T.M. Denton Consultants
440 Oakhill Road
Ottawa, Ontario K1M 1J6

Tel: (613) 745-9383
Fax: (613) 745-1925

A Report on New Media

prepared for the Director General
New Media

Department of Communications

July 1, 1992

by

Timothy Denton

and

Hans Kieferle

Index

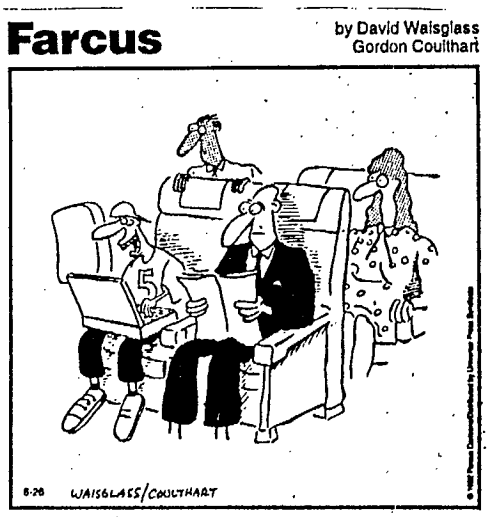
Section 1. A General Introduction to New Media

Section 2. The Consumer Side of New Media

Section 3. Industries and Businesses Related to New Media

Section 3, continued

Selected Figures from ISTC's *Information Technologies, Statistical Review , Annual 1991*



"Wow! I just jammed the air traffic control tower."

A General Introduction to New Media

1.1 What are New Media?

The basic thesis is that new media emerge when the full powers of the computer are matched with communications networks adequate for the traffic. They are starting to emerge now. When computer devices start to be truly portable, hand held, hand-carried, fit-into-your-purse-sized gadgets, we shall see a further elaboration of new media.

New Media are mixed marriages of

computers

software

networks

services

made possible by microprocessors, digital technology, and thousands of innovators in all countries.

New media are only a surprise to those who think in boxes. People have been foretelling for twenty years the marriage of computers and communications. Instant World, the 1971 DOC report, spoke of advances in computer chip technology, the digitization of telephone systems, and what we call in this paper, new media. This is what they said in 1971:

> Telecommunications systems designed primarily for the transmission of information in any form, making the contents of databanks and the processing power of computers commonly and readily available, may open the way to new dimensions of knowledge, not only in business and industry but equally in the home and at school. Moreover, the interactive two-way capabilities of such systems suggest the possibility of much wider participation in politics community affairs, broadcasting and the arts. Eventually for those who can afford it, the standard telephone may incorporate video-screen, keyboard, and printout equipment, giving instant access to all available information and, by simulating face-to-face communication, reduce the need for personal movement and transportation.[1]

We are not there yet. Canada may be as far away from the fully networked world as the dirt roads of 1920 are from the modern highway system, but we are far closer to the world predicted by the Telecommission in 1971 than they were then.

Since 1971, we have seen:

- The introduction of radio-based cellular telephones, ending the monopoly of wire-based carriers,
- Fifty channel television reception,
- Computers faster, smaller, and more powerful by at least three orders of magnitude (1,000 times) with an order of magnitude improvement every decade,
- Telephone systems progressively digitized - which means computerized,
- the mass marketing of computers and electronic games in the home and at work, and
- Direct to home satellites competing with cable television for market share.

We shall see in the next five years

- More competing radio-based telephone services
- The personal digital assistant, a note-book sized computer, diary, address book, writing pad/word processor (the "Newton", Apple 1993)
- Direct broadcast satellites offering smaller and more convenient home receiving dishes

We shall see in the next fifteen years

- The end of the analog vacuum tube television, and the consolidation of the telephone, computer and television as one device, fitting onto desktops.
- Soon after, the personal digital assistant, sized 8 x 11 inches, will be a telephone with a flat video screen, as well as a computer. You can plug it in, or you can unplug it and read it in a bathtub. It will cost somewhere between a penknife and a toaster.

While the details may change, the net direction of society is towards more, not less, networking and computerization; more, not less, new media.

This net tendency is perfectly foreseeable. The acceptance of personal computers in the Canadian home stands in about the same place as telephones did in the 1920's. It takes no great insight to see that computers will require transmission systems able to carry the traffic they will generate, especially when television sets become virtually indistinguishable from computers.

Though new media are emerging, they are hindered technically by the relative backwardness of public networks. At the risk of oversimplification, the reason can be explained in the disparity between the carrying capacity of the computer and that of the public switched telephone network.

Computer power is measured in megabytes. One speaks of a 32 megabyte hard drive - 8 x 32 million bits of information.

The carrying capacity of the ordinary voice telephone is 9,600 bits per second, ten thousand times less.

The computer industry has been building devices whose capacity vastly exceeds the limits for which the public switched network was designed. When television goes digital, and hence the distinction between a TV set and a computer loses significance, the problem will be seen as important, and ways will be found to get around it.

1.2 Why are there New Media?

From the clock in the microwave oven to the telephone that fits in your purse, microprocessor technology lies at the core of the device or the service. It is microprocessors that allow fantastic things to be accomplished in hand-held devices.

There are new media because there are microprocessors. There are microprocessors because there are computer chips. There are computer chips because there are transistors.There are transistors because humans are beginning to exploit the properties and behaviour of subatomic particles, such as electrons and photons[2]

Computers and telephone switches run on chips. Chips are assemblies of transistors. Transistors are devices for the switching and channelling of electrons, which are subatomic particles. Transistors use electrons, rather than mechanisms, to control the flow of other electrons.

The field-effect transistor was invented in 1948 by William Shockley, John Bardeen and Walter Brattain in Bell Labs in New

Jersey. As time passes, this discovery will be seen as important as the wheel, gunpowder, and the printing press, because every device that makes 1992 different from 1948 relies on the transistor.

The massive improvement in the price-performance of computer chips drives nearly every manifestation of change we see around us. There is no end in sight of the productivity and performance improvements to be expected of computer technology.

It may be superfluous to this discussion but it is important to understand why the astounding performance improvements of microprocessor technology will continue. The reason is that mankind has passed beyond the era of mechanical technologies. The difference is at least as important as the passage from the bronze age into the iron, and probably as important as the development of agriculture itself.

In computers we are dealing with phenomena at the level of angstrom units - one ten thousandth of a micron, or ten orders of magnitude smaller than a meter, or a millionth of the width of a human hair.

We are no longer talking about *mechanisms* when we dealing with devices on this scale, nor or they subject to the same set of physical laws. Effects which can be understood only in terms of quantum physics, the same laws that gave us the hydrogen bomb, take precedence here. The behaviour of "matter" at this scale bears no relation to the behaviour of matter at our scale.

Technologies deriving from the exploitation of the physical properties of matter at quantum levels share the characteristics of the branch of physics from which they derive: prodigious transformations are accomplished in infinitesimal spaces with extremely small inputs of energy.

The cost of computing is dropping by more than an order of magnitude every decade, propelled by advances in microprocessor technologies.

In any mechanical system, such as railways or electrical grids, one would strive for 5% productivity improvements in a decade. In telecommunications, productivity can increase by this much in a year, even with a monopoly. Thus it should be no surprise that information technologies show different economic characteristics from boiling and smashing trees to make paper, or melting rock to make steel, or bending metal.

1.3 What is the interest of the Department of Communications in New Media?

Have a look at the Department of Communications Act.

4. The powers, duties and functions of the Minister of Communications extend to and include all matters over which Parliament has jurisdiction, not by law assigned to any other department, board or agency of the Government of Canada, relating to

a) telecommunications, and

b the development and utilization generally of communication undertakings, facilities, systems and services for Canada.

5. The Minister, in exercising his powers and carrying out his duties and functions, under section 4, shall

a) recommend, coordinate and promote national policies and programs with respect to communications services for Canada;

b) promote the establishment, development and efficiency of communications systems and facilities for Canada;

c) assist Canadian communication systems and facilities to adjust to changing domestic and international conditions;

e) compile and keep up to date detailed information in respect of communication systems and facilities and trends and developments in Canada and abroad relating to communication matters....

The industries regulated or otherwise dealt with by the Department, such as telephone systems, radio carriers, and cable, as well as television entertainment, the music industry, movies and museums are directly in the path of this technological revolution.

Moreover, the Minister has full authority to inquire into every topic that bears upon the establishment of policies in this field. This study is one such example.

1.4 What do New Media mean for the Department of Communications?

No one has a monopoly on microprocessor technology. This means that there appears to be no obvious technical reason why a given service must be offered by only one kind of carrier and not another. This means the end of monopolies.

The end of monopolies, which depend on limitations of supply, overturns the Department's assumptions about telephone networks, radio spectrum, broadcast signals, satellite networks and all the transmission media which it has sought to influence on behalf of Canadians.

The monopoly control exercised by public network providers is giving way to a rapidly changing, market-driven, technology-enabled strategic industry. The same change is occurring in television entertainment, and for the same reasons, and there is no reason to believe that the scope of the changes brought about by new media are going to be restricted to any particular sectors. The administration of law, medicine, education and government all stand in the path of change.

1.5 What do New Media mean for Society?

New media will enable intelligent control by equipped and educated people of their information environments.

The most important feature of new media is the degree of intelligent control that participants can exercise over their various environments: of work, play, and entertainment.

Educated and equipped individuals and organizations will create, receive, edit and transmit interactive mixtures of digitized information, including voice, data, still and moving images.

They will do this through personal computers linked into networks.

In a few years' time "it will be as natural to collaborate through a network as it is to prepare a holiday feast with friends in a common kitchen."[3] Work will be reorganized in consequence. It is impossible to foresee perfectly the nature of these changes but it is possible to suggest the nature of what they consist:

- Your real co-workers may not live in the same time-zone or work for the same company as you do;

- Your work, the economic niche in which you fit, will probably depend on the assembly of world-wide markets through telecommunications, which will create economic opportunities that have not yet been imagined.

- The value of face to face meetings may rise as they become

less necessary and less frequent.

> "Organizations are traditionally built around two key concepts: hierarchical decomposition of goals and tasks and the stability of employee relationships over time. In the fully networked organization that may become increasingly common in the future, task structures may become much more flexible and dynamic. Hierarchy will not vanish, but it will be augmented by distributed lattices of interconnections."[4]

Goodbye hierarchy, hello heterarchy!

If desktop computers brought convenience, mobile networked computers will bring freedom.

The second major shift brought about by the intelligence of the networks and devices attached to them will be in the control people will be able to exercise over who, and what, reaches their screens. Telephone answering machines and call recognition services are only the beginning of a transfer of power to the receiver of the message.

The degree of control that people will exercise over which messages reach them means that message senders - of whatever nature - must tailor the message for the interests of the person receiving. The same computer-based systems which are able to target messages much more effectively than mass media are necessary to pass the information filters of the receivers.

The degree of selection applies to movies, news, television programs, computer games, and persons calling. "The network will be sufficiently personalized to anticipate your needs and interests and smart enough to find obscure auctions of fly-fishing equipment in the dead of winter."[5] Television, the vehicle and creator of mass marketing, will be turned upside down.

Choice does not merely mean watching the digital baseball game from the vantage point of the baseball, either. It means choosing the political coloration of your newscast, too.

New media have no option except to be consumer-driven, and the consumer will be in control of what he receives.

1.6 What do New Media mean for Canada?

The key to Canada's economic future lies in the degree to which we adopt the methods of work made possible by computers and networks. Not do so would be like missing the Industrial Revolution.

The evolution of computers and networks, on the one hand, and human resources, on the other, are they key issues for government in this decade. For one issue addresses the nature of work, the creation of value, and the organization of the material and immaterial economies of the future. The other addresses whether we as Canadians will have a population educated enough to earn our living in the world which is aborning.

In this report and the sections which follow, we have attempted to make clear that this world is coming because it is technically possible, it is cheap to provide, and it will be entertaining.

Many forms of new media will develop and gain acceptance because they will constitute new forms of entertainment. Policy makers should not overlook the significance of Nintendo and other games they buy for themselves and their children at Christmas.

In 1992, computer ownership stands about where telephone penetration was in the early 1920's, at 16%. Household penetration of computers and peripherals is 34% for those earning more than $70,000, but the amazing thing is that it stands at more than 5% in families earning less than $10,000.[6]

We know that separate boxes for television, computers and telephones are going to disappear in time. Their fusion will constitute the basis of new media.

2.1 Introduction

This section looks at consumer expenditure on products and services that relate to the emergence of new media. The expenditure patterns that already exist tell us about how new media markets will emerge, what their size is relative to other forms of consumption, and how rapidly they are emerging.

There is no reason to think that the consumer side of new media expenditure will be less important than the supply side.

The assumption is that what is now the **television set** will become **interactive**, eventually combining the functions of the computer, current TV sets, CD players, address books, libraries and the telephone. As has been pointed out[7]

> ...While many companies are girding for the Interactive Age, the biggest boost could come from a joint effort by the world's largest entertainment company, Time-Warner, and the world's largest computer company, IBM.

At stake is not only cultural policy but also the confluence of a mass consumer market, parts of which have traditionally been regulated,[8] while others have not. Accordingly, a closer look at changing consumer preferences for products and services that fall within the boundaries of new media, both regulated and unregulated, may be informative.

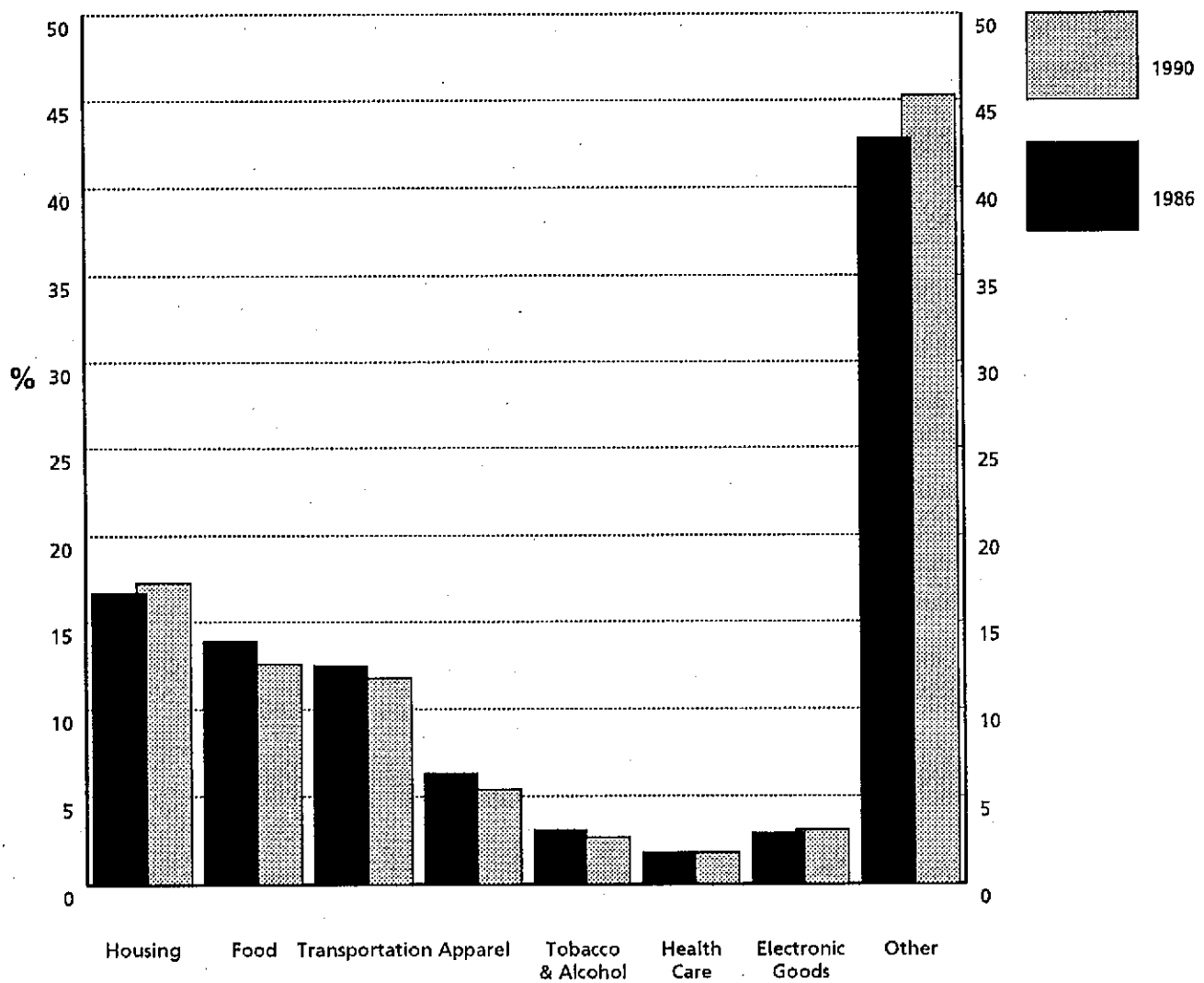
2.2 Urban Household Spending

StatsCan's **Family Expenditure in Canada** (1986 and 1990 Surveys) documents spending patterns by household income group.[9] The 1990 survey, based on a 10% sample (4,860 households) of direct interviews, was undertaken only in 17 major urban areas with an estimated 49% of the nation's 9,625,000 households. The results of these surveys are ideal for a couple of fundamental reasons: they provide valuable insights of periodic dollar spending patterns across family income groups and geographic areas, and, by showing the proportion of households reporting spending on a given item, offer details on how popular the item is now - compared to four years earlier.

1986 and 1990 average total expenditure for urban families are

Graph 1

Per Cent Distribution of Average Urban Family's Expenditures Canada, 1986 and 1990



Source: Table 1

shown in *Graph 1.* This sets the context for the following discussion.

2.3 The Basket of Electronic Goods and Services

The following spending categories make up our **basket** of electronic goods and services - primarily because they are directly related to the consumption of tomorrow's new media products and services.

- ***telecommunication services,***
- ***cablevision,***
- ***personal computers (hardware and software),***
- ***electronic games and parts, and***
- ***home entertainment equipment and services*** [10].

Any changing pattern of household expenditures on these items gives valuable clues about how new media products compare against each other, and against other family expenditures. Their popularity is measured by the percentage of households which report subscribing to a given service. In the telephone and cable industry, the term used is "**household penetration rate**".

Some Limitations

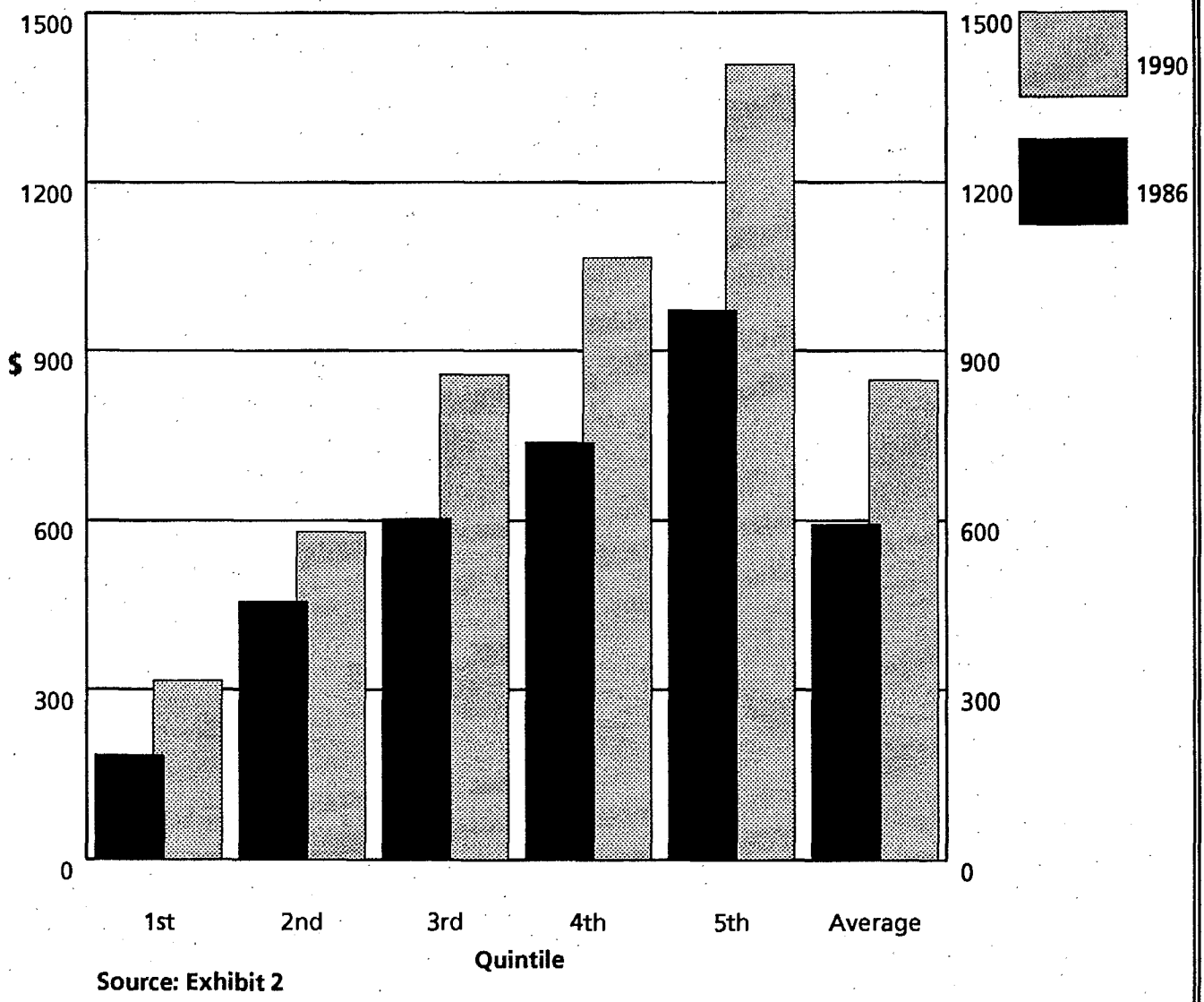
For the present purpose, the **Family Expenditure** survey has certain limitations. For example, inquiries are made about spending habits on **cable-TV** without differentiating between basic and enhanced services.[11]

Also, **electronic home entertainment games** that used to be played on the **TV set** are migrating to the **PC**. Indeed, in the future, the survey is bound to differentiate between PCs and peripherals (e.g., printers), as well as hardware and software. Many products and services that will eventually be identified with new media are not yet on the market, or are just beginning to come on stream.[12]

2.4 Declining Computer Prices

The introduction of new goods and services tends to be marked by high prices which drop off as mass marketing commences. Personal computers and peripherals are good examples of this trend. In 1986, an IBM PC, equipped with an 8-bit processor, retailed for an average of $3,500. By 1990, an IBM compatible 386 PC - now equipped with a 32-bit processor, and running at three to four times the speed of the original, could be bought for $2,500. By June 1992, a veritable PC price war had developed[13]: now a 386SX (without monitor) could be bought for under $1,000 in Canada.

Graph 2 **Spending on Electronic Goods & Services, Except Telephone, by Income Quintile, Canada, 1986 and 1990**



Source: Exhibit 2

2.5 Declining Telephone Prices

Between 1986 and 1990, the nation's Consumer Price Index advanced by a total of 21.8%. However, the telephone services component dropped by 8%.[14] Its effects are at once obvious by looking at average family spending relative to income. Thus, as average family income rose by 26.4%, outlays on telephone services went up by only 21.4%, resulting in a real **consumer surplus** of **five percentage points**. In other words, by 1990, the typical family was able to dial more phone services for the same amount of dollars.

2.6 Real Spending Changes

Table 1 sets forth the picture of changes in income and expenditure between 1986 and 1990. Accordingly, if the **real** rise of spending over the 4-year time period is defined as the difference between income growth on the one hand, and spending increases on the other, the evidence clearly shows that electronic gadgets and services rank high in the consumer's budget.

Exhibit 1
Basket of Electronic Goods & Services
Real Rise of Spending, 1986 to 1990
by Household Income Quintile

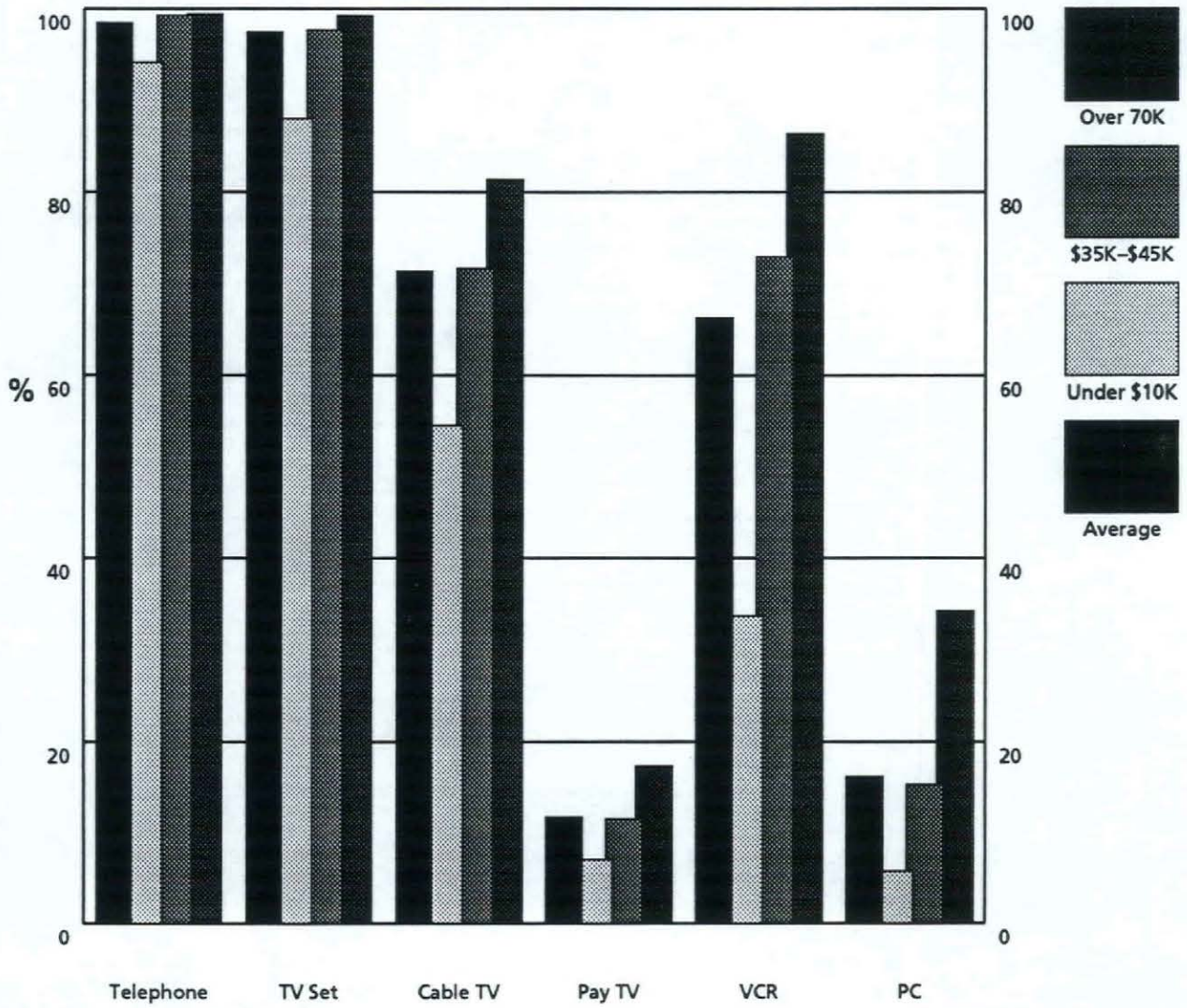
Quintile	% increase
Lowest	16.5
2nd.	-9.0
3rd.	2.5
4th.	9.4
Top	10.2
Average	6.6

Source: Table 1

The Demonstration Effect

Families in higher income groups tend to exhibit the strongest taste for new media products, devoting a faster-growing slice of income to their related activities. As prices of the items in question drop off those of lesser means enter the market. This has been dubbed the **demonstration effect**. As the above shows, top income families increased their spending on electronic gadgets and services by just under **four times** (3.75) the rate families in the third-highest (actually the middle) income group did - even as the top's income advanced by only **23.4%** compared to **27.5%** for the latter.

Graph 3 **Per Cent of Households Equipped with... by Level of Income, Canada, 1990**



Source: StatsCan 13-218

2.7 Electronic Items Other than Telephone Services

Looking now at family expenditure on electronic goods and services **other than the telephone**, over the four-year period, the average family registered a **42.8%** rise in current spending. The following exhibit, illustrated in *Graph 2*, shows this jump by income group.

Exhibit 2
Average Family Spending on Electronic Goods & Services (excluding Telephone)
Canada, 1986 and 1990
(current dollars)

Quintile	1986	1990	% Change
1st.	$186	$315	69.3
2nd.	$455	$580	27.5
3rd.	$603	$857	42.1
4th.	$737	$1066	44.6
5th.	$972	$1408	44.8
Average	$593	$847	42.8

Source: Table 1

2.8 Household Facilities

StatsCan's **Household Facilities by income and other characteristics** (Cat.No. 13-218) provides a profile of ownership and/or subscription rates of telephones, TV sets, cable, cable converters, pay-TV, and VCRs. Table 2, depicted in *Graph 3*, shows the relevant electronic items. It bears emphasizing that this survey encompasses all of the nation's households. The TV set, **at 97%**, ranks only slightly below the telephone penetration rate (98.5%). Two-thirds of households are equipped with VCRs. 16.3% of households are equipped with personal computers.

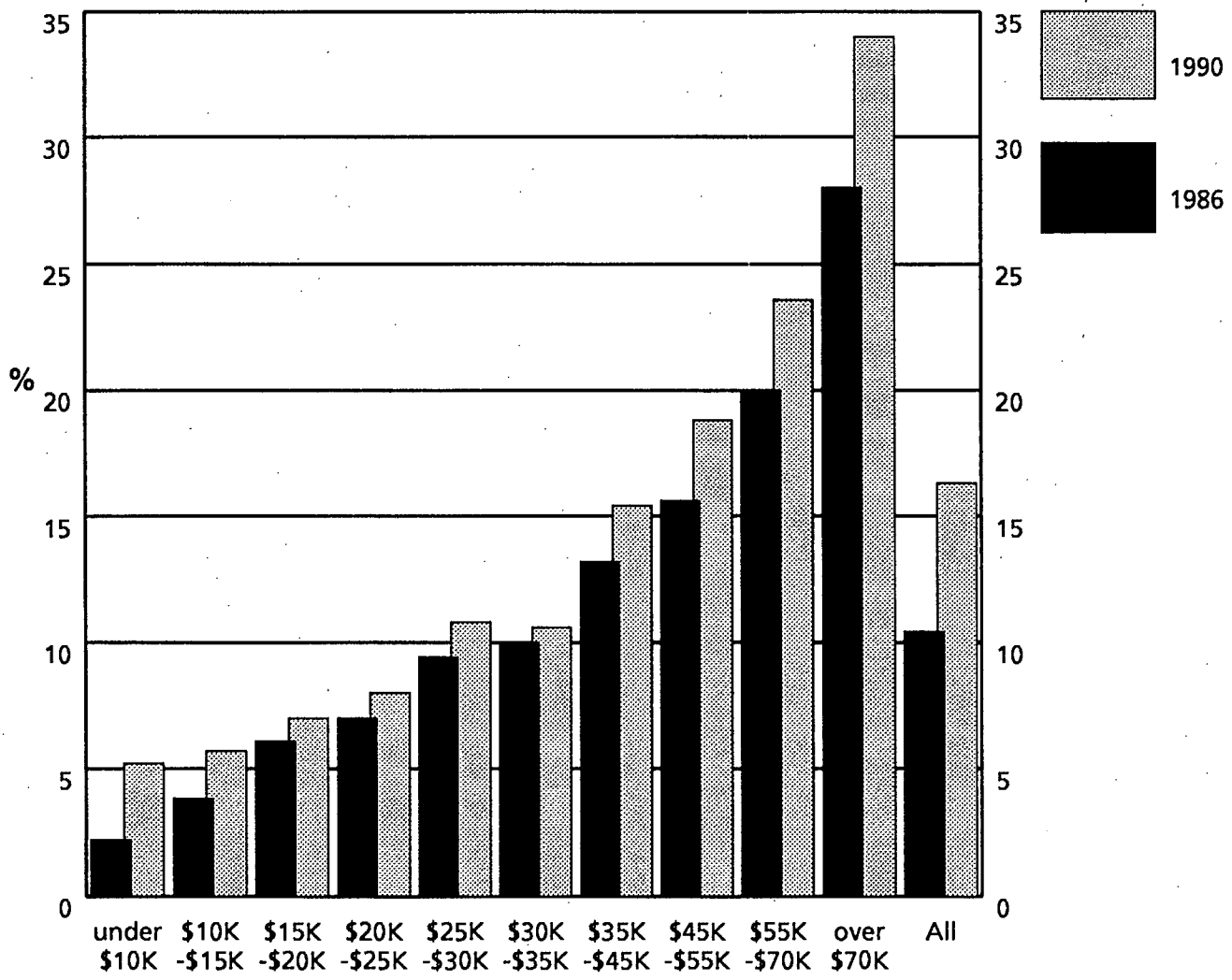
2.9 Subscription Patterns

Telephone

Canada's **telephone penetration rate** is among the highest in the industrialized world. In fact, the subscription rate was so saturated across all urban family income groups in 1986 that four years later it remained practically unchanged - rising from 99.1 to 99.2%.

Graph 4

Per Cent of Households Equipped with PCs, by Income Level Canada, 1986 and 1990



Source: StatsCan 13-218

Cable

By 1990, twelve percent of all households subscribed to pay-TV. Despite price rises in cable TV - over the four-year period, average spending went up 51.7%, while average income went up only 26.3% - the household subscription rate registered an increase of 3.5 percentage points. As *Graph 3* shows, in 1990, 71.3% of the nation's 9.6 million households had cable-TV. Unlike the case of telephone services, a 6.5 percentage points gain of the cable subscription rate in the third income quintile was accompanied by a 63.7% rise of spending. Income in this quintile had risen by 27.5% (Table 1).

Home Entertainment Equipment & Services

There was a 2.6 percentage points gain in the number of households reporting dollar outlays on the 17 items in this category. But, as in the case of telephones, this spending category's pattern of acceptance among urban families was accompanied by a 1.2% drop in spending in real terms. In fact, third income quintile families, registering a 27.5% gain in income, spent only an additional 15.3% on these items.

Personal Computers

StatsCan's Household Facilities Survey shows that, the PC ownership rate for families in the $70,000 and above income group was 28.0% in 1986, increasing to 34.0% by 1990. In 1986, an estimated 927,000 households, or 10.4% of all households, had PCs. That figure increased to 1,527,000 households (16.3% of all households), or by 64.7%. The following, also shown in *Graph 4* gives further details.

Exhibit 3
Per cent of Households Equipped with PCs by Income Level, Canada, 1986 and 1990

Income Group	1986 %	1990 %	Income Group	1986 %	1990 %
under $10K	2.2	5.2	$30K-$35K	10.0	10.5
$10K-$15K	3.8	5.7	$35K-$45K	13.2	15.4
$15K-$20K	6.1	7.0	$45K-$55K	15.6	18.8
$20K-$25K	7.0	8.0	$55K-$70K	20.0	23.6
$25K-$30K	9.4	10.8	over $70K	28.0	34.0
			All	10.4	16.3

Source: StatsCan, 13-218

Although average 1990 spending on computers and supplies amounted to only $140, the figure obscures much of its growing popularity. First, for the average household, 1990 spending was twice as high as in 1986. Moreover, although households in the highest income group (on average) spent twice as much on PCs in 1990 as did those in the second-highest quintile, ($320 versus $159) the former's income was only 67% higher.

Meanwhile, households in the third income quintile had the biggest margin of increase in the participation rate: in 1990, nearly two-and-a-half times as many families in this quintile reported spending on PCs at home than was the case in 1986.

The rising tendency among third and fourth income quintile families to use PCs shows how rapidly personal computing is becoming a standard household activity.

Residential customers are bound to welcome new media in terms of their entertainment value. Trends clearly show that, Canadian homes being wired with cable and the telephone like no other nation, subscribers across the country spend a fast-growing amount of their home entertainment dollars on value-added services. In terms of cable TV this means addressable decoders. It illustrates how, to be successful, new media vendors will opt for a strategy of service debundling. In other words, if the theoretical capability is a virtually unlimited interactive screen, the vast majority of household subscribers may well still prefer bundles of optional services packaged within specific dollar ranges to suit the subscriber's entertainment needs.

Initially, new media will appeal to the well-off; subscribers in the top income group spend (on average) twice as much on cable as folks making around $30,000. The latter middle class group averages cable fees of $12 a month - basic cable. Four years earlier it was $8.

By 1994, will households in the middle income group spend an average of $16 for a basket of cable TV options? Keep in mind that we do not expect the telephone bill to grow by 50% over the four year period ending in 1994.

Electronic Games and Parts

In 1990, the average urban household was twice as likely to use electronic games at home than had been the case only four years earlier. The 1990 average spending of $27 seems a pittance, were it not for the fact that it reflects a four-fold increase over 1986.

Each of the upper three income groups more than doubled their participation rate. Top quintile households averaged spending of $48 - nearly five times as much as in 1986. Again, future survey refinements that make a distinction between money spent on various pieces of hardware, an on software, should throw more light on the burgeoning demand for these products.

To put some of the above in perspective, Table 1 includes a spending item called "reading material". Apparently, in 1990, the average urban household spent barely 17.7% more on reading material than in 1986 - a real decline of 8.6 percentage points.
This may be another example of the limits of this type of survey. After all, tinkering with the PC (a) involves a lot of reading, and (b) acts as some form of substitute for printed reading material.

2.10 Basket of Electronic Items - General Spending Pattern

Measured in current dollars, the average Canadian urban family spent an estimated $1,102 in 1986 on the above five spending categories (excluding "reading material"), an amount that increased to $1,465 in 1990, or by 32.9%. Average income had gone up by 26.3%. The steepest spending rise was among households in the lowest income group (50.6% versus an income gain of 34.1%), followed by those in the third quintile (35.6% versus an income gain of 26.2%), and finally, the top quintile, where spending rose by 33.6% while income went up by 23.4%.

> ***Summing up, across all income groups, consumers show a remarkable rise in preferences for electronic gadgets and services. Electronic games leads the basket, followed by VCR movie rentals, spending on PC hardware and software, and finally, cable TV.***

2.11 Estimates of Consumer Markets

The above allows for some estimates of the scope of consumer markets. Rough estimates suggest that, in 1990, Canada's consumers spent approximately **$11 billion** on the five categories. This assumes that the same pattern of ownership and spending prevailed in the geographic areas not covered by the 17-Cities survey. Following are the details.

Exhibit 4
Estimates of Total Consumer Spending on Electronic Goods & Services Canada, 1990

Item	$ million
Telephones	5,900
Computers	175
Cable TV	1,150
Home entertainment equipment & services	3,900
Electronic games & hobby equipment	45
Total	11,170

Source: Table 1

2.12 Products and Services Associated with New Media

Interactive television will inevitably overlap a wide array of entertainment and information products. From the consumer's perspective, industrial sectors producing and marketing multimedia applications - value-added services - would include at least the following: [15]

- *catalog shopping*
- *cable advertising*
- *electronic messaging*
- *broadcast advertising*
- *information services*
- *theatre*
- *video games*
- *value-added networks*
- *videoconferencing*
- *home video*
- *records/tapes/CDs*

Total 1990 outlays in the United States on the above 11 items has been estimated at $120 billion.

It will be noticed that our inclusion of cable-TV spending in Canada (Table 1) refers to fees paid by households, rather than cable advertising. This requires reconciliation with figures on cable television revenues - discussed below. More importantly, the $11 billion spent by Canadian households includes an estimated $7.0 billion paid for phone and cable-TV bills - both items that are not included in the above U.S. list.

But the most prominent item, catalog shopping in the U.S., accounts for $51 billion of the $120 billion market in the United States. StatsCan's, catalog shopping data suggest 1990 sales by Canadian catalog and other direct marketing firms of about $3 billion. Of course, mail orders placed by Canadian households directly with U.S. firms are not contained in the three billion figure. Once again, this requires further analysis.

Finally, it bears repeating that the present calculations are with respect to household spending - which is only a portion of all final sales of some of the items or categories. For example, most - if not all - money spent on videoconferencing over the telephone will be spent by business and government.

3.1 Nature of the Task [16]

The discussion now addresses the need to quantify the items and services Canada's information technology industries actually produce.

Some of the difficulty with new media can be illustrated by a true story. It has been recorded that when Captain Cook arrived off the coast of Australia, the aborigines took absolutely no notice of his ships - none whatever. Only when men swarmed over sides into landing boats did the aborigines take notice, because humans were something they could perceive; ships were not. New media are like that; we are not attuned to perceiving them, even though they may be as obvious as Cook's ships were in Botany Bay.

The first problem is that services are much more difficult to track than goods. Keeping track of manufactured goods, from central processors to consumer gadgets, is not as complicated as tracing the value of information technology services.

In national accounting, the term "service" refers to a range of activities all the way from haircuts to heart transplants. For the present purpose, human ingenuity devoted to writing micro code (for example) or adding value by way of being a software wholesale agent shows up in one of the twelve industries examined below.

The second problem is another manifestation of our poor grasp of how information technology "services" differ from services as they are commonly understood. The notion of services tends to liken such disparate things as getting a haircut or having a drink brought on a tray to telecommunications and software, as well as the effects these products of human ingenuity have on every other transaction in society. Telecommunications and software might better be considered "immaterial products" than services. A new category in national accounts would prove useful for intellectual property of this nature.

3.2 New Media Viewed as an Enabling Mechanism

The further issue is the role that information technologies play in every other sector of the economy. Although some 6% of the economy is classified as belonging to the information technologies sector, its effects pervade every other, just as manufactured goods do.

New media services encompass the value of enabling technologies, which are beneficial to commercial as well as residential customers.

Today's check-out counter at the supermarket, equipped with optical scanners, improves human performance, elevates accuracy, and greatly boosts just-in-time inventory ordering. Tomorrow's new media will tell the grocer what proportion of degradable produce turned into waste, how and where to store it, and where (on earth) to obtain the best bargains.

How do we value the quality leaps registered in retailing - a service - except by way of the industry's performance? New media contributes to that performance. The same enabling mechanism is at work in a host of other service sectors, such as education, medicine, and finance.

3.3 Principal Findings

- The contribution to Gross Domestic Product (GDP) of all information technologies and service sectors, including telecommunications, is 6% in 1990. In 1986 it was 5.6% These figures include the gross profits of the wholesale computer equipment and software industries.

- Measured by manufactured goods only, Canada is a net importer of information technologies: $9.2 billion in 1991. ($49.4 billion - $40.2 billion).

- The services portion of information technologies is now more important than the transportation services sector. (Figure 9)

- The manufacturing portion of information technologies is now virtually as important as is the pulp and paper industry. (Figure 8)

- Information technologies, both manufacturing and services, show consistently higher growth rates than the rest of the economy. (Figure 10)

- All sectors of the Canadian economy show significantly increased capital expenditures on computer hardware and word processors, especially since 1988. Communication and related equipment shows a very gentle increase in the same period. (Figure 19).

- A variety of measures lend themselves to assess the activity: readers should beware of confusing 1. shipments, or output, 2. retail sales, 3. consumption, and 4. the portion of gross domestic product related to information technologies.

- The services portion is extremely difficult to measure. Factory shipments and inventory are nearly irrelevant; the

human input is difficult to measure and records of it are not kept for national accounts. Thousands of small firms participate in this market.

3.4 Approaches to the Subject

Understanding the size and shape of new media includes an appreciation of (i) the sectoral profile, (ii) the domestic market, and (iii) the sector's contribution to the nation's Gross Domestic Product (GDP). Each offers a different perspective, and each gives rise to distinct and valuable insights into transformations associated with new media. One challenge is to discern and document changes over time in

(a) technology, as it becomes apparent by way of commercial and consumer patterns of practices, tastes and preferences;

(b) industrial organization, including emerging new business alliances, and

(c) the composition of goods-producing and service-oriented firms within the technology sector

3.5 Canada's Information Technologies Sector

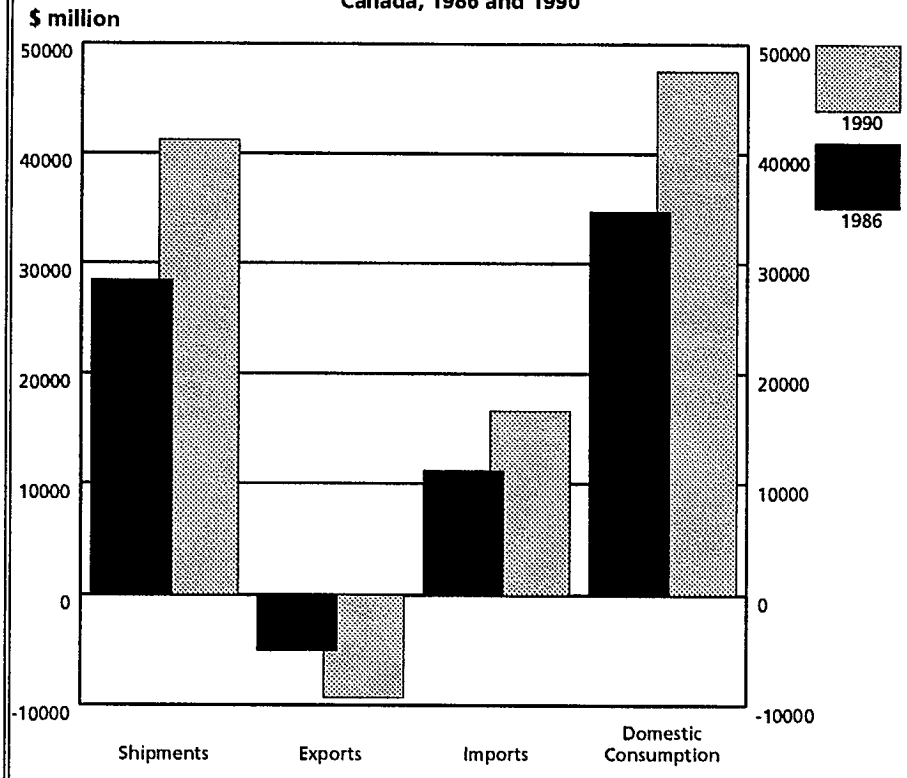
One of the principal difficulties is in finding appropriate sources that document the size and shape of relevant industries. For Canada, one of the best is the ISTC's Information Technologies Branch annual **Statistical Review**. The **Review** documents the increasing importance of information technologies to the Gross Domestic Product (Figure 5).

Some twelve distinct industries comprise the sector.[17] ISTC's Statistical Review carefully describes the principal commodity groups each sector produces.

A convenient view of the sectoral profile appears on the attached Figure 1, "**Information Technologies, Apparent Domestic Market**". Note that

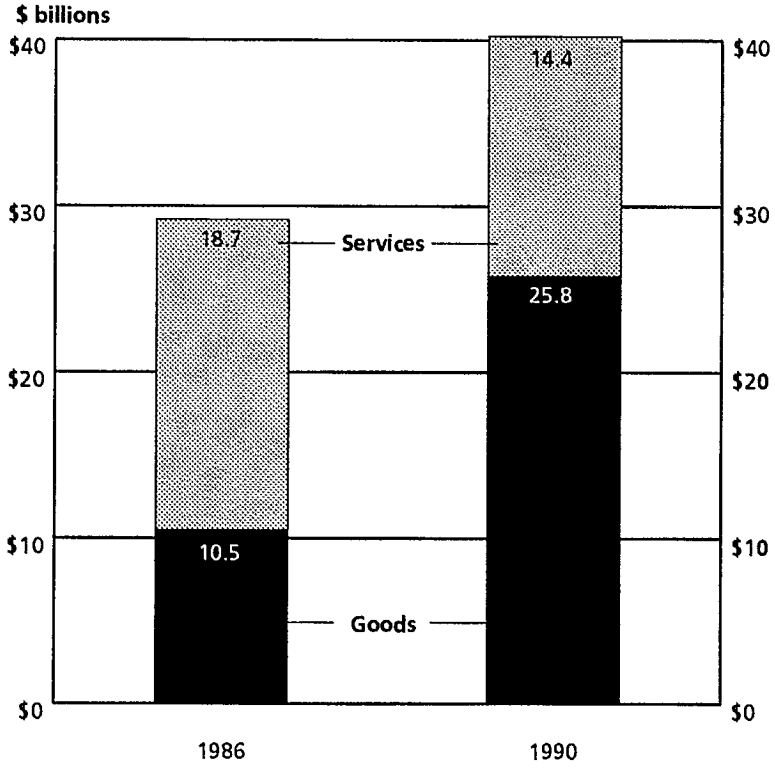
domestic consumption = manufacturing shipments - exports + imports

Graph 5 Information Technologies Industries
Shipments, Exports, Imports & Domestic Consumption
Canada, 1986 and 1990



Source: Table 3

Graph 6 Service and Equipment Components
of IT Industries
Canada, 1986 and 1990



Source: Exhibit 10

Over the four years, the expanding domestic demand for information technology products and services exceeded the nation's GDP growth by five percentage points. Although exports expanded at nearly twice the rate as imports, Canada remains a net importer of electronic goods. The following exhibit, also shown in *Graph 5* provides a summary.

Exhibit 5
IT Industries Key Features*
Canada, 1986 and 1990, $ million

	1986	1990	% Change
Shipments	28,500	40,180	41.0
Exports	5,053	9,273	83.5
Imports	11,165	16,552	48.2
Domestic Demand	34,612	47,460	37.1
R&D	1,226	1,474	20.2
Employment (1)	207,930	251,490	20.9
Canada's GDP (2)	207,930	251,490	20.9

*includes net receipts of the Wholesale of Computer Equipment & Software (SIC 5744); (1) number of persons; (2) StatsCan, Canadian Economic Observer; Source: Table 3

The basic data shown above confirms the goods-producing industries' strong export orientation:

Exhibit 6
IT Industries: Changes between 1986 and 1990

	1986	1990
Exports as percentage of industry output	17.7%	23.1%
Imports as percentage of domestic market	32.2%	34.9%
Output as percentage of GDP	5.6%	6.0%

Source: Table 3

Output sums up a nation's capacity in the sector. Domestic consumption, on the other hand, measures the nation's appetite for IT products and services. There is yet another measure worth noting: The IT sector's share of gross domestic product. A convenient adaptation of the GDP measure is to express it in constant dollars, in our case 1986 dollars, thereby gauging real -

rather than inflationary - trends over time.

3.6 Output

Although, the communication services industry (telephone and cable) accounted for 35.1% of the sector's total, customary practice aggregates the twelve industries into the following four principal categories:

Exhibit 7
Sectoral Shipments, 1990

	$ million	Share	Growth
Consumer electronics (1)	654	1.6%	-25.1%
Telecommunications and electronic components (2)	24,400	60.7%	44.3%
Computers (3)	12,825	32.0%	78.2%
Instrumentation (4)	2,290	5.7%	17.4%
Above	40,170	100.0%	40.9%

The industry groups:
(1) record players, audio-visual equipment SIC 3341
(2) telecommunications equipment SIC 3351, 3352 and 3359
cable SIC 4814; carriers SIC 4821
(3) electronic computing & peripheral equipment SIC 3361
electronic office, store & business machines SIC 3368
computer and related products, SIC 7720;
wholesale of computer equipment & software SIC 5744
(4) Instrumentation SIC 3911 and SIC 3912
Source: See Table 3

3.7 Consumer Electronics: Import Dependence

In 1990, the consumer electronics industry (audio and video recording and duplicating equipment, radio and TV sets, clocks, converters, amplifiers, & speakers) had shipments of $654 million. Note that domestic shipments declined by 25% since 1986. W suspect that a large proportion of consumer electronic sales are not being captured by the methods of Statistics Canada.

The previous section on household expenditures showed that in 1990 consumers spent an estimated $6.4 billion on the following related items:

Exhibit 8
Household Expenditure on Select Items
Canada, 1990

	$/household	$ million
Electronic games	27	260
Computer games	136	1,310
Home entertainment equipment	504	4,850
Above	667	6,420

Source: see Table 3

Keeping in mind that industry shipments are a different concept from retail sales, it could, nevertheless, prove to be a rewarding task to analyze the links between domestic production and final consumption. For example, such an effort could help identify the group of products for which Canada remains almost completely dependent on imports.

3.8 Electronics Goods-Producing Industries
The Domestic Market

To put the sector's profile in context, a distinction between manufacturing shipments versus total shipments exists for only eight of the twelve industries. The eight are the goods-producing industries as distinct from those selling services.

1990 manufacturing shipments ($12.7 billion), plus imports ($16.6 billion), less exports ($9.3 billion) yields an estimated $20 billion domestic market in 1990.

The four services-oriented industries, include telecommunications carriers, cable TV, computer & related services, wholesale of computer equipment & software[18].

An Illustration of Linkage - Cable TV

Domestic demand, derived from industry statistics on the one hand, and household expenditure data on the other, illustrate how, for at least some of the service categories, direct linkages exist. Thus, the cable TV industry (SIC 4814) had 1990 revenues of $1,640 million. At the same time, the Household Expenditure survey shows the average household spent $176 on cable, for a total of $1,635 million (Table 1, at the end of this paper).

It will prove a much greater challenge to reconcile final consumption of some of the other new media products and services by households on the one hand, and by business (as well as government) on the other.

The Activity's Contribution to GDP

The goods producing portion of this sector's share of GDP in 1990 was 3.9%[19]. By itself, this measure tells very little. But year-to-year trends will be a rich source for clues about performance, both within the economy, and in comparison with similar industries in other countries. In this regard, DOC has a vital interest in the continuation of efforts such as ISTC's *Statistical Review*.

Price and trade data would illuminate the discussion. Thus, are price changes in response to foreign competition (equipment and component imports accounted for 18.6% of the domestic market) more directly apparent in some industries than in others? How do industries where prices are regulated stack up against those where the market sets them? Which industry groups show greater import-dependencies than others? Is it changing?

3.9 The Communications Sector

Prices in this group tend to be regulated. As the following shows, the carriers' share varies according to how one categorizes the activity:

Exhibit 9
Telecommunications and Electronic Components Group, 1990
$ million

	Total shipments	Domestic Market	GDP
Telecommunications and electronic components	24,400	22,470	16,570
Telecom and cable share	15,715	15,715	15,715
share in percent	64.4%	70.0%	94.8%

Source:see Table 3

3.10 Equipment Versus Services

The SIC classification scheme shows that, in 1990, total shipments attributable to **equipment and components manufacturers** were $25.8 billion, or 64.1% of the $40.2 billion. Establishments selling **services** invoiced the remaining 35.9%, or $14.4 billion. An estimated $13.7 billion (95.1%) of this service total is due to the telecommunications carrier industry (SIC 4821). *Graph 6* illustrates the changes from 1986 to 1990.

Exhibit 10
Service and Equipment Components of IT Sector
1990 ($ billion)

	$ billion	share
Shipments	40.2	100.0%
Goods	25.8	64.1%
Services	14.4	35.9%
Telecom portion of services component	13.7	95.1%

Source: see Table 3

Documenting the equipment and components segment of tomorrow's new media industries is comparatively easier than trying to review the changing patterns of its associated **service industries**. This is hardly surprising, since quantities and values of semiconductors, PBXs, TV sets, computers, printers, and so on, are readily documented. So are employment and price trends, as well as international trade figures.

As Figure 2 shows, computer shipments totalled $12.8 billion, or 31.9% of the information technology sector's output. The category contains a host of disparate products and services. It should not be confused with the notion of "the total value of computers sold in Canada". For example, the 11,023 firms in the **Computer and Related Services** industry (SIC 7720), which includes programming, processing, repair and maintenance, consulting, and software services had shipments of $5.4 billion. Meanwhile, the **Wholesale of Computer Equipment & Software** (SIC 5744) industry had a gross margin of $3.7 billion - but total sales were $9.9 billion.

3.11 Sources of Information on Related Industries

National Income Accounts, international trade statistics, industry profiles (e.g., StatsCan's **Radio & Television Broadcasting**, Cat.No.: 56-204), and several series on **prices**,

trade, **labour markets**[20], and **consumer spending** patterns are a standard source of relevant data.

Also relevant are the Annual Survey of Manufacturers, as well as Corporate Annual Reports - provided there is a consensus either that a given company actually produces and ships new media commodities or that a part of a company's output belongs into the overall category of new media products and services. For example, for fiscal 1990, Bell Canada and B.C.Tel report $1,298 million revenue from Directory Advertising and Miscellaneous sources. On a nation-wide basis, it would appear that business spends $1.5 billion a year on **Yellow Pages** advertizing. Telephone companies are Canada's largest printers.

3.12 Book Publishing, Sound Recording, Film and Video

Tables 4 and 5 show that revenues in the broadcasting, books publishing, periodical publishing, sound recording, and film & video industries totalled $4.3 billion in 1989-1990.[21]

StatsCan makes a careful distinction between publications that, on the one hand

> "serve the exclusive purpose of advertising, as well as price lists, telephone directories, etc."

and the standard designation of literary and/or journalistic printed matter - the books and journals publishing sectors. The value of printed advertizing sales are nearly impossible to determine, in part because so much of it is done through stores in the United States. Sales of journals and literary works are readily documented. New media are bound to capture some parts of both of these markets.

3.13 Industry Trends - Mergers and Alliances

So far we have looked at statistical information. However, when we look to the future, we leave the relative certainties of the past for prognostication. New media will probably always dwell on the forward horizon, and careful attention must be paid to actual news from the private sector if a new media information system is to work. Signs of new media come by way of corporate mergers and alliances, particularly information on

> ***how they intend to market new innovations,***
> ***how the commodity is to be packaged and priced, and***
> ***its likely appeal to consumers,***

For example, some electronics firms that tended to concentrate on serving corporate and government clients now also cater to small business and household users. A good example is **Northern Telecom** whose traditional focus has been on equipment and software for telecommunications concerns. **NT** now markets a software package, priced between $300 and $600, that lets users "..dial a call, set up a phone directory, and log and track phone calls".[22]

New media without telecommunications would be like bicycles without wheels. As Northern Telecom observes,

> Telephones, faxes, televisions, and personal computers will merge into multimedia telecenters, linking households and businesses in a seamless, global network of networks.

Multimedia efforts bring together enterprises with established, separate traditions and expertise. Thus, **Time Warner** and **IBM** are in the process of forming an alliance to divine the future of televised entertainment. It carries its own inherent risks. For example, after a $1 billion investment, **Prodigy**, a catalog-shopping videotext joint venture of **IBM** and **Sears Roebuck & Co.** is still a long way from breaking even.[23]

3.14 Age of Interactive TV and the Personal Digital Assistant

Interactive TV will eventually combine the functions of personal computers, TV sets and CD players to empower the audience to control the action. It may still be some time yet, but large electronic manufacturers are positioning themselves for the next markets. The touch-sensitive screen may turn out to be more of a novelty than an every-day user item. However, **Sharp** is set to collaborate in the manufacture of Apple's latest product, the Newton,

> "a kind of personal digital assistant, or **PDA**, to vary in size from that of credit cards to notebooks...providing the functions of telephones, mini-television sets, radios, computers and faxes - translating handwriting and speech into stored digital form and transmitting that information, including video, by wireless communication".[24]

In January 1991, **Apple** applied to the FCC for computer communications exclusively on 40 megahertz of the radio frequency bandwidth, between 1850 and 1990 of the radio spectrum, that would allow Apple to transmit data at high speeds over distances of as much as 150 feet.[25]

Defining new media as **interactive TV** only scratches the surface of what is at stake, which is a process encompassing the design, development, and marketing of technologies ranging from central processors, signal compression techniques, networking, relational data base management, and a host of new hardware - from **laptop Pc's, PCNs, HDTV** sets, to innovation in the manufacture of new, almost three-dimensional **LCD screens.**[26]

How and when interactive TV gets to the market is still an issue of both the preferred technology, and government policy. Ultimately, consumer acceptance will point the way to this future. Thus, Japan's and the EC's jump-start on HDTV, focusing on improved **analog** signal processing, may well backfire - even though the EC is proposing a subsidy of more than one billion dollars for 38 companies that have agreed on developing the system.[27] **Digital** transmission accommodates the interactive TV much better.

Standard setting for multimedia becomes more complex. **IBM** and **Apple** are now recruiting **Sony** and **Matsushita** into a partnership for supporting their emerging system, dubbed **Kaleida.** Meanwhile, **Microsoft** is trying to sign up Japanese manufacturers for its multimedia standards.[28]

Marketing tomorrow's **smart TV sets** is bound to involve joint ventures by firms from the electronic carriage, the microprocessor, the publishing as well as the entertainment industries. Thus, **AT&T, U S West,** cable giants **Tele-Communications Inc., Home Box Office** and **Cinemax, Hewlett-Packard Co., Toshiba Corp., C.Itoh & Co., Microsoft, IBM** and **Time Warner,** are conducting consumer tests designed to plumb the depths of the **interactive TV** [29].

Their efforts promise to sweep computers, consumer electronics, telecommunications, entertainment and publishing into one huge industry sector that prepares and transmits digital information - sound, data, graphics, and video broken into computer code. More powerful devices - the kind that fully recognize handwriting and speech, and zap data over airwaves, or wire - will require a few more years of advances in microprocessors, miniaturized memory cards, and sophisticated software. **Apple's** John Sculley ventured to estimate that this mega industry will amount to $3.5 trillion of sales in a decade's time. He announced the establishment of a new division: **Apple-P.I.E.,** for "personal interactive electronics".[30]

3.15 Clone Makers and Competition

Chip design and production illustrate the competitive process. Constantly driven to advance processor performance, manufacturers like **Motorola** and **Intel** have pursued fundamentally **different** design approaches. While IBM's **RISC** chip (reduced instruction set

computing) matches Digital's **ALPHA** processor in terms of performance, it is different in design approach.

A reading of George Gilder's Microcosm [31], especially chapters 15 and 16, will reinforce the view that chip design is moving in the same direction as publishing, to the desktop. No end of innovation or dispersion of power is in sight.

Competitors frequently clone high-priced products - giving rise to patent disputes. For example, on having lost a copyright suit over the use of Intel's 287 **microcode** software, AMD Inc.'s stock fell 38%.[32] Nevertheless, clone makers keep dominant firms in check.[33]

On the other hand, since compatible communications protocols are critical for all telecommunication carriers, alternative enabling techniques still vie for users. For example, two alternative techniques, **TDMA** and **CDMA**, are being tested to make improved digital communication for cellular and the personal communications network (PCN) operational.[34]

3.16 Software Issues

- **Microcode and Operating Systems**

Some would argue that apart from certain basic improvements in microprocessor technology, the whole issue reduces to software. Here, standards become a real issue. Whether it is firmware - the embedded commands in microprocessors - or a work station's operating system, some approaches meet the processor's specifications better than others. At the PC level, the enabling mechanism - the operating system that allows for true graphical user interface (a variation on the theme of interactive TV) - is in a state of transformation: Seven distinct PC operating systems are on the market.[35] DOS is receding. Windows competes with OS/2. Apple's system is still today's standard to beat. AT&T's Unix System Laboratories Inc. has just announced System V, Release 4.2 "designed to go after the next generation desktop computers".[36]

- **Networking**

Fundamentally, algorithms developed for wide area telecommunications software differ little from those used in local networking. **LAN** and **desktop publishing** are the two software applications with high priority among PC users. In **LAN**, competitive and accommodating forces among developers are just now in a new phase. Proprietary programs were restricted to a limited range of PCs - because each of the four major **LAN** applications

Apple's **AppleTalk**, IBM's **TokenRing**,
Xerox' **EtherNet**, and Novell's **NetWare**

is based on an algorithm suitable only for specific processors and its underlying **microcode**. None would "talk to" another. Only just now did **Novell** announce that its latest version of **NetWare** would run on any of the more than 2,500 hardware and software environments.[37]

- **Applications**

Proprietary applications for desktop publishing, are another story. Until now, icons and other graphical user interface features, found in Microsoft's **Windows**, and **Quattro**, **Lotus 1-2-3**, **WordPerfect**, or IBM's **Word**, have given rise to disputes on "look-alikes", or "feel-alikes". In the broadest sense, this too is a standards issue. So are approaches to video compression and handling algorithms - the new media's absolute must.[38]

3.17 Service De-Bundling and Prices

"Revenue-generating enhanced services" is a key to both the telephone and cable industries' pricing strategies. Heavily influenced by regulations, it combines the need (if not obligation) to provide **basic hook-up services** at a minimal charge, with the desire to entice users to consume discrete bundles of optional services - each adding value to the new concept of communications.

Marketing strategies that emphasize **value-added services** spawn a whole new series of de-bundled, optional service prices.[39] For example, in 1990, Bell Canada's residential phone customers spent an average 33 **per cent of combined local charges** (including occasional installation & repair services) on "**optional local services**" - now numbering a round dozen.[40] Only one - touchtone - is covered in the local component of StatsCan's telephone price index.[41] Similarly, de-bundling takes place in cable TV services, where much needs to be learned about prices.[42]

3.18 Government Spending

In 1989/90, Canada's municipal, provincial, and federal governments spent $5 billion on culture (StatsCan, 87-206). Radio and TV broadcasting account for nearly $2 billion. In the same year, the combined sectors of book publishing, periodicals, sound recording, and film and video had revenues of $2.3 billion (Table 5). However, some of the sector's revenue came by way of subsidies. The above $5 billion spent by government contains subsidies for entertainment and culture industries. However, the extent of these

(net) subsidies, particularly as they flow into film, publishing, and broadcasting simply cannot be ascertained. Subsidies end up as receipts by private sector industries. Even more to the point: some recreational spending overlaps with cultural activities, such as live concerts, or certain TV programming.

Table 1
Average Urban Household Income and Spending on Selected Items, by Income Quintile Canada, 17 Major Cities, 1986 and 1990

	Mean	1st Q.	2nd.Q.	3rd.Q.	4th.Q.	5th.Q.
			Average household size			
1986	2.63	1.55	2.15	2.74	3.19	3.53
1990	2.56	1.59	2.11	2.59	3.14	3.37
			Income before taxes ($)			
1986	38,924	10,300	21,610	33,738	47,560	81,415
1990	49,186	13,814	28,613	43,036	60,007	100,460
4-year change						
	26.3%	34.1%	32.4%	27.5%	26.2%	23.4%
Average spending on:						
			Telephone services ($)			
1986	509	298	481	514	574	678
Rate	99.5%	97.6%	99.8%	99.9%	99.9%	99.8%
1990	618	414	574	596	712	796
Rate	99.6%	98.8%	99.5%	99.9%	99.9%	99.7%
4- year change in spending:						
	21.4%	38.9%	19.3%	15.9%	24.0%	17.4%
			Cablevision ($)			
1986	116	70	95	113	147	160
Rate	64.1%	45.1%	54.8%	66.4%	73.8%	80.3%
1990	176	111	146	185	210	230
Rate	67.6%	47.0%	59.5%	72.6%	79.1%	79.8%
4-year change in spending						
	51.7%	58.5%	53.7%	63.7%	42.8%	43.7%
			Home Entertainment Equipment & Services ($)			
1986	403	116	320	444	511	625
Rate	78.0%	45.7%	77.4%	81.6%	90.5%	92.1%
1990	504	180	362	512	658	810
Rate	80.6%	54.0%	79.4%	84.1%	93.2%	93.8%
4-year change in spending:						
	25.1%	55.2%	13.2%	15.3%	28.7%	29.6%

Rental of Videotape Recordings ($)*						
1986	41	8	26	43	58	72
Rate	43.1%	14.2%	33.6%	44.6%	57.1%	66.6%
1990	75	28	54	88	110	94
Rate	55.6%	24.8%	47.6%	60.4%	71.6%	73.7%
4-year change in spending						
	82.9%	250.0%	107.7%	100.0%	89.6%	30.5%
Electronic Games and Parts ($)						
1986	5	--	3	6	9	10
Rate	7.6%	--	5.4%	8.0%	11.0%	11.2%
1990	27	8	13	29	39	48
Rate	16.0%	5.1%	7.2%	17.0%	23.3%	27.4%
4-year change in spending:						
	440.4%	--	333.3%	383.3%	333.3%	300.8%
Computer equipment & supplies ($)						
1986	69	--	37	40	70	177
Rate	6.4%	--	3.5%	5.9%	10.6%	16.5%
1990	140	16	59	131	159	320
Rate	12.9%	3.4%	5.1%	11.5%	17.0%	27.6%
4-year change in spending:						
	103.0%	--	58.4%	227.5%	127.1%	80.8%
Reading Material ($)						
1986	231	101	172	210	269	404
Rate	93.7%	81.0%	94.5%	96.4%	97.4%	98.2%
1990	272	128	200	247	311	474
Rate	92.3%	79.5%	91.1%	95.4%	97.1%	98.5%
4-year change in spending:						
	17.7%	26.7%	16.2%	17.6%	15.6%	17.3%
All Above, excluding reading material ($)						
1986	1,102	484	936	1,117	1,311	1,650
Share of Income						
	2.8%	4.7%	4.3%	3.3%	2.7%	2.0%
1990	1,465	729	1,155	1,453	1,778	2,205
Share of Income						
	3.0%	5.3%	4.0%	3.4%	3.0%	2.2%
4-year change in spending:						
	32.9%	50.6%	23.4%	30.0%	35.6%	33.6%

"Rate" refers to the per cent of households in each income group reporting spending on a given category or item. *This item appears within "home entertainment equipment and services". Source: StatsCan, Family Expenditure in Canada, 17 Major Cities, 1986 and 1990, unpublished data.

Table 2
Per Cent of Households Equipped with...
by Family Income Group
Canada, 1990

	Household Income Group			
	Average $43,838 %	Under $10,000 %	$35,000 $45,000 %	$70,000 & over %
Telephones	98.5	94.2	99.3	99.5
TV sets				
One	57.5	73.7	58.0	36.0
Two	39.4	14.3	39.7	63.3
Cable-TV	71.3	54.6	71.6	81.4
Cable converter	45.2	31.1	45.4	57.4
Pay-TV	11.9	7.0	11.7	17.4
VCR	66.3	33.7	72.9	86.4
Personal computers	16.3	5.7	15.4	34.2

Source: StatsCan, 13-218

Table 3
Information Technologies Industries
Shipments, Exports & Imports, R&D Spending and Employment
Canada, 1986 and 1990

SIC	Description	million dollars 1986	1990
3341	Record Player, Radio & Television		
	Shipments	873	654
	Exports	200	190
	Imports	1,707	1,426
	R&D	8	3
	Employment(persons)	2,524	1,768
3351	Telecommunication Equipment		
	Shipments	2,185	3,175
	Exports	1,178	1,089
	Imports	741	658
	R&D	621	703
	Employment(persons)	8,528	13904
3359	Other Communication & Electronic Equipment		
	Shipments	2,268	3,237
	Exports	152	893
	Imports	477	1,251
	R&D	282	334
	Employment(persons)	15,182	17350
3352	Electronic Parts & Components		
	Shipments	819	1,285
	Exports	1,163	3,072
	Imports	2,014	4,834
	R&D	31	38
	Employment(persons)	9,015	10013
3361	Electronic Computing & Peripheral Equipment		
	Shipments	1,755	3,013
	Exports	1,867	2,820
	Imports	4,195	5,224
	R&D	216	323
	Employment(persons)	6,712	6,448
3368	Electronic Office, Store & Business Machines		
	Shipments	653	670
	Exports	100	358
	Imports	734	910
	R&D	23	19
	Employment(persons)	1,325	1,390

table 3 continued

		million dollars	
3911 Indicating, Recording & Controlling Instruments			
	Shipments	1,076	1,310
	Exports	213	557
	Imports	796	1,522
	R&D	31	21
	Employment(persons)	7,172	8,194
3912 Other Instruments & Related Products			
	Shipments	875	977
	Exports	180*	294
	Imports	500*	727
	R&D	14	33
	Employment(persons)	3,657	3,577
7720 Computer and Related Services			
	Revenue	3,514	5,423
	Employment(persons)	42,128	55007
4814 Cable Television			
	Revenue	767	1,641
	Employment(persons)	7,523	9,800
4821 Telecommunication Carriers			
	Revenue	10,866	14,073
	Employment	104,166	124,036
5744 Wholesale of Computer Equipment & Software			
	Gross Margin	2,850	3,690
Above Totals			
	Shipments	28,500	40,150
	Per cent Change		40.9%
	Exports	5,053	9,273
	Per cent Change		83.5%
	Imports	11,165	16,552
	Per cent Change		48.2%
	R&D	1,226	1,474
	Per cent Change		20.2%
	Employment	207,932	251,487
	Per cent Change		20.9%

*estimate

Source: IST, Information Technologies Statistical Review, 1991

Table 4
Revenue, Expenses and Employees
Radio and TV Broadcasting, Canada, 1989
($ '000)

	CBC	Private Stations	Total
Operating Revenue			
Local	35,289	890,264	925,553
National	121,317	844,488	965,805
Network	129,990	186,129	316,120
Airtime Sales 1989	**286,596**	**1,920,881**	**2,207,477**
Airtime Sales 1984	**154,096**	**1,360,930**	**1,515,025**
% Change 1984-89	**86.0%**	**41.2%**	**45.7%**
Production and Other	3,155	125,478	128,633
Total	289,751	2,046,359	2,336,110
Operating Expense	1,229,326	1,979,418	3,208,744
of which:			
Salaries & Benefits	616,849	727,551	1,344,400
Number of employees	10,605	19,180	29,785
Net Income after income taxes	---	61,674	

Source: StatsCan, Cat.No. 56-204

Table 5
Total Revenue, by Sector
Canada, 1989-90
$ million

Book Publishing	965
Periodicals Publishing	903
Sound Recording	340
Film & Video	587
Total	2,279

Source: StatsCan, 87-202, 87-203, 87-204, 87-210

Endnotes

1. Instant World, A Report on Telecommunications in Canada, Information Canada 1971, p. 161

2. Transistors work on the effect of electrons tunnelling through a wall (the positive-negative junction) in the form of probability waves before they reassume mass and velocity as particles. All microprocessors depend on the quantum-mechanical behaviour of electrons.

3. "Networked Computing in the 1990s" by Lawrence Tesler, Scientific American, September 1991, page 91

4."Computers, Networks and Work" Lee Sproull and Sara Kiesler in Scientific American, September 1991

5. "Products and Services for Computer Networks", by Nicholas Negroponte, Scientific American, September 1991, page 111

6. See Exhibit 3 in the section following. Source: Household Facilities by Income and other Characteristics,StatsCan 13-218

7.WSJ, May 21, 1992

8. Much of the debate centres around "natural monopoly" in telecommunication, TV broadcasting, and cable-TV. The public good argument rests on the proposition that monopolists supply less than an optimal amount of services, that is, prices are higher than necessary primarily because of scarcity. In other words, there is only a limited amount available of the good in question, and few, if any, substitutes exist.

The point of new media products and services, however, is that as traditionally separate functions are combined, new media substitute for monopolies, and their vast capabilities put the lie to the old monopoly arguments.

This is not an enviable situation for regulators. But what to do with future conglomerates of telephone, broadcasters, cable, entertainment conglomerates, electronic manufacturers and software assemblers?

For example, IBM's "Paris" high speed networking technology for a packet-switching method of transmitting voice, data, and images led to a joint undertaking with BellSouth. Paris uses Synchronous Optical Network (SONET) links of speeds of up to 662 megabits per second, or the equivalent of sending 14,000 single-

spaced typewritten pages per second. Will the FCC indirectly regulate certain IBM activities? (WSJ, January 29, 1991).

Meanwhile, in April 1992, the FCC,

> ...under fire for turning its high-definition television proceedings into a windfall for broadcasters, proposed to restrict the flexibility of broadcasters entering the HDTV business... In 2008, the agency proposed, broadcasters would have to turn in their conventional TV channels and broadcast solely in high-definition. That would mark the end of conventional TV broadcasts, and mean that consumers would have to buy high-definition sets - or hope that TV companies came up with electronic attachments that let conventional sets pick up high-definition signals. HDTV sets are expected to go on sale in about two years at an initial price of $6,000. The proposals "reflect the seriousness of the Commission in getting back regulatory control of transmission frequencies as soon as possible (WSJ, April 10, 1992).

2. "Family Expenditure in Canada, 17 Metropolitan Areas", Family Expenditure Surveys Division, Statistics Canada, Special Printout, January 28, 1992

10. Includes spending on radios, audio devices, pre-recorded and blank tapes and videos, records and Cds, TV sets, VCRs, camcorders, video rentals, parts purchased, and maintenance & repairs (see, StatsCan, Family Expenditure in Canada, categories 3301-3318).

11.StatsCan's Household facilities (13-218) puts the 1990 number of cable subscribers at 1,150,000. The industry estimates that 495,000 (43%) also have addressable decoders (pay TV).

12.Kodak's Photo CD products are an example.

13.For example, in May 1991, the U.S. retail price of the Compaq DeskPro 386SX (without a monitor) stood at $1,955. In June 1992, Compaq's 386SX ProLinea was priced at $999.

14. StatsCan, The Consumer Price Index, 62-001 (item 220794)

15.WSJ, May 21, 1992, p. A6

16. Task One as described in the statement of work is comprehensive. It states:

A. Provide a report on the relevant statistical indicators of the traditional

telecommunications
software applications,
film/video
sound recording
printed publishing
databases,
cable and broadcasting
computer graphics,
multimedia applications
advanced communications and cultural industries

and such other businesses and industries connected to communications as DGNM and the consultant agree are relevant;

B. the patterns of growth and change within these industries, including

changing patterns of capital flows, R&D, trade

C. Consumption of services provided by these industries;

D. Where available, comparisons are to be made of Canadian to foreign indicators of business activity and consumption of these products and services;

17.They are:

SIC 3341	Record Player & TV sets
SIC 3351	Telecommunications Equipment
SIC 3352	Electronic Parts & Components
SIC 3359	Other Communications & Electronic Equipment
SIC 3361	Electronic Computing & Peripheral Equipment
SIC 3368	Office, Store, & Business Machines
SIC 3369	Other Office, Store, & Equipment
SIC 3911	Indicating, Recording, & Controlling Instruments
SIC 3912	Other Instruments & Related Products
SIC 7720	Computer & Related Services
SIC 4814	Cable Television
SIC 4821	Telecommunications Carriers

Industry, Science and Technology, Information Technologies Statistical Review, 1991 Annual

18.Put simply, the size of the domestic market is not the same as the aggregate of industry profiles. For example, manufacturing shipments in the office, stores, & business machines industry (SIC 3368) were $358 million, while total shipments were $671 million.

19.StatsCan, "Canadian Economic Observer" September 1991

20.Even the labour market benefits: See, "Job-Hunters Turn to Software and Data Bases to Get an Edge", WSJ, June 16, 1992. p.B7

21. StatsCan 87-202, 87-203, 87-204, 87-210 (1989-1990)

22.For example, Northern Telecom announced that it will begin shipping a desktop video conferencing system that includes a video circuit board to fit IBM-compatible and Apple Pc's, a camera, communications hardware and software at a price ranging from US$2,900 to $3,500. Another product, costing between $299 and $600, will turn a PC into a "telephone management centre", allowing the user to dial a call, set up a phone directory, and log and track phone calls (WSJ, June 11, 1992, p. C11).

23.WSJ, May 21, 1992

24.WSJ, May 26, 1992, p.B1

25.WSJ, January 29, 1991

26.WSJ, June 9, 1992, p.B1

27.European manufacturers, broadcasters and producers will receive as much as...$1.11 billion in subsidy to convert to high definition television. HDTV sets could go on sale as soon as this year. The EC accord with 38 firms caps more than a year of negotiations on introducing the costly newer system. The aid requires EC government approval. The pact came even though the technology could be replaced within a decade by more advanced digital broadcasting, requiring HDTV sets to be upgraded. WSJ, June 17, 1992, p. A12

28.WSJ, May 21, 1992, p.B10

29.See, "Smart Sets - Age of Interactive TV May Be Nearing as IBM and Warner Talk Deal" WSJ, May 21, 1992.

30.WSJ, May 26, 1992, page B6

31. Simon & Schuster, 1989, ISBN 0-671-50969-1

32.The dispute covers only Intel's microcode on 287 math co-processors (WSJ, June 19, 1992, p. B5).

33.Cyrix Corp. and Chips & Technologies are being sued by Intel for trying to market a hybrid of Intel's 386SX and 486 microprocessors. Texas Instrument, with several patent cross-licensing agreements with Intel, is now siding with the other two (WSJ, June 4, 1992). Meanwhile, Advanced Micro Devices Inc. (ADM) and Intel are waiting for rulings on two separate copyright infringement suits. They deal primarily with the micro-code embedded in the 286, 386 and 486 Intel chips being cloned by ADM (WSJ, June 10, 1992, p. B6).

34. At first, converting the analog cellular telephone to digital seemed dependent on a technique known as time division multiple access (TDMA), but now, code division multiple access (CDMA) has

arrived. Ameritech Corp. finally announced that it plans to test both techniques - and let customers decide which one provides better service. WSJ, June 16, 1992, p. B4

35.They are, DOS, OS/2, NeXT, DG, UNIX, VAX, and MAC.

36. Just announced was System V, Release 4.2 - competing with Microsoft's Windows NT, and IBM's OS/2. Designed to "...go after the next generation desk top computers", Release 4.2 will be marketed through Novell's distribution channels. WSJ, June 16, 1992, p.B7

37.WSJ, June 17, 1992

38.Apple's QuickTime has been called "the best program for compressing and handling video images" (WSJ, June 10, 1992, p. B6)

39.Bell Atlantic recently advertised the following 32 services and products it offers:

Centrex BVP Norstar Eagle Sets Electra Mark II
Sentry I Sentry II Sentry III Answer Call
Call Block Call Waiting Priority Call Repeat Call
Return Call Select Forward Ultra Forward Speed Calling
Remote Call Forwarding 800 Intelligent 800 WATS
Maximum Value Plan Fax Machines Modems
Digital data lines LANgate Centracom Consoles Voice Mail
Paging Local Service, Directory Assistance
(WSJ, November 22, 1991)

40.Bell(CAC)28Dec90 - 1 IC2

41.The U.K.'s two-year old price-cap regulation of BT sets annual price reductions at 6.25 percentage points less than the year-to-year inflation rate. Now Oftel has called for a further 1.25 percentage point tightening (WSJ, June 10, 1992, p. A9).

42.In 1990, 21% ($284 million) of Canada's cable industry total revenue ($1,355 million) was attributable to de-bundled services: payTV (Table 2).

1990 IT Industry Overview
(Including Communication Services)
Sommaire de l'industrie TI pour 1990
(Services de communication inclus)

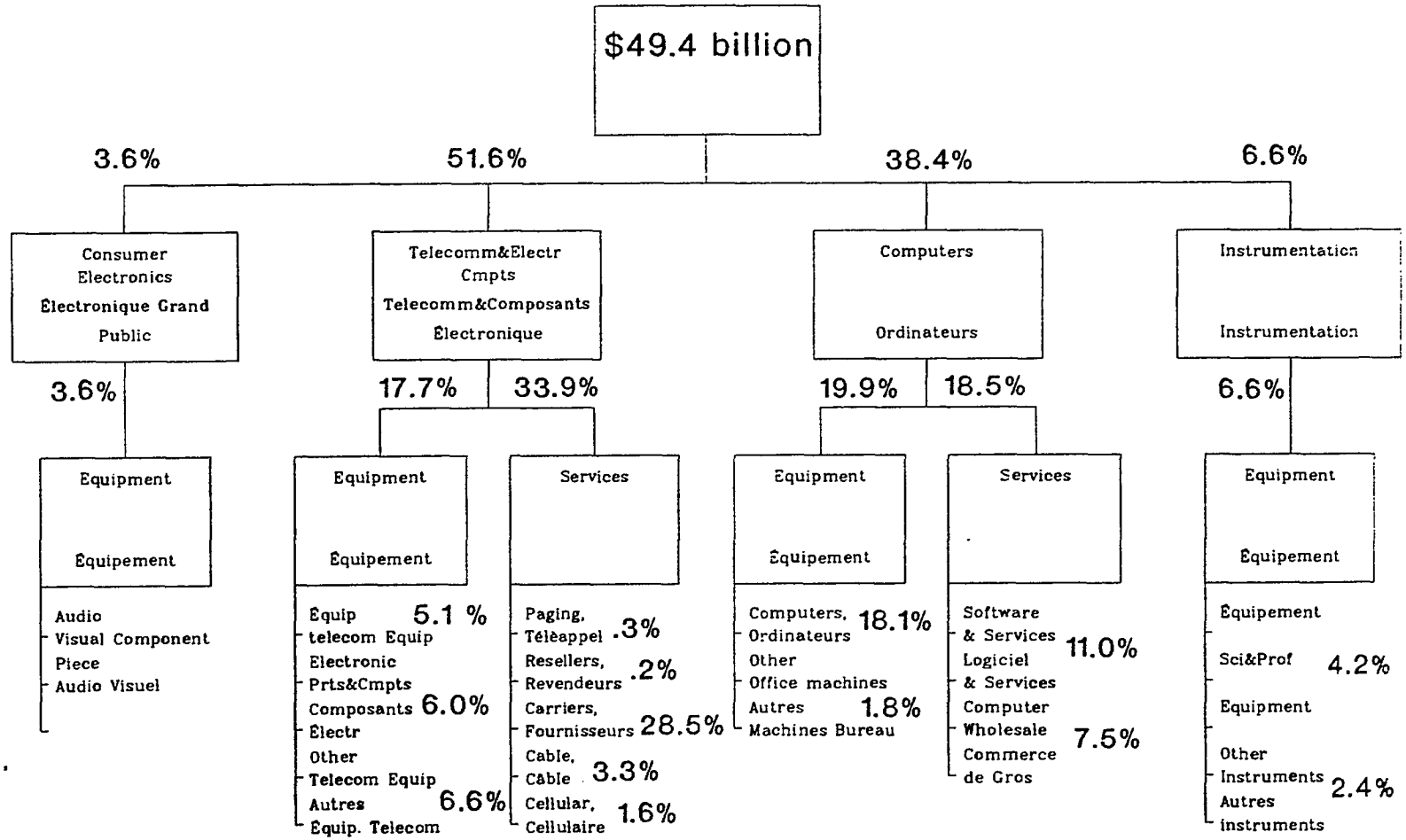
Profiling Data ($ 000's)	3341	3351	3352	3359	3361	3368	3911	3912	7720	6744	4814	4821a	4821b	Cellular	Resellers	Paging	Total	Données - Profil ($ 000's)
														Cellulaire	Revendeurs	Téléappel	Total	
Number of Establishments	16	55	262	242	209	46	282	171	11 023								12 306	Nombre d'établissements
Production Employment	1 768	13 904	10 013	17 349	6 448	1 390	8 194	3 577									62 643	Travail de production
Production Salaries & Wages	41 144	473 231	246 024	603 724	166 997	31 825	203 543	98 936									1 865 424	Salaires et traitements de travail de la production
Admin & Exec Employment	456	8 341	2 319	8 779	5 406	2 501	4 246	2 421									34 469	Travail d'administration et gestion
Admin & Exec Salaries & Wages	22 231	430 455	100 242	305 959	234 289	105 822	177 418	99 674									1 476 090	Salaires et traitements d'administration et gestion
Total Employment	2 224	22 245	12 332	26 129	11 854	3 891	12 440	5 998	55 007		9 799	118 910	5 126				285 955	Emploi total
Total Salaries & Wages	63 376	903 686	346 266	909 684	401 286	137 647	380 961	198 610	2 093 468	1 401 177	346 792	4 541 534					11 724 487	Total des salaires et traitements
Manufacturing Shipments	526 538	2 955 485	1 186 612	2 900 019	2 857 207	358 102	1 097 115	742 369									12 623 447	Livraisons manufacturières
Manufacturing Value Added	165 813	1 801 667	668 024	1 671 286	1 322 794	88 537	593 898	364 924									6 676 943	Valeur ajoutée manufacturière
Total Shipments (Revenue)	654 016	3 174 788	1 285 237	3 237 582	3 013 232	670 599	1 309 925	977 076	5 423 291	3 689 298	1 641 129	13 739 814	333 899	780 000	100 000	140 000	40 169 886	Total des livraisons (recettes)
Total Value Added	197 903	1 834 896	686 938	1 797 844	1 377 210	256 093	667 155	444 418									7 262 457	Total de la valeur ajoutée
GDP (1986 constant dollars)	170 500	1 301 941	482 735	1 207 724	1 709 762	114 438	797 908	531 518	3 018 000			13 575 200					22 909 726	PIB (aux prix de 1986)
Investment (capital expenditure)		317 500	317 500	317 500	80 300	80 300	86 000	86 000									1 285 100	Investissement (immobilisation)
R&D Expenditures	3 000	703 000	38 000	334 000	323 000	19 000	21 000	33 000	231 000								1 705 000	Dépenses au titre de la R-D
Trade Data (000's)																		Données de commerce ($ 000's)
Total Imports	1 425 765	657 609	4 834 118	1 251 274	5 224 188	909 837	1 522 198	726 796									16 551 785	Total des importations
Total Exports	190 030	1 088 836	3 072 390	892 633	2 820 457	358 191	557 465	294 251									9 274 253	Total des exportations
Manufacturing Shipments	526 538	2 955 485	1 186 612	2 900 019	2 857 207	358 102	1 097 115	742 369									12 623 447	Expéditions manufacturières
Apparent Domestic Market	1 762 273	2 524 258	2 948 340	3 258 660	8 950 236	909 748	2 061 848	1 174 914	5 423 291	3 689 298	1 641 129	13 739 814	333 899	780 000	100 000	140 000	49 437 708	Marché intérieur apparent
Total Exports / Manufacturing Shipments	36.09	36.84	258.92	30.76	98.71	100.02	50.81	39.64									73.47	Total des exportations / Expéditions manufacturières
Total Imports / Apparent Domestic Market	80 90	26.05	163.96	38.40	58.37	100.01	73.83	61.86									33.48	Total des importations / Marché intérieur apparent
Trade Data (% of IT Total)																		Données de commerce (% du total des TI)
Total Imports	8.6	4.0	29.2	7.6	31.6	5.5	9.2	4.4									100	Total des importations
Total Exports	2.0	11.7	33.1	9.6	30.4	3 9	6.0	3.2									100	Total des exportations
Manufacturing Shipments	4.2	23.4	9.4	23.0	22.6	2.8	8.7	5.9									100	Expéditions manufacturières
Apparent Domestic Market	3.6	5.1	6.0	6.6	18.1	1.8	4.2	2.4	11.0	7.5	3.3	27.8	0.7	1.6	0.2	0.3	100	Marché intérieur apparent
Revenue (% of IT Total)	1.6	7.9	3.2	8.1	7.5	1.7	3.3	2.4	13.5	9.2	4.1	34.2	0.8	1.9	0.2	0.3	100	Recettes (% du total des TI)

Footnote:	Note:
Computer Services are based on IDC growth rates	Les services informatiques sont basés sur les taux de croissance prévues de IDC
Communication Services are IDC estimates	Les services de communication sont des prévisions par IDC

Figure 1

INFORMATION TECHNOLOGIES DE L'INFORMATION

APPARENT DOMESTIC MARKET / MARCHÉ INTÉRIEUR APPARENT

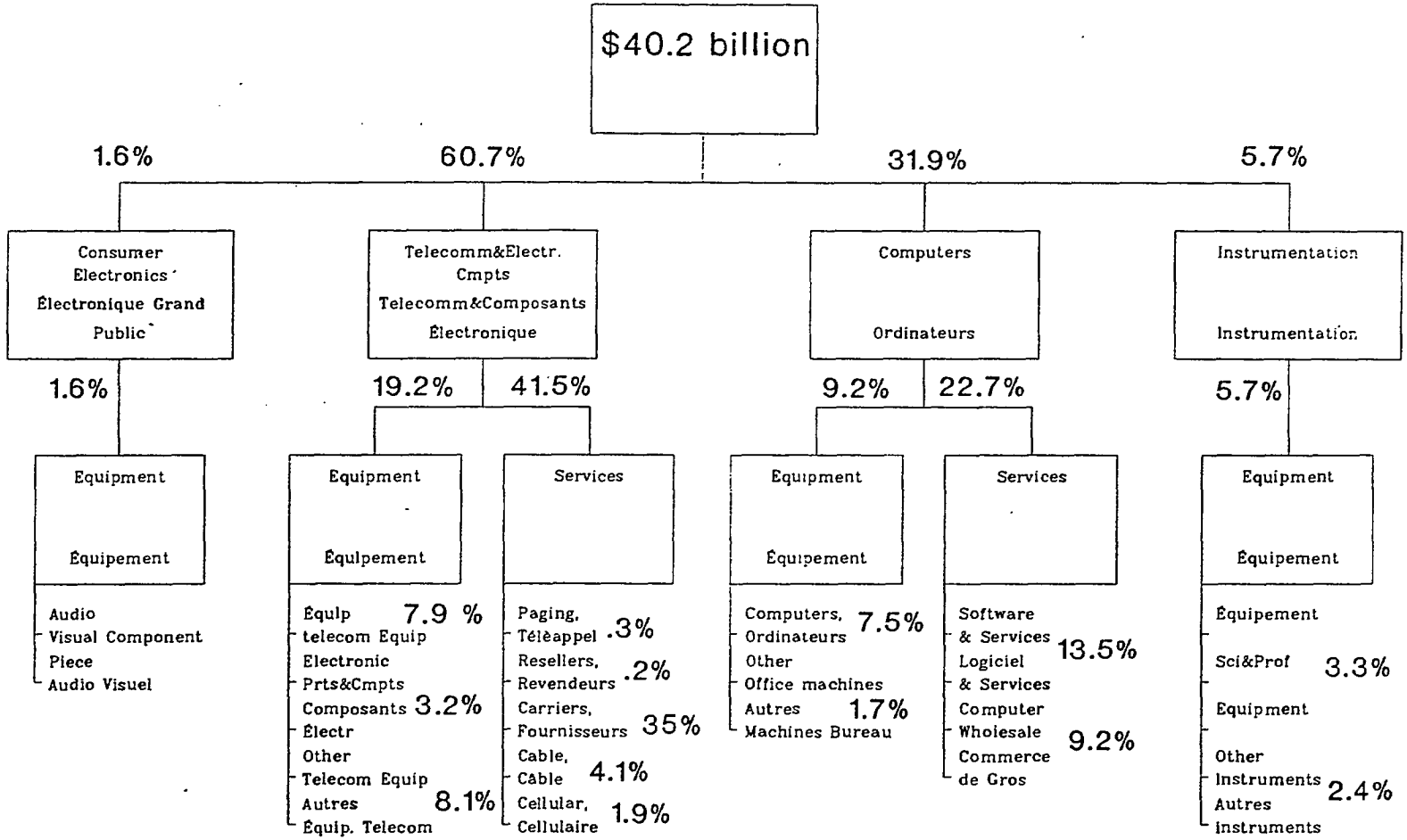


Source: ISTC estimates of Total Manufacturing Shipments and total Service Revenues based upon Statistics Canada Data.
Estimates for Resellers, Cellular and Paging provided by IDC.
Figures may not add to 100% because of rounding.

Les données prévues par ISTC pour les livraisons manufacturières et le total des recettes sont basés sur les donnés fournis par Statistiques Canada.
Les données prévues pour les revendeurs, cellulaire et téléappel parviennent de IDC.
Les totaux sont arrondis et ne correspondent pas toujours à l'addition de 100%.

INFORMATION TECHNOLOGIES DE L'INFORMATION

TOTAL REVENUES / TOTAL DES RECETTES



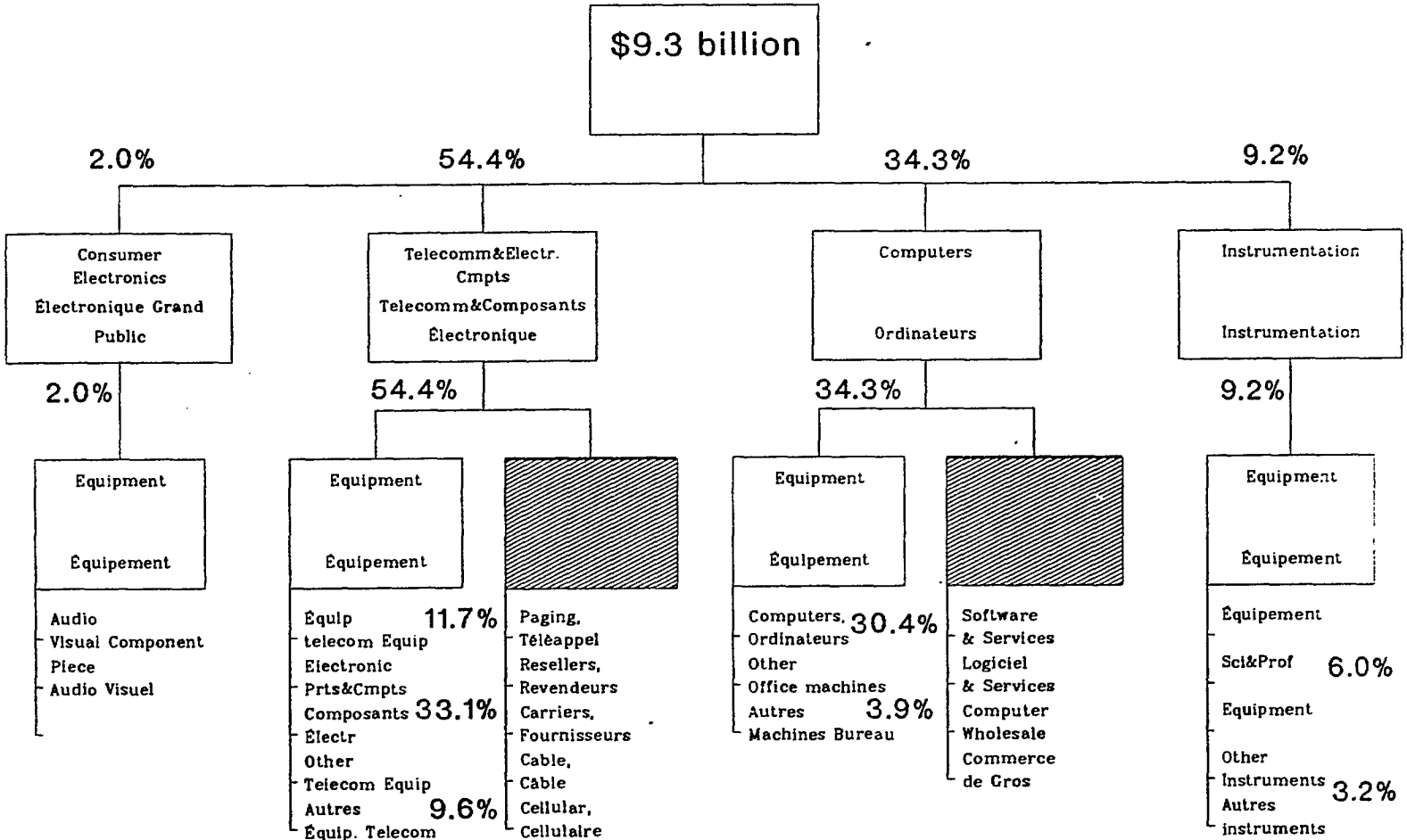
Source: ISTC estimates of Total Manufacturing Shipments and total Service Revenues based upon Statistics Canada Data
Estimates for Resellers, Cellular and Paging provided by IDC
Figures may not add to 100% because of rounding

Les données prévues par ISTC pour les livraisons manufacturières et le total des recettes sont basés sur les donnés fournis par Statistiques Canada
Les données prévues pour les revendeurs, cellulaire et téléappel parviennent de IDC
Les totaux sont arrondis et ne correspondent pas toujours à l'addition de 100%

Figure 2

INFORMATION TECHNOLOGIES DE L'INFORMATION

TOTAL EXPORTS*/ TOTAL DES EXPORTATIONS*



Source: ISTC estimates of Total Manufacturing Shipments and total Service Revenues based upon Statistics Canada Data.

Estimates for Resellers, Cellular and Paging provided by IDC.

Figures may not add to 100% because of rounding.

•For manufactured goods only.

Les données prévues par ISTC pour les livraisons manufacturières et le total des recettes sont basés sur les données fournis par Statistiques Canada.

Les donnée prévues pour les revendeurs, cellulaire et téléappel parviennent de IDC.

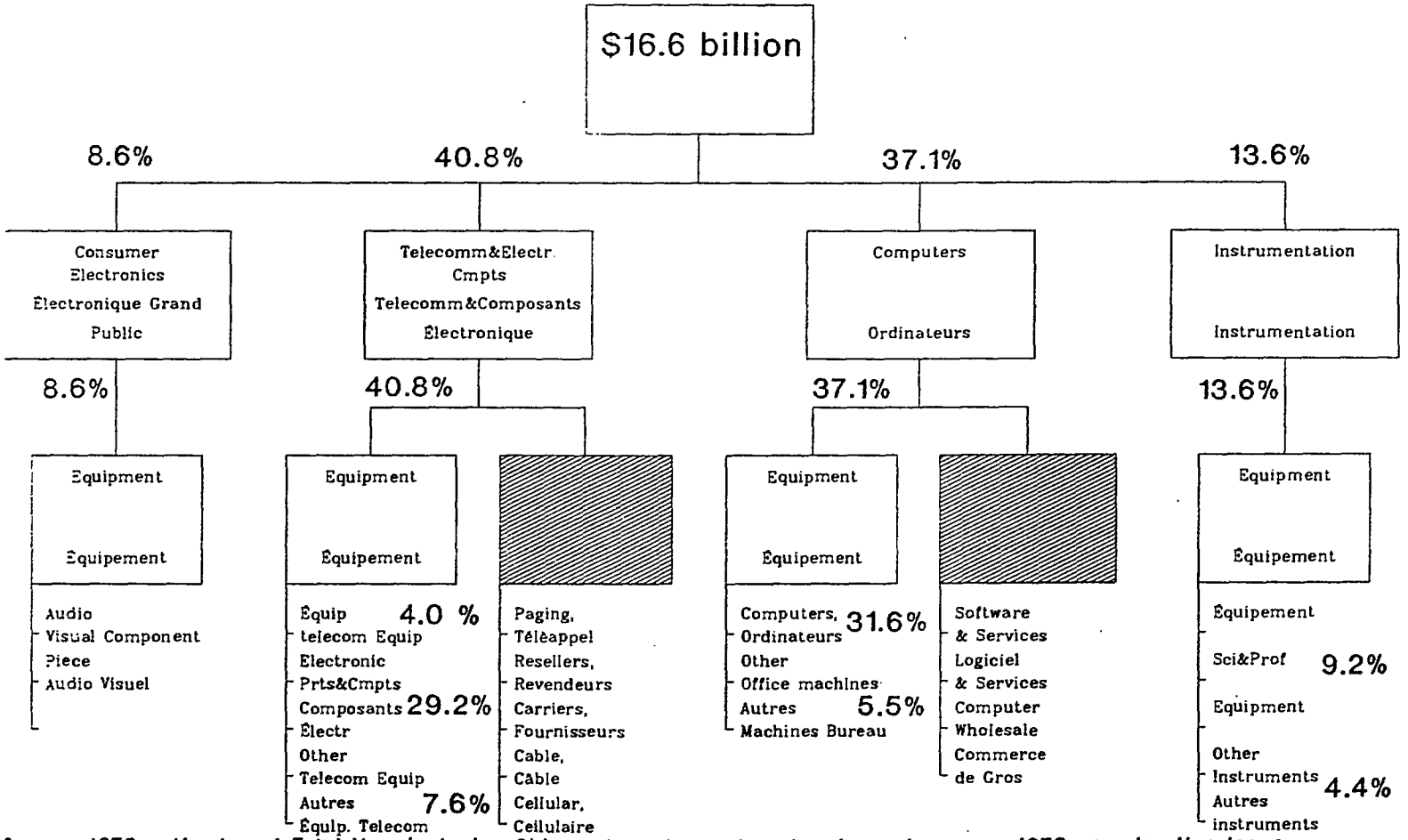
Les totaux sont arrondis et ne correspondent pas toujours à l'addition de 100%.

•Pour les marchandises manufacturières seulement.

Figure 3

INFORMATION TECHNOLOGIES DE L'INFORMATION

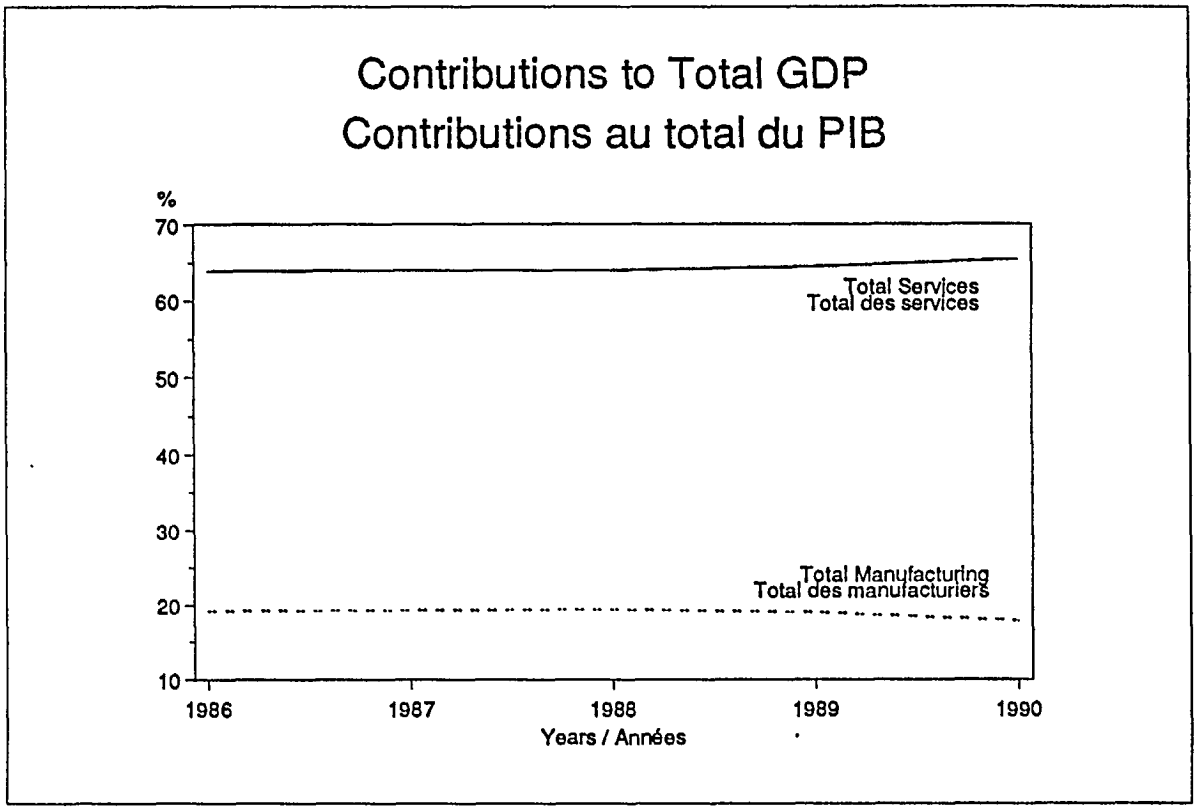
TOTAL IMPORTS*/ TOTAL DES IMPORTATIONS*



Source: ISTC estimates of Total Manufacturing Shipments and total Service Revenues based upon Statistics Canada Data.
Estimates for Resellers, Cellular and Paging provided by IDC.
Figures may not add to 100% because of rounding.
*For manufactured goods only.

Les données prévues par ISTC pour les livraisons manufacturières et le total des recettes sont basés sur les donnés fournis par Statistiques Canada.
Les données prévues pour les revendeurs, cellulaire et téléappel parviennent de IDC.
Les totaux sont arrondis et ne correspondent pas toujours à l'addition de 100%.
*Pour les marchandises manufacturières seulement.

Figure 4


Contributions to Total GDP
Contributions au total du PIB
%
70
60
50
40
30
20
10
Total Services
Total des services
Total Manufacturing
Total des manufacturiers
1986
1987
1988
1989
1990
Years / Années

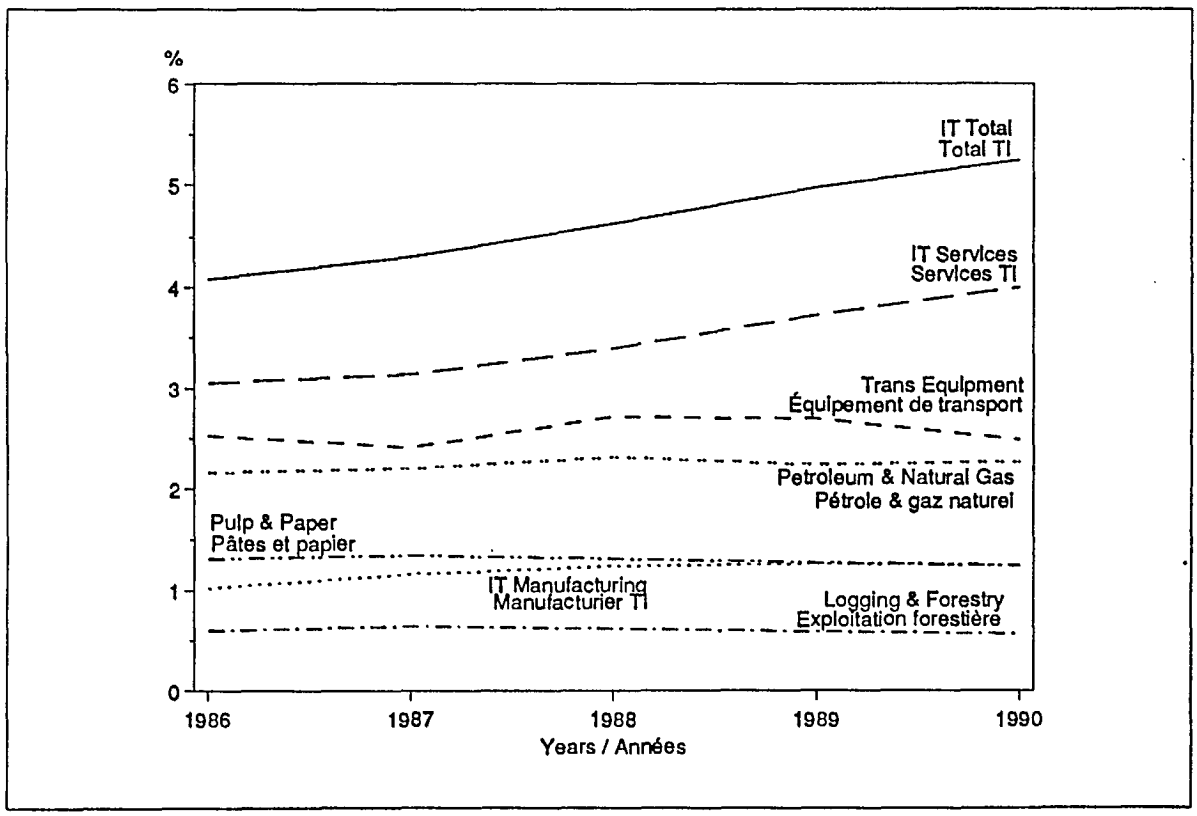
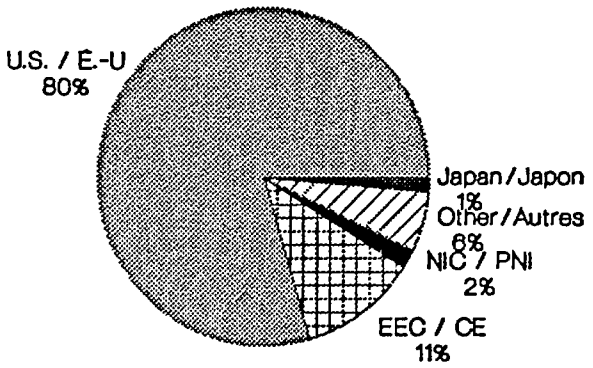
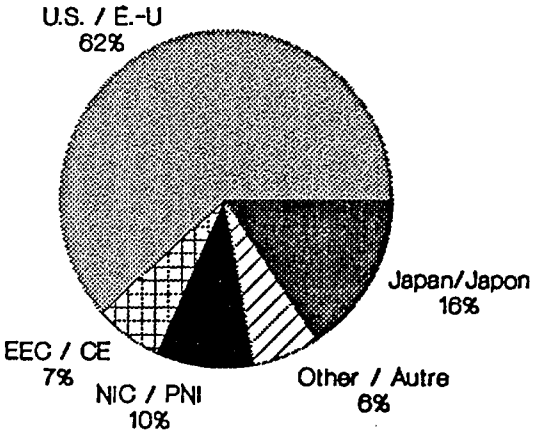

%
6
5
4
3
2
1
0
IT Total
Total TI
IT Services
Services TI
Trans Equipment
Équipement de transport
Petroleum & Natural Gas
Pétrole & gaz naturel
Pulp & Paper
Pâtes et papier
IT Manufacturing
Manufacturier TI
Logging & Forestry
Exploitation forestière
1986
1987
1988
1989
1990
Years / Années

Figure 5

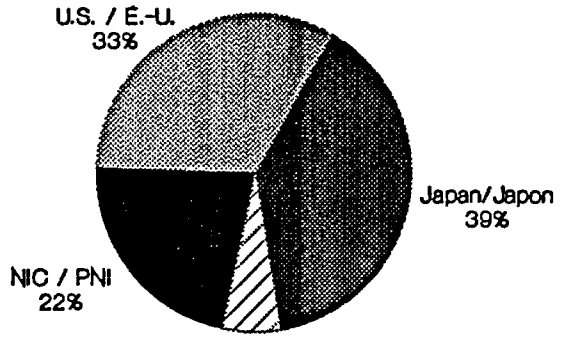
CANADIAN IT EQUIPMENT TRADE - 1991
COMMERCE D'ÉQUIPEMENT TI CANADIEN - 1991



EXPORTS / EXPORTATIONS
$10.09



IMPORTS / IMPORTATIONS
$16.30



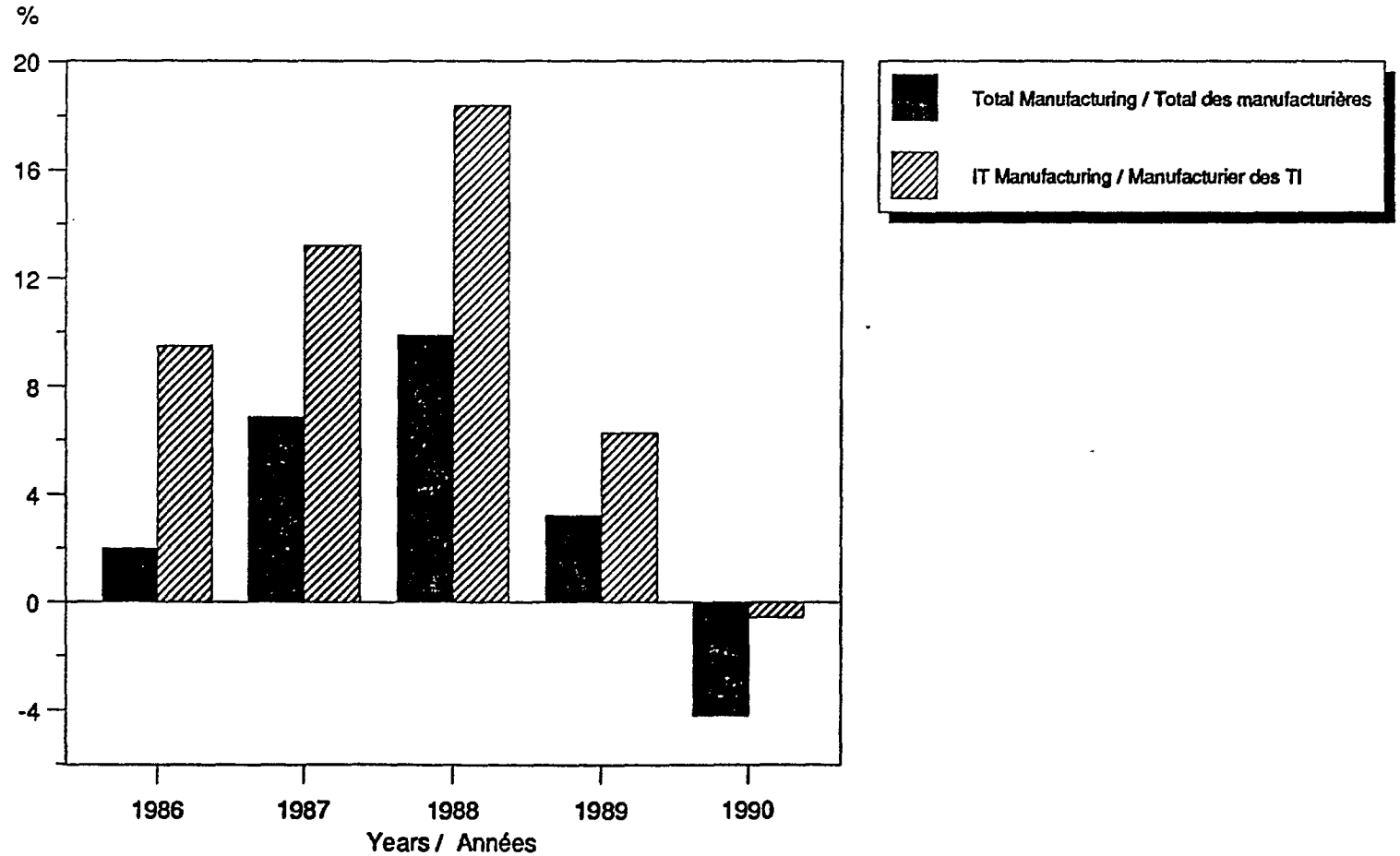
BALANCE / SOLDE
-$6.21

($ Billions / Milliards)

Source: Statistics Canada / Statistiques Canada

Figure 6

Growth of Canadian Manufacturing Shipments
La croissance des livraisons manufacturières canadiennes
1986-1990



Source: Statistics Canada / Statistiques Canada

Figure 7

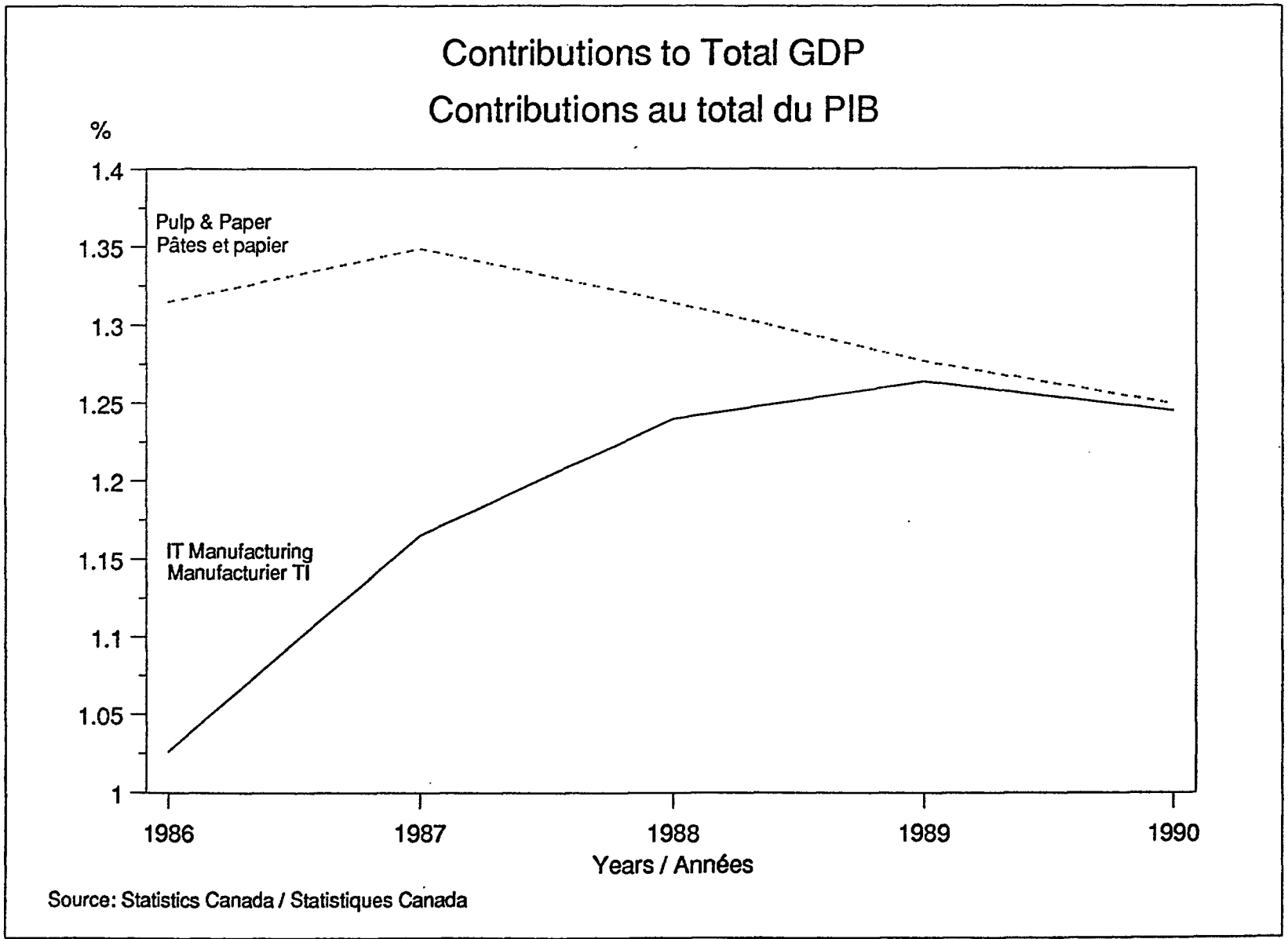
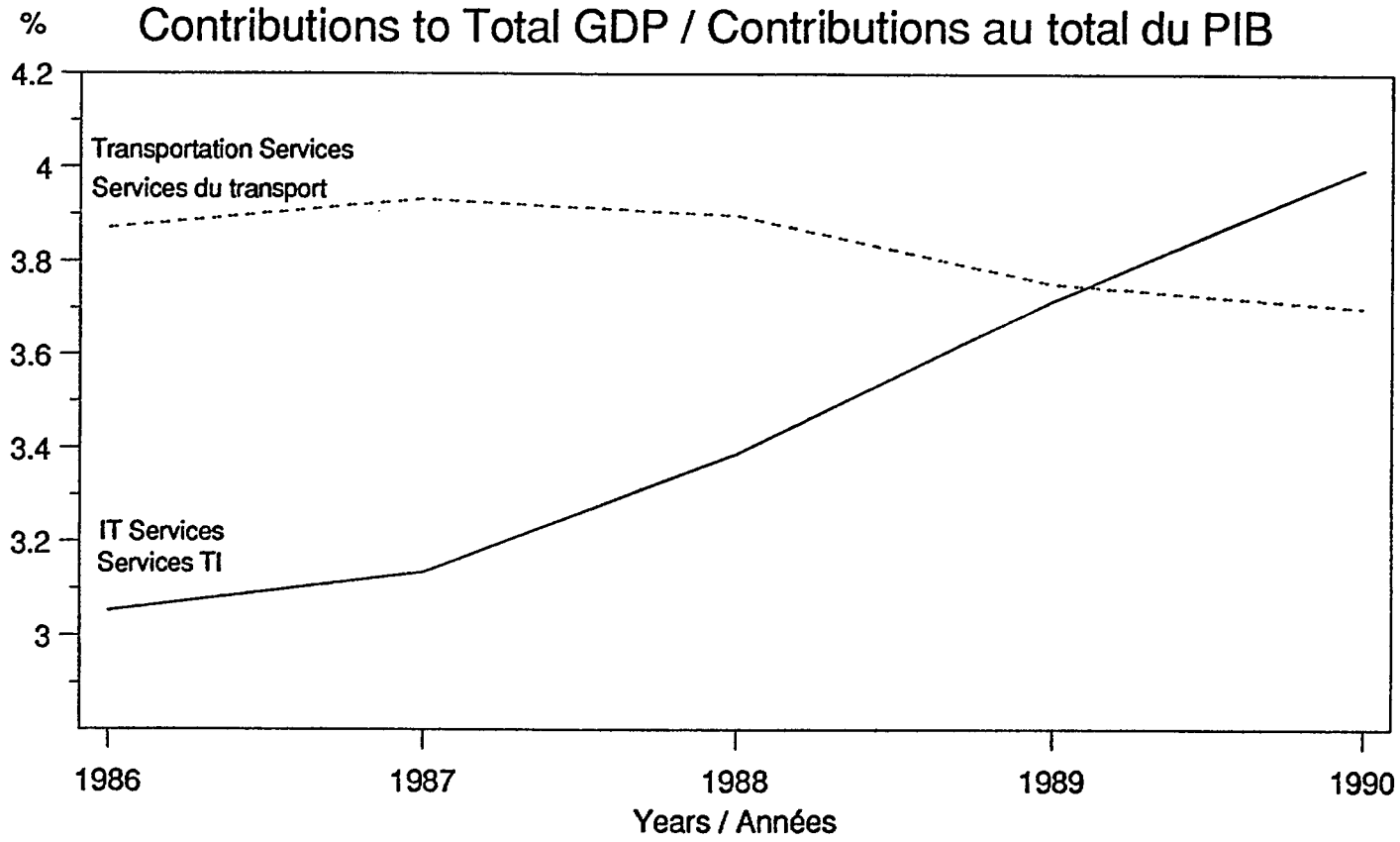

Contributions to Total GDP
Contributions au total du PIB
%
1.4
1.35
1.3
1.25
1.2
1.15
1.1
1.05
1
Pulp & Paper
Pâtes et papier
IT Manufacturing
Manufacturier TI
1986
1987
1988
1989
1990
Years / Années
Source: Statistics Canada / Statistiques Canada

Figure 8



IT Services include Computer and Related Sevices, Telecommunication Carriers and Wholesale of Computer Equipment and Software.
Transportation Services include Air transport & services incidental, Railway transport & rel. services, Water transport & rel. services, Truck transport industries, Urban transit system industry and Interurban & rural transit systems.

Les services informatique et services connexes, Transmission des télécommunications et Vente en gros d'équipement informatique et logiciel sont inclues dans Services TI.
Industries du transport, Transp. aérien & services relatifs, transp. ferroviaire & services rel., transp. par eau & services rel., Industries du cammionage, Ind. du transport en commun urbain et Transp. en commun interurbain/rural sont inclus dans Services du transport.

Source: Statistics Canada / Statistiques Canada

Figure 9

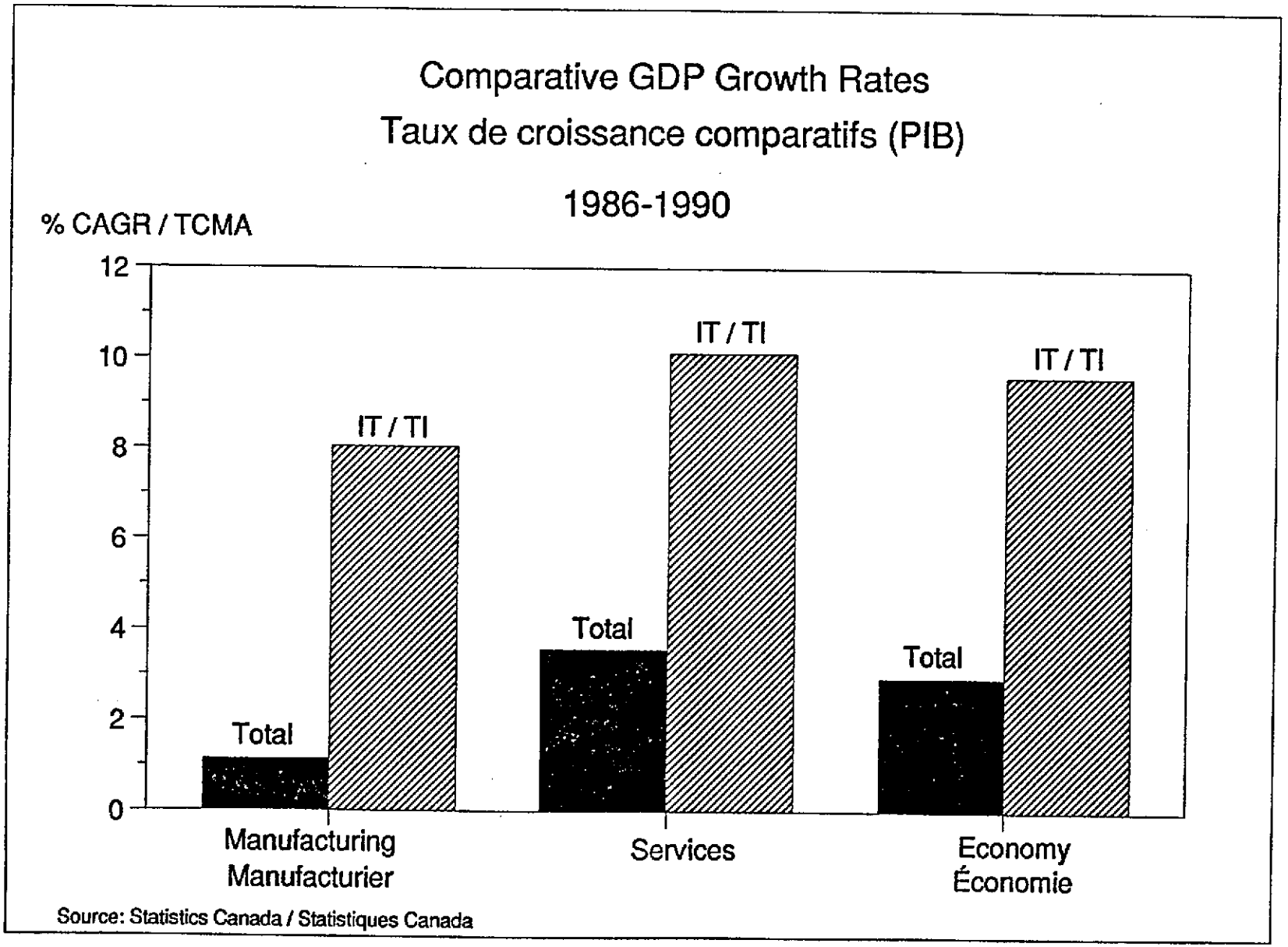
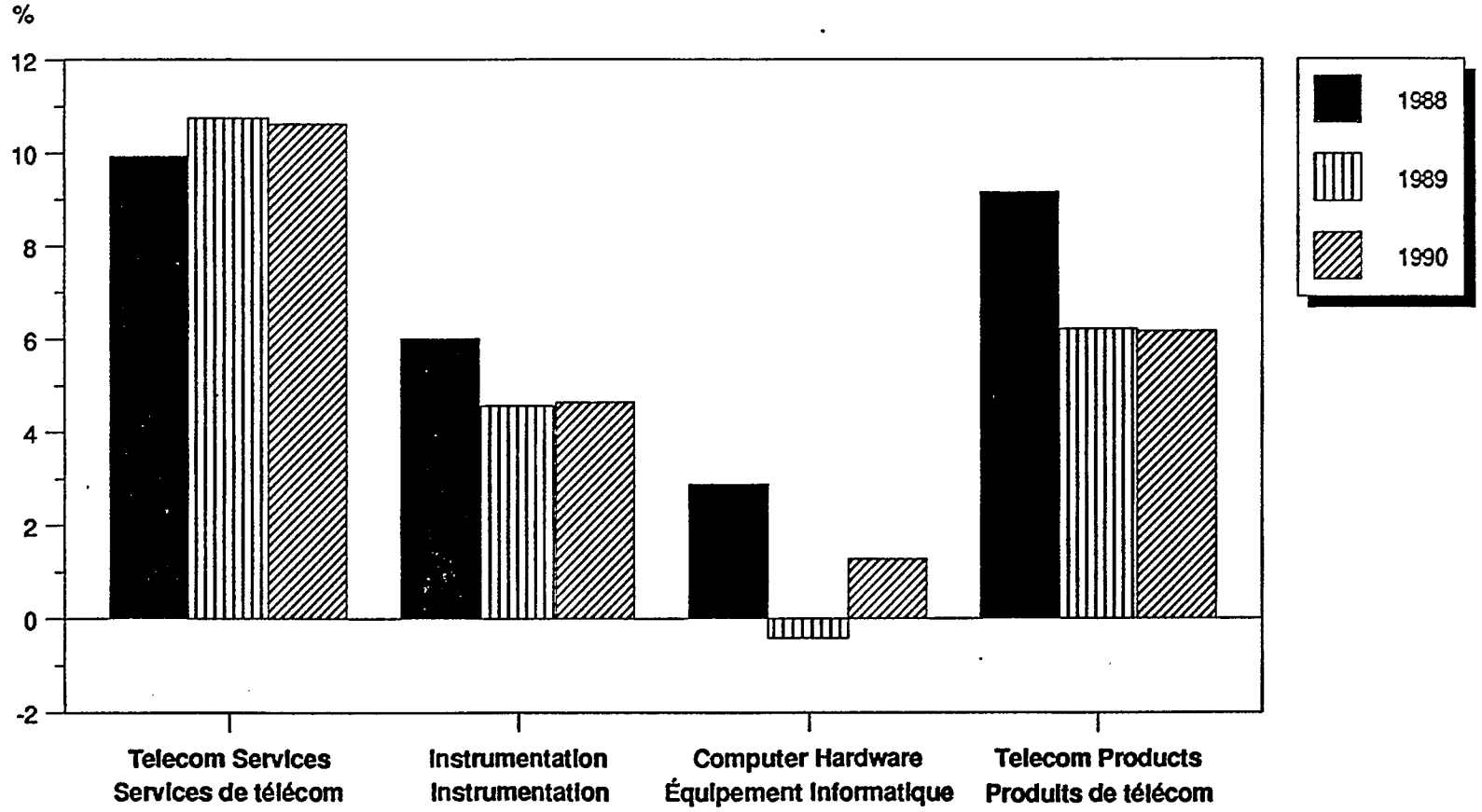

Comparative GDP Growth Rates
Taux de croissance comparatifs (PIB)
1986-1990
% CAGR / TCMA
12
10
8
6
4
2
0
IT / TI
IT / TI
IT / TI
Total
Total
Total
Manufacturing
Manufacturier
Services
Economy
Économie
Source: Statistics Canada / Statistiques Canada

Figure 10

Profits as a Percentage of Operating Revenue
Bénéfices en pourcentage des recettes d'exploitation

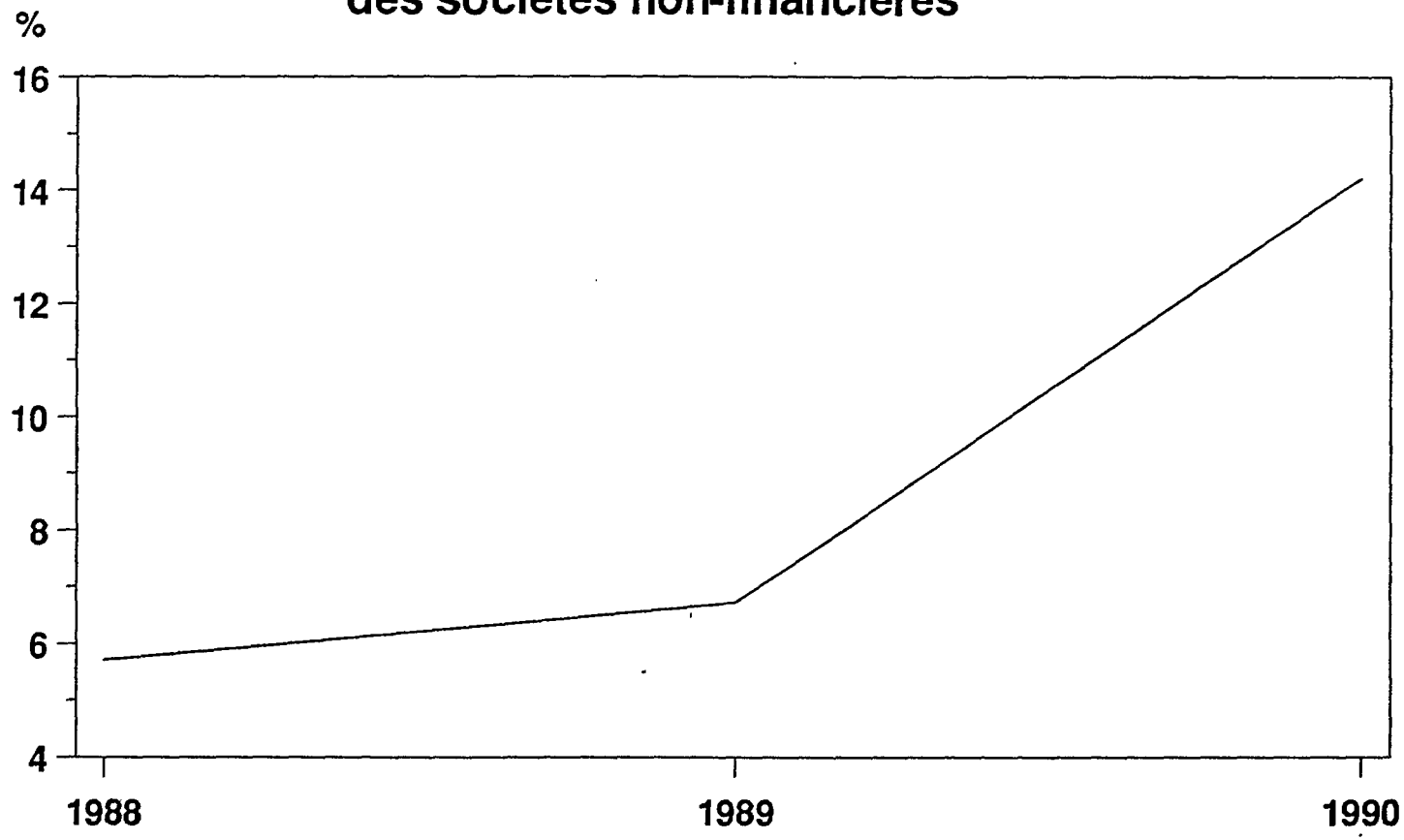


Source: Statistics Canada Quarterly Financial Statistics / Statistiques financières trimestrielles de Statistiques Canada

Figure 11

IT's Profits as a Percentage of Total Non - Financial Corporate Profits

Les bénéfices TI en pourcentage des bénéfices total des sociétés non-financières



Source: Statistics Canada Quarterly Financial Statistics / Statistiques financières trimestrielles de Statistiques Canada

*Computer Services profits added from catalogue 63-222
*Les bénéfices des Services informatique ajoutés du catalogue 63-222

Figure 12

IT Total
Total TI

Apparent Domestic Market / Marché intérieur apparent

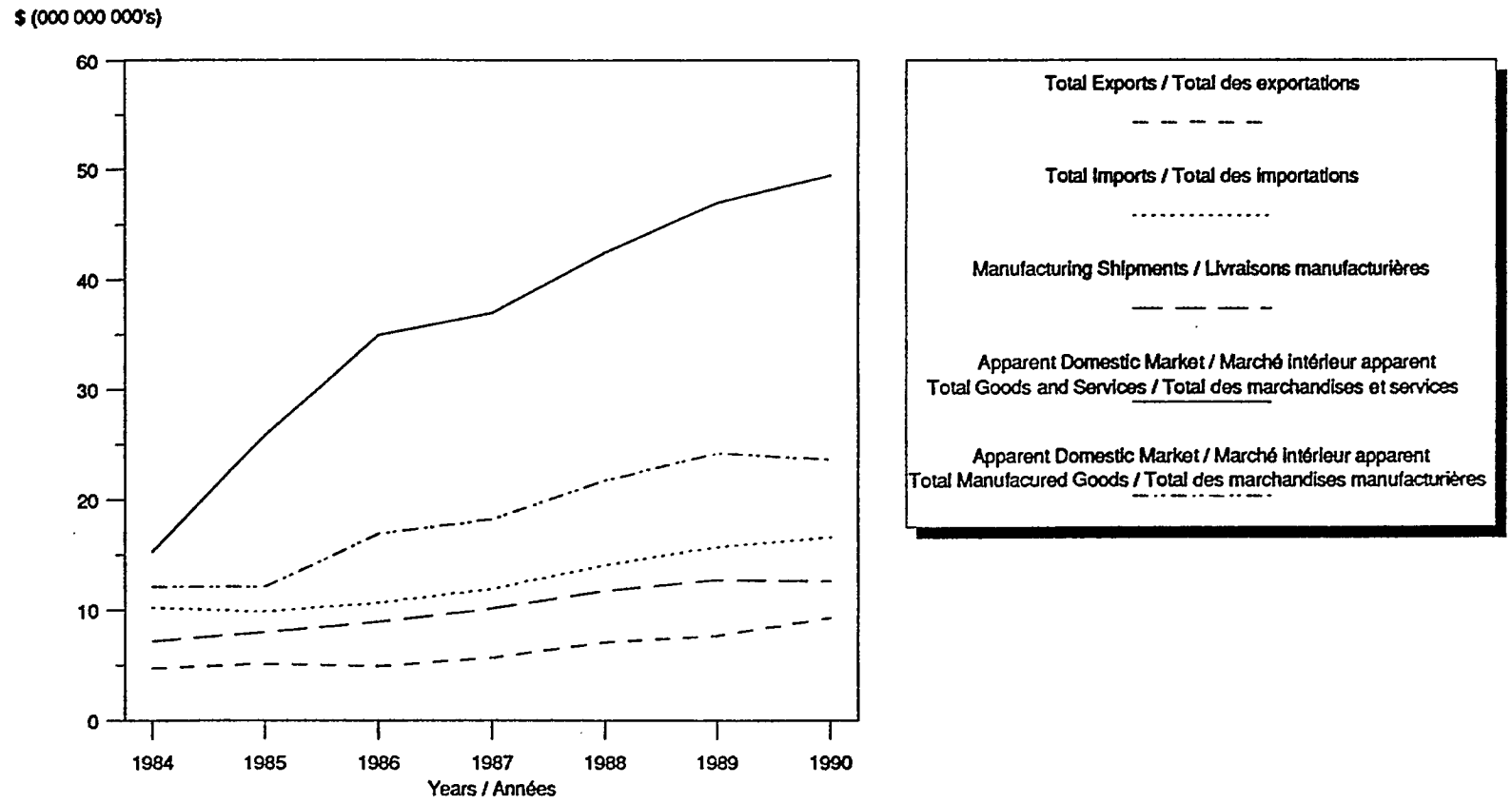


Figure 13

Capital Expenditures on IT Goods in Canada by Sector
Dépenses d'immobilisations sur les marchandises TI au Canada par secteur

Forestry and Most Mining Sector / Le secteur de forêts et la plupart d'exploitation minière

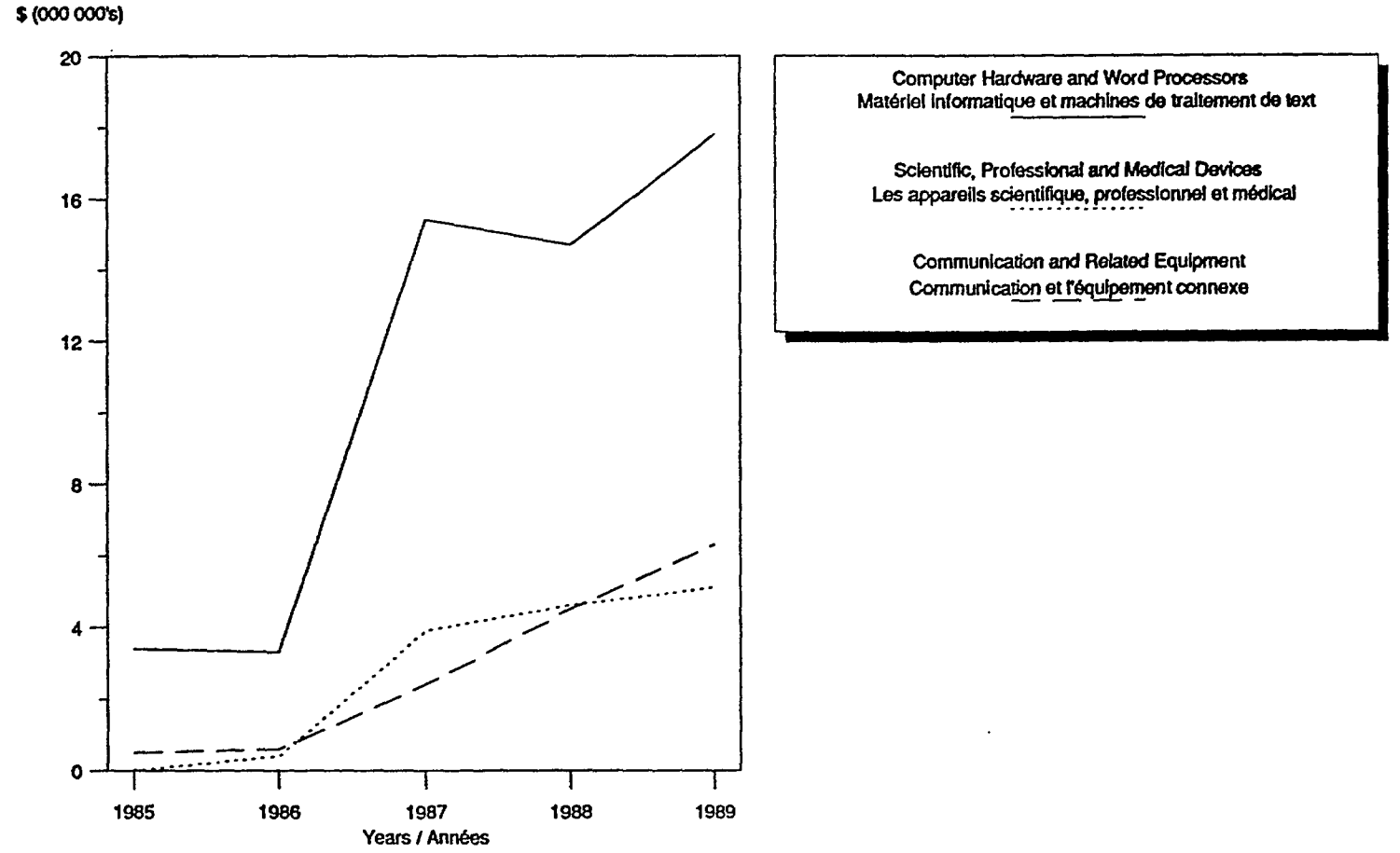


Figure 14

Capital Expenditures on IT Goods in Canada by sector
Dépenses d'immobilisations sur les marchandises TI au Canada par secteur

Manufacturing Sector / Le secteur de fabrication manufacturière

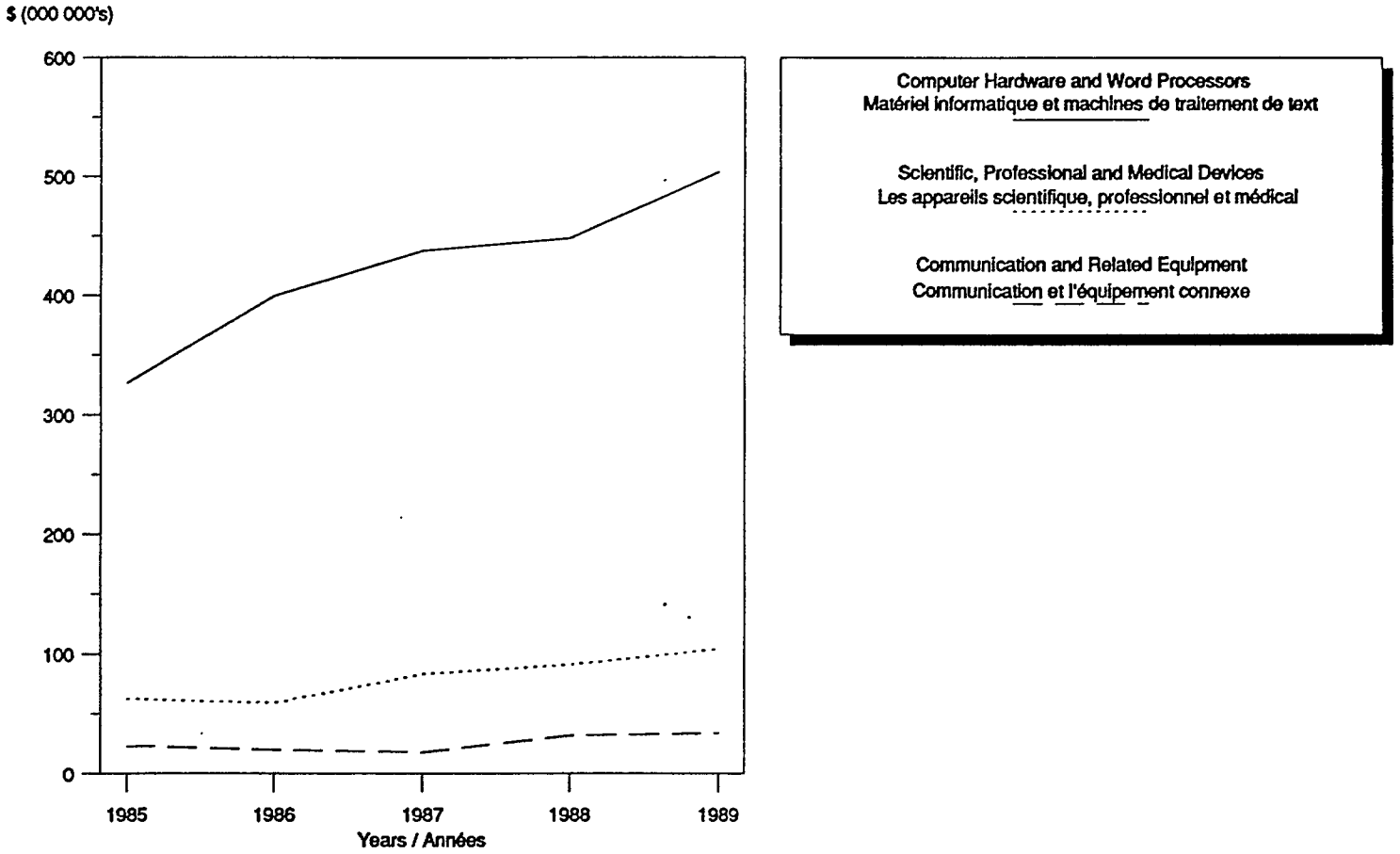


Figure 15

Capital Expenditures on IT Goods in Canada by Sector
Dépenses d'immobilisations sur les marchandises TI au Canada par secteur

Utilities Sector / Le secteur des services public

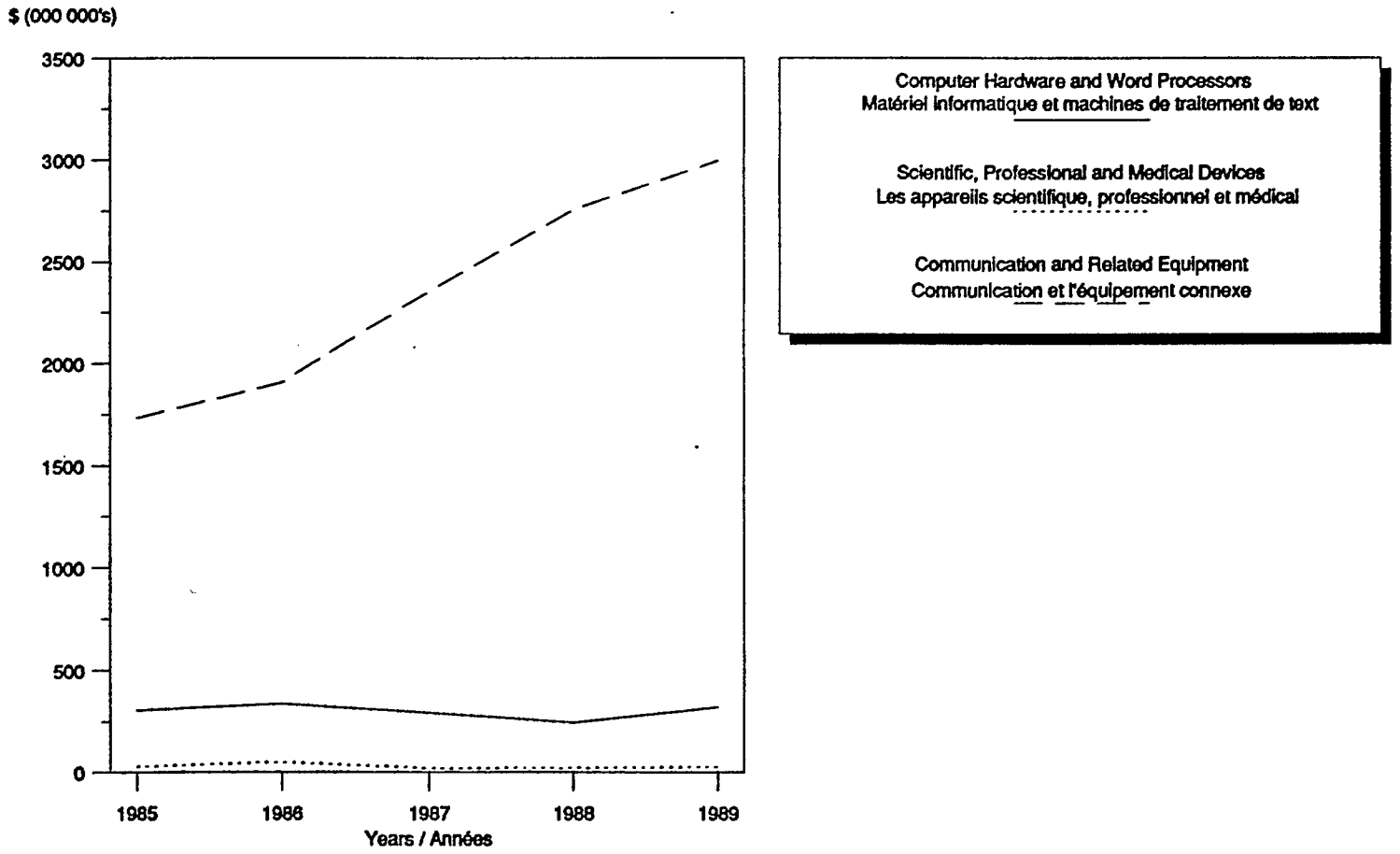


Figure 16

Capital Expenditures on IT Goods in Canada by sector
Dépenses d'immobilisations sur les marchandises TI au Canada par secteur

Trade, Finance and Commercial Sector / Le secteur de commerce, finance et secteur commercial

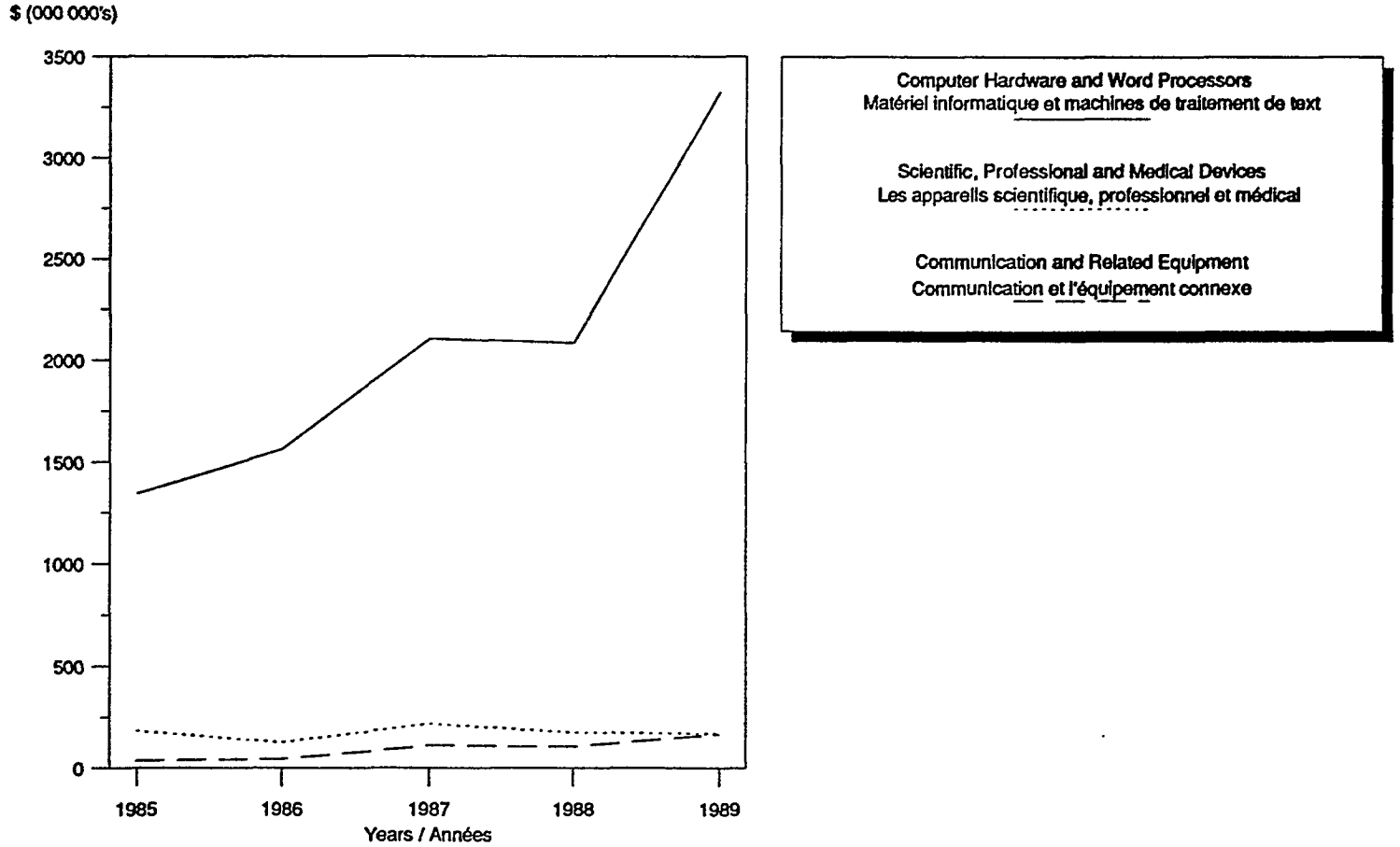


Figure 17

Capital Expenditures on IT goods in Canada by sector
Dépenses d'immobilisations sur les marchandises TI au Canada par secteur

Institutions, Government Departments Sector / Le secteur d'institutions, secteur gouvernementale

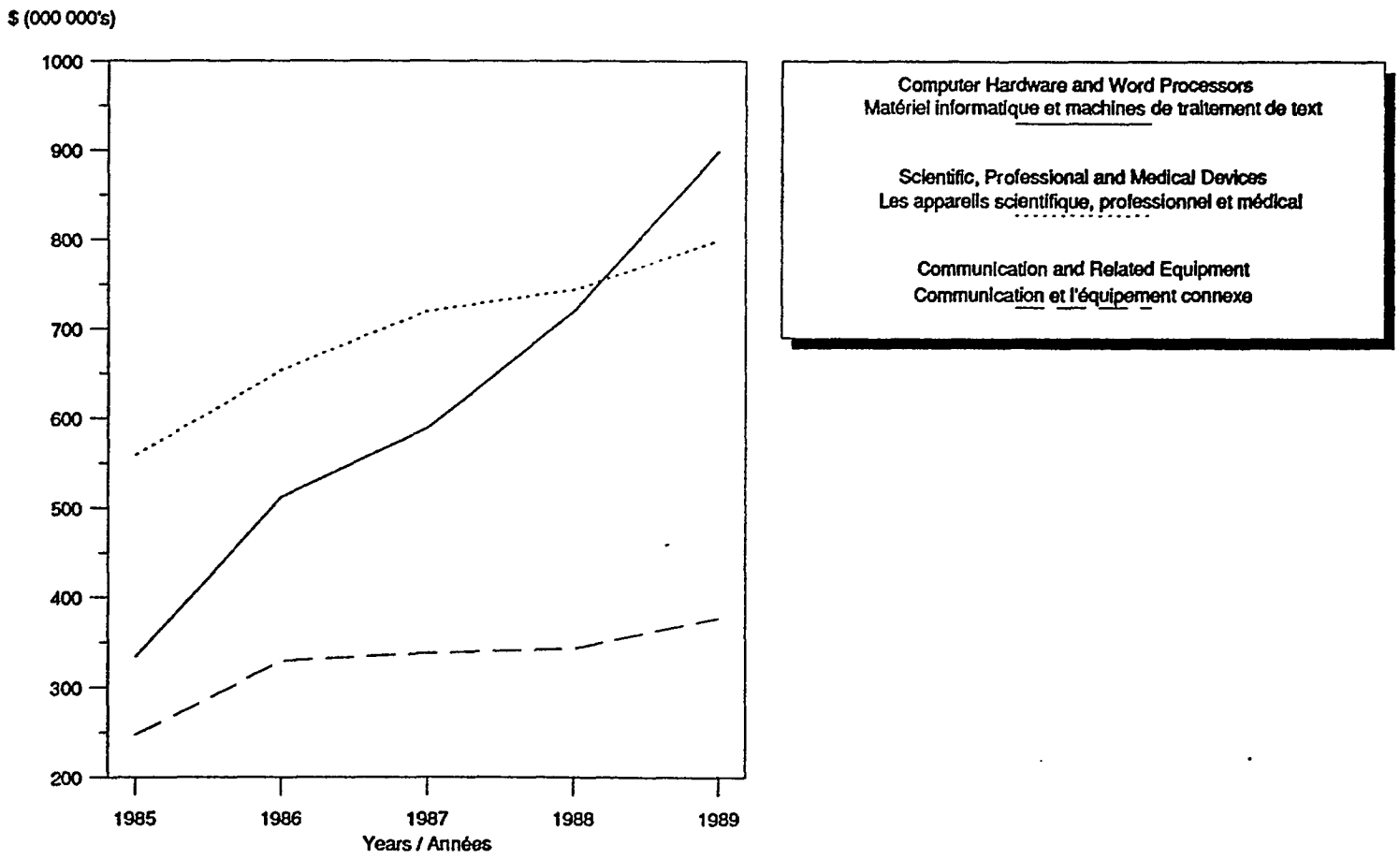


Figure 18

Capital Expenditures on IT Goods in Canada by sector
Dépenses d'immobilisations sur les marchandises TI au Canada par secteur

Grand Total of All Sectors / Grand total des secteurs

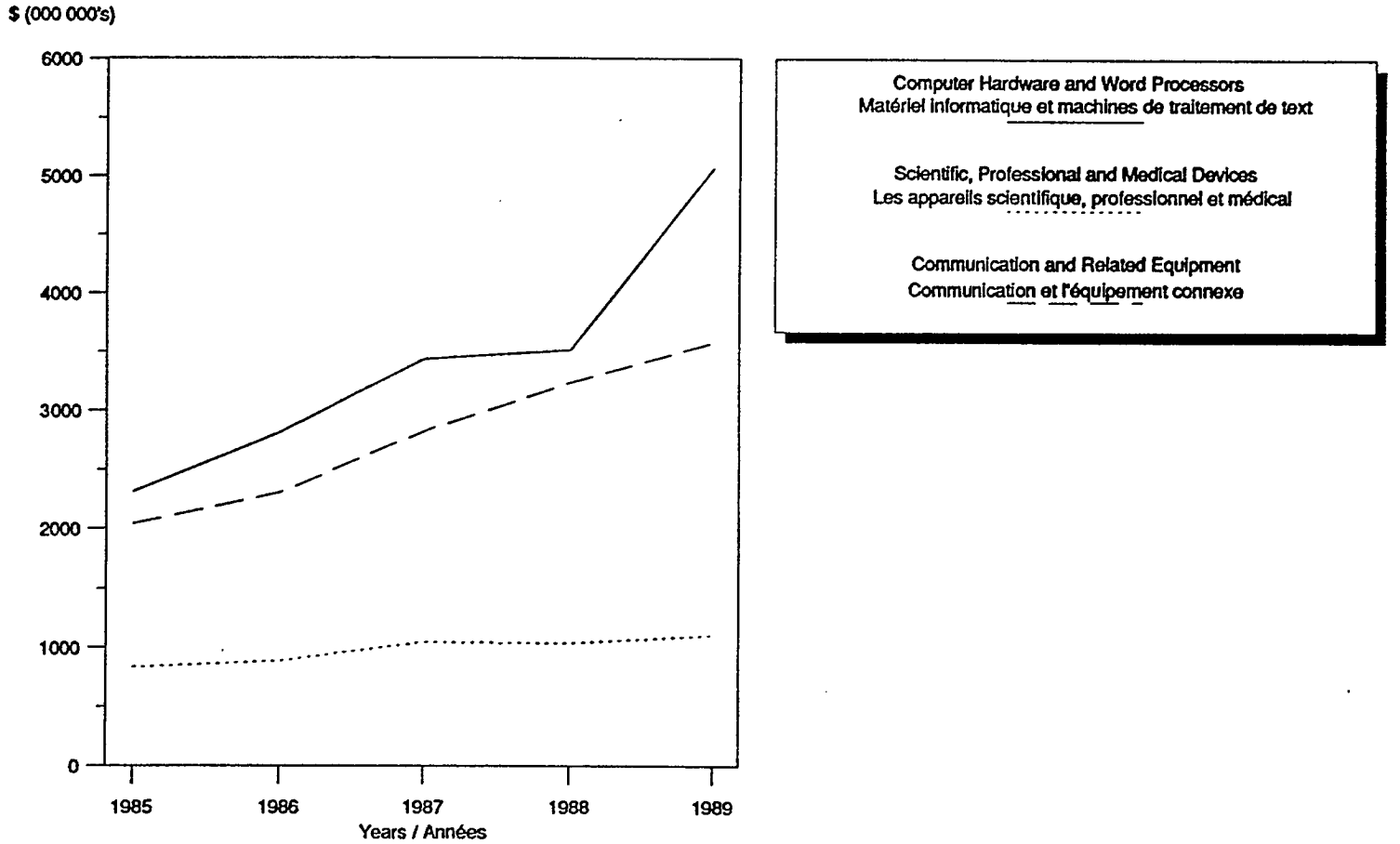


Figure19