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**WORKING PAPER**

**CANADIAN TELECOMMUNICATIONS  
CARRIERS  
AND THEIR SUPPLIERS**

**NATIONAL TELECOMMUNICATIONS BRANCH  
INDUSTRIAL RESOURCES DEVELOPMENT**

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1974

**JUNE, 1974**

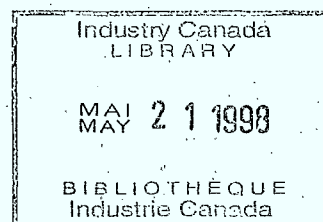


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CANADIAN TELECOMMUNICATIONS CARRIERS AND THEIR SUPPLIERS

A preliminary inquiry into the procurement  
and supply of manufactured hardware to the  
Common Carrier Industry. →

NATIONAL TELECOMMUNICATIONS BRANCH,  
INDUSTRIAL RESOURCES DEVELOPMENT.

JUNE, 1974.

Sur demande, le ministère des Communications vous  
fera volontiers parvenir un exemplaire français.

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## WORKING PAPER

### CANADIAN TELECOMMUNICATIONS CARRIERS AND THEIR SUPPLIERS

#### EXECUTIVE SUMMARY

This Working Paper explores the relationships between Canada's telecommunications common carriers and their suppliers. Forecasts of carrier expenditures provided by the Canadian Telecommunications Carriers Association show that the carriers collectively are the largest procurement group for electronics and communications hardware. This large market is served by a number of indigenous manufacturers, and to a lesser degree by importers of foreign-built hardware. The respective roles of these two supply groups are discussed, and some comparison is made with the relations that exist between carriers and suppliers in other developed countries.

As many of the opinions herein expressed are condensed from the submissions of representatives from various carrier and supplier organizations, this report does not necessarily represent the views of the Department of Communications or of the federal Government, and no commitment for future action should be inferred from this paper.

The paper was not initiated with the objective of reaching a firm set of conclusions, but rather to present in one document an overview of the industry that would serve as a background for discussion between carriers, manufacturers, and governments on matters of common concern. Certain observations have emerged from the inquiry around which discussions will probably focus. These are summarized below.

A domestic manufacturing industry with a solidly-based Canadian research and development capability is a necessity to ensure low-cost telecommunications in Canada. Only in this way can equipment suited to the Canadian environment be designed and manufactured. The decline of a strong Canadian presence in telecommunications research and development, manufacturing and distribution would have a profound effect on the carriers. Equipment costs

would increase, and many other hidden costs associated with compatibility, standardization, documentation, training and premature obsolescence would add to the burden. The carriers would be less flexible in meeting the needs of users, and unable to respond rapidly to new user demands. The inevitable consequences of carrier dependence on foreign technology would be higher prices and a lower grade of service for Canadians.

Canada's telecommunications carriers have been well served by the vertically-integrated manufacturing industry and other specialized manufacturers. Captive markets and North American equipment standards have prevented excessive competition, in consequence the supply industry is less fragmented than most other manufacturing sectors. Unrestricted competition in telecommunications manufacturing would weaken this predominantly Canadian industry resulting eventually in higher equipment prices to the carriers rather than lower, since a fragmented industry cannot perform as efficiently as a lesser number of large integrated operations.

A number of actions have been taken in the United States to weaken the vertical integration structure, including the restriction of the manufacturing arm to certain markets. These initiatives are not appropriate to Canada, where research and development, manufacturing, and carrier operations are on a much smaller scale.

All developed countries have recognized the importance of a strong manufacturing capability in telecommunications, and have taken special measures to support the manufacturing sector. Most telephone systems are owned and operated by the state, and monopoly purchasing power is used to support a limited number of domestic manufacturers. As a consequence, trading in telecommunications equipment between developed countries is limited to a few highly specialized items.



The manufacture of telecommunications equipment is scale-sensitive, and the minimum scale for competitive manufacturing in Canada is rising faster than the domestic market growth. Canadian manufacturers are aware of this fact and are seeking export opportunities. Without expansion of markets, the prices charged to Canadian carriers will eventually be increased, leading to increased imports and a decline in the share of domestic market available to Canadian manufacturers. This trend, once established, is almost impossible to reverse.

Canada's telecommunications carriers have a vital interest in the preservation of a strong and viable manufacturing sector and their views and special requirements must be considered in any review or development of an industrial strategy for the electronics sector.

The domestic market for telecommunications equipment cannot support a large number of manufacturers, therefore a rational distribution of manufacturing activity must be accomplished without encouraging the establishment of new foreign suppliers, which would eventually result in loss of ownership and control.

A dilution of Canadian control in the manufacturing sector, and reduction in R&D activity, would cause the hardware requirements of Canadian carriers to be subordinate to the design and development dictates of larger and more influential markets. Once control of manufacturing, development costs, and the rate of innovation are lost to Canada, the economic consequences will prevent the realization of the full role of communications in the areas of trade, commerce, cultural enrichment and entertainment.



## INTRODUCTION

WORKING PAPER

THE CANADIAN TELECOMMUNICATIONS CARRIERS AND THEIR SUPPLIERS

INTRODUCTION

The Canadian Government regards the whole field of communications in Canada as a key sector that must be subject to effective Canadian control<sup>1/</sup>. The largest component of this sector is represented by the common carriers, members of the Canadian Telecommunications Carriers Association, who provide over 99% of telephone and telegraph service in Canada.

With total construction expenditures around \$1 billion annually, the carriers exert a profound influence on the telecommunications manufacturing industry in Canada. Conversely, the longevity of major items of telephone plant makes the carriers highly sensitive to assured sources of supply.

The purpose of this paper is:

- (a) To explore Canadian common-carrier relationships with suppliers, and to evaluate the past performance of Canadian manufacturers in serving carrier equipment needs.
- (b) To identify factors which affect the viability of Canadian manufacturers, and to assess the possible impact of these factors on carriers and users.

The paper comprises five sections:

Section 1 presents carrier statistics and carrier spending estimates.

Section 2 offers information on major suppliers and presents a condensation of supplier comments.

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<sup>1/</sup> Proposals for a "Communications Policy for Canada" - Green Paper, March 1973.

Section 3 discusses three major product sectors: switching, transmission and terminal equipment.

Section 4 compares carrier/supplier relations in Canada and the United States with those prevailing in other developed countries, and also discusses export opportunities for Canadian manufacturers.

Section 5 presents a review of the factors that have been identified as likely to have a major impact on future carrier/supplier relations in Canada.

Most of the information used to compile this paper has been obtained from in-depth interviews with executives of supplier companies and from detailed spending estimates of the carriers, this latter information being supplied by the Canadian Telecommunications Carriers Association. Supplier sales figures and carrier spending estimates were received in confidence and are therefore aggregated in the body of the report.

The paper is not intended as a trade directory, but deals with the industry in total. Every effort has been made to include all industry comments, but obviously some editing was necessary and doubtless many small companies have been excluded from the survey of manufacturers.

The authors are grateful for the whole-hearted cooperation of executives of the supply industry, Canadian manufacturers and foreign-owned subsidiaries operating in Canada, all of whom gave very freely of their time and opinions. An impressive amount of corporate and product information, much of it confidential, was made available to our interviewers.

The cooperation of the Canadian Telecommunications Carriers Association, in collecting details of past and future construction expenditures from member carriers is also gratefully acknowledged.

As so many of the opinions herein expressed are condensed from the submissions of representatives from various carrier and supplier organiza-

tions, this report does not necessarily represent the views of the Department of Communications or of the federal Government, and no commitment for future action should be inferred from this paper.

This report is to be considered as a background working paper and no effort has been made to edit it for uniformity of terminology with other studies.

## 1. THE CARRIERS

### Page

#### I. Profile of the Carriers

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#### II. Carrier Construction Expenditures

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## SECTION 1 : THE CARRIERS

### I. PROFILE OF THE CARRIERS

Canada's telecommunications needs are served by two distinctive telecommunications groups, the telephone companies and the telegraph companies, together with COTC and Telesat, who provide overseas and domestic satellite service respectively. The major individual companies are members of the Canadian Telecommunications Carriers Association (CTCA). This Association has twenty-three members, providing more than 99% of all telephone and telegraph service in Canada.

The combined gross plant of CTCA members exceeds \$8.6 billion, and annual revenues in 1972 were over \$2 billion. Revenues of the two major telegraph carriers, CN Telecommunications and CP Telecommunications totalled \$116 million in 1972, less than 6% of total industry revenues. Prior to World War II, these two companies provided public telegraph service and served the communications needs of the parent railways. From August 1, 1947 there has been a progressive pooling of CN and CP telecommunication operations, including development of new services such as Telex, Broadband and Infodat, and in construction of a jointly-owned transcontinental microwave system. CN/CP Telecommunications have competed for many years with the telephone company organization, Trans-Canada Telephone System (TCTS), in the provision of private wire services, and this competition is intensifying in the rapidly evolving area of data-communications, which CN/CP view as a natural extension of their message record activities. Combined total dollar purchases of teleprinter, telex subscriber, electronic transmission and switching equipment by CN and CP for the year 1972 were about \$26 million, or less than 3% of total industry expenditures, therefore in the discussion that follows the equipment requirements of the telephone carriers predominate.

Major statistics of CTCA members have been grouped as follows:

	<u>Total Canada Telephones</u> %
A. Bell Canada and Subsidiaries	
Bell Canada	61.4
Bell Subsidiaries	8.2
B. GTE Subsidiaries	
British Columbia Telephone Co.	10.1
Other Subsidiaries	2.2
C. Government-Owned Systems	
Provincial	13.1
Municipal	2.7
D. Other Carriers	
CN Telecommunications	0.5
CP Telecommunications	
COTC	
Telesat	
E. Total CTCA	99.2 <sup>1/</sup>

The structure of the Canadian carriers is characterized by private ownership. The eastern half of the country from the Atlantic through Ontario, representing about 70% of the population and telephones, is almost entirely served by Bell Canada and its subsidiaries. On the West Coast about 10% of the population and telephones is served by the British Columbia Telephone Company; 80% of the population is served by these two companies. Bell is 97% Canadian-owned, whereas B.C. Telephone is 51% owned by the Anglo-Canadian Telephone Company,

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<sup>1/</sup> Includes 1.1% for the Canadian Independent Telephone Association, a member of CTCA representing the Independent Telephone Systems of Ontario and Quebec.



a Canadian subsidiary of General Telephone and Electronics Corporation (GTE) New York. GTE controls the largest non-Bell telephone system in the United States, about equal in telephones to all of Canada. As is common in the North American industry, these operating companies are vertically integrated with R&D and manufacturing companies.

The public sector constitutes less than 20% of population and telephones; served by three provincial systems and one municipal system in the Prairie Provinces, and by CN Telecommunications in the Yukon and the Northwest Territories. (CN Telecommunications also operates in Newfoundland and northern British Columbia). Total telephones in Canada were about 11 million in 1972.

As mentioned, CTCA includes CN Telecommunications, CP Telecommunications, COTC and Telesat Canada in addition to the telephone companies. CN/CP<sup>2</sup>/ offer voice, video and data communication services, both switched and private wire, in competition with the telephone companies. COTC is an international carrier providing links to foreign countries except the United States. Telesat Canada provides domestic satellite service to the CTCA carriers and the Canadian Broadcasting Corporation, in wholesale blocks of 960 one-way voice channels (one RF channel).

A statistical profile of the various groups within CTCA is contained on the following pages. The information contained there has been gathered from company annual reports, Statistics Canada publications, and in a few instances, conversations with individual carriers.

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<sup>2</sup>/ CN/CP Telecommunications is a consortium of CNT and CPT.

CARRIER PROFILE (CTCA) - 1972

GROUP A : Bell Canada and Subsidiaries

A.1 Bell Canada

Operating Area	Ontario, Quebec	% Total Canada
Population	13,961 K	63.5
Telephones	6,742 K	61.4
Employees	37,993	47.4
Cost of Plant	\$ 4,677 M	54.1
Operating Revenues	\$ 1,125 M	55.3
Construction Expenditures	\$ 492 M	49.5

Remarks

- incorporated company: 97% Canadian owned  
2% AT&T interest (common equity only).
- dominant in the industry by virtue of its size and vertical integration.
- by far the largest operating company.
- operating subsidiaries and majority owned affiliates provide service in Newfoundland, Nova Scotia, Prince Edward Island and New Brunswick.
- vertically integrated with R&D (Bell-Northern Research) and manufacturing (Northern Electric Company, Micro-systems International).
- federally incorporated and regulated (Canadian Transport Commission).
- also operates in NWT and Labrador, but plans to sell its Labrador holdings to Newfoundland Telephone Co.

A.2 Newfoundland Telephone Co. Ltd.

Operating Area	Newfoundland	% Total Canada
Population	537 K	2.4
Telephones	110 K	1.0
Employees	939	1.2
Cost of Plant	\$ 79 M	.9
Operating Revenues	\$ 22 M	1.1
Construction Expenditures	\$ 11 M	1.1

Remarks

- incorporated company, 99.7% owned by Bell Canada.
- provincially incorporated and regulated (Newfoundland Board of Commissioners of Public Utilities).

A.3 Maritime Telegraph & Telephone Co. Ltd.

Operating Area	Nova Scotia	% Total Canada
Population	802 K	3.7
Telephones	324 K	3.0
Employees	2,898	3.6
Cost of Plant	\$ 227 M	2.6
Operating Revenues	\$ 55 M	2.7
Construction Expenditures	\$ 25 M	2.5

Remarks

- incorporated company, 52.2% owned by Bell Canada without control (voting limited to 1000 shares).
- provincially incorporated and regulated (Nova Scotia Board of Commissioners of Public Utilities).

A.4 Island Telephone Co.

Operating Area	Prince Edward Island	<u>% Total Canada</u>
Population	114 K	0.5
Telephones	39 K	0.3
Employees	225	0.3
Cost of Plant	\$ 23 M	0.3
Operating Revenues	5 M	0.3
Construction Expenditures	\$ 3 M	0.3

Remarks

- incorporated company, 52.7% owned by Maritime Telegraph & Telephone Co. Ltd.
- provincially incorporated and regulated (Prince Edward Island Public Utilities Commission).

A.5 New Brunswick Telephone Co. Ltd.

Operating Area	New Brunswick	<u>% Total Canada</u>
Population	648 K	3.0
Telephones	261 K	2.4
Employees	2,245	2.8
Cost of Plant	\$ 202 M	2.3
Operating Revenues	\$ 50 M	2.5
Construction Expenditures	\$ 23 M	2.3

Remarks

- incorporated company, 50.5% owned by Bell Canada.
- provincially incorporated and regulated (New Brunswick Board of Commissioners of Public Utilities).

A.6 Northern Telephone Ltd.

Operating Area	Northern Ontario	<u>% Total Canada</u>
Population		
Telephones	52 K	0.5
Employees	361	0.5
Cost of Plant	\$ 24 M	0.3
Operating Revenues	\$ 5 M	0.3
Construction Expenditures	\$ 2 M	0.2

Remarks

- incorporated company, 90.8% owned by Bell Canada.
- provincially incorporated and regulated (Ontario Telephone Service Commission).

A.7 Téléphone du Nord de Quebec Inc.

Operating Area	Northwestern Quebec	<u>% Total Canada</u>
Population		
Telephones	57 K	0.5
Employees	285	0.4
Cost of Plant	\$ 43 M	0.5
Operating Revenues	\$ 10 M	0.5
Construction Expenditures	\$ 5 M	0.5

Remarks

- incorporated company, 100% owned by Northern Telephone Co.
- provincially incorporated and regulated (Quebec Public Service Board).

A.8 Télébec Ltée

Operating Area	Central Quebec	<u>% Total Canada</u>
Population		
Telephones	40 K	0.4
Employees	186	0.2
Cost of Plant	\$ 28 M	0.3
Operating Revenues	\$ 5 M	0.3
Construction Expenditures	\$ 3 M	0.3

Remarks

- incorporated company, 95.1% owned by Bell Canada.
- provincially incorporated and regulated (Quebec Public Service Board).

GROUP B : GTE Subsidiaries

B.1 British Columbia Telephone Company

Operating Area	British Columbia	% Total Canada
Population	2,291 K	10.4
Telephones	1,114 K	10.1
Employees	10,107	12.6
Cost of Plant	\$ 911 M	10.5
Operating Revenues	\$ 224 M	11.0
Construction Expenditures	\$ 130 M*	13.1

Remarks

- incorporated company, 50.7% owned by The Anglo-Canadian Telephone Co., a Quebec subsidiary of General Telephone and Electronics Corporation, New York.
- second largest operating company, about 1/6 of Bell Canada in telephones.
- corporate association through GTE with R&D and manufacturing. GTE manufacturers in Canada are Automatic Electric Co., Brockville, Ontario and Lenkurt Electric Co., Burnaby, B.C., who have R&D responsibility for certain products.
- federally incorporated and regulated (Canadian Transport Commission).

\* Includes Okanagan Telephone Co. (B.2) a wholly-owned subsidiary of British Columbia Telephone Co.



B.2 Okanagan Telephone Co.

Operating Area	South Central B.C.	<u>% Total Canada</u>
Population		
Telephones	67 K	0.6
Employees	559	0.7
Cost of Plant	\$ 43 M	0.5
Operating Revenues	\$ 9 M	0.4
Construction Expenditures	\$ (1)	(1)

Remarks

- incorporated company, 99.9% owned by B.C. Tel.
  - provincially incorporated and regulated (British Columbia Public Utilities Commission).
- (1) Included with British Columbia Telephone Company.

B.3 Quebec Téléphone

Operating Area	Eastern Quebec	<u>% Total Canada</u>
Population		
Telephones	177 K	1.6
Employees	1,611	2.0
Cost of Plant	\$ 161 M	1.9
Operating Revenues	\$ 37 M	1.8
Construction Expenditures	\$ 17 M	1.7

Remarks

- incorporated company, 56.75% owned by The Anglo-Canadian Telephone Co.
- provincially incorporated and regulated (Quebec Public Service Board).

GROUP C : Government-owned Systems

C.1 Manitoba Telephone System

Operating Area	Manitoba	<u>% Total Canada</u>
Population	993 K	4.5
Telephonea	481 K	4.4
Employees	3,979	5.0
Cost of Plant	\$ 347 M	4.0
Operating Revenues	\$ 69 M	3.4
Construction Expenditures	\$ 37 M	3.7

Remarks

- provincial system regulated by Manitoba Public Utilities Board.

C.2 Saskatchewan Telecommunications

Operating Area	Saskatchewan	<u>% Total Canada</u>
Population	910 K	4.1
Telephones	345 K	3.1
Employees	2,614	3.3
Cost of Plant	\$ 258 M	3.0
Operating Revenues	\$ 60 M	3.0
Construction Expenditures	\$ 23 M	2.3

Remarks

- provincial system regulated by a Cabinet appointed Board of Directors, the Minister of Telephones and a standing committee of the Saskatchewan Legislature.

C.3 Alberta Government Telephones

Operating Area	Alberta	<u>% Total Canada</u>
Population	1,671 K	7.6
Telephones	615 K	5.6
Employees	6,908	8.6
Cost of Plant	\$ 676 M	7.8
Operating Revenues	\$ 141 M	6.9
Construction Expenditures	\$ 84 M	8.5

Remarks

- provincial system regulated by the Alberta Public Utilities Board.

C.4 edmonton telephones

Operating Area	Edmonton	<u>% Total Canada</u>
Population		
Telephones	241 K	2.2
Employees	870	1.1
Cost of Plant	\$ 113 M	1.3
Operating Revenues	\$ 24 M	1.2
Construction Expenditures	\$ 13 M	1.3

Remarks

- municipal system regulated by elected representatives of the City of Edmonton.

C.5 Thunder Bay Telephone Dept.

Operating Area	Thunder Bay, Ont.	<u>% Total Canada</u>
Population		
Telephones	57 K	0.5
Employees	124	0.2
Cost of Plant	\$ 23 M	0.3
Operating Revenues	\$ 4 M	0.2
Construction Expenditures	\$ 2 M	0.2

Remarks

- municipal system regulated by Ontario Telephone Service Commission.

C.6 Ontario Northland Communications

Operating Area	Northern Ontario	<u>% Total Canada</u>
Population		
Telephones	2 K	-
Employees	280	0.3
Cost of Plant	\$ 23 M	0.3
Operating Revenues	\$ 6 M	0.3
Construction Expenditures	\$ 1 M	0.1

Remarks

- provincial system formerly regulated by the Canadian Transport Commission. Quebec properties sold to Téléphone du Nord de Quebec (A.7) and self regulated as of January, 1973. Regulation by Ontario Telephone Service Commission is under study.

GROUP D : Other Telecommunications Carriers

D.1 CN/CP Telecommunications

		<u>% Total Canada</u>
(a) CN Telecommunications		
Operating Area		
Telephones - Nfld., Yukon, NWT, Northern B.C., Other Telecom- munications - Canada		
Telephones	56 K	0.5
Employees	4,174	5.2
Cost of Plant	\$ 339 M	3.9
Operating Revenues	\$ 75 M	3.7
Construction Expenditures	\$ 21 M	2.1
(b) CP Telecommunications		
Operating Area		
Telephone - nil Other Telecommunications - Canada		
Telephones	-	
Employees	2,188	2.7
Cost of Plant	\$ 139 M	1.6
Operating Revenues	\$ 41 M	2.0
Construction Expenditures	\$ 5 M*	0.5

Remarks

- not separately incorporated. A consortium of the telecommunication departments of CNR (a federal Crown Corporation) and CPR (an incorporated company).
- regulated by the Canadian Transport Commission.
- costs and revenues are shared equally, except for services provided by only one member of the consortium, notably telephone service by CNT.

\* Estimate.

D.2 Canadian Overseas Telecommunication Corporation

Operating Area	Overseas	<u>% Total Canada</u>
Telephones		
Employees	778	1.0
Cost of Plant	\$ 154 M	1.8
Operating Revenues	\$ 44 M	2.2
Construction Expenditures	\$ 38 M	3.8

Remarks

- provides overseas circuits to most parts of the world other than the U.S., via submarine cable, HF radio and satellite.
- federal Crown corporation regulated by Canadian Transport Commission.

D.3 Telesat Canada

Operating Area		<u>% Total Canada</u>
Telephones		
Employees	212	0.3
Cost of Plant	\$ 75 M	0.9
Operating Revenues	\$ —	—
Construction Expenditures	\$ 37 M	3.7

Remarks

- incorporated company, founded in 1969, jointly owned by the Government of Canada, 13 approved telecommunication carriers and ultimately the public.
- provides domestic satellite service.
- no regulatory review at present.

GROUP E : CTCA

	<u>Total CTCA</u>	<u>Total Canada</u>	<u>% CTCA Total Canada</u>
Telephones	10,901 K	10,987 K	99.2
Employees	79,966	80,206	99.7
Cost of Plant	\$ 8,616 M	\$ 8,641 M	99.7
Operating Revenues	\$ 2,026 M	\$ 2,035 M	99.6
Construction Expenditures	\$ 989 M	994 M	99.5

Remarks

- CTCA includes the Canadian Independent Telephone Association, an association of independent (non-Bell) telephone systems in Ontario and Quebec. Quebec Téléphone, the Thunder Bay Telephone Dept. and Ontario Northland Communications, who are individual members of CTCA, are shown in B.3, C.5 and C.6. The other non-Bell systems in the two provinces accounted for 121,000 telephones in 1972 or 1.1% of total Canada. These telephones are included in the CTCA total.
- CTCA also includes the Trans-Canada Telephone System, an organization which administers the toll network.



## SECTION 1 : THE CARRIERS

### II. CARRIER CONSTRUCTION EXPENDITURES

Without question the carriers are the significant demand factor in the market<sup>1/</sup> for telecommunications equipment in Canada. In 1973 their purchases amounted to \$1 billion and by 1980 should rise to \$2 billion. This is the conclusion reached from a CTCA tabulation of actual expenditures for 1967-72 and projected expenditures to 1976. An uncertainty is introduced by the future development of data communications, expected to be large but not reflected in the CTCA forecast. Under these circumstances the \$2 billion level of expenditures in 1980 may be taken as conservative.

The CTCA data are presented in five charts to portray the main sectors of the market. Land, buildings and sundry items such as motor vehicles and tools are excluded, so that the 'construction expenditure' of the charts is somewhat lower than the corresponding figure in the carrier annual reports. In general all CTCA carriers are represented except Telesat, which had specialized and non-recurring expenditures for satellite equipment in the years 1971-73, amounting to about \$100 million in total. As a further caution it may be noted that Charts II-2 to II-5 added together are slightly less than the material component of Chart II-1, a discrepancy caused by the lack of detailed information in a few cases. The charts are based on the standard classification of accounts used by the carriers, which does not permit a complete analysis of construction expenditures. It is hoped to remedy this defect in future discussions with the carriers.

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<sup>1/</sup> The telecommunications market here defined excludes radar, navigational equipment, television/radio broadcast and home receivers, and Community Antenna Television (CATV). The cost of installation labour is included.

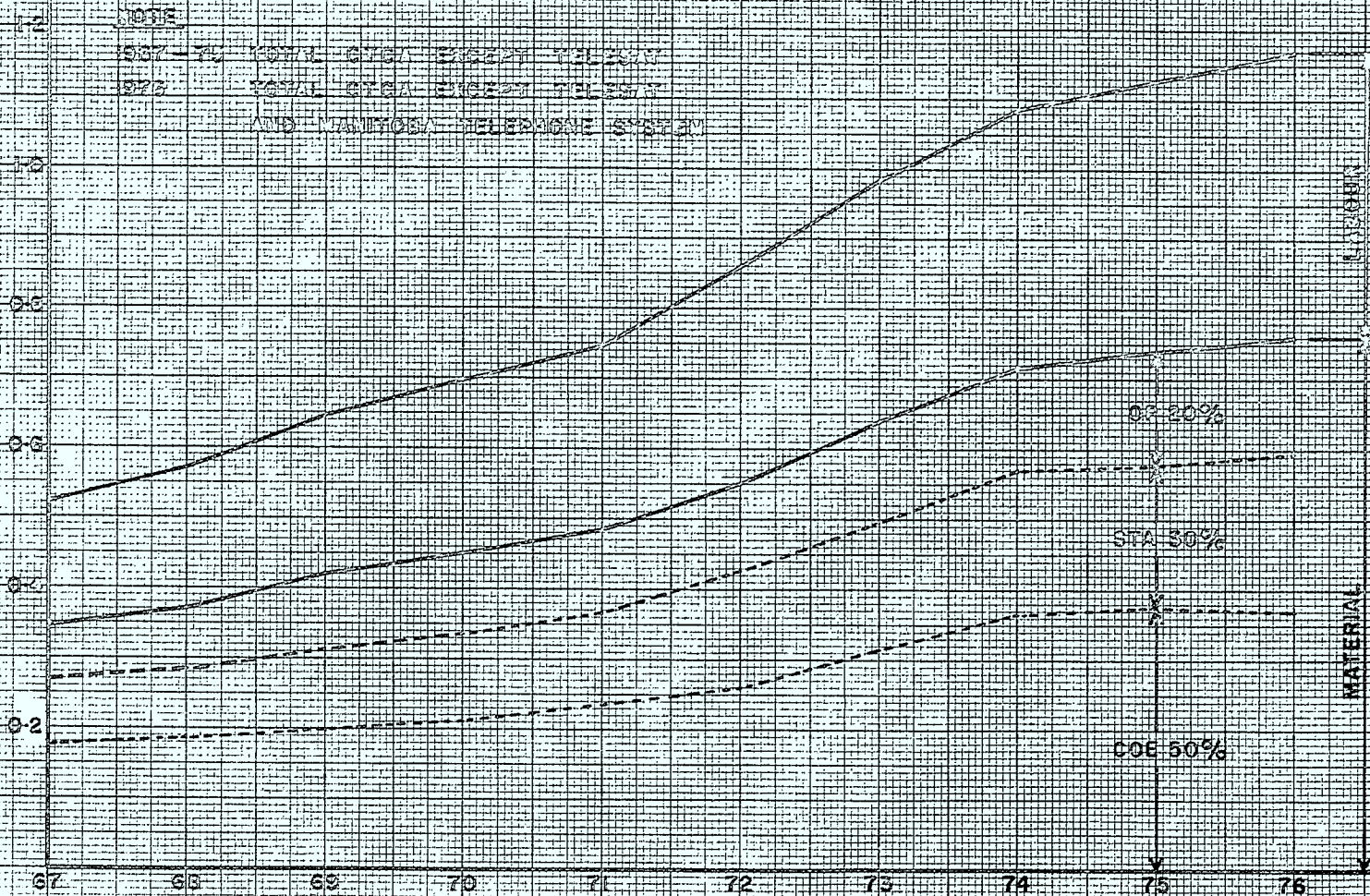
Not obvious from the charts is the annual growth of construction expenditures, varying from 7% to 15% for the period 1967-74 in accordance with business conditions. An average growth of 10% per year is representative of all plant categories - Central Office Equipment, Station (Terminal) Equipment and Outside Plant. The low growth indicated for 1975-76 does not agree with previous years and probably results from the tendency to underestimate when extrapolating beyond known construction projects.

# ESTIMATING CONSTRUCTION EXPENDITURES

NOTE:  
537 - TOTAL COST OVER 20227 TELEPHONE  
572 - TOTAL COST EXCEPT TELEPHONE  
AND MANHOLE TELEPHONE SYSTEM

CONSTRUCTION EXPENDITURES  
NOT IN \$

LABOR  
1/3  
MATERIAL  
2/3



YEAR



CHART II-1

TOTAL CONSTRUCTION EXPENDITURES

Chart II-1 shows material, labour and total construction expenditures of the CTCA carriers except Telesat Canada for the period 1967-76. Labour consists of the engineering, plant, traffic and installation activities associated with the construction project, performed by either carrier or outside contractor. Over the years labour has been constant at one-third of total expenditures, but the proportion varies by type of equipment being highest (80%) in labour intensive plant such as underground conduit and lowest (20%) in electronic equipment of plug-in design. In future the trend to electronic designs will reduce labour costs in relation to material but not necessarily in absolute terms.

The material component of expenditures represents sales of the manufacturing industry to the carriers, forecast at \$715 million in 1974, of which 50% is devoted to Central Office Equipment (COE), 30% to Station (Terminal) Equipment and 20% to Outside Plant. This relationship has been stable since 1967, but the advent of electronic gear should lower the proportion of Outside Plant in future years. Interest charges during construction and reused material, amounting to 3% of material expenditures, are ignored since they are less than the error of estimate.

Total construction expenditures have doubled from \$0.5 billion in 1967 to \$1.0 billion in 1973, a period of six years, and on the same basis should redouble to \$2.0 billion in 1980. As noted, a rapid growth in data communications would be additional to this figure since it is not reflected in the CTCA forecast. The estimated expenditures for 1974 are as follows:

Material

COE - Switching	\$215 million
- Radio & Circuit	150 million
Station (Terminal) Equipment	200 million
Outside Plant	150 million

Total \$715 million

Installation 370 million

Total Construction Expenditure \$1,085 million

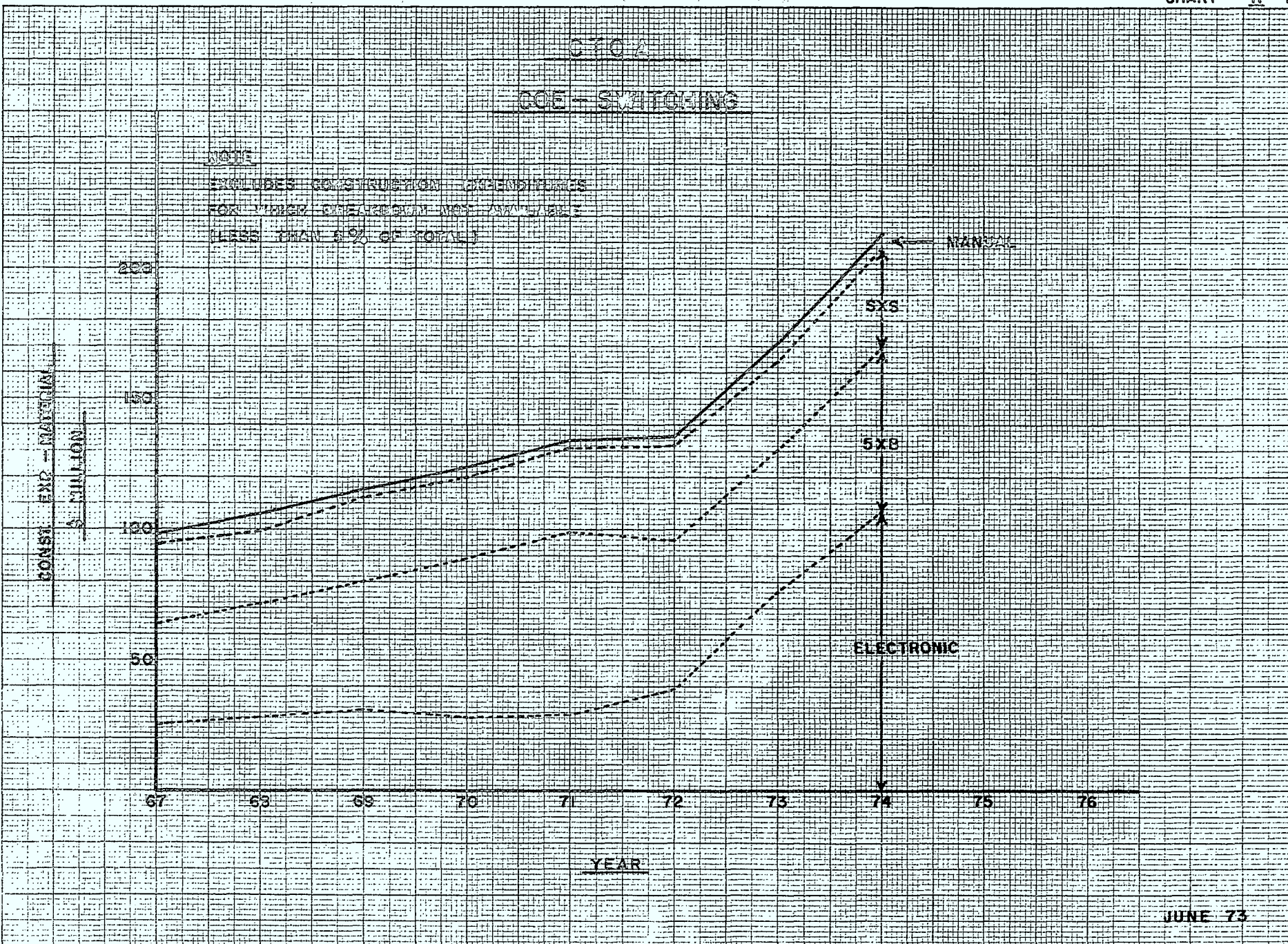


CHART II-2

COE - SWITCHING

COE-Switching is of particular interest because of the rapid increase in electronic systems, which have tripled in three years to a level of \$100 million in 1974, one-half of the total switching expenditure. Crossbar procurement has declined slightly and step-by-step not at all, indicating a continuing future for these electro-mechanical systems in spite of obsolescence. Projections are made difficult by the steep rise in total switching expenditures, 25% annually in 1973 and 1974, caused by the expansion of electronic systems. Assuming the more usual growth rate of 10% per year and a steady demand for electro-mechanical equipment, the market in 1980 would be \$250 million electronic, \$70 million crossbar and \$30 million step-by-step, in all a total of \$350 million.



COE - CIRCUIT 3, RADIO

NOTE:  
EXCLUDES OF REVISION ESTIMATES  
FOR WHICH THE ABOVE COST AVAILABLE  
LESS THAN 5% OF TOTAL

CONST. AND MATERIAL  
\$ MILLION

200  
150  
100  
50

67 68 69 70 71 72 73 74 75 76

YEAR

RADIO  
CIRCUIT

JUNE 73

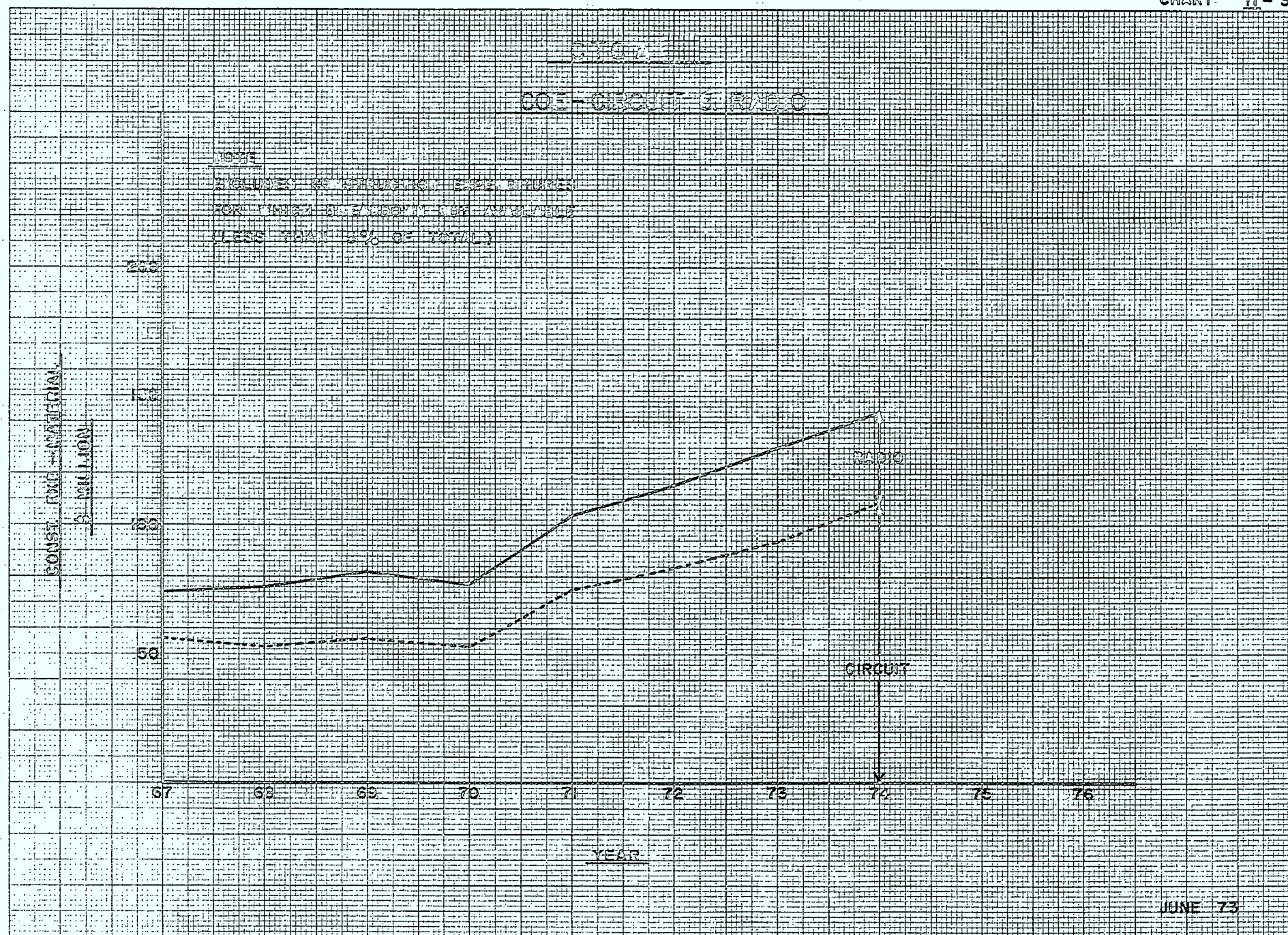




CHART II-3

COE - CIRCUIT AND RADIO

COE-Radio consists primarily of microwave equipment, but Circuit includes a variety of transmission equipment - analog multiplex, digital multiplex, cable carrier systems and voice frequency terminal equipment to name a few. Total expenditures have increased steadily to a level of \$150 million in 1974 of which 25% is radio. 1970 was an exception to the trend and evidently a bad year for radio and multiplex.

# STATION EQUIPMENT

NOTE:  
EXCLUDES CONSTRUCTION EXPENDITURES  
FOR WHICH SPECIAL INVESTIGATION  
LESS THAN 5% OF TOTAL

CONST. EXP. NATIONAL  
IN MILLIONS

200  
150  
100  
50  
0

67 68 69 70 71 72 73 74 75 76

YEAR

RADIO TELEPHONE  
TELETYPE  
SEA. COMM. UTILITY  
LARGE PBX  
SMALL PBX, KEY SYSTEMS  
TELEPHONE SETS, MISG.

CHART II-4

STATION EQUIPMENT

More than half of Station Equipment is represented by Private Branch Exchanges (PBX), key systems, telephone sets and the associated connection material, mainly house wiring and terminals. Teletype has grown to \$20 million in 1974 because of the expected demand in new services such as Infodat and Dataroute, and the use of electronic terminals more expensive than the electro-mechanical teletypewriter. Radio-telephone refers to carrier-owned equipment on customer premises, mainly mobile stations; carrier-owned base stations for mobile and point-to-point service are generally on company premises and included with COE-Radio. At \$5 million annually radio-telephone is small in relation to total station equipment, \$190 million in 1974.



CTCA

OUTSIDE PLANT

NOTE

INCLUDES CONSTRUCTION EXPENDITURES  
FOR WHICH BREAKDOWN NOT AVAILABLE  
(LESS THAN 5% OF TOTAL)

CONST. EXP. - MATERIAL  
\$ MILLION

200

150

100

50

67

68

69

70

71

72

73

74

75

76

YEAR

OTHER - POLES, UG CONDUIT  
SUSPENDING CABLE, AERIAL WIRE  
BURIED CABLE  
UG CABLE  
AERIAL CABLE

JUNE 73

CHART II-5

OUTSIDE PLANT

Outside Plant expenditures by type of plant are available until 1971 only. Projected they reach \$145 million in 1974, consisting mainly of buried/underground/aerial cable (80%) with the remainder in poles, underground conduit, submarine cable and a small quantity of open wire. The major application of cable is to provide a physical voice circuit over a pair of wires from Central Office to subscriber, still the dominant mode of transmission in loop plant.

## 2. SUPPLIERS

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## SECTION 2 : SUPPLIERS

### I. INTRODUCTION

The telecommunications manufacturing industry in Canada consists of about 235 companies, many of which supply equipment to Canadian common carriers. 64% of the total manufacturing activity is located in Ontario, 22% in Quebec, 7% in British Columbia, and the remaining 7% in other parts of Canada.

The industry is dominated by the Northern Electric Company and to a lesser degree by two GTE companies, Automatic Electric and Lenkurt Electric. These companies have strong corporate ties with common carriers, and supply practically all the equipment required by their associated operating companies, from switching machines to station equipment located on the subscriber's premises. Together they account for an estimated 75% of the Canadian domestic market.

The remainder of the Canadian common carrier market is supplied by smaller Canadian manufacturers, by Canadian subsidiary plants of large foreign-owned multinational firms, and by importation of equipment from U.S., European and Japanese sources.

In this paper such items as ownership, products, future developments and profitability were considered but were not documented by companies. The intent was to present an overview of the industry rather than a detailed description of each company.

Suppliers are discussed under four headings as follows:

- II. Northern Electric Company
- III. GTE-Automatic Electric-Lenkurt Electric
- IV. Other Manufacturers
- V. Importers and Foreign Subsidiaries

## SECTION 2 : SUPPLIERS

### II. NORTHERN ELECTRIC

The Northern Electric Company, a subsidiary of Bell Canada, is the largest manufacturer of telecommunications equipment in Canada, with almost ten times the sales volume of its nearest competitor. Manufacture of telephone equipment in Canada began with the production of telephone sets at Brantford, Ontario in 1878. This was followed in 1882 by the formation of the Mechanical Department of Bell Canada, later to become the Northern Electric and Manufacturing Company in 1895. Separate cable manufacturing companies were established in 1899 and 1911, the Wire and Cable Company and Imperial Wire and Cable Company respectively. Bell Canada initially held up to 90% ownership of all the subsidiaries, but at various dates in the early 1900s up to a 40% interest in each of the subsidiaries was sold to Western Electric Company in the U.S., in order to provide more working capital. In 1914, the subsidiaries were amalgamated to form Northern Electric Co. Ltd. Bell Canada retained majority interest in the new firm, and Western Electric held a 44% interest.

From the beginning, Northern and its predecessors produced equipment designed in the U.S. by Western Electric, using their manufacturing information. Northern's dependency on imported technology can best be explained by quoting from a speech given to the Canadian Manufacturers' Association in June, 1972 by Mr. V.O. Marquez, then Chairman of the Board of Northern Electric<sup>1/</sup>:

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<sup>1/</sup> "Building an Innovative Organization", an address by Mr. Marquez to the Canadian Manufacturers' Association, June 1972. An instructive parallel between Northern and L.M. Ericsson, Sweden, is presented.



"During the years of early development ..... Northern, in the classic Canadian fashion, secured its designs from a U.S. source of telephone technology and concentrated on manufacturing these U.S. designs in Canada to serve the Bell Telephone Company of Canada and the rest of the Canadian market. Although the telephone had been invented in Canada ... by our reasoning, it was clearly simpler and more economical for a Canadian manufacturer, like Northern, to make use of U.S. designs (rather) than to generate domestic designs of its own."

This imported technology, together with the technical, operational, and administrative information supplied by the American Telephone and Telegraph (AT&T) Company to Bell Canada by means of a Service Agreement, provided the basis for the excellent telephone service that exists in Canada today. Northern was assured full access to the results of a continuous and successful research and development program without risk and at minimum cost. This seemingly idyllic situation would probably have endured until the present day, but, as Mr. Marquez continued:

".... in 1956, the roof fell in on Northern Electric. A severe and sudden change in Northern's technical environment, quite beyond the company's control, but exemplifying the kind of 'catastrophe' which any Canadian manufacturer might have to face today, took place. A dispute between the U.S. Department of Justice and the American Telephone and Telegraph Company resulted in a Consent Decree which effectively throttled the flow of product design, of process technology, of manufacturing know-how, of purchased apparatus and components from Western Electric to Northern. At the time, Northern had no design capability of its own, employed no scientists engaged in product or process development and had never been interested in markets outside of Canada.

When Northern was cut off from the source of technology on which it had been dependent for seventy-five years, the critical need to generate its own design competence, under forced draught, so to speak, embarked the company on a traumatic and costly experience from which it has not yet fully emerged. Competent scientists and design engineers were not available in Canada in sufficient numbers - they had to be sought outside. The high

cost of generating domestic designs, coupled with the even higher learning cost of developing an adequate degree of sophistication in this skill, was and continues to be a heavy financial burden for the company to carry. It soon became evident, as it had to the Ericsson Company eighty years earlier, that these new and heavy costs could not be supported by the domestic market alone.

In the fifteen years since 1956, Northern has been striving to learn, under great pressure and under conditions of extreme urgency, how to develop and maintain an adequate degree of competence in skills that the L.M. Ericsson Company had acquired gradually, progressively and considerably less painfully, over a period of eighty years."

The "Consent Decree" to which Mr. Marquez referred restricted Western Electric to the role of supplier to the U.S. Bell System (with certain exceptions) and Western decided to sell its interest in Northern. Before 1957 Western held 44% of the Northern equity, the remainder being owned by Bell Canada. Bell acquired 90% ownership in 1957, increasing this to 99.9% in 1962 and 100% in 1964.

Although Western Electric ownership had diminished in 1957, Northern still had a Technical Information Agreement which provided relatively free access to Western design and manufacturing information. When the TIA was renewed in 1959 for a five-year term, and again in 1964, the amount of information was greatly reduced and the economic terms became less favourable. In the 1969 renewal information dried to a trickle, consisting of certain design items for electronic switching with no manufacturing data. Northern had royalty free use of Bell Telephone Laboratories and Western Electric patents for equipment delivered to Bell Canada and its subsidiaries by virtue of the Bell-AT&T Service Agreement, but a patent does not disclose technology. Essentially, Northern is now in the same position with respect to Western as any other manufacturer.

With the end of Western Electric technology in sight, Northern had to find an alternative. This was the R&D laboratory established in 1958, which was reorganized in 1971 as a separate company, Bell-Northern Research, owned 51% by Bell and 49% by Northern. The task of launching a new R&D facility and bringing it quickly to a state of development comparable to long-established organizations in other countries was a difficult one. First of all, skilled managers, scientists and engineers were required to supply the entrepreneurial, innovative and development expertise needed. Moreover, massive infusions of capital became necessary not only to purchase the Western Electric equity but also to set up the required laboratory facilities in Canada.

Other difficult facts had to be learned the hard way, by actual experience. Canadian management had never been faced with such problems as choosing the most promising R&D areas or when to take losses and terminate losing projects for products which had initially appeared to be winners. Development costs mounted due to the increasing complexity of the telecommunication products selected for development. It soon became evident that not every development was a winner and that eventual success often rests upon a series of costly failures.

As late as 1964 virtually all of Northern's product portfolio with the exception of power cables was still dependent on imported designs. Displacement of mature products such as No. 5 Crossbar and the 500 telephone set is a slow process and only in 1972 did the proportion of Canadian designs in Northern's manufacturing portfolio exceed one-third of the total. This share is expected to exceed 75% in 1977.

Bell-Northern Research is now the largest industrial R&D establishment in Canada, employing 1400 persons. It has developed original designs in analog multiplex, microwave radio, stored program electronic switching

and most recently a 270 megabit/second coaxial cable system. The vacuum created in 1956 has been filled, but at a cost, and Northern is now actively seeking a broader market base, in order to support the ever increasing technological expenditures.

### Products

Northern is the only firm that manufactures a full range of telecommunications products in Canada, and one of two manufacturers of central office switching equipment. (The other is GTE-Automatic Electric). Operating from sixteen manufacturing locations spread over seven provinces, Northern produces all kinds of switching, transmission, outside plant and terminal equipment<sup>2/</sup>. Principal products are listed below:

#### Telephone Switching Systems

- Electro-mechanical exchanges, local and toll
- Electronic exchanges, local and toll
- Private automatic branch exchanges, electro-mechanical and electronic
- Data switching
- Centrex
- Automatic call distribution
- Intercom systems

#### Telecommunications Power Plants

- 24V, 48V and 130V power plants
- Ringling and tone plants

#### Transmission Systems

- Microwave radio
- Satellite electronics
- Carrier multiplex
- Digital lines and channel banks
- Voice frequency and program units

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<sup>2/</sup> Certain low volume, specialized equipment is not manufactured, e.g. telex switchers, telephone switchers for the COTC gateway exchanges, trans-oceanic submarine cable and repeaters, certain satellite and ground station equipment, and heavy route coax analog systems.

#### Telephone Sets

- Residential, coin and business telephone sets
- Key telephone sets and systems
- Hands-free telephone sets
- Data input sets

#### Data Handling Equipment

- Modems
- Digital data sets

#### Apparatus

- Ringers, cords, handsets, dials, couplers

#### Wires and Cables

- Telecommunications wire and cables
- Power wire and cables

#### Outside Plant

- Loading coils, connectors, protectors,  
cable terminals, splice cases

Since 1964 the Northern Electric R&D Laboratory, and its successor BNR, have had the responsibility for updating most of the product portfolio, including products of Western origin, and at the same time have introduced a large number of new products, some of which are listed below:

#### Switching

- World's largest Video Switcher for CBS, New York
- Program and other equipment for EXPO 67
- CBC Master Control at EXPO 70
- SA-1 and SF-1/2 Small Crossbar Systems
- Minibar Switch
- SP-1 Stored Program Control Switching System
- SG-1 Digital PBX
- SE-2 PBX

#### Aerospace

- Satellite tracking antenna for CRC
- Arctic Earth Station for Bell Canada
- Low cost TVR Earth Station for Canadian North
- Production of Electronic Platform which forms  
the heart of the ANIK Satellite

### Telephone Apparatus

Award Winning CONTEMPRA  
Invention of the Electret Microphone  
Lightweight Noise Cancelling Head Set

### Radio and Transmission

Parametric Amplifier  
RA-3 Solid State and TWT Microwave Radio  
RB-3 FM Terminal  
MA-5 Analogue Multiplex  
LD-4 PCM System on Coax Cable  
NELC 375 Coax Cable

### Major Subsidiaries

#### Northern Telecom Inc., Boston, Mass.

A wholly-owned subsidiary, NTI was incorporated in 1971 to manufacture and market telecommunications equipment in the United States. Sales offices have been established in New York, Texas, Florida, Illinois, and California. A telephone apparatus assembly plant has been set up in Port Huron, Michigan, and new manufacturing plants will be in operation in California and North Carolina early in 1974 to produce electronic switching systems, private branch exchanges, and other telecommunication products.

In 1973 NTI acquired Northeast Electronics Corporation, a U.S.-owned manufacturer of telecommunication test equipment. To facilitate expansion, a \$1 million plant is being built at Concord, New Hampshire.

#### Nedco Ltd., Montreal, Canada

Nedco is a wholly-owned subsidiary of Northern Electric, and together with its subsidiaries distributes electrical and industrial products with sales outlets in 41 Canadian cities. In August, 1973, Nedco acquired at \$3.25 per share over 94% of the 1,273,254 outstanding shares of Zenith Electric Supply Ltd., a Toronto based electrical and electronic wholesale distributor with 11 branches in Ontario.

Microsystems International Limited,  
Montreal, Canada

MIL manufactures semi-conductors including integrated circuits for the computer and telecommunications industries. Its principal manufacturing facilities are located near Ottawa, Ontario, with an assembly plant in Malaysia. Marketing subsidiaries are established in West Germany and the United States.

MIL is listed on the Toronto, Montreal and Vancouver stock exchanges, but as of December 31, 1973, Northern held 68.6% ownership. Since formation in 1969, MIL has incurred a loss of over \$26 million to September 30, 1973. Of this amount \$3.6 million represents a loss for the nine months ended September 30, 1973.

Although sales have been growing rapidly, the company has reportedly been plagued by production-line problems. Late in 1973, major changes were made at the senior management level with the objective of moving the company to a profitable position.

Northern Electric Telekomunikasyon, A.S.,  
Turkey

Incorporated in 1967, this subsidiary is 51% owned by Northern, 49% by the Posts and Telegraphs Administration of the Republic of Turkey. The plant produces switching equipment, power supplies and telephone sets.

Northern Electric Co. (Ireland) Ltd.,  
Galway, Ireland

NE Ireland, a wholly-owned subsidiary, was incorporated in 1973 to manufacture products associated with telephone station equipment and electronic private branch exchanges, components and sub-assemblies.



Nevron Industries Co. Ltd.,  
Montreal, Canada

The wholly-owned subsidiary was formed in 1972, with a capital of \$5 million, to make investments of a venture capital nature.

Northern Electric and Subsidiaries' Consolidated Sales<sup>3/</sup>

Year	Consolidated Sales (\$ millions)	Net Earnings (\$ millions)	No. of Employees
1973	612.8	32.0	25,073
1972	534.3	20.1	20,787
1971	576.3	12.6	23,230
1970	563.6	4.1	24,986
1969	482.5	11.0	26,032
1968	426.3	9.4	23,682

The drop in sales between 1972 and 1971 Northern attributes to the phasing out of various lines that had been unprofitable for some years. Northern sells to all segments of the Canadian operating telephone company markets and believes it has approximately 70% of the market.

In 1972, 58% of consolidated sales (\$309 million) were to Bell Canada and its subsidiaries. Virtually all products are sold to common carriers. In 1972 Northern ranked 204th in sales on the Fortune list of the 300 largest industrials outside the United States, behind Plessey and L.M. Ericsson, its nearest competitors who were 147th and 116th respectively.

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<sup>3/</sup> Source: Announced Results for 1973, and Annual Reports.



### New Ventures

Until 1956, Northern operated in the best branch plant tradition, as a virtual Western Electric subsidiary and captive supplier to Bell Canada and (to a lesser degree) other Canadian carriers. Since 1956 the major task has been to replace the dependency on Western Electric technology with an in-house capability, without losing ground in the domestic market. It soon became evident that the R&D program that was required could not be supported out of domestic sales alone, and in response to this realization Northern in the late 1960s made several attempts to enter export markets, with rather mixed results.

From the initial ventures into foreign markets came evidence that export sales outside of North America led to an increase in development costs, rather than helping to spread the existing costs of R&D over a wider base. The modifications of Northern's switching equipment for the Turkish market, for example, were extremely costly and the Turkish subsidiary has not yet contributed significantly to the company's earnings.

As a consequence, Northern now appears to be concentrating its short-term export sales effort in the United States, where a large, if fiercely competitive market is available, but where most of the company's products can be sold without costly redesign and modifications. This strategy still allows for the export of cables, telephone sets, terminal equipment, transmission equipment, and miscellaneous hardware, all of which can be incorporated into carrier networks outside of North America with minimum system compatibility problems.

The initial approach to the European Economic Community market has been made by establishing the Ireland subsidiary and the company anticipates building more plants in Europe. Another recent move was the licensing of the Plessey Company of England to manufacture and market certain of Northern's products in the U.K. and other markets.

Northern officials now consider the company to be a multinational corporation, manufacturing a broad line of telecommunications products for sale throughout the world. The short-term emphasis on the U.S. market provides an immediate outlet for many of the company's innovative new products and, at the same time, it appears related to a strategy of buying time so as to develop new generations of equipment that will be suitable for all markets without the need for costly modifications.

A stated company objective is to reduce the dependency on Bell Canada sales by increasing sales to non-Bell customers. In a move designed to facilitate this expansion, Northern in November, 1973 filed a preliminary prospectus with the various Securities Commissions in Canada with the intention of making an initial offering of common shares<sup>4/</sup>. In a letter to Bell Canada shareholders, Mr. R.C. Scrivener, Chairman, made reference to the continuing expansion of Northern Electric's business, the necessity for equity financing, and the requirement for the infusion of new capital to assist in the expansion of Northern's business in Canada, the U.S., Europe and other countries.

The task faced by Northern in launching a significant assault on world markets appears large but not insurmountable. Just as Ericsson in 1876 and Northern in 1956 were forced into a course of action as a matter of survival, so in the 1970s Northern is faced with the realization that even a substantial share of the independent market in the U.S. will only serve to move the company to another plateau.

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<sup>4/</sup> The official prospectus was issued 4 Dec 73, and offered 2,600,000 authorized but unissued common shares at a price of \$15.00 each. This issue which was favourably received has effectively reduced Bell Canada's ownership of Northern to 90%.

## SECTION 2 : SUPPLIERS

### III. AUTOMATIC ELECTRIC - LENKURT ELECTRIC

GTE Automatic Electric is the second largest telecommunications manufacturer in Canada after the Northern Electric Company, and the only other manufacturer of switching equipment. Automatic Electric has corporate ties with the second largest operating company, B.C. Telephone<sup>1/</sup>, and offers a complete line of equipment to all the carriers, except for the transmission equipment manufactured by its subsidiary GTE Lenkurt, discussed below. Electronic and step-by-step (SXS) switching and parts for telephone sets are manufactured at Brockville, the telephone sets are assembled at a small plant at Lethbridge, Alberta. The remainder of the product line consists of "bought-in" items obtained from over 200 suppliers. Crossbar switching is not manufactured.

Automatic Electric's role in GTE (General Telephone and Electronics Corporation, New York) is in the area of the smaller central offices, where Brockville has R&D and manufacturing responsibility for the whole corporation. To fulfill this role a 2400 line/trunk electronic stored program switcher, the type C-1 EAX, was developed in Canada. This design, recently expanded to 4800 line/trunk, has been sold to B.C. Telephone, Canadian carriers, and in the U.S., Israel and Mexico. Volume is expected to increase with the expanded version, particularly in the U.S., the major export market. The market acceptance of the C-1 EAX in Canada is due in part to its place in the electronic switching portfolio - it complements but does not compete with larger systems. Automatic Electric also manufactures the large type 1 EAX electronic switcher, a U.S. design which competes with the Northern Electric SP-1 in sizes over 10 thousand lines.

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<sup>1/</sup> Automatic Electric and B.C. Tel are controlled through intermediate companies by General Telephone and Electronics Corporation, New York - a parent holding company. This contrasts with the Bell Canada system in which Northern Electric is controlled directly by Bell Canada, a parent operating company.

The other switching product of Automatic Electric is SXS equipment, for which there is still a moderate and constant market<sup>2/</sup>. SXS equipment was first installed in Canada fifty years ago, and it is now obsolete although 50% of the telephones in Canada are still served by SXS offices. Most carriers no longer install SXS except for extensions to existing offices. Nevertheless, Automatic Electric in 1972 produced more lines of SXS than electronic and they expect to be making SXS until 1990 at least. Improvements are still being made to the venerable Strowger switch and life tests on SXS switches are still performed to determine the effect of new components and materials.

Automatic Electric, as a manufacturer of SXS equipment, feels the effect of competition from imported crossbar equipment in the PBX field. As a result they have adopted a 100-400 line crossbar PBX made in Japan by Hitachi to a specification prepared by Automatic Electric in the United States and Canada. Two Canadian carriers have purchased this product.

Lenkurt Electric, with headquarters and main plant at Burnaby, B.C., is the largest secondary industry on the West Coast. Smaller plants are located at Regina and Rimouski, and a new manufacturing facility is planned for Saskatoon. A complete range of transmission product is manufactured - light and heavy route microwave radio, analog multiplex, digital multiplex of the T1/T2 type, subscriber carrier, voice frequency terminal equipment, and data modems of low and medium speed. Sales are mainly to the domestic common carriers, although in recent years a considerable export business has developed. Other customers include industrial users in Canada such as the Hydro utilities.

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<sup>2/</sup> Total SXS volume for all manufacturers is \$30-35 million per year throughout 1967-74, according to CTCA forecasts in I-II. Market share declines from 30% to 15% of total switching in this period.

Lenkurt Electric, although controlled by GTE New York, is managed almost entirely by Canadians. The Canadian operation was established as a sales outlet about twenty years ago, about the same time as Automatic Electric in Brockville and it has since grown into a large marketing, development and manufacturing organization. GTE has delegated corporate R&D responsibility to Lenkurt for certain products, e.g. 2 GHz light-route radio.

In common with other domestic manufacturers, Lenkurt has suffered from the vagaries of the transmission market in Canada. Although the growth rate in transmission channels has been relatively constant and predictable over the long term, there have been short term fluctuations in demand which have dislocated the industry. In periods of high demand it has been necessary to import equipment to supply the market. During low demand it is difficult to retain skilled personnel, which has a significant bearing on the continued health and profitability of the business. The situation is complicated by the large number of Canadian transmission manufacturers in relation to the domestic market.

An anti-trust action brought by International Telephone and Telegraph Corporation against GTE in the United States has resulted in a lower court decision to divest GTE of its manufacturing subsidiaries in the United States and Canada. This action has the object of requiring the GTE operating subsidiaries to purchase equipment in the open market, and as such it parallels the suit of the U.S. Department of Justice against AT&T which culminated in the Consent Decree of 1956 (Section 2-II). The lower court decision has been appealed by GTE and will probably take several years to resolve. If upheld, it would be a major break from the vertical integration that characterizes the North American telecommunications industry.

## SECTION 2

### IV. OTHER MANUFACTURERS

In addition to the vertically-integrated manufacturers discussed earlier, more than one hundred other companies manufacture telecommunications equipment in Canada. Included in the "other manufacturers" category are:

- (a) small Canadian-owned companies who manufacture a limited range of specialized products, and sell most of their output to the carriers;

(Example - Pylon Electronic Development Co. Ltd.).

- (b) large foreign-owned subsidiary plants, who manufacture an extensive range of industrial, commercial and consumer electronic equipment, but sell only a small proportion of their output to the carriers;

(Example - RCA).

- (c) small foreign-owned subsidiary plants, who manufacture a limited range of specialized products, and sell most of their output to carriers.

(Example - Farinon Electric).

All of these companies have contributed to the development of telecommunications in Canada, and have enabled Canadians to have the best of both worlds in telephone service and facilities. Together with importers, these manufacturers serve many specialized carrier requirements, which the two major manufacturers cannot service economically. In some areas (notably transmission) there is fierce competition between suppliers.

To appraise the special problems that the "other manufacturers" face in serving the carrier market, a questionnaire was prepared to provide a basis for discussion. This section is therefore presented in question and answer form, and is representative of industry views. A remarkable consensus was evident on most questions.



Q 1. What constraints inhibit your Company's participation in the Canadian telecommunication common carrier market?

A. For most Canadian manufacturers not vertically integrated with carriers, a major constraint is of course vertical integration itself. As a group, the most vociferous comments emanated from the manufacturers of transmission equipment, where suppliers must compete with Northern Electric. Recognizing these comments, there are several areas of concern.

One problem common to the smaller manufacturers is the question of standards and engineering specifications. Each of the twenty-two common carriers apparently writes individual engineering specifications, which may require expensive modifications to equipment by the suppliers before they are able to submit a quotation. Many manufacturers felt that some national organization should exercise an engineering standards coordination function which would ensure the same standards across Canada.

Documentation was mentioned as a problem to the smaller manufacturers. Most common carriers insist on drawings and maintenance procedures in their own standard formats to facilitate training their maintenance personnel. These documents are difficult and expensive to produce for small organizations and the extent of the problem is sometimes not fully appreciated when the selling price is quoted.

Other difficulties arise in dealing with the larger carriers such as identifying the proper person to talk to in the organization, finding a new person due to frequent personnel moves and the lack of liaison between design and current planning groups, often causing totally unrealistic forecasts of requirements to be quoted.

Q 2. Do you have problems in determining the size of the Canadian market for your products?

A. A severe marketing problem arises from the number of carriers with head offices from coast to coast. Few manufacturers can maintain offices in all major cities, and they are therefore unable to maintain adequate contact with their potential customers. Most manufacturers think the problem is compounded unnecessarily by the excessive secrecy of carriers, who are extremely reluctant to discuss future plans with would-be suppliers.

Q 3. Who are your main competitors and how do you rank your own company?

A. This question is self-explanatory and served to identify any companies who might otherwise have been overlooked.

Q 4. What companies are important customers other than common carriers?

A. The major sales outside the carriers are for micro-wave systems for hydro companies, and for export, however this type of business tends to be feast or famine.

Q 5. In your opinion, what should be the government role to foster further development of the telecommunications supply industry in Canada?

A. Most suppliers commented on the deficiencies of one or other of the government's industry support programs. One often quoted example was that the availability of government-financed aid has encouraged foreign-based companies to bid on offshore telecommunications projects against established Canadian suppliers and after obtaining a contract, setting up manufacturing facilities in Canada based on the one contract. When the contract is completed, the manufacturing capacity becomes available for work in Canada, thus further fragmenting manufacturing capacity. Another example is the practice of providing development grants to foreign-owned companies who then design products to compete with existing Canadian suppliers.

Many small companies complain that assistance programs are geared to larger, well-established companies, the entrepreneurial one-man Canadian operation with a bright idea must usually sell the majority interest outside of Canada or go bankrupt trying to raise venture capital.

Export financing by government agencies was another area reserved for severe criticism. CIDA<sup>1/</sup> in particular came under attack for not sufficiently emphasizing the need to spend in Canada a higher percentage of the funds allocated to aid programs. Industry spokesmen pointed out that international traders such as Japan, West Germany, Britain and others all adopt a hardline pragmatic approach to obtaining the maximum value to themselves for the aid furnished.

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<sup>1/</sup> Canadian International Development Agency.



Some suppliers were critical of the DREE<sup>2/</sup> programs to the effect that provision of government aid in some cases has been based on humanitarian and political grounds rather than on sound business, marketing and economic practices. Established manufacturers are suspicious of government attempts at "artificial fertilization", particularly when the result is to create new competitors.

Q 6. In your opinion, what are the present strengths and weaknesses of the Canadian telecommunications industry?

A. The difficulty of obtaining capital for innovative developments in Canada was mentioned as a definite weakness. Possible reasons were cited, such as financial prudence in not being willing to back any but sure-thing projects and the small Canadian market even for well-designed innovations. Suppliers have noted some reluctance on the part of Canadians to accept domestic designs.

One strength mentioned frequently was the high quality of the Canadian-trained people available. Canadian educational and training programs have been slanted towards knowledge-based skills with emphasis on innovative approaches and managerial accomplishments, based on hopes of fostering knowledge-based industries in Canada. Unfortunately, such industries have either not been started or have not been successful for a number of reasons and suppliers claim that many of the better men have gravitated to jobs in other countries where their superior qualities are recognized and rewarded.

Several companies saw the bright side of being small in the opportunity to modify their designs quickly and at small expense and thus better meet the needs of their customers than the larger monolithic organizations usually found possible.

The most serious weakness among the companies surveyed is the lack of a solid R&D base upon which to build future production. Many companies have developed innovative products which have been marketed here and abroad in the field of telecommunications, but the percentage of the sales dollar spent on R&D is small.

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<sup>2/</sup> Department of Regional Economic Expansion.

Q 7. Accepting that Canadian manufacturers cannot supply all the hardware needs in the telecommunications field, what, in your opinion, would be profitable areas of concentration for Canadian manufacturers?

A. Most companies surveyed did not accept the fact that Canadian manufacturers cannot supply all types of telecommunications hardware. The creation of Telesat Canada was quoted as an example of failure of government policy in not following through to the establishment of a high technology industry in Canada. The country has the world's first domestic satellite system, but no resident manufacturing capacity that can be exploited in world markets, for most of the technology is imported. Manufacturers claim that the decision to purchase the satellite from the U.S. was based on first cost considerations, without regard for the future business which would have accrued to Canada if the systems had been designed and built here<sup>3/</sup>.

Q 8. What are the probable new services and new types of equipment likely to be in demand within the next five years?

A. The possible liberalization of carrier tariffs so as to permit the connection of customer-owned terminal equipment to the national switched networks is of interest to potential suppliers of terminal equipment. They anticipate easier access to markets, but at the same time there is concern that increased demand for new types of terminal equipment may be met by importation of equipment from Europe and Japan.

The field of data communications is also expected to grow rapidly, but several manufacturers expressed the view that the carriers would control the rate of expansion of new services, including data.

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<sup>3/</sup> Editorial Note: The U.S. supplier of the Telesat satellite agreed to place subcontracts with Canadian suppliers for certain of the components required. This has since been extended to include satellites other than for Telesat. Additional satellite sales probably will increase this value to Canada in the future.

The most frequently discussed topic during interviews with manufacturers was the procurement policies of the publicly-owned carriers and Crown corporations. Most manufacturers contend that by comparison with other Canadian carriers, COTC, Telesat and Canadian National Telecommunications have a poor record in supporting domestically-based industry. The carrier disclaimers to the effect that the products purchased offshore are too specialized or too low volume to interest Canadian manufacturers are not acceptable by industry. Many specific examples were quoted.

One scenario is that a small Canadian company, with the assistance of the Department of Industry, Trade and Commerce grant, develops a new product with domestic and export potential. When development is completed, the product is evaluated by the domestic carriers and in due course tenders are called. At the same time, the company is making equipment available for evaluation by possible overseas customers. When all the bids are in, the contract is awarded to a U.S. or European company on the basis of a lower initial price, even though the equipment does not always meet the tender specifications.

The loss of one contract is bad enough, but only the tip of the iceberg, for the successful bidder loses no time in announcing his success to other potential customers, with the implicit suggestion that if a Canadian government-owned carrier refuses to buy a "made-in-Canada" product, there must be something wrong with it. This basic inconsistency, whereby a government-owned carrier declines the opportunity to purchase a product developed with the aid of government funds, is incomprehensible to most suppliers.

Industry criticism of government procurement policies extends to all departments and all levels of government. Most manufacturers deplored

the lack of government policy that would use government purchasing power to complement its incentive and other aid programs and in this way strengthen the industry. Present government policies appear to manufacturers as contributing to excessive fragmentation and perpetuation of our dependency upon imported technology.

## SECTION 2 : SUPPLIERS

### V. IMPORTERS AND FOREIGN SUBSIDIARIES

Half of the world's telephones are located on the North American continent. This huge market, although dominated by Western Electric in the United States and Northern Electric in Canada, has always appeared attractive to the major European equipment manufacturers. The Europeans have been established in Canada for some time and more recently Japanese manufacturers have entered the market by forming alliances with European and U.S. subsidiaries operating in Canada. The major suppliers represented in Canada are briefly surveyed below.

#### AEI Telecommunications

The first European manufacturer to appear in Canada, and to this day the most active in terms of manufacturing, was Siemens Brothers<sup>1/</sup>, a subsidiary of British Siemens. This company set up shop in Winnipeg in 1924, and assembled Strowger telephone switching equipment from British design and manufacturing drawings. The simple design of the Strowger system made British and North American equipments almost compatible, and only very minor modifications were required. As a consequence, no development work was necessary in Canada, even the schematic diagrams being prepared in Britain. In later years the development of the North American systems gradually but inexorably drifted away from European practices.

The evolution of unique North American standards effectively closed the door on substantial foreign penetration of the manufacturing sector, except for those companies willing to design and build equipment to Canadian specifications. Siemens Brothers, with an assured share of British markets were, like all other European manufacturers, reluctant to invest in R&D for development of uniquely Canadian designs, a sound

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<sup>1/</sup> Now known as AEI Telecommunications (Canada) Ltd., a subsidiary of GEC Telecommunications Ltd. (U.K.).

decision considering that markets were small and by no means assured. Nevertheless, Siemens Brothers has survived in Winnipeg to this day with a reasonable degree of autonomy, by importing Strowger switches and metal stampings from Britain, and assembling obsolescent Central Office equipment, mostly to extend existing offices. By making a little bit of everything else the company is able to achieve sufficient sales volume and remain a viable operation in Canada.

Due to a continued commitment to supply Strowger equipment for the British Post Office, the parent company still does not have a crossbar PABX and in 1971 AEI, no longer able to sell the venerable BPO PABX No. 3, turned to Japan. An agreement was signed to represent Nippon Electric Company (NEC) for two size ranges of crossbar PABX, 100-400 lines and a larger unit of 600 lines and up. It is significant that NEC has appointed AEI as distributor for sales to the telephone carriers but not any future interconnect market. Several would-be attachers have been approached by NEC as prospective agents in the event interconnection is permitted.

Of the European subsidiaries surveyed, AEI is the only company that has maintained a continuing manufacturing capability in Canada. Present employment is around 200 persons. Faced by a widening gap between the parent company designs and Canadian practices, and a market share too small to support the development of new designs, the company in recent years has taken on a number of "custom jobs". In the future there may be more concentration on special "one-off" jobs, supplemented by partial assembly and distribution of imported products.

#### Plessey Canada Limited

The Plessey Company of Great Britain was formed in 1965 by a merger of Automatic Telephone and Electric of Liverpool, England and Etelco (Ericsson Telephone Co.)<sup>2/</sup> of Beeston, Nottingham, England.

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<sup>2/</sup> A one-time subsidiary of L.M. Ericsson, Sweden.



Prior to the merger, the two companies both operated subsidiaries in Canada, with head offices in Toronto. Both companies maintained a minimum presence in Canada, primarily a sales/engineering office, with equipment installers imported from the United Kingdom for the larger jobs. In the late 1950s and early 1960s, the companies were supplying and installing Strowger SXS at rock bottom prices and sales to the smaller carriers were brisk. When the parent companies merged, a new subsidiary, Plessey (Canada) Ltd. was formed, selling point-to-point radio, multiplex and miscellaneous equipment in addition to SXS. Until recently, Plessey did not manufacture in Canada, their Toronto office consisting of sales, engineering and installation staff. Plans are now underway to assemble in Toronto a PBX that has been developed in Canada from an earlier U.K. design.

The U.S. subsidiary of Plessey recently opened a plant to assemble PABX equipment imported from Japan (Oki Electric) for the U.S. interconnect market. This move appears to confirm the parent company's lack of products suited to the North American market.

#### IT&T Canada Ltd.

A subsidiary of the world-wide communications conglomerate, IT&T Canada has headquarters in a modern plant at Guelph, Ontario and telephone instrument assembly plants in the three Prairie Provinces. IT&T is a true multinational which imports products into Canada from plants in the United States, Britain, Sweden, France and Belgium. Main manufacturing activities in Canada involve telephone instruments, assembled in Manitoba, Saskatchewan and Alberta, and key telephone equipment is exported to the Caribbean and Latin American countries. The company has recently developed in Canada a 100-line electronic TDM PABX, which will be competitive with a similar machine developed by Northern Electric.

This product, developed by the small R&D group will be manufactured in the United States for the U.S. telco market, leaving the Guelph plant to serve the Canadian market and the U.S. inter-connect market.

About 50% of IT&T (Canada) manufacturing activity in Canada is now devoted to fulfilling a contract with the Canadian Post Office for postal mechanization equipment. Initial orders from the Post Office were filled with equipment designed and manufactured in Belgium, but the bulk of the equipment has been further developed from the Belgian design and is now manufactured at Guelph, Ontario.

The company's customers include most of the Canadian carriers, offering a variety of products, and no one product dominates.

#### L. M. Ericsson

A wholly-owned subsidiary of L.M. Ericsson, A.B. Stockholm, Sweden, the Canadian branch was opened in 1953 with a one man sales office, which has since expanded to approximately 80 employees. Ericsson has not suffered to the same degree from the major drawback faced by other companies discussed in this section, namely incompatible and/or obsolete products. Ericsson pioneered the development of the crossbar switch, and has led the industry in design and development of many new products. The high quality and technical excellence of the company's products, plus the fact that labour rates in Sweden parallel those in North America, have resulted in cost problems in Canada. The crossbar PBX equipment offered in Canada was for several years in advance of domestic and other imported designs but hopelessly non-competitive in price. Until 1967, Ericsson's record in Canada was spotty. To maintain viability the company imported a large range of products, selling a little of each product to achieve break-even. Products

included long life vacuum tubes, telephone cable, electronic and electro-mechanical components, intercom equipment, production recording equipment, etc.

A few comparatively major sales kept the company afloat. Bell Canada and Maritime Telegraph and Telephone purchased between them eight community dial offices (crossbar) in the 1000-2000 line range. About a year following these sales, Northern Electric announced an exchange in a similar size range, and this avenue dried up. COTC purchased crossbar telex and telephone international gateway exchanges for use in Montreal and Vancouver. In both these instances, Ericsson was offering equipment not available in Canada, ahead of the "state of the art".

In 1966-67, customer demands for more innovative features in PABX equipments over 50 lines, and the increasing obsolescence and high maintenance costs associated with SXS equipment led the carriers to an evaluation of the L.M. Ericsson range of crossbar PABX. At this time no other supplier could offer a crossbar machine, and the carriers, mindful of the lower maintenance costs associated with crossbar, gradually moved to the Ericsson equipment. Bell Canada is the largest user in the size range 90-540 lines, other carriers also use the 50 line model. Ericsson sales in the two size ranges of PABX imported into Canada have grown steadily from 1967 to 1972, however there is some concern that sales to the carriers may have "peaked" due to the entry of several new suppliers into the crossbar market, notably the Japanese manufacturers. Ericsson are therefore stepping up the promotion of their extensive line of highly sophisticated intercommunications equipment, which although expensive has gained a measure of acceptance in recent years. All equipment sold in Canada is imported from Sweden.

Pye-TMC and Pye Electronics Ltd.

Subsidiaries of Pye of Cambridge, these two companies are solely importers and distributors. Pye-TMC, operating from an office and warehouse in Toronto, has proved to be tough competition for Canadian manufacturers of VFCT and multiplex equipment. Pye Electronics Limited markets British manufactured VHF and UHF mobile radio equipment, maintaining sales and service facilities in all major Canadian cities and a head office in Montreal.

In common with most importers, both Pye companies try to supplement their main line of equipment by representing other foreign suppliers. Pye-TMC recently entered into an agreement to represent American Data Corporation, and Pye Electronics Ltd. has at various times represented Hallicrafters, Dumont, Philips, Reach Electronics, and others to round out the product line. There is no R&D activity, engineering effort being in the area of systems engineering.

Philips Electronics Ltd.

A subsidiary of Philips Holland, the company's main plant located in Toronto is primarily concerned with the manufacture of a range of colour television receivers that were designed and developed in Canada for the North American market. A plant to manufacture electric light bulbs was recently opened in London, Ontario.

Other major activities include a business equipment division which markets an extensive range of dictating machines, mini-computers, calculators, inter-communications and radio paging systems. Most of this equipment is imported from affiliated plants in Europe, together with a number of small domestic appliances.

The Telecommunications Division's main product being manufactured in Toronto is Instrument Landing Systems, and related airport communications equipment.

The major product being sold to carriers at this time is coaxial cable systems in various size ranges from 2 to 60 MHz and a common control high-speed uniselector PBX. This latter item is now facing stiff competition from crossbar and electronic systems.

Siemens Canada Ltd.

The present Siemens Canada company was established in 1962 as a wholly-owned subsidiary of Siemens A.G. Munich, West Germany. From a 58,000 sq.ft. plant in Montreal, P.Q., the company markets a broad range of products, including electronic and electrical components, telecommunications equipment, communications measuring equipment, X-ray and other medical electronics equipment, high voltage motors, automatic control equipment and motor controls. From 1956, six years prior to the incorporation of Siemens Canada Ltd., Siemens has supplied equipment for the Canadian telex network operated by CN/CP Telecommunications. The company now has over 100 switching centres operational in Canada as part of the telex network, and has maintained its position as a major supplier.

In 1972, the parent company's world sales exceeded \$4.5 billion, including \$1.1 billion in North and South America. In the same year, world sales of telecom equipment exceeded \$1 billion, but the company has made little attempt to market such products in North America except for the telegraph equipment previously noted. In 1973 however, the company announced its intention to market telephone switching equipment in the United States. What impact this decision will have on the U.S. market (if any) and implications for Canada are not known at the time of writing.

### The Future for Importers

Companies discussed in this section are mostly Canadian subsidiaries of European manufacturers and they supply less than 10% of the Canadian carrier requirements. Most of them sell a considerable range of products to a large number of customers in order to achieve a respectable sales volume. Except for extensions to existing central offices, most imported sales are in peripheral areas, CAMA and ANI equipment, PABX, some cable, multiplex equipment, and small CDOs<sup>3/</sup>.

The possibility of any European supplier making inroads into the market for large central offices is remote. The British manufacturers will have their hands full for several years in filling the demand for hardware created by the BPOs recently announced \$10 billion expansion program. France, Germany and Italy are also faced with a similar domestic demand. The L.M. Ericsson Company of Sweden moves into a market only when market access is assured. A few years ago, Ericsson purchased the majority interest in North Electric of Galion, Ohio, and introduced its modern designs. The market did not develop as expected, and the company's interest was sold to United Telecommunications. Given an assured market for 30,000 lines of PBX equipment, Ericsson would probably extend its assembly operations in Canada. So would most other European subsidiaries.

Most of the companies compete with each other, by importing products designed for other markets to fill in the gaps in Northern Electric's product line. To maintain viability, most companies also represent other foreign suppliers, thus spreading marketing costs over a wider base.

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<sup>3/</sup> CAMA - Centralized Automatic Message Accounting  
ANI - Automatic Number Identification  
PABX - Private Automatic Branch Exchange  
CDO - Community Dial Office



### Research and Development Facilities

The suppliers discussed in this section of the report do not maintain R&D facilities in Canada. The technical staffs are generally systems and equipment engineers, preparing quotations, maintaining liaison between customer and overseas plant, and modifying foreign designs to fit Canadian markets, which one executive aptly described as a "bend and fit" operation. The quality of jobs available with the importers is generally high, there are few assembly line jobs available. Only one company (IT&T) claims any rationalization of R&D, but this is generally meaningless as the results of the R&D are sent to New York and the decision where to manufacture made there.

### Factors Restricting Foreign Penetration of Canadian Market

Quite naturally the importers see the dominant position of Northern Electric, and to a lesser degree GTE Automatic, as the major stumbling block inhibiting their sales efforts. Importers are essentially on the outside looking in, a "chicken and egg" situation exists whereby many of their major products are incompatible with North American markets and the parent companies are reluctant to develop compatible products unless market access is assured.

It is probably a blow to Canada's national pride, but many industrialized countries classify Canada as a developing country, and in the home office many executives find it difficult to understand why their products do not receive the same dutiful acceptance in the Canadian marketplace as in ex-colonies and "third world" countries. As a result, Canadian based managers have difficulty in convincing their superiors "back home" of the need for innovative and creative designs, and of course they cannot provide the markets necessary to justify new developments. Consequently the possibility of any rationalization which assigns a major product line to the Canadian subsidiary for development, manufacture and world distribution is extremely unlikely.

Marketing costs in Canada are extremely high. The carriers are spread over 4 thousand miles, and most products must be demonstrated to, and evaluated by, up to a dozen carriers from coast to coast. This condition results in many importers being under-represented, as they usually maintain offices in only one major city. This problem is, of course, common to most small Canadian-owned companies.

Little change is forecast in sales to the telecommunications carriers. Most managers of Canadian subsidiaries are agreed that the problem of unsuitable product and slow deliveries cannot be solved in Canada, solutions must come from head office.

#### Summary and Forces for Change

Many of the companies discussed in this section have been represented in Canada for many years, and they have allowed Canadian carriers to have the best of both worlds. Major Canadian manufacturers have supplied the volume components such as telephone sets, switching and transmission equipment. Importers have filled the gaps by providing many of the specialized and sophisticated components that are of too low a volume to justify development and production in Canada.

Most importers are looking to interconnection as a means of increasing their sales volume in Canada, particularly for PABX equipment. Approximately 30% of carrier purchases of PABX are from importers, but carriers tend to standardize on the products of one supplier for an indeterminate period, leaving other suppliers out in the cold. If there is some liberalization of carrier tariffs so as to permit the interconnection of customer-owned terminal equipment, then those companies who have been unable to sell their products to the carriers will have an alternative market to exploit.

Many suppliers have pointed out that a more dramatic change in market shares could come about if Japanese companies were to establish manufacturing facilities in Canada. The Japanese telephone system is generally compatible with that of North America, since the basic technology was imported from the United States and Japanese manufacturers do not have to contend with the major product incompatibility problems that have prevented penetration by European suppliers.

### 3. SOME MAJOR PRODUCTS

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### SECTION 3 : SOME MAJOR PRODUCTS

#### I. INTRODUCTION

Telecommunications equipment manufacturers usually group types of equipment in five broad categories:

1. Subscriber apparatus, telephone sets, etc.
2. Business communications systems, PABX, data communications.
3. Central Office switching equipment.
4. Wire and cable, including terminals, connections, etc.
5. Transmission equipment - microwave and multiplex.

Carriers on the other hand have a more detailed system of accounts and equipment is broken out into three broad categories:

1. Central Office equipment (installed on carrier premises).
2. Station equipment (installed on customer premises).
3. Outside Plant (connection between 1 and 2).

These three basic categories are then broken down into much more detail.

In this section the three main categories chosen for discussion are:

1. Switching equipment - Central Office.
2. Transmission equipment - multiplex and radio.
3. Terminal equipment - equipment installed on customer premises.

The fourth category "Outside Plant" is omitted since it consists mainly of cable and accessories manufactured in Canada and technology is not the controlling factor. Cable prices for example are closely related to the prices of copper and aluminum raw material.

### SECTION 3 : SOME MAJOR PRODUCTS

#### II. SWITCHING

Section 1-II identified COE - Switching equipment as the largest single item of telecommunications equipment purchased by Canadian carriers. Except for a few highly specialized machines all of the central office and toll switching equipment used in Canada is manufactured by the two major domestic suppliers, Northern Electric and GTE Automatic Electric.

In all countries telecommunications plant is characterized by a very high degree of standardization, which provides some obvious operating advantages in the areas of staff training, documentation, spare parts inventories, etc. For telephone switching equipment, there are additional special and compelling reasons in favour of equipment standardization. Carriers can realize very substantial economies by purchasing switching machines with a large ultimate capacity, but installing only sufficient equipment to meet immediate needs. As the system grows, future needs are met by small increments as required. If these economies are to be realized however, the additional equipment must be of the same type and compatible with the original installation. As most telephone exchanges have a minimum in-service life of at least 30 years, carriers therefore are heavily dependent on the supplier for continuity of supply. In most developed countries carriers have assured this continuity by buying from a limited number of domestic suppliers and by contributing to the manufacturer's R&D programs to provide a degree of control over innovation.

The longevity of switching equipment has also provided a measure of protection for manufacturers, for a substantial portion of their current output is always devoted to extending systems installed one to twenty years ago. Paradoxically, this market security is two edged and requires of the manufacturer a continuous intensification of R&D effort. A switching manufacturer's product mix must maintain a delicate balance



between the oldest and the newest, failure to develop new systems eventually results in declining manufacturing effort. Manufacture of older systems must continue for up to 30 years to provide equipment for extensions to existing systems, and as the amount of old equipment in manufacture inexorably declines, it must be offset by increased manufacture of newer systems.

In the past, major changes in switching systems have seldom occurred at intervals of less than 20 years. Bell Canada introduced the step-by-step (SXS) switching machine to Canada in the early 1920s, and the majority of SXS installed is still in service. In 1956, Bell started to introduce crossbar type switching machines which were capable of meeting new service demands, and other carriers followed suit.

In 1967 the pace started to accelerate with the installation of Canada's first electronic exchange, the No. 1 ESS, an imported Western Electric design partially manufactured in Canada by Northern Electric. A total of eleven No. 1 ESS offices were installed, but the system proved to be very expensive, more than twice as much as the alternative crossbar equipment. This was due to the No. 1 ESS design and its imported technology as well as the low Canadian volume. The system is intended for large metropolitan offices of 30,000 lines for which there are few applications in Canada. It is an expensive blend of electronic and electro-mechanical technology from a design point of view, and each renewal of the technical agreement came at a higher price. Canadian modifications and cost reductions were difficult since design control, particularly control of the software, resided in the United States. As a result of all these factors it was decided in 1972 to discontinue new installations, only five years after the first job in 1967. Further work on No. 1 ESS will consist of extensions to fill out the existing 11 offices to capacity.

Use of the No. 1 ESS design by Bell Canada served to permit Northern Electric's design and manufacturing engineers to become fully acquainted with the technology of stored program switching machines and hastened the introduction of a Canadian alternative to No. 1 ESS, the Northern Electric SP-1, which had been under development since 1963. The gestation period of this electronic exchange extended over 8 years until the first commercial installation in 1971 at Aylmer, Quebec. Centrex and 4-wire toll versions are scheduled for 1974. SP-1 is a 20,000 line office, more suited to the Canadian environment than No. 1 ESS because of smaller size and economies in design. Costs are comparable with crossbar and economic down to 4,000 lines, making the transition to electronic switching easier for the operating companies. This is confirmed by volume of sales in the United States and Canada.

It can be assumed that the electronic age has finally arrived in Canadian switching and carriers have forecast that all new offices will be electronic. The venerable Strowger and crossbar systems will continue for many years, but by 1974 the production of stored program electronic systems will predominate, which will mark the beginning of a new era in telecommunications switching, more dynamic than the past. No longer will the design life<sup>1/</sup> be fifty years, as it was for the electro-mechanical crossbar and Strowger systems. At the same time that obsolescence is accelerating, longer lead times and higher costs are incurred in R&D and production engineering. Thus the familiar cycle of high technology begins, in which each generation of equipment is more productive than the last, but also more expensive and shorter lived. New generations such as digital switching are already in the preparatory stages of development, and the anticipated development and introduction costs for this and other new systems will pose fundamental problems for both manufacturers and carriers.

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<sup>1/</sup> The short design life of electronic switching (perhaps 20 years) should be distinguished from the long service life of 40-50 years for both electronic and electro-mechanical systems.

For manufacturers, the advance of electronic technology has opened the field to suppliers other than the traditional switching manufacturers. Before the electronic age a few specialized components of simple construction were needed, and since the components were not readily available the equipment manufacturer usually made them himself. This was the case for the step-by-step switch, the crossbar switch and telephone relays. In electronic systems there are more components of more general use and much greater depth of technology. Under these circumstances it is no longer economic for the equipment manufacturer to make all his components and he turns to the components industry for a wide range of product. Not only are components shared throughout the electronic industry, so are design concepts. Thus the switching manufacturer, once protected by his own design lore and specialized components, is now subject to increasing competition from other segments of the electronics industry. Recent years have seen IBM, Burroughs and Philco-Ford enter the switching field in other countries.

For carriers, the entry of new manufacturers, and of competition, might at first appear attractive in terms of offering alternative solutions and increased innovation. In truth however, the capital intensive nature of the carrier industry, and the method of capital formation, could quite easily make the carrier the victim of technology, rather than the beneficiary, at least in the switching sector. Switching machines installed today must still meet some basic criteria that are dictated by the carrier's existing investment. Not only must new systems work well with existing systems that date back to the twenties, they must also provide good service themselves for the next 20-30 years when they will still be in place meeting new service demands and working alongside newer machines yet to come. One carrier executive summed up the impact of technology this way:

"In the early 1900s, manufacturers developed switching systems that are still in service 50 years later. Technology appears to be taking us to the point where present generations of equipment will be obsolete in five years."

Rapid developments in telecommunications do appear to be leading to an increasing rate of hardware obsolescence. On the other hand, the user demand for reliability and developments in solid-state electronics are leading to longer and longer component life, mean times between failure for some components are measured in hundreds of years. This contradiction can only be resolved by separating function from hardware, and the next generation of full electronic stored program switching systems will probably meet this objective.

The electronic switcher is in fact a specialized computer and its potential lies in the versatility of the stored program or software, which will permit an easy adaptation to the unknown services of the future without hardware obsolescence. To retain a measure of restraint over the direction of future technology, and to assure control of the rate of innovation, carriers in most developed countries are moving toward even closer ties with their designated manufacturers.

SECTION 3 : SOME MAJOR PRODUCTS

III. TRANSMISSION

The types of equipment comprising the transmission sector are listed in Table 1 below:

TABLE 1

Transmission Sales to Common Carriers - 1972

Radio - light and heavy route	\$ 18 M
Satellite Earth Stations	12
Multiplex - analog and digital	34
Analog Cable Systems (carrier)	2
Voice Frequency Products	12
Voice Frequency Carrier Telegraph (VFCT)	3
Antenna and Waveguide	2
Supervisory Systems	2
Mobile Radio & Associated Control	<u>6</u>
	\$ <u>91</u> M <sup>1/</sup>

Total industry sales in 1972 were approximately \$130 million, of which 70% was to the carriers, 15% to other domestic users, and 15% exports. 94% of the carriers' requirements were supplied by established Canadian manufacturers. Table 2 lists the suppliers of radio and multiplex, who account for the major share of the market.

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<sup>1/</sup> This figure differs from the CTCA construction expenditure for COE - Circuit & Radio, which is \$115 million in 1972 (Chart II-3). The difference is due to federal sales tax, provincial sales tax and freight charges which are not included above, and to the fact that carrier account codes do not correspond exactly with the equipment listed above.

TABLE 2

Transmission Products and Suppliers

	MICROWAVE	ANALOG MULTIPLEX	DIGITAL MULTIPLEX	V.F. EQUIPMENT	ANALOG CABLE SYSTEM	DIGITAL CABLE SYSTEM	SATELLITE SYSTEM	VOICE FREQ. CARRIER TELEGRAPH	SUPERVISORY
<u>MANUFACTURERS</u>									
Northern Electric	X	X	X	X	X	X	X	X	X
GTE Lenkurt Electric	X	X	X	X	X	X		X	X
RCA Ltd.	X						X		X
Raytheon	X						X		
Farinon	X	X		X					
Marconi	X		X				X		X
Collins	X	X		X	X				X
Northern Radio								X	
Automatic Electronic Systems								X	X
Omicron									X
<u>IMPORTERS</u>									
GEC England		X							
Transcom				X					
IT&T		X	X						
Westcom					X				
Pye-TMC			X	X				X	



More than one-half of carrier procurements were for multiplex and radio equipment, and most of the sales to other domestic users, and exports, were for the same two categories of equipment.

The total market for these two products in Canada was approximately \$100 million, and the first seven companies listed in Table 2 are in fierce competition for over 90% of this volume.

Unlike the switching sector, the benefits of standardization are less inherent in transmission, and the seven major suppliers in Canada have thus been able to survive on the limited market available. Most of the U.S.-owned subsidiary plants were originally established as "miniature replicas" of the parent company, but more recently have assumed full responsibility for certain types of transmission products, and carry out some R&D in Canada within the confines of the parent's overall strategy.

The rapid development of electronics technology, the continued rise in the volume of telephone traffic, and the transmission of television signals have all contributed to the volatility of the transmission industry, and CTCA forecasts show demand still growing at the rate of 10% per year.

New technological concepts such as digital radio, coaxial cable and optical fibre systems are under various stages of development in Canada, and will be available to meet the demand for new data and broadband services that will be offered by the carriers.

As with most other products, the dominant supplier of transmission equipment in Canada is Northern Electric, which supplies most of Bell Canada's requirements. Other suppliers feel that action is required to improve the information exchange between the carriers

and the non-vertical aligned manufacturers. Guidelines, system requirements and specifications issued by the carriers are often combinations of various supplier specifications, and as a result are often costly if not impossible to comply with.

Some manufacturers have expressed the view that the transmission sector is plagued by fragmentation, both by the number of carriers each with different equipment standards and by the number of suppliers. When asked if rationalization of the transmission equipment manufacturing sector was a possibility, some manufacturers who are subsidiaries of U.S.-owned corporations pointed out that any co-operation between the subsidiaries in Canada could contravene U.S. anti-trust laws and would not therefore be permitted by the parent company. Most suppliers agreed privately that there are too many companies chasing too little business, but all companies are looking to the other fellow to rationalize. A further complication is the level of carrier procurement, which varies significantly from year to year, since transmission equipment tends to be added in large increments. Manufacturers point out that the long-term demand for transmission products is fairly constant and predictable, and they feel that carriers are not cognizant of the effect which fluctuations in procurement can have on manufacturers producing for a limited market.

Until 1971, no one would have forecast an increase in the amount of transmission equipment being imported into Canada, particularly in view of the large number of domestically based suppliers. Nevertheless, Japanese interests are now bidding on selected microwave projects, and have been awarded several contracts. The success of the Japanese bids exposes the fallacy that a large number of suppliers ensures low prices, for a surfeit of low-volume manufacturers cannot operate as efficiently as a large multinational firm. The transmission

industry can therefore be considered as vulnerable to foreign penetration, particularly as the vertical integration safeguard is less effective in this area. One carrier, in defending a purchase of imported microwave equipment is on record with the statement:

"... (we) operate in a competitive industry, and cannot afford capital costs any higher that can be achieved. The process of purchasing equipment, from domestic or foreign sources, depending on relative price is important, in our view, in retaining a competitive position in the telecommunications industry".

In this particular instance, the difference in price between the successful Japanese bid and the next lowest Canadian manufacturer's bid was less than 5%. Most manufacturers based in Canada have agreed privately that better knowledge of carrier requirements and economies of scale resulting from longer production runs could easily offset up to 5% price differential, particularly if the carriers could agree on more uniform standards, and centralize their evaluation, procurement, and documentation procedures.

### SECTION 3 : SOME MAJOR PRODUCTS

#### IV. TERMINAL EQUIPMENT

The terminal sector is defined for the purpose of this paper as that part of the communications carrier's plant that is normally installed on customer's premises. Data received from CTCA has been used to determine that approximately 30% of the carrier's yearly budget is spent in the terminal sector. CTCA estimates that during 1973 the total carrier market for terminal equipment amounted to \$183 million. This can be broken down into three groups as follows:

(a) Large PBX, small PBX and key systems	\$ 61 M
(b) Telephone sets (single and multi-line)	31 M
(c) Miscellaneous station equipment and connecting hardware, teletypewriters, mobile radio, data terminals, etc.	91 M
	<hr/>
	<u>\$183 M</u>

In addition some \$99 million was expended on installation labour, making a total addition to the terminal sector of the telecommunication common carriers during 1973 of \$282 million.

Expenditures in the terminal sector are growing at the rate of 10% per year, and if this rate of expansion continues, by 1980 annual expenditures by the carriers will exceed \$550 million. This projection ignores the probable introduction of new sophisticated telephone type terminals, or the impact of data communications. The widespread introduction of new services could result in the carriers spending closer to \$1 billion annually by 1980, however many of the specialized data terminals will probably be provided by users. Telephone type terminals used by business subscribers may also be provided by users at some time in the future, if there is some liberalization of carrier tariffs so as to permit the interconnection of customer-owned equipment.

a) PBX Equipment

Most terminal equipment used by the carriers up to the end of 1973 was manufactured in Canada, with a few notable exceptions such as PBX equipment. In recent years there have been increasing demands from the business community for larger size PBX systems with certain sophisticated features not previously available. To fulfill this demand, which domestic suppliers were unable to meet without undertaking a very expensive development program, Bell Canada in 1967 standardized on an import unit, following the lead of other telephone carriers who had ordered similar units from foreign manufacturers. L.M. Ericsson, Plessey, IT&T, AEI/GEC, Hitachi and Nippon Electric are among the foreign companies active in PBX sales in Canada. Sales are made to all common carriers and most of the equipment sold uses crossbar switching techniques.

Northern Electric is presently the only manufacturer of PBX equipment in Canada, and they have recently completed development of a new 80 line electronic PBX designed for the smaller business user. Approximately 80% of PBX systems installed in Canada and the U.S. are within the size range encompassed by the SG-1, with the result that the unit has received wide acceptance for telephone company use and also in the U.S. interconnect market.

PBX equipment is now undergoing a transition from electromechanical to electronic switching, and development costs in the order of \$2-3 million have been estimated as being necessary to bring a new system into production. This indicates annual sales in the order of \$12 million for five years would be required to amortize development costs, and the development cannot therefore be justified without assured access to a good share of the market.

The development cost of new-generation PBX equipment has been increasing with each successive generation and is now to the point of being prohibitive if restricted to possible sales in Canada. European and latterly Japanese manufacturers have provided much of the PBX equipment used by Canadian carriers in recent years, using equipment designed for their domestic markets but modified to North American standards. As a result, no manufacturer either domestic or foreign, enjoys a market for any one product in this category with any particular carrier in excess of \$5 million annually and Canadian manufacturers have to look to export markets if development costs are to be recovered within a reasonable period.

b) Telephone Sets

Telephone sets and key telephone equipment are manufactured in Canada by Northern Electric, GTE Automatic Electric and ITT, the latter named company operating assembly plants in each of the Prairie Provinces. The large volume of production has had the effect of holding down prices. The 500 type telephone set for example, which is the workhorse of the industry, is presently being sold by Northern Electric to non-Bell customers for less money than in 1961, and substantially less than when it was first introduced in the mid-50s.

c) Miscellaneous Station Equipment

Included in this category are cables, wires, terminals, most of which are supplied by a number of Canadian manufacturers. Some types of equipment such as mobile radio are purchased by competitive tender and in recent years a number of suppliers, both domestic and foreign, have held portions of the market.



### Future of Terminal Sector

Most manufacturers foresee little change in the market distribution in the terminal sector. The volume markets for telephone sets will probably continue to be supplied by Canadian manufacturers. The demand for more specialized products such as PBX equipment is likely to be satisfied in some measure by increased sales of imported equipment.

The most significant event which could impact on future carrier procurement of terminal equipment would be a liberalization of carrier tariffs so as to permit interconnection of customer-owned terminal equipment to carrier switched networks. The growth of the interconnect industry in the United States and possible impacts in Canada are now examined.

### Liberalization of Carrier Tariffs so as to Permit Attachment of Customer-Owned Terminal Equipment to Carrier-Owned Switched Networks

### The U.S. Experience

From the early days of telephony in the U.S., the Bell System and the so-called "independents" developed the nation-wide telephone switched networks within the concept of end-to-end service, whereby all equipments forming part of the system, including the telephone sets, are owned and maintained by the carriers. A very high degree of standardization of equipment and operating methods has characterized the industry, leading to allegations in recent years that telephone carriers were taking unfair advantage of their monopoly position by denying to subscribers the benefits of innovative new services, particularly sophisticated new types of terminal equipment and systems.

Large business users and users with specialized communications requirements such as hotels spearheaded the demand for some form of competition in the supply of terminal equipment that would allow them the opportunity

to purchase, lease, rent or otherwise acquire advanced systems at substantial savings. These users were supported by entrepreneurs who saw opportunities for profit by serving selected segments of the telecommunications market, and by equipment manufacturers, mostly of foreign origin, who for years had been frustrated in their efforts to sell telephone equipment into the virtually "closed shop" that the Bell System market in particular appeared to represent.

In 1968 the Federal Communications Commission (FCC) ruled in the historic Carterfone decision<sup>1/</sup>:

"... that the Bell System tariffs had been unreasonable, discriminatory and unlawful in the past and that the provision prohibiting the use of customer provided inter-connecting devices should, accordingly, be stricken".

The Carterfone decision had the effect of creating a brand new "Interconnect" industry, by permitting the telephone subscriber to purchase, install and maintain his own terminal equipment. By the end of 1972, this new industry had achieved sales of \$127.5 million in the voice equipment category. Tables 1 and 2 on page 79 show the distribution of the markets by types of product, and the forecast growth up to 1975.

Table 1 shows that foreign manufacturers are supplying most of the equipment to the "Interconnect" distributors. Only Automatic Electric and North Electric manufacture in the U.S., the latter using L.M. Ericsson (Sweden) designs.

The dominance of foreign suppliers in the U.S. interconnect market is hardly surprising. Prior to the Carterfone decision, vertically integrated U.S. manufacturers had a secure hold on the major portion of the terminal equipment market, producing a complete but limited

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<sup>1/</sup> The Carterfone is an inductive device that cradles the telephone handset without making a direct electrical connection. Its purpose is to provide a voice connection between the telephone and the base station of a mobile radio system.

TABLE 1

1972 Market Shares of Leading U.S. Interconnect Suppliers

<u>Distributor</u>	<u>Main Equipment Handled</u>	<u>Share of PABX and Key Set Market (Dollar Sales)</u>	
Arcata	Ericsson, Nippon Electric Oki, Automatic Electric, Nitsuko & Others	25%	
ITT	ITT	14%	
UBC	North, Fujitsu	12%	
UCS	Hitachi	10%	
RCA	Hitachi, Oki	5%	
Teleci	Hitachi	5%	
Norelco	Philips	4%	
Litcom	Oki, Nitsuko	4%	
Rollins	Nippon Electric	3%	
Others		<u>18%</u>	<u>100%</u>

Source: Frost & Sullivan, (Telephone Engineer and Management, 15 Jan 73).

Table 2

U.S. Interconnect Market Projections  
(\$ millions)

	<u>PABXs</u>	<u>Key Systems</u>	<u>Voice Gadgetry</u>	<u>Service</u>	<u>Total</u>
1971	\$ 40	\$ 10	\$ 10	\$ 2½	\$ 62½
1972	80	20	20	7½	127½
1973	110	40	40	15	205
1974	160	70	60	27	317
1975	220	120	90	44	474

Source: Frost & Sullivan, (Telephone Engineer and Management, 15 Jan 73).

range of terminal equipment in response to the carrier dictates of standardization, ease of maintenance and longevity. No independent domestic manufacturers seriously contemplated the development of terminal equipment as there was no assurance of penetrating the major market. Consequently, on day one of interconnection, the immediate demand for hardware, and for "user choice", could only be met by importation of foreign-built equipment.

There are now signs that some U.S. manufacturers are being attracted to this new market. Philco-Ford and Executone, two companies who are not traditional telephone equipment suppliers, have developed sophisticated new electronic PBX systems, and other companies are cautiously evaluating marketing potential. It should be noted however that contrary to the early customer demands for "innovation", the best selling PBXs in the U.S. Interconnect market have been those with minimum frills and the lowest price.

The future of the "Interconnect" industry in the U.S. is still not assured. The Bell System is meeting competition directly by new service offerings, and indirectly by focusing attention on the long-term impact of interconnection on rates charged to small users. Many state regulatory commissions are heeding the Bell System predictions of the dire consequences that will flow from allowing what is described as "uncontrolled cream-skimming" of carrier revenues, and have called for an in-depth analysis of the economic effects of interconnection in the public interest. Other states are challenging FCC jurisdiction by calling for the telephone companies to own, maintain, and be responsible for all equipment used in intra-state telephone service. Despite a number of reports from advisory committees, there is no agreement in sight that would govern technical standards and performance criteria

for customer-provided equipment, and most of this equipment is being connected to carrier networks by means of carrier provided "coupler" (except where equipment is connected without carrier knowledge). Numerous court actions are in progress or in process of appeal with the objective of eliminating the protective coupler arrangement.

Harry Newton of Frost and Sullivan, Inc. commented on the 1972 Interconnect scene as follows:

"Of course, for many interconnect companies, the regulatory delays were God-sent; they happily marketed their answering machines, conferencing devices, key sets, smaller PABXs and other gadgetry for direct connection to the phone system (caveat emptor), while less venturesome companies stayed on the sidelines"<sup>2/</sup>.

Newton also reported that red ink and regulatory frustration plagued the major interconnect companies in 1972, but smaller firms reaped handsome profits. This observation is supported by the fact that in 1973, several major U.S. corporations withdrew from the interconnect market.

At the end of 1973, most of the regulatory, jurisdictional, technical and economic conflicts and delays that have plagued the industry remain unresolved and in some cases have escalated.

#### Interconnection in Canada

The growth of the interconnect industry in the U.S. has led to customer demands for similar liberalization of carrier tariffs in Canada, and the pressures are essentially from the same groups of users, entrepreneurs and foreign equipment suppliers as in the U.S. Many Canadian based subsidiaries of U.S. owned corporations are also in favour of inter-

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<sup>2/</sup> Harry Newton, Frost & Sullivan, Inc. "Interconnect Expects to Grow 70% in 1973", Telephone Engineer and Management, 15 Jan 73.

connection, particularly manufacturers of mobile radio systems and data terminal equipment. There are no pressures from the traditional Canadian telecommunications equipment manufacturers.

There are four major groupings of terminal equipment that are of interest to would-be "Interconnect" companies in Canada for attachment to telephone networks:

1. The accessories or "gadget" market, answering machines, auto-dialers, etc.
2. Single line telephones, plain and fancy.
3. The ubiquitous key-telephone, used by most businesses in Canada.
4. PBX private-branch-exchanges, as used by medium and large businesses.

The market for data terminals is still insignificant to Canadian manufacturers compared with expenditures on "voice" terminals, and in any event most data terminals are already permitted interconnection. The data sector is therefore not considered in this review of carrier/supplier relationships.

#### 1. The Accessory Market

One of the major market sectors for interconnect equipment, and one where no Canadian manufacturer is represented, is the growing market for telephone answering machines, auto dialers, and other assorted gadgetry. All of this equipment is presently imported from the Far East, and is considered to be part of the consumer electronics market. The doubling of demand for telephone accessories that could result from interconnection may at first glance create opportunities for Canadian manufacturers. In reality, domestic manufacturers cannot compete and as a result do not manufacture the mass-market consumer items such as tape recorders, etc., from which telephone answering machines are descended. They will be even less able to compete in the smaller market for telephone accessories. The result will be increased opportunities for importers of equipment manufactured in the Far East.



2. Single Line Telephones and Decorator Sets

There are three companies presently manufacturing single line telephone sets in Canada, the total market for the year 1973, was around \$20 million. This market is unlikely to be affected by interconnection, as most residence subscribers would continue to obtain their "main" telephone from the carrier. The market for extension telephones, and decorator telephones, would however be a prime target for importers.

3. Key Telephone Sets

There are three manufacturers of key telephone sets in Canada. The key telephone market, which serves almost exclusively business users, is around \$20 million annually in Canada and, as in the United States, is expected to be a prime target for attacher companies. In the U.S., most of the key equipment installed by attachers is imported from Japan. It is interesting to note that the Japanese equipment is usually a copy of U.S. designs, with the same operating features. The only advantage is the lower price, which appears to indicate that in the U.S. the motivating force for interconnection is initial cost rather than innovation. This trend would undoubtedly be repeated in Canada.

4. PBX Equipment

The PBX area is the most lucrative sector of the terminal business, and one where imports already have a firm foothold in the Canadian market, accounting for approximately 30% (about \$12 million) of carrier purchases in 1973. Only Northern Electric manufactures PBX equipment in Canada, and even this company does not manufacture all size-ranges of equipment. No other company has in recent years attempted to manufacture a PBX in Canada, for the PBX is a complicated machine and the relatively small Canadian markets do not justify the development costs. Imported

equipments, on the other hand, were originally designed to service larger foreign markets and therefore can be modified for sale in Canada and still compete with domestically-produced equipment, for most of the indirect costs have been recovered in the home market.

#### Impact on Canadian Manufacturers

The immediate effect of interconnection in Canada will therefore be greater opportunities for foreign manufacturers. Most of the organizations listed in Table 1 have existing marketing facilities in Canada, all are poised to enter as a natural extension of the U.S. market. In addition, U.S.-owned companies now entering the fray will move into Canada. In self-defence, Canadian manufacturers may be forced into alliances with offshore manufacturers if competition forces the carriers to offer the same types of low-cost equipment being sold by the Interconnect companies.

The advent of interconnection in Canada, and the creation of a new industry, should present new opportunities for Canadian manufacturers, however it is difficult to project such a scenario in view of the U.S. experience. Some manufacturers with whom this problem was discussed advocated the development of strict hardware type-approval standards as a means of preventing the importation of low-cost inferior equipment. This approach is not realistic as most of the imported PBX equipment that would be offered for sale in Canada is already being purchased by the carriers, is not inferior, and is presently connected to the network. Another suggested approach was to provide a suitable time lag from the announcement of interconnection to the starting date so as to permit Canadian manufacturers time to develop a range of terminal equipment. To implement this suggestion could require financial assistance from a Department of Industry, Trade and Commerce incentive or development program, and possibly some special consideration,

for the project might not satisfy the normal criteria for development assistance such as market potential. The domestic market for certain types of terminal equipment has been too small to encourage the traditional suppliers to develop a complete range of equipment, presumably this constraint would also apply to new comers.

In summary, the liberalization of tariffs to provide for attachment of customer-owned equipment to the switched networks is expected to provide more opportunities to foreign manufacturers than to Canadian manufacturers unless a special effort is made to safeguard Canadian interests. It is not the purpose of this paper to explore the effect of interconnection on the carriers, but it would be appropriate to point out that the more successful the interconnect business, the more likely are the carriers themselves to procure foreign-built terminal hardware in order to remain competitive. The overall gain to the country's economy may still justify tariff liberalization, however the justification would be more convincing if interconnection were to result in increased employment in manufacturing. Without special measures, the only increase in employment from interconnection will be in the service sector. Canadians must resist the drift towards a society where all exist by taking in each other's washing.

#### 4. THE WORLD SCENE

#### SECTION 4 : THE WORLD SCENE

The purpose of this section is to compare the market conditions and carrier supplier relations as they exist in Canada with those that prevail in other developed countries. The predominant structure that has emerged in the telecommunications industry in North America is vertical integration, whereby a single corporation, together with its subsidiaries, exercises responsibility for telephone service from research and development through to the customer's telephone. This pattern of private ownership is in marked contrast to the system that prevails in most other developed countries where the telephone system is operated by the state, using hardware supplied by privately-owned domestic manufacturers.

The Canadian telephone system is closely linked to that of the United States, and together they form a North American system that has reached a very high standard of development and one which allows telephone users to dial from one country to another without regard for national boundaries. To this extent the Canadian and U.S. telephone networks can be considered as one system. At the corporate level the similarities are heightened by the degree of vertical integration in both countries, and by the cooperation between carriers on both sides of the border that has been necessary to develop and retain operating compatibility. Nevertheless, there are significant differences between Canada and the U.S. at the carrier/supplier level, and it is therefore instructive to compare these differences before proceeding to the broader task of comparison between Canada and other countries where state ownership is the norm.

##### Canada

Sections 1, 2 and 3 provided an "as is" snapshot of Canadian demand and supply for telecommunications products. The picture that emerges is one of a reasonably watertight industry. Bell Canada and its subsidiaries

operate almost 70% of the nation's 11 million telephones, and the GTE affiliates, B.C. Tel., Okanagan Tel. and Quebec Tel. account for 12%. Both these groups of companies are integrated with domestic manufacturers. Notable exceptions to the integrated pattern are the three provincially-owned carriers in Manitoba, Saskatchewan and Alberta, who operate 13% of Canada's telephones. Table 1 shows the major Canadian carriers and their supplier affiliates where applicable:

TABLE 1  
Vertical Integration in Canada  
(1972)

<u>Carrier</u>	<u>Supplier Affiliate</u>	<u>No. of Telephones</u>	<u>%</u>
Bell Canada	Northern Electric	6,742,000	61.4
Maritime Tel. & Tel.		324,000	3.0
New Brunswick Tel.		261,000	2.4
Newfoundland Tel.		110,000	1.0
Island Telephone		39,000	.4
Northern Telephone Ltd.		109,000	1.0
Telebec		<u>40,000</u>	<u>.4</u>
		7,625,000	69.6
B.C. Tel.	GTE Automatic Electric	1,114,000	10.1
Okanagan Tel	GTE Lenkurt Electric	67,000	.6
Quebec Tel.		<u>177,000</u>	<u>1.6</u>
		1,358,000	12.3
Alberta Government Tel.		615,000	5.6
SaskTel		345,000	3.1
Manitoba Tel. System		<u>481,000</u>	<u>4.4</u>
		<u>1,441,000</u>	<u>13.1</u>

Source: Annual Reports.



The corporate ties between Bell Canada and Northern Electric are further strengthened by their joint ownership of Canada's largest privately-owned research and development laboratory, Bell-Northern Research, where R&D activities are maintained at a sufficient level to take care of all but the most sophisticated and/or low volume requirements. A number of U.S. subsidiaries also manufacture in Canada and importers supply those products which are in demand but of insufficient volume to warrant design, development and production in Canada.

In summary, there exists in Canada a solid telecommunications equipment manufacturing base, majority owned by Canadians, and with relatively secure domestic markets. Equipment is imported from many other countries to fill certain specialized low-volume product requirements, without posing a serious threat to the indigenous suppliers.

#### United States

In the United States, the Bell System as the operating arm accounts for some 85% of the nation's 130 million telephones. Western Electric, the supply affiliate, manufactures over 90% of the Bell System's hardware requirements and 1972 sales exceeded \$6.5 billion. As Table 2 shows, all but 6% of telephones in the United States are operated by carriers with some degree of manufacturer affiliation:

TABLE 2

Vertical Integration in the U.S.  
(1972)

<u>Carrier</u>	<u>Supplier Affiliate</u>	<u>No. of Telephones</u>	<u>%</u>
American Telephone & Telegraph Co. (Bell System)	Western Electric	108,811,000	82.7
General Telephone & Electronics (GTE)	Automatic Electric	10,623,000	8.1
United Telecom	North Electric	2,642,000	2.0
Continental Telephone	Superior Continental Corp. Vidar	1,945,909	1.5
Other Independents	-	<u>7,585,091</u>	<u>5.8</u>
		<u>131,606,000</u>	<u>100.0</u>

Source: Companies' Annual Reports, U.S.I.T.A.

The Bell System comprising 23 separate operating companies provides telephone service to almost five-sixths of the users in the United States, about 108 million telephones at the end of 1972. The rest of the service, over 21 million telephones, is provided by around 1800 independent companies. More than 80% of these "independents" are owned by holding companies, the largest being shown in Table 2 above.

Table 3 provides a comparison of the size of the U.S. telephone industry in relation to General Motors, which for years has ranked as number one among U.S. corporations:

TABLE 3

Comparative Financial Statistics of U.S. Telephone Companies  
(1972)

<u>Company</u>	<u>Assets</u> ( <u>\$000</u> )	<u>Revenue/Sales</u> ( <u>\$000</u> )	<u>Employees</u>
General Motors	18,273,382	30,435,231	759,543
AT&T	60,025,045	20,904,112	778,551
GT&E	9,521,809	2,220,263*	79,859*
United Telecom	1,729,359	597,622	25,461
Continental Telephone	1,566,095	467,208	19,000

\* Operating telecoms only.

Sources: Fortune, May 1972 - Largest U.S. Companies  
Moody's Public Utility Manual

As may be seen, American Telephone and Telegraph Company (AT&T) outranks General Motors, in terms of assets and number of employees, but ranks second in terms of revenues.

Western Electric from the very beginning has dominated the telephone supply industry in the United States, and the relationships between the Bell System and its major supplier have provided a source of income to the legal profession for more than 50 years. In 1925 Western was forced to divest itself of its international holdings by an anti-trust action. To this day Western is barred from exporting telecommunications

equipment. The extent of Western's dominance of the U.S. telecommunications manufacturing scene is such that in 1972 combined exports of telecom equipment from all other U.S. manufacturers were less than \$80 million, mostly to serve the needs of U.S. armed forces abroad.

From 1925 on, Western Electric devoted its efforts to the U.S. domestic market. In 1949 however, the U.S. Department of Justice filed a suit under the Sherman Anti-Trust Act. The complaint held that AT&T had granted exclusive licenses to Western Electric and that AT&T required its operating companies to purchase their equipment requirements from Western, AT&T's wholly-owned subsidiary. The Department of Justice suit sought to restructure the equipment market and make it subject to open competition.

The Department abandoned its anti-trust suit in 1956 and entered a Consent Decree which required, inter alia, Bell to make its portfolio of patents issued prior to January 24, 1956 available to all U.S. firms on a royalty-free basis but allowed AT&T to retain its ownership of Western Electric as its exclusive supplier. Subsequently issued patents were to be licensed to any applicant with reasonable royalties. The requirement for Bell subsidiary companies to make their equipment purchases on a competitive basis was dropped. As a further result of this Decree, Western Electric disposed of its interest in Northern Electric, Bell Canada's supply affiliate.

Despite the efforts made to restrict the Bell System/Western Electric relationships, the manufacturing arm has continued to expand and 1972 sales exceeded \$6.5 billion. In more recent years, therefore, the attention of the anti-monopoly forces appears to have shifted to the operating sector and a number of rulings have been made by the U.S. Federal Communications Commission (FCC) with the objective of providing more competition for the carriers, and concurrently, more opportunities for equipment manufacturers. The FCC has licensed a large number of

private microwave systems, and has more recently permitted the establishment of so-called specialized communications carriers. The historic Carterfone decision, whereby FCC ruled that AT&T's foreign attachment tariff was unreasonable and unduly discriminatory, has also posed a competitive challenge to AT&T operating subsidiaries.

AT&T has responded to the challenge from private systems by the introduction of Telpak, a "wholesaling" of individual private line rates for large users, offering reductions of up to 85% over previous individual rates. The U.S. carriers are now responding to competition in the terminal field by the reduction of tariffs for PBX and key systems for business users. It should be noted that the new entries into the U.S. communications arena are almost 100% "cream-skimmers". The specialized carriers operate on lucrative high density routes such as Chicago to St. Louis, and the interconnect companies operate in the major cities, serving the business community.

To the extent that market rivalry has resulted in a reduction in the prices charged to some end users, the FCC policies have been effective, and this has led to demands for similar liberalization and introduction of competition in Canada. These demands range from liberalization of carrier tariffs so as to permit interconnection of customer-owned equipment to carrier networks through to outright attacks on the vertical integration system by proposing that Bell Canada and its operating subsidiaries should be required to procure hardware by competitive tender. To appraise the possible benefits to Canadian telecommunications users that would result from a weakening or dismantling of the vertical integration system, it is only necessary to take a look at the independent telephone company market in the U.S., where an interesting parallel exists.

Critics of vertical integration in the U.S. are challenging a supplier/carrier relationship that provides service to over 100 million telephones, the largest captive market in the world. Outside of the Bell System,

only GTE has manufacturing affiliates that can supply all types of hardware, the United Telecom and Continental groups must purchase many items outside. Including the latter two groups as "independents", there is in the U.S. a total of 11 million telephones not affiliated with a complete manufacturing capability. This market, which is approximately the same size as the total Canadian market, has for over 50 years been a battle ground for a score or more independent manufacturers. There is no evidence to suggest that the supplier competition so engendered has resulted in lower costs, better service, or more innovative offerings by the independent operating companies.

#### Summary of U.S./Canada Comparison

The major supplier in the U.S., Western Electric, is the world's largest producer of telecommunications equipment, serving the world's largest market (108 million telephones), and affiliated with the world's largest privately-owned research and development laboratory. Although the U.S. market for telecommunications equipment is mature, normal growth, provision of new services, and replacement of obsolescent equipment gives Western an annual sales volume in excess of \$6.5 billion (in 1972). Even though Western is not permitted to sell outside the Bell System, its volume of business appears to have reached a self-sustaining level, sufficient to support a very large R&D program, and also to realize massive scale economies in most manufacturing activities.

Canada's major supplier, Northern Electric, is less than one-tenth the size of Western, and ranks about tenth on the list of world manufacturers. By virtue of its corporate ties with Bell Canada, Northern has a reasonably assured market of 7 million telephones. As in the U.S., the Canadian market is also mature, and provided Northern with total sales of around \$450 million in 1972. Unlike the U.S. however, the Canadian market is not adequate to support the level of R&D that will be required in the



future to maintain Canada's telephone system on a par with the U.S. Failure to sustain an adequate level of R&D will eventually result in a return to the dependency on imported technology from which the industry has so recently emerged.

No country can develop all its needs, and it will always be necessary to use foreign technology where it is available and superior to that existing in Canada, but imported technology is usually subject to licensing constraints that limit its use to home consumption in the recipient country. The use of imported technology must therefore always be weighed against the loss of export sales that would have resulted from home-grown technology.

Importation of technology for home consumption only also leads to increased manufacturing costs, for the manufacture of telecommunications equipment is scale sensitive, and the minimum scale for competitive manufacturing in Canada is rising faster than the domestic market growth. Without expansion of markets, the prices charged to Canadian carriers will eventually have to be increased, leading to increased imports and a decline in the share of the domestic market available to Canadian manufacturers, leading to even higher costs. This trend, once established, is almost impossible to reverse.

It is concluded therefore that the remedies proposed to counter vertical integration in the U.S. are not appropriate to Canada. What is needed is less fragmentation of the domestic carrier market, and a commitment on the part of Canadian carriers to the products of domestic manufacturers.

Canadian manufacturers have to find expanded markets to support the cost of R&D and to maintain the scale necessary to keep manufacturing costs down. While pursuing export opportunities, manufacturers must have reasonable assurance that their domestic markets will not be subject

to erosion through misguided attempts to follow the U.S. example, and by infiltration from offshore.

The performance and competitiveness of domestic manufacturers can be evaluated in the world markets, in competition with the British, Americans, Swedes, Germans, and Japanese. If Canada's manufacturers can compete and make sales in this league, there is no reason to fear that "lack of competition" in Canada will increase prices charged to Canadian carriers. Exports will keep prices down both by economies of scale in manufacturing and by spreading the research and development burden over a wider base.

#### State-Owned Systems

As stated earlier, in all developed countries with the exception of the U.S. and Canada, the telephone companies are state-owned. How do the systems compare? What concerns motivate state-owned carriers in their procurement policies? First a glance at statistics related to telephone development in the top ten countries of the world.

TABLE 4

#### Telephones in Service in Developed Countries

	Millions of Telephones		Compound Growth Rate 1963-1973	Telephones per 100 Population Jan 1973
	Jan 1973	Jan 1963		
United States	131.6	80.9	5.5	62.8
Japan	34.0	9.3	15.4	31.5
United Kingdom	17.5	8.9	7.8	31.4
West Germany	16.3	7.0	9.7	26.8
USSR	13.2	5.8	9.5	5.3
Italy	11.3	4.7	10.4	20.8
Canada	11.0	6.3	6.3	50.0
France	10.3	5.0	11.1	20.0
Spain	5.7	2.1	11.7	16.4
Sweden	4.8	3.1	5.2	59.3

Source: AT&T: The World's Telephones, January, 1973.

In all of the countries shown in Table 4 (except Canada and the U.S.), the telephone system is owned by the state and each country has taken measures to protect and develop its electronic manufacturing industry, particularly in the telecommunications sector. Under state control the carrier follows a deliberate government policy and buys from a number of domestic manufacturers. Centralized purchasing power is used to develop and structure the manufacturing sector, even to the extent of rationalization, mergers, etc. Even in the European Economic Community, there is very little inter-trading between members. Tariff barriers have been removed, but very significant technical and other barriers remain. The telephone administration acts as the design authority and nurtures close associations with the telecommunications manufacturing sector. There is little standardization of telephone switching equipment between one country and another; each has its national system and approved suppliers. Perhaps the most frank admission of the existence of non-tariff barriers is contained in the 1969/70 Annual Report of the Telecommunications Engineering & Manufacturing Association (TEMA), an association of British equipment manufacturers. Speculating on Britain's imminent entry into the ECC, TEMA are on record as follows:

"This Association's immediate concern is to ensure that there should be no unilateral lifting of the non-tariff barriers by this country, but rather, that the U.K., in cooperation with other West European countries, should agree on the mutual easing of all such hindrances to free trade within the community".

Most state-owned telephone systems act as the design authority and provide financial assistance to domestic manufacturers in the development of new products. Exact figures are difficult to obtain but a reasonable estimate would indicate that approximately 50% of R&D is directly or

indirectly financed by government-owned carriers. In no other industry, except defence and derivations thereof such as aerospace, do governments contribute so heavily to new product development. The one striking similarity between the private and state ownership systems is the degree of control that the carriers exercise on the innovative process, in order to protect their investment in telephone plant, particularly in the switching sector.

All carriers are vulnerable to change. In North America, for example, the over 140 million telephones in service include magneto, common battery manual, Strowger, crossbar and electronic systems spanning more than 80 years of technology. As each new service has been introduced, it has had to be compatible with existing hardware. With over \$100 billion invested in North American telephone systems, even the most revolutionary innovation would be delayed if the impact were to obsolete prematurely a small percentage of the existing investment. Most countries recognized this fact very early in the development of telephone systems and took positive steps to obtain firm control over the manufacturing area and the associated development facilities from whence innovation springs. Obviously this control over innovation and rate of obsolescence cannot be exercised if the design centres and corporate decision centres are located outside national boundaries and for this reason, state-owned carriers traditionally purchase from domestic manufacturers.

In North America the system of vertical integration, whereby the carriers own the manufacturing and R&D facilities, has served as the control mechanism. In European countries, the state-owned carriers exercise control by buying only from selected domestic suppliers, influencing and controlling the rate of innovation by judicious injection of R&D funds, and by monopoly purchasing power.

Opponents of vertical integration are critical of the alleged "cosy" relationship that exists between carriers and suppliers in Canada and the U.S. In actual fact, however, the cosiness of manufacturer/carrier relationships is much more pronounced in other developed countries where the national telephone system is state-owned. There the manufacturer is dealing with one carrier only, and furthermore with a government agency whose procurement policies are subject to national considerations such as employment. In Canada, on the other hand, the manufacturer must deal with a number of carriers, of varying size and ownership patterns and with first responsibility to shareholders. It is hardly surprising therefore that major manufacturers are often abused, for they cannot be all things to all carriers. Yet bigness is necessary to remain competitive. The answer is not a fragmentation of manufacturing to conform with the fragmented market (the carriers), but rather a need for closer cooperation between carriers in Canada to achieve a greater degree of standardization.

As Table 4 shows, carriers in most developed countries outside of Canada, U.S. and Sweden are experiencing a high growth rate. Demand is growing in pace with increased living standards. Carriers are investing heavily in new plant and modernization programs, in many instances to compensate for under-investment in previous years. These factors are providing very large markets for the domestic manufacturers of these countries, but there is still concern that R&D costs must be controlled and duplication avoided. Here we briefly examine carrier/supplier cooperation in Britain, where an extensive modernization program is underway, and in Sweden, where the telephone system compares favourably in development and excellence with those of North America.

### Britain

For many years the British Post Office, the state-owned communications carrier, negotiated bulk purchase agreements for switching equipment with five major suppliers (later reduced to three by mergers) and paid an agreed price to all manufacturers over an agreed period of time. Competition was invisible, and the only incentive for a manufacturer would be to reduce his costs and thereby increase profits but taking care not to reduce costs too much or the Post Office, who maintained auditors in manufacturing plants, would take a harder line on future bargaining. In any event, any increased profits as a result of cost reductions would be shared according to a predetermined formula between the manufacturer and the carrier. The Post Office financed most product development, directly or indirectly, provided that supplier R&D was directed to Post Office requirements.

There were two main disadvantages to the system, yet it endured for many years. First, tight carrier control over manufacturer innovations inhibited development programs. Second, as the major manufacturers were forced to produce outmoded equipment for the home market, exports of switching equipment declined steadily.

In 1969 the Post Office was reorganized as a Crown corporation, and in response to political pressures, the bulk purchase agreement was abruptly terminated in favour of competitive procurement. At the same time, a Post Office/Industry group, the "Advisory Group on Systems Definitions" was formed to advise the Post Office on definitions and specifications for the telecommunications system of the seventies and beyond. Essentially, this group provides the opportunity for manufacturers to have a say in systems engineering, and provides them with the opportunity to exert a greater influence on the R&D process. As an example, manufacturers would be expected to suggest changes to proposed new systems that would make the equipment more suitable for export.



Although Post Office procurement is now competitive, most R&D is jointly undertaken by the Post Office and the three major manufacturers, on an even closer degree of collaboration than before. British manufacturers have agreed that they can no longer individually finance the increasing cost of R&D; they are still adjusting to the problem of joint R&D on the one hand and open(?) competition on the other.

Nevertheless, now that initial misgivings have subsided, no manufacturer wants to return to the bulk-purchase agreements, for the benefits of joint R&D outweigh the disadvantages. For its part, the Post Office, by giving manufacturers a greater voice in systems definitions, have removed a major objection of the manufacturers - and the British Government - that adherence to outmoded systems and designs was inhibiting export performance for the industry. In summary, closer carrier/manufacturer cooperation is expected to benefit both parties.

#### Sweden

The major telecommunication manufacturer in Sweden is L.M. Ericsson A.B., whose 1972 sales exceeded \$850 million. Less than 20% of Ericsson's sales are to the Swedish Government Telephone Administration, the group has manufacturing and sales facilities in more than 50 countries and its major sales are in countries where the group maintains a manufacturing capability. More than half the Swedish Telephone Administration requirements are met by its own factories, using slightly modified Ericsson designs. The carrier is therefore vertically integrated with a major section of the supply industry, but can also influence L.M. Ericsson designs to some degree. In 1970 the state-owned carrier combined with Ericsson to form Ellemtel A.B., a jointly financed R&D facility which will work in part to reduce the amount of duplication of R&D activities. The duplication was once justified by the explanation that Ericsson developed for foreign markets while the Administration developed for the Swedish system. The formation of a joint R&D facility appears to be a tacit admission that this duplication is no longer affordable.

Possible Export Markets for Canadian Telecommunications Products

We have discussed in this section the mature domestic market within Canada, and have concluded that normal growth and replacement of telecommunications equipment will not support the necessary level of R&D nor will it continue to provide for economies of scale in manufacturing. In Section 2 we discussed Northern Electric's efforts in the U.S. markets, as a means of providing a significant increase in sales without incurring a disproportionate amount of new development costs.

Difficult though penetration of U.S. markets may be, to find substantial new markets is even more of a problem. The developed countries have opted for close ties between carriers and manufacturers, and with the exception of Canada and the United States, have taken positive steps to strengthen the ties. The result is a combination of non-tariff barriers virtually impenetrable from one developed country to the other. Although it may in the future be possible to gain limited access to these developed country markets by the establishment of manufacturing subsidiaries therein, this solution would probably be vigorously opposed by manufacturers already established. This leaves only the developing countries of the so-called third world as an export market for manufactured telecommunications products.

The carriers in the developing countries recognize that equipment must be imported initially, however the same concerns that occupy carriers in developed countries still apply, and in order to gain significant inroads into these markets, a strong local "presence" is required of the supplier. This obviously implies a multinational approach to the export market, with research and development, systems engineering, and component manufacturing in Canada, and assembly operations in the host country. Successful multinational telecommunications equipment manufacturers,

such as IT&T and L.M. Ericsson, have achieved close working relationships with national carriers in all countries where significant sales are made. In Canada, Northern Electric's success is due to close working relationships with Bell Canada and other carriers. This relationship breaks down when systems are to be installed thousands of miles away from corporate headquarters.

Northern Electric is the only Canadian-owned company with the capability and the corporate freedom to assume a multinational role, and in fact appears to be moving in this direction by the establishment of subsidiaries in the United States, Turkey and Ireland. These countries are not "third world" of course, but they provide a toe-hold in new markets and more importantly they provide an opportunity to gain "hands-on" experience of multinational operations as a prelude to a more ambitious undertaking.

A basic fact of life is that third world markets are small, despite the impressive percentage growth figures. Peru, for example, has a 15% growth rate, adding 60 thousand telephones a year, less than the annual growth in Metro Toronto. Many observers have compared the less than 1% ratio of telephones to population in developing countries to the 50% penetration achieved in Canada, with the implicit assumption that huge markets are therefore available. In reality, however, in terms of telephones many countries would settle for 3 or 4 telephones per hundred population. Telephone development will never "take off" in any of the developing countries until local manufacture is possible. Because of the high labour content (value added), the manufacture of telephone equipment is a natural for developing countries, nearly all countries with telephone development in excess of 2-3% of population have some form of local manufacture.

European manufacturers have been able to serve the small third world markets in the past by providing "off-the-shelf" designs usually priced to exclude most indirect costs, but still able to return higher than normal profits. On the other hand, Canadian manufacturers competing in world markets are presently faced with the necessity of making costly equipment modification, which results in a lower than normal mark-up, a dilution of profit and a significant increase in risk.

Equipment standards are in fact the major obstacle facing Canadian manufacturers in attempting to penetrate export markets. Since Western Electric was effectively removed from international markets in 1925, there has been no effective North American influence on equipment standards anywhere in the world. European manufacturers have provided most of the telephone equipment used in developing countries, and these designs are so well entrenched that they cannot be dislodged. Canadian suppliers must adapt the domestic design or develop new international designs for export. The magnitude of the task facing Canadian manufacturers in mounting a significant assault on world markets can be better understood by reference to Table 5, which lists some (but not all) of the international suppliers. All of the companies listed, with the exception of Western Electric and Northern Electric, are well established in world markets, and they have established manufacturing subsidiaries in those countries where they have been able to obtain access to carrier markets.

TABLE 5

Dollar Value of Telecommunication Equipment Sales  
by Selected Manufacturers, 1972

Company	Dollar Value of Total Sales Millions of U.S. Dollars	Per Cent of Sales Attributable to Telecommunica- tions Equipment	Dollar Value of Telecom Equipment Sales, Millions of U.S. Dollars
Philips Industries N.V.	6,180 <sup>1/</sup>	8.0	496
Western Electric	6,551	100.0	6,551
IT&T	8,557	22.0	1,883
GT&E	4,327	13.5	583
Siemens	4,580 <sup>1/</sup>	23.0	1,054
L.M. Ericsson	893	87.9	785
Plessey	839	43.7	367
Nippon Electric	1,017	47.0	478
Northern Electric	534 <sup>2/</sup>	84.5	451 <sup>2/</sup>
Hitachi	4,862	15.5	754

<sup>1/</sup> Calculated at exchange rates existing at company's year end.

<sup>2/</sup> Canadian Dollars.

Sources: 1. Companies' Annual Reports.  
2. Moody's, Industrial Manual, 1973.  
3. Moody's, Public Utility Manual, 1973.

The above table clearly shows that even Canada's major supplier, Northern Electric, faces extremely powerful competitors in world markets. All of these international companies are operating from a secure domestic base, protected by the jungle of non-tariff barriers that so concerned British manufacturers contemplating entry into the Common Market. While pursuing export opportunities, Canada's manufacturers also need reasonable assurances that the home market will not be infiltrated from offshore.

## 5. FUTURE DEVELOPMENTS

## SECTION 5 : FUTURE DEVELOPMENTS

The preceding sections of this paper have been devoted primarily to an examination of carriers and suppliers in Canada, and in some other countries for purposes of comparison. The evaluation of the performance of Canadian manufacturers in serving carrier equipment requirements has confirmed that the telephone carriers have traditionally purchased most of their hardware needs in Canada, except for certain specialized requirements. Despite the fact that the relatively small Canadian market consists of ten major telephone companies, each with its own views on procurement and standards, these companies are integrated into a national network which necessitates a high degree of equipment standardization.

National carriers such as CN/CP Telecommunications, Telesat, and COTC, on the other hand, have more specialized requirements. Their combined annual construction expenditures are less than 10% of total carrier expenditures, and include such diverse items of equipment as communications satellites, undersea cables, and telex switching systems. These low volume requirements have not attracted the major domestic manufacturers and have therefore been mainly served by foreign suppliers.

The obvious conclusion is that the major Canadian manufacturers have maintained a firm hold on the domestic market for the volume items of hardware, leaving the low-volume specialized requirements to foreign suppliers. A concomitant observation is that as equipment markets become more specialized (fragmented), the opportunities for foreign suppliers are increased.

Most Canadian manufacturers surveyed in connection with this report have agreed that the next five years are crucial to the survival of a viable electronics industry in Canada. For the last ten years imported products have taken the lion's share of the growth in the consumer electronics market in Canada, and in 1972 accounted for over 50% of this sector. Only in the



relatively small "Telephone and Telegraph" equipment sector has importer penetration been resisted. The major factors that have so far prevented a take-over of this sector include:

- (a) The "free" use of technology imported from the U.S.
- (b) The unique North American technical standards.
- (c) The cost competitiveness of Canadian built hardware.
- (d) Vertical integration between carriers and suppliers.

Several new trends are developing which will combine to reduce the effectiveness of the above factors as a means of preserving the viability of Canadian manufacturers. We now turn to an identification and discussion of these trends and the possible impacts on carriers and users.

#### 1. Impact of Technological Change

The electro-mechanical switching systems which have served the telephone companies for many years are rapidly giving way to new systems based on increased use of electronic components. All telephone carriers surveyed have forecast increasing utilization of new electronic switching systems. As the use of electronic systems accelerates, the equipment compatibility factor which has provided a measure of protection for traditional Canadian manufacturers will be reduced, as many of the design concepts and components used in electronic system are common to the entire electronics industry. Traditional telecommunication manufacturers may thus be faced with challenges from the general electronics sector. If these challenges originate from existing U.S. subsidiary plants using imported technology, or from European and Japanese suppliers, the switching equipment sector could experience the degree of fragmentation that foreign subsidiaries have already brought to the transmission equipment sector.

## 2. Rising Costs of R&D

Canada's major supplier maintains extensive research and development capability in Canada. Bell-Northern Research, Canada's largest privately-owned research laboratory, spends over \$40 million a year. This large expenditure has enabled Northern Electric to sever its dependency on technology imported from the U.S., but these large expenditures on R&D cannot be recovered from the sale of products on the domestic market, export markets must be developed and at the same time domestic markets must be retained.

The impact that a decline in domestic R&D would have on carriers in Canada can be demonstrated by the example of Northern Electric's electronic switcher, type SP-1, which was designed and built in Canada for economic use in average size Canadian cities. Prior to this development, Bell Canada purchased several No. 1 ESS switchers designed for larger U.S. cities. These units proved to be extremely costly, hence the development of SP-1 at approximately half the cost per line.

The SP-1 development project resulted in expenditures in excess of \$40 million, and approximately \$1 billion worth of sales must be realized to recover these R&D costs. Without a secure domestic market, Northern could never have undertaken the SP-1 development and all carriers would have been faced with the prospect of either continuing to purchase obsolete electro-mechanical equipment or paying twice as much to purchase the No. 1 ESS switcher designed for U.S. markets. The success of the SP-1 program is confirmed by the fact that the system is being sold successfully in the United States. As this market develops, the resulting scale economies will help hold down prices charged to Canadian carriers.

## 3. Barriers to Exports

Canadian manufacturers face significant barriers in seeking new markets for telecommunication equipment, for virtually every developed nation

has taken measures to protect and develop its electronic manufacturing industry, particularly in the telecommunications sector. Under state control, the carrier buys from a number of domestic manufacturers. Centralized purchasing power is used to develop and structure the manufacturing sector. Manufacturers are encouraged to develop unique national standards, and the various non-tariff barriers that result are generally impregnable to Canadian exporters. European manufacturers and carriers are extremely active in the work of the International Telecommunications Union, with the result that CCITT standards are now accepted by most of the developing countries of the third world. Even though more than half the world's telephones are located in North America, Canadian-built equipment must undergo extensive modifications for use in third world markets.

#### 4. Foreign Competition in Canada

New competitors are entering the domestic market. Three Japanese manufacturers are now represented in Canada and are making sales to the Canadian carriers. Unlike the Europeans, Japanese suppliers have few compatibility problems; the basic technology was imported from the U.S. and improved upon. In the next five years, the Nippon Telephone and Telegraph Co. will install 19.7 million additional telephones in Japan, this is almost twice as many telephones as are presently in service in Canada. The opportunities for scale economies are enormous, a slight increase in production could also supply Canada's five-year needs. The marginal export volumes could be priced to exclude most overhead and indirect costs and still return substantial profits to the manufacturer.

If foreign penetration of the Canadian carrier market increases, Canada's manufacturers in self-defence may be forced into alliances with off-shore manufacturers. Such an eventuality would have a drastic effect on employment, and on the ability of domestic manufacturers to remain responsive to carrier needs.

## 5. Interconnection

Within the next two years, there may be some liberalization of carrier tariffs so as to permit the attachment of customer-owned equipment to the switched network in selected areas of Canada. The advent of interconnection will provide an extension of markets for the specialized products that are presently being imported because they are of too low a volume for Canadian manufacturers to produce economically. Many of the larger PABX systems, for example, are already supplied by imports from Britain, Japan and Sweden, all carriers purchase some imported PABX equipment. Most international suppliers have established marketing and service facilities in Canada, and if interconnection provides the opportunity to sell direct, the market share of importers will obviously increase. Many of the single line attachments, such as telephone answering machines and decorator telephones, are already being imported from the Far East, this market is considered to be an extension of the consumer electronics sector and unlikely to attract Canadian manufacturers.

## Discussion of Trends

The five trends listed above can be summarized very briefly. No more "free" technology, R&D must be paid for out of sales. The Canadian market is not large enough to provide the sales volume needed. Foreign competition in Canada will intensify as user requirements become more specialized. Exports can help spread the R&D burden, but outside of the U.S. market, formidable non-tariff barriers exist. Unless Canadian manufacturers can increase sales, there will be an eventual decline in R&D and manufacturing activity leading to increased costs for domestic carriers.

It would be futile to attempt to arrest or circumvent these trends. They are a natural fall-out from the acceleration of technology which manifests

itself in user demand for innovative new services. There is, however, a need for measures that will strengthen the capability of domestic manufacturers, so that they can withstand competition in domestic markets and at the same time compete more effectively against powerful multinational corporations in world markets. There are two additional factors to be considered which could have the effect of weakening the telecommunications supply industry in Canada to the extent that carriers would once again be dependent on foreign technology. These factors are the increasing criticism of the relationship between Bell Canada and Northern Electric, and the possible fragmentation of manufacturing as a result of provincial industrialization policies.

#### Bell Canada/Northern Electric Relationships

As a subsidiary of Bell Canada, Northern Electric Company does enjoy a privileged position in the domestic market, supplying telecommunications equipment to Bell and to other operating telephone companies controlled by Bell Canada. It has been suggested that Bell and its subsidiaries should be compelled to invite competitive bids for hardware procurements so as to introduce competition into the supply sector. This simplistic solution ignores the fact that the only effective competition would be from foreign suppliers. In all developed countries carriers have the problem of determining if the prices paid for hardware are competitive, but no country invites competition into its own backyard as a price evaluation technique.

Another suggestion is that Bell should divest itself of Northern Electric, so as to remove any suspicion that Bell could transfer profits from a regulated monopoly into an unregulated subsidiary by means of inflated equipment prices. While this solution would satisfy some students of economics, it leaves unanswered many basic questions, including: Where in Canada

could a buyer be found? What is the value of Northern if separated from its major market? Is the real value of the Bell-Northern relationship contained in the closely integrated planning and operational relationship that has been developed? The Canadian obsession with monopoly is imported from the U.S., where in recent years many attempts have been made to break up the relationship between Western Electric and the Bell System. A glance at the relative stature of Northern Electric in comparison with the major multinational telecommunications corporations reveals that Northern, though it may appear a powerful organization within Canada, is but a healthy infant in the international arena.

#### Provincial Industrial Development Policies

The second factor that could have a major impact on the viability of telecommunications manufacturing is the legitimate demands of many provinces for a more equitable distribution of secondary industry in Canada, which could lead to deliberate efforts to use provincial or carrier purchasing power as an instrument of industrial development policy. Secure domestic markets have encouraged the major telecommunications manufacturers in Canada to invest in modern, efficient production facilities for long production runs. The costs of hardware have remained competitive in Canada and on world markets due to the economies of mass-production. In recent years provincial initiatives have resulted in several manufacturers establishing small "assembly" plants in different provinces. Manufacturers have responded to these pressures reluctantly, however they recognize that token manufacturing of one product may result in a greater share of the market for other products, particularly in those provinces where the telephone operating company is provincially-owned. From the provincial viewpoint, an additional 150 jobs may even justify paying a premium for the locally manufactured products but the overall effect has been to fragment

Canadian production facilities, and to increase costs for all users. Manufacturers fear that increased provincial pressures could lead to further inefficiencies and result in increased costs which eventually must be borne by the users.

Most provinces have a definite communication manufacturing deficit while at the same time Ontario and Quebec have large surpluses. This makes the Canadian market extremely vulnerable to penetration by a foreign supplier willing to establish an assembly plant, in one of the Western provinces for example, in return for access to the markets of provincially-owned carriers. Once established, the new supplier would seek to expand its markets. The initial advantages of marginal costing and imported technology would result in formidable competition for existing Canadian suppliers. The immediate result would be lower prices, as the new supplier buys into the market. Existing manufacturers would respond by increased marketing activity, financed by a cut-back of R&D expenditures. Eventually the loss of sales would result in increased manufacturing costs, and prices would have to be increased accordingly. When the new supplier had achieved the desired degree of market penetration, there would be no further need for price-cutting, and the prices charged to domestic carriers would then be adjusted upwards and stabilized at the higher level.

Only one Canadian company, Northern Electric, has the corporate freedom to forestall a foreign initiative by establishing a plant in Western Canada. But Northern already has sixteen plants in seven provinces, which works against the principle of scale economies. Furthermore, new plants in new locations only provide Northern with a transfer of production capacity, not an increase.



### An Industrial Strategy

This paper is not intended to propose an industrial strategy for the electronics sector, but rather to bring into focus the special interests of the carriers, who collectively consume a very large share of the industry's total output. Many of these interests, such as continuity of supply, control of design and innovation, standardization, and long amortization periods, often appear to be applying the brakes on the industry at the same time that technology is accelerating. These carrier concerns appear to be quite legitimate however and they apply world-wide, regardless of whether the carriers are privately-owned or state-owned.

In most developed countries, the telecommunications equipment market is protected by the carrier for the carrier, as a matter of government policy, and out of concern for national security and the public interest. Measures that weaken manufacturing capability are avoided. Developing countries aspire to the same degree of security for their own telecommunication systems. These factors indicate the need for preservation of a strong manufacturing sector in Canada, they also indicate some of the essential requirements that require careful consideration if the industry is to remain viable. Some of these are:

- to discourage the establishment of new foreign suppliers in Canada who would manufacture or import equipment which would compete directly with products of domestic manufacture;
- to establish closer liaison between carriers and domestic manufacturers, in such areas as equipment design, standardization, procurement plans and long-term planning, with the objective of providing assured markets for domestic manufacturers, subject to performance;
- to encourage exports of telecommunications equipment and thereby enable Canadian manufacturers to maintain the critical mass necessary for volume production and R&D.

Unlike most manufacturing in Canada, the telecommunications sector is majority owned by Canadians. This desirable situation did not result from government intervention, but largely as a result of anti-trust actions in the United States which forced Western Electric to divest itself of a 44% interest in Northern Electric. It is not necessary to "buy-back" control; what the industry needs is the support of both provincial and federal Governments by the formulation of cohesive and complementary policies to preserve domestic markets and encourage exports. Without such measures, there is the possibility of an eventual decline in the existing manufacturing capability.

A dilution of Canadian control in the manufacturing sector, and reduction in R&D activity, would cause the hardware requirements of Canadian carriers to be subordinate to the design and development dictates of larger and more influential markets. Equipment costs increase and many other hidden costs associated with compatibility, standardization, documentation, training and premature obsolescence would add to the burden. The carriers would be less flexible in meeting the needs of users, and unable to respond rapidly to new user demands. The inevitable consequences of carrier dependence on foreign technology would be higher prices and a lower grade of service.

Once control of manufacturing costs and control of the rate of innovation are lost to Canada, the economic consequences will prevent the realization of the full role of communications in the areas of trade, commerce, cultural enrichment and entertainment.

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