	Large	All
Specialized	101,900	109,200	128,500	112,700
Diversified	156,600	139,600	164,400	156,400

Medium-sized firms were successful in accessing foreign markets

Penetrating foreign markets is a challenging task. Before a business can become an exporter, it must gain an understanding of regulatory arrangements, pricing norms, strategic opportunities and customer servicing strategies that will be effective in the target country.

Firms in the computer systems design have successfully entered foreign markets (Chart 4). In 2001, 15% of industry revenues came from exports.

Large firms accounted for the lion's share of the market (49%), but medium-sized firms also fared extremely well. In fact, medium-sized firms earned a higher proportion of overall revenues (27%) from exports than did large firms (16%).

As might be expected, small firms are not important players in the export field. Their export share is far smaller than their revenue share (Chart 5). Clearly, they have not tapped into foreign markets to the same extent as their large and medium-sized counterparts.

Larger firms probably hold a competitive advantage when targeting foreign markets. They are more likely to have in-house marketing departments in which their employees can concentrate on marketing their firm's services to clients abroad. Also, they may find it easier to enter into partnering agreements with
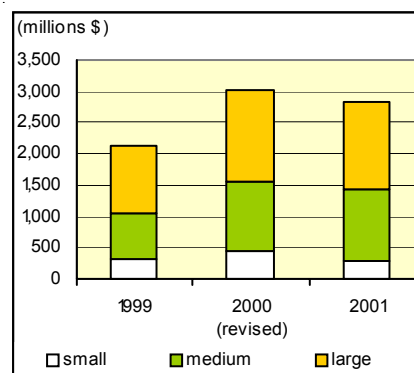
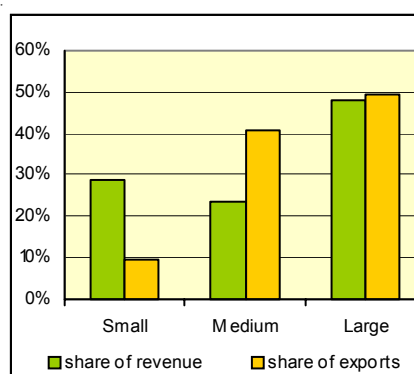**Chart 4.**
Export revenues by firm size

(millions $)

Legend: small, medium, large (years 1999, 2000 (revised), 2001)

Chart 5.
Percentage of revenues and exports, 2001

Legend: share of revenue, share of exports (Small, Medium, Large)

foreign firms, thus gaining immediate access to their partner's clients.

Large firms are more attractive partners because they have larger numbers of clients that will be accessible to the partnering firm. In addition, they can use their partner as a source for information about regulatory and cultural environments in the target country, thus enhancing their chances of success.

About 62% of large firms were exporters. That compares with 41% of medium-sized firms and just 4% of small firms.

United States is largest export market

The United States is the industry's largest foreign market, with more than $1.9 billion in purchased services. Europe ranks a distant second at $521 million. Both large and medium-sized firms have been successful at establishing business ties in American and European markets.
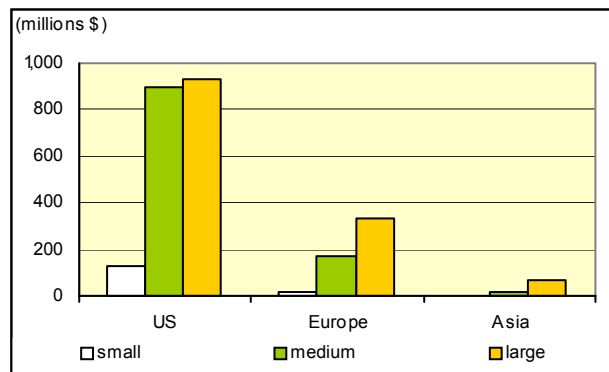
Chart 6.
Export revenues by region and by firm size, 2001

Employment: Small firms show biggest proportional gains during past four years

Employment in computer systems design expanded rapidly from 1998 to 2000, before easing off in 2001 (Table 7). Employment peaked at 132,705 in 2000, a 61% increase from 1998. A year later, it had declined 3.5% to just over 128,000. This level was still 55% higher than in 1998.

Growth between 1998 and 2000 was more or less evenly distributed across firms of all size categories. But this was not the case during the decline in 2001, when employment among medium-sized firms dropped 22%. In contrast, employment levels among large firms were unchanged, while employment among small firms actually rose 15%.

Overall, the number of firms in the industry remained relatively constant in 2001 (Table 1). As a result, it is likely that a large portion of the gains in employment among small firms occurred because medium-sized firms trimmed their employment to fewer than 10 employees, becoming small firms in the process.

Proportionally, small firms made the biggest gains during the four-year period. In 2001, they accounted for 28% of total employment, compared with 26% in 1998. Large firms accounted for 45% in 2001, up marginally from 44%, while medium-sized firms represented 27%, down from 30%.

Table 7.
Number of employees by firm size

	1998	1999	2000	2001
Small (less than 10 employees)	21,350	29,164	31,371	35,975
Medium (10 to 99 employees)	25,070	28,130	44,070	34,585
Large (100 or more employees)	36,058	52,387	57,264	57,445
All firms	82,478	109,681	132,705	128,005

Findings

The Computer System Design and Related Services Industry is an important industry in the Canadian services sector. Firms classified to it employ more than 128,000 people and revenues earned have increased sharply over the past several years, reaching $18.6 billion dollars in 2001.

The industry contains some very large firms, but the vast majority are small firms that employ fewer than 10 people. In fact, just over one-half of the 43,400 firms in the industry do not have any employees at all. Large firms represent less than 1% of the population, but they employ almost half of the industry's workforce, and generate about 48% of total revenues earned.

Firms in computer systems design provide a variety of services. Some firms are specialists that offer clients only one or two different services, while others are diversified, and offer clients an array of services. Small firms are most likely to be specialized, although many large and medium-sized firms are also specialized.

Even though the majority of firms are specialized, it is the diversified firms that generate higher revenues. This was true within all three size categories. Apparently, being able to offer an array of services is an important consideration in generating additional business for systems design firms.

Exports are a key source of revenues, accounting for 15% of total revenues earned. The United States is by far the largest purchaser of services from this industry. Medium-sized firms (those with between 10 and 99 employees) have faired quite well in the export market. For them, about 27% of revenues earned come from exports.

Firms of all sizes are significant participants in the industry's labour market. In 2001, large firms employed 45% of workers in the industry as compared to 28% for small firms and 27% for medium-sized firms.

Appendix 1

Percentage of revenues earned by type of service provided, 2001

Type of service	All firms	Small	Medium	Large
Computer systems design services				
IT technical consulting	25.0%	35.2%	23.0%	21.2%
web site design and development	4.8%	6.0%	5.8%	3.7%
database design and development	4.3%	9.3%	6.1%	1.0%
customization and integration of software	7.7%	6.1%	14.9%	5.0%
custom application design and development	9.3%	7.7%	7.8%	10.8%
network design and development	1.4%	2.7%	1.7%	0.7%
computer systems design, development and integration	12.0%	7.9%	12.0%	14.0%
IT technical support	5.9%	8.7%	6.2%	4.4%
Data processing services				
web site hosting with integration of related applications	0.3%	0.6%	0.4%	0.0%
web site hosting without integration	0.1%	0.2%	0.1%	0.1%
application service provision with integration services	0.3%	0.1%	0.2%	0.5%
application service provision without integration	0.3%	0.0%	0.0%	0.5%
business process management services	2.0%	0.9%	0.4%	3.4%
collocation services	0.0%	0.0%	0.0%	0.0%
data storage services	0.0%	0.0%	0.0%	0.0%
data management services	0.3%	0.1%	0.2%	0.4%
video and audio streaming services	0.0%	0.0%	0.0%	0.0%
IT infrastructure and network management	5.8%	0.3%	0.2%	11.1%
information and document transformation services	0.4%	0.0%	0.1%	0.7%
Other services				
packaged software revenues	4.6%	4.6%	6.3%	3.8%
provision of Internet access and backbone services	0.1%	0.1%	0.2%	0.0%
Internet telecommunication services	0.1%	0.2%	0.1%	0.0%
IT-related training services	0.7%	1.1%	0.8%	0.5%
sales of hardware purchased for resale	7.4%	4.5%	5.1%	10.0%
sale of hardware of own manufacture	0.2%	0.3%	0.5%	0.0%
lease and rental of computer equipment	0.4%	0.5%	0.1%	0.4%
repair and maintenance of equipment of own manufacture	1.3%	0.8%	4.5%	0.0%
third party maintenance	0.1%	0.3%	0.1%	0.1%
payments from Canadian subsidiaries or affiliates	1.3%	0.7%	0.4%	2.1%
payments from foreign subsidiaries or affilliates	1.8%	0.0%	1.3%	3.0%
other services	2.0%	1.0%	1.6%	2.7%

Appendix 2

NAICS-based ICT sector industries

Manufacturing:
Commercial and service industry machinery (33331)
Computer and peripheral equipment (33411)
Telephone apparatus (33421)
Radio and television broadcasting and wireless communications equipment (33422)
Audio and video equipment (33431)
Semiconductor and other electronic components (33441)
Navigational, measuring, medical, and control instrumentation (33451)
Communication and energy wire and cable (33592)

Services:
Software publishers (51121)
Cable and other program distribution (51322)
Telecommunications services (5133)
Other information services (51419)
Data processing services (51421)
Computer systems design and related services (54151)
Electronic and precision equipment repair and maintenance (81121)
Computer, computer peripheral and pre-packaged software , wholesaler-distributors (41731)
Electronic components, navigational and communications equipment and supplies, wholesaler-distributors (41732)
Office and store machinery and equipment, wholesaler-distributors (41791)
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