GAMMA
UNIVERSITÉ DE MONTRÉAL ☐ MCGILL UNIVERSITY

INFORMATION SOCIETY PROJECT. PAPER I-10.

INDUSTRIAL STRATEGY AND THE INFORMATION ECONOMY: TOWARDS A GAME PLAN FOR CANADA.*

By

Kimon Valaskakis

Peter S. Sindell

APRIL, 1980.

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*This paper was commissioned by the Federal Department of Communications but the authors assume sole responsibility for its contents.

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*Only the principal investigators are bound by the content of this report. Nevertheless they wish to thank the consultants for the valuable insights they have provided.

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Two briefing papers were produced as additional inputs to this report by:

T. RINGEREIDE, (Bell Canada). "Some Thoughts on the Respective Roles of Government and Business as Canada Enters the Information Age".

J. SCHAFER, (CNCP Telecommunications). "Discussion Paper on the Information Economy, Telecommunications and Government Policy".

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GAMMA INFORMATION SOCIETY PROJECT:

PAPERS AND REPORTS

PAPER 1: The Micro-Economics of Information. Structural and Regulatory Aspects. (J.Bernstein). GAMMA: 1979.

PAPER 2: Macro-Economie de la Société Informatisée. (R.J.Bernadat) GAMMA: 1979.

PAPER 3: La Poussée Technologique et les coûts unitaires décroissants en télématique. (J.Louis Houle). GAMMA: 1979.

PAPER 4: Public Policy and the Canadian Information Society. (P.S.Sindell). GAMMA: 1979.

PAPER 5: Social Implications of the Information Economy. (E.I.Fitzpatrick-Martin). GAMMA: 1979.

PAPER 6: Research and Development in the Information Sector of the Canadian Economy. (R.Wills). GAMMA: 1979.

PAPER 7: The Information Society: The Issue and the Choices. (K.Valaskakis). Integrating Report on Phase I. GAMMA: 1979.

PAPER 8: Tele-Informatics, Productivity and Employment: An Economic Interpretation. (Y.Rabeau). GAMMA: 1980.

PAPER 9: Public Acceptance of the New Information Technologies: The Role of Attitudes. (W.L.Gardiner). GAMMA: 1980.

PAPER 10: Industrial Strategy and the Information Economy: Towards a Game Plan for Canada. (K.Valaskakis, P.S.Sindell). GAMMA: 1980.

INTRODUCTION

THE OBJECTIVES OF THIS REPORT

- Background
- The Specific Purpose of this Report.

In Canada, the prevailing view is that the revolution primarily concerns the telecommunications industry. The consequences of this perception are that the revolution is perceived as being of concern only to communications bodies both inside and outside government and, thus, escapes the attention of the highest level decision makers outside the field of communications. As a result, the impacts of the revolution on areas other than communications tend to be ignored and the entire phenomenon is given a low priority outside these circles. In the United States studies by Machlup, Parker and, especially, Porat have interpreted the changes as leading to an "information economy." One sector of national economic activity, the information sector, is increasing its weight in the GNP. Forty six percent of the U.S. GNP is generated in that sector and over fifty two percent of the labor force is employed in it. This sectoral approach although wider than the mere focus on telecommunications still reveals only part of the enormous potential impact of the revolution.

European studies (especially the Nora-Minc report in France) focus not on information but on "informatisation" which is the French word for computerization. The indicators of the revolution are, in this view, not the weight of information activities in the GNP but the number and quality of computers in operation with their modems and other peripheral equipment. Based more on this European perception, GAMMA proposes that the revolution should be viewed not as a series of sectoral changes but as

a profound transformation in the mode of production. We contend that, we are experiencing a new industrial revolution as far-reaching as the one which occurred in Britain in the eighteenth century.

The central process of change we propose to call "informediation", which can be defined as an increasing pattern of person-machine and machine-machine interfaces not just in communications but in production. Information technologies are increasingly mediating all of our economic activities with the result that information capital is replacing the other factors of production. Informediation appears to save a) labor, b) energy, c) time, d) resources, and, even, e) physical capital. The result of rapid informediation is to provoke important dislocations in our economy which will bring both threats and promises. The threats will be realized if we misinterpret the changes while the promises will be fulfilled if we take appropriate corrective action.

We contend that the microprocessor plays the same central role today that the steam engine played in the British industrial revolution. In the same way that the steam engine's use in railways tempted observers to conclude that the British industrial revolution was confined to the transport sector, the microprocessor's use in telecommunications may tempt contemporary observers to label it a communications revolution. In fact, the steam

engine altered the mode of production in eighteenth century Britain, changing the economy from agricultural to a capital intensive manufacturing mode. Similarly, the contemporary industrial revolution is changing the production function by introducing robotics and the now probable scenario of a very high level of automation.

The introduction of robotics creates a problem of unbalanced growth. In the celebrated Harrod-Domar-Solow model of economic growth a balance between the factors of production is maintained in the long run. In other words, disemployment effects are cancelled by new employment opportunities and the capital-labor substitution tends to cancel itself out. If we assume unlimited growth, then capital 'deepening' (i.e. additional capital investment) will continue to create jobs in the long run. However, with the information revolution, the capital requirements for job creation will tend to become astronomical as the efficiency of information capital displaces inefficient (and often overpriced) labor. If we now assume limits to growth (because of energy, environmental and social constraints) then the required capital deepening may never take place and the capital-labor substitution may become permanent.

The bottom line is that the technological revolution which is creating a highly informediated economy presents a new set of challenges not adequately dealt with by a business-as-usual approach.

2. THE DETERMINANTS OF INDUSTRIAL LEADERSHIP IN THE EIGHTIES. (Chapter 2).

Given the new "rules of the game", industrial leadership in the eighties is intimately connected with successfully harnessing technological change. Market penetration becomes a function of three variables:

a) Accurate technology forecasting;
b) Changes in the relative costs of the various alternative technologies;
c) Public acceptance and rejection of the new technology.

2a. Accurate Technology Forecasting.

We believe that technological change occurs in demarcated quantum jumps, which we can call technology generations, and that each generation possesses a life cycle consisting of seven stages:

Stage 1: Discovery of a Scientific Principle.
Stage 2: Invention (application of the principle).
Stage 3: Innovation (first commercial use of of this invention).
Stage 4: National Diffusion (dissemination of the invention within a country).
Stage 5: International Diffusion (dissemination of the invention internationally)

CONCLUSIONS AND RECOMMENDATIONS

The Objectives of this Report.

1. The "Informediation" Economy: Evidence of a New Industrial Revolution?
2. The Determinants of Industrial Leadership in the Eighties.
3. The Game Plans of Canada's Competitors.
4. Toward a Game Plan for Canada.
5. General Recommendations.

Specific Recommendations.

THE OBJECTIVES OF THIS REPORT. (Introduction)

This study, commissioned by the Federal Department of Communications, explores some of the policy issues arising from the question "How best can we maintain Canada's international competitiveness in the face of the information revolution?" This revolution consists of rapid techno-economic change in computers and telecommunications which will lead to far reaching impacts on almost every sector of our society. In particular, this study develops the concept of industrial strategy in the context of the emerging information economy and proposes a tentative "Game Plan" for Canada. This plan is based on a broad interpretation of the nature of the information revolution and a diagnosis of Canada's strengths and weaknesses. As such the conclusions of this report fall under four headings: 1) the scope of the technological revolution in computers and telecommunications, 2) the determinants of industrial leadership in the eighties, 3) the industrial strategies of Canada's competitors and, finally, 4) our proposed game plan for Canada.

1. THE "INFORMEDIATION" ECONOMY: EVIDENCE OF A NEW INDUSTRIAL REVOLUTION? (Chapter 1).

Rapid progress in the computer industry (miniaturisation of computers and dramatically improving performance-cost ratios) and allied changes in telecommunications (digital communications, videotex, satellite transmission, fibre optics) are amounting to a so-called information revolution. But the nature and scope of this revolution, in our view, has been misinterpreted thus far.

Stage 6: Decline (phasing out the invention).

Stage 7: Obsolescence (final demise of that invention and replacement by a new technology generation).

The time period between each stage of a technology generation may be called gestation time. The time period between technology generations themselves may be called transition time. Accurate forecasting of gestation and transition times becomes a prerequisite for industrial leadership.

The existence of technology generations and a technology life cycle opens up the interesting possibility of alternative technological strategies: These will differ according to which stage of technological change they focus on. In other words, industrial leadership may be seized not by repeating other countries' technology-cycles but overtaking them. In some cases, basic R&D may be a losing strategy. Industrial emulation and the importation of foreign technology may sometimes accelerate the catching up process.

All told, at least five basic technological strategies exist:

(1) Basic R&D	Starting from scratch with a given technology generation.
(2) Adopt	Pure technology transfer. Adoption of foreign technology by imitation or licensing agreements.
(3) Adopt and Adapt	Imitation and Improvement.
(4) Minor leap-frog	Skipping a stage in the technology cycle.
(5) Major leap-frog	Skipping the present technology generation and going on to the next one.

If one is behind, adopt and adapt and leap-frog strategies are best. If one is ahead, then basic R&D is necesary to maintain leadership and prevent the competitor's leap-frog.

2b Changes in the Relative Costs of Various Alternative Technologies.

This second factor is extremely important in determining industrial leadership. It will influence transition and gestation times and must be analyzed in as broad a context as possible. The relevant costs include the following:

- energy costs
- the level of wages and salaries
- the cost of physical non-information capital
- the cost of information capital
- The cost of natural resources
- the general level of inflation
- the cost of borrowing

An inaccurate forecast of relative costs is usually the most important single explanation of great planning disasters and industrial failures.

2c. Public Acceptance and Rejection of the New Technology

Accurate forecasting of public attitudes concerning new products and new technologies is equally important for successful industrial leadership. The public at large is composed of individuals and institutions. Both may either accept, reject or resist the new technology. Resistance is a temporary rejection or a slow rate of acceptance and must be distinguished from outright rejection, which is permanent.

Institutions may reject technological change because of vested interests, lack of information on the issues, cultural or corporate traditions, or the force of inertia. Labor unions in

particular generally react negatively to technological change because of the feared disemployment effects.

Individuals may reject or resist technological change because of certain attitudes. These are:

(1) "The technology may replace me." (OBSOLESENCE. This is a legitimate fear of the capital-labor substitution which is characteristic of the information revolution.)

(2) "The technology may be used to invade my privacy." (PRIVACY)

(3) "The technology may involve too much." (TECHNOPHILIA)

(4) "The technology may be used to exploit me." (TECHNOPHOBIA/EXPLOITATION)

(5) "The technology may become a 'crutch'." (DEPENDENCE. Many teenagers are unable to multiply without a pocket calculator).

(6) "The technology may generate too much information." (INFORMATION OVERLOAD)

(7) "The technology may depersonalize me." (FEAR OF INFORMEDIATION)

(8) "The technology may change me." (MEDIA AS MESSAGE)

(9) "The technology may take too much time." (OPPORTUNITY COST. To learn to use a word processor or a computer requires time and effort. The time allotted to this endeavour might have a high opportunity cost. Other things would have to be given up. If the opportunity cost is high then people will not bother learning to use the new machine.)

(10) "The technology may force me to change my habits." (FORCE OF INERTIA & HABITS)

3. THE GAME PLANS OF CANADA'S COMPETITORS. (Chapter 3)

In this chapter we reviewed the "game plans" of Canada's major competitors vis-à-vis the information revolution: the United States, Japan, France, West Germany, the United Kingdom, and Sweden. Rather than analyse each country's plan separately we have done comparative analyses along a number of dimensions which we believe to be important in any national approach. The dimensions we have chosen are: overall awareness of the information revolution(3.2), overall governmental policy approaches to the information revolution(3.3), degrees of concertation present (3.4), technological strategies(3.5), human resources strategies (3.6), and apparent time horizons chosen(3.7).

In order to place the six countries on a "spectrum of awareness" from least to most we analysed awareness among governmental, industrial, and labor elites and awareness among the general public. Our assumption is that explicit consciousness, definition, and knowledge of an issue such as the information revolution precedes policy formulation and action and that this awareness begins with these elites and then spreads outward to the general public through the media. In performing the analysis we looked for a coherent, overall understanding of the phenomenon as a whole in all its complexity and ramifications, i.e. an understanding of it as the beginning of a second industrial revolution rather than just a series of developments in computers and communications.

From this perspective we found that the United States has the least overall awareness of the issue as an issue followed by West Germany, which does, however, have some awareness among elites. The United Kingdom and Japan in contrast demonstrate high awareness among the elites and some awareness among the general public. We judged France and Sweden to have the highest overall societal awareness of the issue, with both high awareness among elites and high awareness and debate on the issues among the general public.

In thinking about overall governmental approaches to the information revolution we made a distinction between the anticipatory, "proactive" policy approach and the fire fighting or "reactive" approach. The proactive approach implies high level governmental attention, study, and analysis of potential problems at the first sign of their existence followed by sensitization and education of the population and relevant groups within it and, once this has been done, formulation and implementation of coherent governmental policies and actions to forestall, ameliorate, or moderate the anticipated problems. The reactive approach involves governmental action only when problems are so acute that they generate pressure on the government from the various interest groups affected.

Studying the six governments we would classify France, Japan, the United Kingdom, and Sweden as proactive in their approach to the information revolution while West Germany and the United States are reactive in approach.

Concerning concertation, which comes from the Latin verb conserere, "to join together", we discussed the degree of concertation in four areas:

1. Public sector/private sector
2. Private firm/private firm
3. Labor/management
4. Government/labor/management.

From this analysis we find that the United States appears to lack explicit concertation mechanisms in all four areas, while the U.K. has concertation only between the public and private sectors. France has public-private and private-private whereas Japan, Sweden, and West Germany have mechanisms in place for all four kinds of concertation. However, recognizing the broad scale of concertation in Sweden and West Germany, it should be noted that Japan and France, driven by well formulated technological policies, have focused their concertation mechanisms much more sharply and more actively on th information revolution area. We have discussed in detail the results of this concertation in France and Japan with particular attention to the role of the PTTs and to the rationalization of industry structure and research and development in such areas as VLSI and the office of the future.

In the domain of technological strategy the United States government depends on the leadership of American-based multinationals to prevent problems from arising. In contrast the Japanese have have chosen an "adopt and adapt" strategy, often

coupled with "minor" or "major leap frogs", to use the terminology developed in Chapter 2. Examples include VTR technology, the digital watch, main frame computers, robotics, and some kinds of silicon chips.

In addition the Japanese government funds cooperative public-private research and development in specific generic areas of technology such as the recently completed VLSI programme. This programme cost four hundred million dollars over four years (one third paid by the government) and would have cost 1.6 billion additional U.S. dollars without concertation.. A number of other factors which aid the Japanese in effecting a succesful technological policy are discussed, including the debt-equity ratio in Japanese companies, the long range pay back period allowed for, the high ratio of technical to non-technical people, zero defect quality control, and the use of automated test and manufacturing equipment (robots).

Japanese policy seems to be motivated directly by the perceived need to replace the automobile, steel, ship building, and consumer electronics industries as they decline in the West & Japan and migrate to the newly industrializing countries such as Brazil, Korea, and Taiwan. Both the French and the Japanese have conceptualized opportunities arising from the new industrial revolution and are preparing for the day when microelectronics is the "heartland technology" and telematics is the "heartland

business." Both the French and the Japanese are orienting themselves toward a telematic strategy and all the products,software, and systems (based on computers) which go with it: mass fax, communicating word processors, EFT, electronic mail, videotex, fibre optics, specialized terminals, satellite systems, and so forth.

The Japanese, unlike the French, however, have invested significantly in robotics and presently have 13,000 of the world's approximately 17,500 robots.

The U.K. strategy lacks this telematic thrust except for Prestel and is much more oriented toward chips, software development and international marketing, and helping industry to use microelectronics to improve productivity and create new products. Neither W. Germany or Sweden appears to have an explicit technological policy although they both aid their domestic computer industries and W. Germany supports chip manufacturing to some extent.

In the area of human resources the French approach emphasizes the long term through education of children in elementary and highschool about computers while the Japanese spend about three billion dollars U.S. per year on computer training and education. The U.S. lacks an explicit policy; the U.K., Sweden, and W.Germany have developed specific occupational training programs in the computer area. Sweden has also mounted retraining programs for those displaced by automation.

Vis-à-vis time horizons chosen Japan and France have opted, it seems, for medium to long term horizons while the U.K. seems to be near to medium term in its overall orientation. W. Germany and Sweden are near term in their techno-economic orientation it would appear, while Sweden is long term in the social policy area.

4. TOWARD A GAME PLAN FOR CANADA. (Chapter 4).

Our proposed game plan for Canada attempts to maximize Canada's potential comparative advantages. It is discussed in detail in Chapter 4 and is summarized in Table 1 on the next page. Here we will just emphasize the highlights.

4a) Canada's Industrial Strategy should have as its Prime Goals Wealth Creation and an Export-Orientation.

This is not necessarily tantamount to job creation since the new technologies substitute capital for labor. The alternative priority of job creation is, we submit, a losing proposition because the introduction of robotics abroad will increase foreign productivity to the point where it will threaten not just some Canadian jobs but entire Canadian industries. A job creation priority therefore may be self-defeating. Instead, placing priority on wealth creation with redistribution and redeployment policies would permit economic expansion. The benefits could then be distributed so as to ensure a smooth frictionless transition and no loss of income by the displaced workers.

In addition, an export-orientation rather than the mere protection of the internal market will create the necessary economies of scale and scope which will generate the added wealth.

TABLE C-1

THE PROPOSED GAME PLAN FOR CANADA.

GOALS:	1) Priority to wealth creation through the use of advanced technology.
	2) Priority to export-orientation rather than mere import-substitution in order to achieve economies of scale.
	3) Redistribution and re-allocation mechanisms to ensure absorption of the displaced labor force and retraining.
TIME HORIZON:	4) Usually medium-run rather than short or long-run (in compatibility with the technology cycle).
TECHNOLOGICAL STRATEGY:	5) Emphasis on the leap-frog approach rather than basic R&D or repeating foreign experiences from scratch except when Canada already has the lead.
CHOICE OF SECTORS:	6) Choices should be made collectively by the public and private sectors in concertation.
	7) Choices should build on present strengths in telecommunications, office communications, cable television, computer systems, software, and services, and satellites, focus on network oriented integrated systems and products using Canada as a test bed, and should take into account forecast developments in cultural industries, robotics, and other areas where we could use the leap-frog.
ROLE OF ACTORS:	8) Replacement of the confrontation-economy by a concertation economy: replacing the four adversary systems by four concertation systems.

b) The Optimum Technological Strategy is not Basic R&D but the Leap-Frog.

If technological cycles and discrete technological generations exist, then the possibility of leap-frogging becomes extremely interesting. This has been a favorite Japanese strategy. With relatively low basic R&D expenses, during the first two decades of the Japanese "miracle", Japan has managed to catch up and surpass many of its competitors. Its basic technological strategy has been to adopt and adapt and more often than not, leap-frogging over entire technological generations. Japan's present leadership in some fields of electronics was planned and prepared, long before the current technological inventions were available anywhere.

The alternative strategy, doing basic R&D in order to promote "technological sovereignty", does not appear to be conducive to industrial leadership for Canada (with a few exceptions) for two reasons. First, given a smaller GNP, Canada cannot match the absolute level of R&D expenditures in the U.S., Japan, or Germany. Secondly, since information increasingly has become an international commodity, a strategy which uses foreign technology and builds on it with a view to a leap-frog seems more cost-efficient than one which ignores foreign technology. In this light, the Science Council's recommendation to limit or restrict the importation of foreign technology, allegedly in order to develop our own, appears particularly counterproductive.

c) In Order to Implement this or any other Industrial Strategy, Canada must move from its present 'Confrontation-Economy' to a more Desirable 'Concertation-Economy'.

The Science Council has singled out weak Canadian R&D and Canada's status as a branch plant economy as the principal reasons for our poor performance in world markets. The Economic Council, on the contrary, identifies protectionist policies as the most important retarding factor.

The view that we are proposing here is that both these diagnoses are partially true but incomplete. A more fundamental reason for poor economic performance is the inability of Canadian entrepreneurs to go beyond the invention stage to innovation and dissemination of the invention at home and abroad. In turn, we contend the most important reason for this is Canada's four-fold adversary system which amounts to a confrontation economy.

As we explain in Chapter 4, Canada's adversary system manifests itself in four confrontation-systems whose workings tend to promote general stalemate.

The four are:

(i) The Public Sector vs Private Sector confrontation.

(ii) The Firm vs Firm confrontation. This is encouraged by

anti-combines legislation and the federal government's competition policy, the net result of which is to prevent any rationalization of Canadian industry.

(iii) The Labor vs Management confrontation.
Each party uses its maximum weapons of strikes and lock-outs with abandon.

(iv) The Federal vs Provincial confrontation.
Eleven governments vie for sovereignty over dozens of disputed jurisdictional sectors.

We submit that by maximizing internal competition Canada has minimized its external competitiveness. With eleven generals and many more antagonistic actors, it is hardly possible for Canada to compete successfully against Japan Inc., the U.S. multinationals and European neo-mercantilism.

In order to implement a game plan, Canada needs team work. Only by replacing the four confrontations with national concertation can we harness the considerable natural and human resources which we enjoy as a nation to maintain industrial competitiveness in the 1980's.

5. GENERAL RECOMMENDATIONS.

A list of specific recommendations is found in Table 2. Our principal recommendation is that the federal government take the leadership in establishing consultative processes to achieve national concertation. This initiative should be taken by the highest level of government to match the attention that the information economy is receiving at the Prime Ministerial and Presidential levels in France, the U.K., and Japan. Establishing concertation mechanisms to replace each of the four confrontation systems should itself be achieved through team work by the actors involved. Therefore, joint committees of the Federal-Provincial, Public-Private, and Labor-Management actors must be set up. In the case of the Firm vs. Firm confrontation system, we must consider seriously revision of the anti-combines legislation and promote cooperation between corporations domestically and, particularly, in the international arena.

One crucial area requiring concertation which involves all of the players is the development of an explicit human resources strategy. This strategy must deal both with present and anticipated shortages of engineers and software programmers, especially in the microprocessor field, and with the retraining which will be required by those who will be displaced by the new information technologies.

TABLE C-2

SPECIFIC RECOMMENDATIONS.

1. Canada's industrial policy should give first priority to wealth-creation coupled with a re-distribution policy which will ensure that workers losing their jobs will share in the benefits of automation by being retrained and not losing their income.
2. Canada's industrial strategy should give priority to the penetration of international markets in those fields where Canada has or can develop a comparative advantage. Accordingly, the development of its information technology should reflect that priority and be outward looking.
3. Canada's choice of sectors for explicit support and development should be chosen jointly through concertation between the federal and provincial governments, on one hand, and industry on the other. The specific sectors chosen should(1) build on the precise strengths Canada possesses in telecommunications, office communications, cable television, computer systems, software, and services, and satellites;(2) focus on network oriented integrated systems and products using Canada as a "test bed";(3) take into account the forecast development of the cultural industries, robotics, and other areas where we could leap-frog.
4. Canada's technological strategy should be based on the leap-frog idea whenever possible. However, a potential leap-frog

RECOMMENDATIONS CONTINUED

must be thoroughly examined in the light of attitudes, consumer behaviour, institutional reactions and the possibility of resistance and/or rejection. Appropriate steps must be devised to prevent resistance-rejection from arising.

5. Case studies of failed innovations should be conducted in order to enlighten us on the nature of resistance-rejection.

6. The feasibility and desirability of a public sector/private sector partnership is a top research priority which should be undertaken on the initiative of both these sectors. Close attention to foreign experiences is important in order to identify where Canada can "adopt and adapt" certain successful foreign techniques of concertation.

7. Given that the labor-management confrontation-system is a major impediment to innovation and a source of waste, the modalities of an alternative system of concertation should be jointly explored. In particular, labor's institutional resistance to technological innovation should be reduced by including labor representatives in the planning of industrial strategy. Once again, the study of foreign experiences may be enlightening.

BACKGROUND

In the Fall of 1978, GAMMA embarked on a long-term study of the nature and implications of the emerging "Information Society", i.e. a society where the principal economic activity is no longer the transformation of goods but rather the transformation of information. An initial contract from the federal Department of Communications funded the first phase of the study, which ended in March, 1979. The purpose of the initial phase was first to identify the causes of the so-called "information revolution" and, second, to describe the possible scenarios which might emerge from the resulting Information Society.

The results of the first phase were presented in seven papers. Six papers were specific and technical in nature and outlined, in turn, the micro-economic, macro-economic, social, technological, R&D, and public policy aspects of the question. The seventh paper was an integrating report which assessed the relative strengths of each causal factor and went on to describe the alternative information society scenarios themselves and their possible consequences. We found that the most important causal factor was technological progress and the resultant reduction in unit-costs, which together can be described loosely as "technology-push". Demand pressures were viewed as more induced than fully independent of technology-push.

As for the forms the Information Society could take, we constructed three scenarios. In the first, one takes maximum

advantage of the convergence of computer and telecommunications technology. A "central electronic highway" penetrates every home, office, and factory and is linked with local computer terminals. This scenario was termed "Telematique" from the French contraction of the expression for telecommunications-informatics.

The second scenario emphasized the other alternative—predominantly un-connected stand-alone small computers. First advanced by the French computer scientist Bruno Lussato, the "Privatique" scenario (which is a contraction for private informatics) stresses the economic and normative advantages of stand-alone individual computers. The economic advantages stem from the probability of lower unit-costs (the cost of peripherals and telecommunications having fallen at a lower rate than the cost of the computer-on-a-chip itself). The "normative" advantages stem from the perceived need to decentralize and individualize the computer revolution.

Telematique and Privatique are not mutually exclusive. The question is one of emphasis and timing. Will stand-alone computers pre-empt a full tele-informatic network or lead to one? If the latter, what is the probable timing of the conversion of privatique to télématique (assuming complete interconnection is the "final" long-run scenario)?

A third possibility, which really acts as a brake on the other two, is the Rejection Scenario. In this scenario an Information Society does indeed emerge but with a marked preference for low and intermediate technology - the exact analog to the ecologically inspired 'appropriate technology' movement. The possibility of rejection or, at least, resistance to the new information technology is examined at some length in one of the background papers for this report, Paper I-9, by W.L. Gardiner entitled "Public Acceptance of the New Information Technologies: The Role of Attitudes."

The present document is part of the second phase of the Information Society Project and generally deals with the probable consequences of the information revolution. This current phase has been divided into two foci. The first focus, which encompasses this paper, deals with Canada's competitiveness in the world economy. In effect it assumes that the Information Society is essentially a "good" thing and the sooner Canada can fully adopt the new technologies the better. Its ultimate output is therefore the design of an internationally oriented competitive strategy for Canada and its modes of implementation.

The second focus, not covered in this paper but dealt with in other GAMMA documents (see list of GAMMA papers and reports above), considers the larger question of the social costs and benefits of the Information Society. It does not assume that all the changes are necessarily for the better; it takes a more normative and balanced approach, sifting out the pros and cons of an Information Society.

THE SPECIFIC PURPOSE OF THIS REPORT

This report was commissioned directly by the Department of Communications to consider some of the policy issues emerging from the information revolution. Its specific purpose is to work out a "game plan" for Canada in the eighties, taking into consideration the various constraints and opportunities arising from the international system. It is based on original work by the Project Director, K.Valaskakis,and the Assistant Project Director, P.S.Sindell, in consultation with four research associates at GAMMA, Drs. Houle, Gardiner, Rabeau and Mr. Ducharme. Professor Rabeau and Dr. Gardiner each contributed individual papers (Papers I-8 and I-9 respectively). In addition, Messrs. T.Ringereide of Bell Canada and J.Schafer of CNCP Telecommunications have contributed briefing papers. (See Research Team above for further details).

Because this report offers a possible "game plan" for Canada a note of explanation is in order. Essentially, international competition may be viewed as a 'game' - not because it is not serious but because it can be investigated by means of game theory since there are "players", "pay-offs" and "optimum moves". Ordinary public policy is, in fact, a series of "tactics" in a larger game which is often not even explicit. To be coherent, these tactics must fall within an umbrella "strategy".

An analogy from an actual game might, in this connection, be very enlightening. Hockey involves a series of tactics which in turn relate to an overall strategy defensive or offensive, "wide-open" or "tight", etc. Against a specific opponent, a 'game plan' is devised which is a combination of selected strategies and tactics suitable for that particular encounter.

Some readers might balk at the idea that Canada is involved in an international game of economic competition. This very reluctance to view the competitive situation in this light confers a marked advantage on Canada's economic rivals who have no such compunction. Japan clearly views economics as an extension of the competition between nations - a kind of inversion of Clausewitz's dictum which could now read "economics is a continuation of military competition by peaceful means". Japan openly wishes to be "Dai-Ichi" (Number One) by the end of the twentieth century and harnesses all its energies to that end.(1) France and West Germany have similar but perhaps less explicit ambitions. French policy, for instance, aims at securing the No. 3 position behind the U.S. and Japan. The U.K. and the U.S. do not articulate their overall goals as explicitly

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1. For elaboration of this point please see Zavis Zeman. 1980. The Men with the Yen: Some Foreseeable Japanese Developments and their Relevance to Canada. IRPP.

but do have well articulated policies in some industrial areas. Canada, on the other hand, is in the very vulnerable position of being in the game without quite realizing the stakes or even some of the rules. This allows other countries to take initiatives which remain unmatched by Canada (non-tariff barriers, covert governmental support to industry, etc).

The overall purpose of this paper is to contribute an interpretation of both the nature of the stakes involved and some of the rules of the game. Specifically it addresses the following questions:

(1) What are the true nature and possible economic consequences of the so-called information revolution (excluding the social consequences dealt with elsewhere)? In other words, what are the stakes? (Chapter 1).

(2) What, in fact, are the emerging "rules of the game" of international industrial competition in the eighties? In other words, what are the determinants of industrial leadership? (Chapter 2).

(3) What are the prevailing game plans of Canada's principal competitors? (Chapter 3).

(4) What should the elements of a Canadian game plan be and how could such a game plan be implemented? (Chapter 4).

CHAPTER 1

THE 'INFORMATION' ECONOMY: EVIDENCE OF A NEW INDUSTRIAL REVOLUTION?

1.1 INTRODUCTION

We contend in this chapter, that although by now almost everyone is aware of the impressive technological progress in computers and telecommunications, very few decision-makers have fully realized the enormous scope and potential of this contemporary revolution. To offer an assessment of that potential, it is necessary to review what in fact has changed in these two fields.

The word 'revolution' has been grossly abused in the contemporary world and there seems to be scarcely a sector which cannot legitimately claim its own revolution. Transportation, chemicals, aviation, education, even fashion and sexual mores have each experienced 'revolutionary' change. There is a 'new' economics, a 'new' biology, a 'new wave' in cinema, the arts, theatre, painting, etc. Alvin Toffler's felicitous expression "future shock" has been an apt description of the sixties and seventies. It is for this reason that one must be extremely prudent before conferring the term 'revolution' on yet another activity

Yet no other word can adequately describe the technological change in computers and telecommunications. The advent of semiconductor technology has led to the manufacture of computers-on-

a-chip of silicon - with greater and greater performance. During the nineteen-seventies, the performance/cost ratio improved exponentially, thanks to large-scale integrated circuits. At the same time the performance/size ratio also improved significantly. This simultaneous increase has led to the phenomenon of technology-push(1) a situation where electronic products flood the market and are bought because of their low cost whether people really need them or not. Supply creates its own demand. Many people have, for instance, bought four or five hand-calculators when one is needed. Their motivation to purchase has been just their availability at low cost. It is instructive to note that some high-powered calculators with engineering functions are being bought by people who could not possibly have any use for them.

The telecommunications industry has experienced a parallel expansion. "Smart telephones", videotex terminals, computer conferencing and data banks, fiber optics, packet switching, and communications satellites have all contributed to a climate of revolutionary change in this field and made the dream of a central electronic highway interconnecting homes, factories, offices, vehicles, etc. closer to realization.

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1. For elaboration see: J.L.Houle. 1979. Poussée technologique et coûts décroissants en téléinformatique Rapport I-3, GAMMA; and K.Valaskakis. 1979. The Information Society:The Issue and the Choices, Paper I-7, GAMMA.

But how are these changes to be interpreted? Is it yet another example of the technological change which has been the norm since the beginning of the twentieth century or are we witnessing something more fundamental?

1.2. FIRST INTERPRETATION: THE CHANGE IS CONFINED TO THE TELECOMMUNICATIONS INDUSTRY.

In this interpretation, the nature and extent of the revolution is confined to one sub-sector of the economy: the telecommunications industry. This is the prevailing view in Canada, probably because we have a strong telecommunications sub-sector. As a result, there has been a marked tendency to subsume the entire information revolution within the field of telecommunications. Canada has the highest cable-penetration rate in the world (in 1976 it stood at 66.8% of all available households serviced by cable), an advanced communication satellite system, a strong telephone infrastructure and a series of companies (some large like the Bell - BNR - Northern Telecom complex, others smaller like Mitel, SED, and Interdiscom) doing innovative research in telecommunications. In addition, the federal government is actively involved in launching the Telidon videotex system, first for Canadian consumption but eventually with an eye to export markets. It is not surprising then to discover that, in Canada, there is a temptation to associate the revolution only with the telecommunications industry.

1.3. SECOND INTERPRETATION: THE "INFORMATION ECONOMY".

The shift from a strictly telecommunications focus to that of the so-called "Information Economy" can be attributed to the work of U.S. researchers such as Parker, Machlup, and, especially, Porat who popularized the term. In essence, it singles out the notion of 'information' as a unifying link and observes the surprising growth of the information sector in the economy. In Porat's formulation, this information sector encompasses both a primary and a secondary sub-sector. The 'primary information sector' includes all activities related to the overt purchase and sale of information by information-providers to consumers. The 'secondary information sector' includes the public and private bureaucracies which provide internal information services for firms specializing in non-information products.

The thrust of Porat's contribution - which inevitably shocks when first read - is that as far back as 1967, the primary information sector accounted for 25% of the U.S. GNP, while the secondary information sector accounted for another 21%, or a grand total of 46% of the U.S. GNP. Since this proportion seems to be steadily increasing, not only in the U.S. but in most OECD countries, the expression 'information economy' becomes legitimate. When close to half of measured economic activity involves information processing rather than manufacturing, it is reasonable to suppose that the structure of the society is radically

changing. Furthermore, in measuring the ratio of information-workers to the total labor-force, it was found that in 1970, 53% of the U.S. labor-force was engaged in information activities, with similar figures for Canada and the other OECD countries.(1)

The 'Information Economy' approach of Porat, although useful and full of valuable insights, runs the risk of leading to yet another misinterpretation of the magnitude of the changes involved. The focus on information has the effect of once again confirming the changes examined to a sector, certainly a larger sector than telecommunications alone but still just a sector. Accordingly, there is a tendency to construct a problématique around such issues as privacy, information overload, access to information, trans-border data flows while ignoring the industrial issues. The above dimensions of the debate are certainly central to a social and normative assessment of what is happening. But they shed little light on issues such as international competitiveness and wealth and/or job-creation implications. After all, many pre-industrial societies were 'information economies'. We could probably argue that any non-industrial

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1. For more extensive analysis of the information sector accounts, see M.U. Porat, 1977. The Information Economy. U.S. Dept. of Commerce; R.Jouandet-Bernadat. 1979. Macro-economie de la Société Informatisée, GAMMA; and the forthcoming paper by L.M. Ducharme, Les Indicateurs Techno-Economiques de la Révolution Télé-Informatique. GAMMA, forthcoming, 1980.

religious elite is, in the widest sense of the term, an "information society." The very generality of the concept robs it of some of its usefulness as applied to the contemporary scene. Precisely what is interesting about the present situation is that it involves technological change, which has both important social and economic implications.It is for this reason that European and Japanese studies on the subject have tended to focus more on the structural than the sectoral aspects.

1.4 THIRD INTERPRETATION: THE INFORMATION REVOLUTION HERALDS A CHANGE IN THE VERY MODE OF PRODUCTION. IT IS A NEW INDUSTRIAL REVOLUTION.

A mode of production is a method of mixing and combining factors of production to achieve a given output. In economic theory, it is reflected in the 'production function', relating input-proportions to final output. A change in the mode of production, (more often than not brought about by technological change), has almost always heralded the birth of new types of economies and societies. The third interpretation, then is that we are witnessing a very basic transformation in the mode of production with far-reaching consequences which go way beyond telecommunications and even the 'information sector'.

The 'mode of production' interpretation is echoed in equivalent language in the major French government study known as the

Nora-Minc Report(1). In this massive, multi-volume document, an ambiguity of the French language is put to good use. The report focuses not on the growth of the information sector, which is hardly mentioned, but on the diffusion of computers. "L'Informatique" initially meant information science but has now become synonymous with computer science. La "Société Informatisée" is not quite the information society of Porat. It is the computer society characterized by the ubiquitous silicon chip. Accordingly, the indicators of 'La Société Informatisée' are not the number of information workers or the size of the information sector in the GNP but the number of computers, modems, data bank terminals, stand-alone microprocessors, etc,in use. In the major publication, Les Chiffres Clés de l'Informatisation(2), a complete inventory of the rate of diffusion of small and large computers in France is attempted.

The convergence of telecommunication and computer technology in France is known as tele-informatique or télématique for short.The term is less cumbersome than 'compunication' and can be readily translated in to English as tele-informatics. However,

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1. Simon Nora and Alain Minc. 1978. L'Informatisation de la Société. Documentation Française.
2. 1978. Mission Informatisation de la société, Ministère de l'Industrie, France.

once again, there is the danger of going off on a tangent because tele-informatics may bring us back again to a focus on telecommunications alone.

Attempting to encompass the entire spectrum of changes, E.I.Fitzpatrick-Martin has proposed the term "Informediation"(1). "Informediation" refers to the handling, storage and processing of information by high technology media (including the full teleinformatic nexus),and is principally concerned with the Person/Machine interface which is emerging as the central relationship in the new Information Society. Fundamentally, informediation is not only a contemporary method of communication but also of production.Indeed, not only are person to person relationships increasingly mediated by machines but there is the distinct possibility of a machine/machine dominated economy. The emerging science of robotics may develop into a scenario of fully automated production where industrial robots would be directed by other robots with minimum human intervention. Robotized factories, previously existing only in the imagination of science-fiction writers, already exist in Japan and Sweden and elsewhere.

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1. See Social Implications of the Information Economy, Paper I-5, GAMMA, 1979: also described in K.Valaskakis. 1979. The Information Society: The Issue and the Choices, Paper 1-7, GAMMA.

The 'Informediation' economy implies then that the basic mode of production is changing in all sectors. In this sense, the term "new industrial revolution" has been proposed implying that the changes are of similar scope and magnitude to those of the British Industrial Revolution in the eighteenth century.

Several authors have already raised this issue. In 1973, Daniel Bell introduced the idea of a service-dominated economy in The Coming of Post-Industrial Society(1). Christopher Evans in The Mighty Micro(2), has underlined the revolutionary characteristics and far-reaching implications of the computer-on-ship. Most recently, Alvin Toffler argues in The Third Wave(3),that we are experiencing a new generation of progress. The first wave was the invention of agriculture 10,000 years ago. The second wave was the British industrial revolution and the third wave is the sum total of the changes now taking place.

1.5. EVIDENCE OF A CONTEMPORARY INDUSTRIAL REVOLUTION.

The British industrial revolution was an interconnected series of changes which completely transformed the British economy at the end of the Eighteenth century. Yet, the expression 'industrial revolution' was first used by Paul Mantoux a century later. In one of the best accounts of the industrial revolution, David Landes in The Unbound Prometheus, describes the changes involved:

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1. Basic Books.

2. 1980, Victor Gollancz.

3. 1980. Morrow.

The words 'industrial revolution' - in small letters - usually refer to that complex of technological innovations which, by substituting machines for human skill and inanimate power for human and animal force, brings about a shift from handicraft to manufacture and so doing, gives birth to a modern economy...

The words sometimes have another meaning. They are used to denote any rapid significant technological change and historians have spoken of "an industrial revolution of the thirteenth century", "an industrial revolution in the cotton south"...In this sense, we shall eventually have as many 'revolutions' as there are demarcated sequences of industrial innovation(our emphasis)

Finally, the words, when capitalized, have still another meaning. They denote the first historical instance of the breakthrough from an agrarian,handicraft economy to one dominated by industry and machine manufacture...

The heart of the Industrial Revolution was an interrelated succession of technological changes. The material advances took place in three areas:

(1) There was a substitution of mechanical devices for human skills.

(2) Inanimate power - in particular steam took the place of human and animal strenght.

(3) There was a marked improvement in the getting and working of raw materials...(1).

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1. David Landes. 1970. The Unbound Prometheus, Cambridge University Press, p.1.

In essence then, as is noted in summary form in Table 1-1, the first industrial revolution involved a substitution of mechanical capital for human labour, a substitution of mechanical for human and animal energy, and a series of key innovations centered around the steam engine, which was the technological innovation par excellence of the eighteenth century. Altering the mode of production led to a decrease in the demand for skilled labour and an increase in the demand for unskilled labour. The former process led to anti-technological resistance (the Luddite movement where bands of workers destroyed capital equipment for fear of disemployment) while the latter process led to what Marx termed the creation of an industrial proletariat. The 'thirst' for unskilled labor dictated by the technology of the 'factory-system' led to the massive employment of women and children.

As Landes points out later in his book, there was a second industrial revolution starting about 1870. Like the first, it involved a substitution of mechanical for human and animal energy but whereas the first was based on the steam engine and coal, the second involved electricity, the internal combustion engine and new energy sources such as hydro-power and petroleum.

TABLE 1-1

RIVAL VIEWS OF THE
SIGNIFICANCE OF THE
REVOLUTION IN TELE-INFORMATICS

1. The change is primarily in the field of telecommunications (dominant Canadian view).

2. The change affects the growth of a particular sector of the economy known as the Information Sector (dominant U.S. view, Porat, Machlup, etc).

3. The change is not sectoral but a fundamental alteration in the mode of production and of society. (Nora-Minc, Barron-Curnow, Bell, Toffler, etc).

4. The new mode of production can be described by the term 'informediation', i.e. increasing person-machine and machine-machine interfaces in economic activity (GAMMA).

It can be argued that the 'computer-on-a-chip' now heralds a third industrial revolution. Like the other two, there is a substitution of capital for labor but unlike the other two, information capital is now displacing not just labor but also non-information capital and energy. In other words, the microprocessor is developing as the ultmate conserver device: it saves labor, energy and physical space.

1.6. THE PRODUCTIVITY, GROWTH, AND EMPLOYMENT DEBATES.

In a background study, produced in conjunction with this report, Professor Yves Rabeau(1) examined the impact of tele-informatics on productivity and employment in light of both the theory of economic growth and the OECD experience with technological progress. He identified three major trends associated with tele-informatics.

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1. Y.Rabeau.1980. Tele-Informatics, Productivity and Employment: An Economic Interpretation. Paper I-8, GAMMA.

TABLE 1-2

EVIDENCE OF A NEW
INDUSTRIAL REVOLUTION

Event	Characteristics.
The first industrial revolution.(1750-1870)	- Substitution of mechanical capital for human labor. - Decreased demand for skilled labor. - Increased demand for unskilled labour. - Key invention: The steam engine. - Key resource: Energy (coal). - Substitution of mechanical for human and animal energy.
The second industrial revolution. (1870-1970)	- Substitution of mechanical capital for human labor (the age of steel, etc.) - Key innovations: Harnessing of electricity and the internal combustion engine. - Key resources: coal, hydro-power,petroleum. - Substitution of mechanical for human and animal energy.
The third industrial revolution. (1970-?)	- Substitution of information capital for human labor. - Decrease in demand for skilled labor - Decrease in demand for unskilled labor. - Decrease in demand for physical capital. - Decrease in demand for energy capital. - Key invention:the computer on a chip - Key resource: information.

First, the deepening of information capital implies a non-neutral change in the production function, reducing the need for all other inputs. In other words, the enormous productivity of the new information machines seems to reduce the demand for:

- basic materials
- land and infrastructure
- energy
- transportation-services
- non-information capital
- non-information labor
- information labor.

The productivity slowdown in OECD countries observed in the seventies may now be reversed because of teleinformatics. However, this productivity increase need not necessarily create new jobs for human labor.

Second, massive reductions in the cost of the new information technologies coupled with increases in the cost of some rival inputs, principally human labor and energy, may further bias the substitution effect in favour of machines.

Third, the tele-informatic revolution may not only improve the production processes for existing goods but introduce a whole new series of hitherto unheard of commodities (videotex, electronic briefcases, etc). The net result could be an increase in wealth and, therefore, possibly also in psychological satisfaction through the expanded consumption of information commodities.

When the nature of the new technology is now placed within the context of economic growth theory, a fundamental problem arises. In the fifties, the debate about automation and the capital-labor substitution led to the emergence of two schools of thought. The first, known as the structuralist school, believed that the fundamental change in the structure of production was automation, which was irrevocably labor-saving and therefore a cause of unemployment. The second school expounded the opposite thesis of expansionism. According to its proponents, economic growth would restore a balance between labor and capital by creating new jobs. The disemployment effect would be cancelled by new employment opportunities in the expanding industries.

The expansionist school apparently won the debate. We say apparently because although there was no massive disemployment in the fifties and sixties, the quantum of human labor needed to produce a given GNP level declined. This decline took the form of steadily decreasing working hours and was, in addition, masked by the 'tertiarisation' of the economy i.e. the absorption of large numbers of workers by the tertiary sector. This sector, dealing primarily in information commodities, has an output which is difficult to measure. There may be dozens of jobs of doubtful, indeed, perhaps even of zero productivity in the tertiary sector which, are not likely to be identified for want of an adequate performance indicator. The performance indicator for a bureaucrat, an academic or a consultant, is rarely anything more than peer judgement. This raises the possibility of fictitious jobs, i.e. jobs which have a zero marginal product to society as a whole, although they are 'useful' in the view of the worker's immediate superior. It would appear then that through a combination of shorter working hours and the creation of quasi-fictitious jobs, the structuralist fear of technological unemployment was avoided in the fifties and sixties.

But the advent of the microprocessor in the seventies and eighties with its high productivity and low-cost, offers a new challenge to the balanced-growth expansionist thesis. Although the basic Harrod-Domar-Solow model of growth still stands, the

change in relative cost between information capital and all the other inputs creates the following problem. Although capital-deepening in the production function may still create jobs, we may now require an astronomical amount of capital to maintain full employment. If, for instance, we reach a stage where say, $100,000 or $1 million is required to create every new job, the potential for new employment will be low. With unlimited growth, there would only be a short-term problem. But with the possibility of limits to growth, the capital-deepening expansionist hypothesis becomes much less applicable.

The evidence of the existence of limits to growth comes from many sources. First, there are physical limits to growth stemming from the lesser availability of energy and raw materials, higher resource prices and the increasing cost of environmental protection. Second, there are institutional limits to growth arising from labor-management and other disputes which increase the cost of labor and render the human input less reliable, less disciplined, and less productive. Finally, there are social limits to growth relating to rejection and resistance syndromes where the general public refuses to absorb the increased wealth. If effective demand fails, then growth is inevitably slowed.

The implication is that the structuralists are staging a come-back victory. The teleinformatic revolution is creating a structually unbalanced growth trend with the rate of disemployment exceeding that of new employment. In this sense, the third industrial revolution is merely the culmination of the other two: a continual substitution of capital for labor, now involving robotics.

The expansionist view will continue to have its adherents. In Zavis Zeman's survey of international opinions concerning the impact of micro-electronics on employment, no consensus emerges(1). However, the onus of proof is gradually shifting to the expansionists, because whereas the disemployment effects of micro electronics are easily documented, the new employment effects are much less so. The favorite phrase "there is no evidence that microelectronics produces a net disemployment effect" is losing its force since it is as easy to say, "there is no evidence that microelectronics produces new jobs". Past experience is an inadequate guide for the same reason that it would have been manifestly absurd for eighteenth century economists to extrapolate from agricultural production in order to forecast the industrial employment experience.

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1. Zavis Zeman. 1979. The Impacts of Computer/Communications on Employment in Canada: An Overview of the Current OECD Debates. IRPP.

This point has been dramatically brought home by Wassily Leontief in his metaphor on the full-employment of horses. The first part of the metaphor assumes that productivity studies in agriculture are conducted in order to determine whether horses continue to be useful productive agents after tractors are introduced. If tractors are replacing horses and we divide the total agricultural output by the number of horses still employed, we discover a surprising phenomenon. The fewer the horses, the higher their individual productivity. The last horse left has immense productivity and when he is removed, the productivity of horses in agriculture becomes...infinite! The tempting but obviously fallacious conclusion is to believe that horses are going to be in great demand in agriculture because of their "high productivity" when , in fact, the opposite is true.

The second part of the metaphor reveals even a greater absurdity. The horses displaced by the tractors "join a union" and profess not to be worried because surely jobs will be found for them in industry.

The fact is, there are no jobs for horses in industry because the manufacturing mode of production does not require horses. Yet, technically speaking, one could still follow the theory of the expansionist school and argue that full employment for horses is possible. Horses are still used today for races,

for leisure riding, to pull antique hansome cabs in parks and to act in Westerns. In fact, horses are today very expensive, probably more expensive in real terms than when they were needed for transportation and agricultural production. In order to create enough jobs to fully employ horses, enormous capital and very high levels of affluence would be required which, again, could theoretically be achieved if there were no limits to growth. Everyone could have his own horse. But the reductio ad absurdum is telling: when the mode of production changes, it is naive to believe that the same factor proportions will be needed to produce a given output.

1.7 SUMMARY

The argument of this chapter may be summarized as follows:

(1) Information technology is different (as Gordon Thompson has forcefully emphasized(1) and is not just more of the same. One of the fundamental elements of difference is the all encompassing process of informediation: person-machine and machine-machine interfaces replacing person-person interfaces. The capital-labor substitution is a continuation of the trend started by the first industrial revolution but with a vengeance.

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1. G.Thompson. 1979. Memo from Mercury: Information Technology Is Different. IRPP.

(2) The new technology creates wealth but not necessarily jobs. In fact, a trade-off is beginning to arise: if job-creation is given maximum priority, then technological change must be controlled and a slowdown of productivity growth must be accepted. Conversely, if wealth-creation is given the highest priority, than adoption of the most advanced technology is necessary, which does not automatically imply more jobs.

(3) The changes provoked by informediation are structural, not sectoral. They do not just relate to the telecommunications field or even to the information sector but rather to the entire economy.

(4) A new industrial revolution is in the making. Although some may balk at the use of the adjective 'industrial' preferring the more popular term "post-industrial", we submit this is a semantic issue. If "industrial" is interpreted in the narrow sense of "manufacturing goods" using the rules dictated by the British industrial revolution, then obviously we have gone beyond that. If, on the other hand, 'industrial' is seen as synonymous with transformation or high throughput, as opposed to simple extraction then, we are indeed witnessing a new industrial revolution. As David Landes put it, any demarcated sequence of innovation (i.e. a major technological generation) is an industrial revolution. What is characteristic of the new throughput is that it is information-intensive rather than energy and labor-intensive like the previous one.

The policy implications of such an industrial revolution are far from trivial. What they indicate is that international competition is now governed by a new set of rules. Any country which wishes to remain internationally competitive cannot afford to ignore this new technology. On the contrary, it must adopt some sort of strategy and formulate a game plan based on the new dynamics of industrial leadership.

It is to these dynamics that we now turn.

CHAPTER 2

THE DETERMINANTS OF INDUSTRIAL LEADERSHIP IN THE EIGHTIES.

2.1. The Need for an Industrial Strategy.

2.2. The Key Variable of Industrial Leadership: The Technology Life Cycle.

2.3. The Critical Role of Gestation and Transition Times.

2.4. The Elements of an Industrial Game Plan.

2.1. THE NEED FOR AN INDUSTRIAL STRATEGY

One of the determinants of industrial leadership is, we submit, a carefully thought out industrial strategy. When entering a competitive situation, a country may decide either to let things develop on their own (laissez-faire with a 'tonight we improvise' attitude) or choose a game plan. Although the subject of industrial strategy has been discussed in Canada for a good ten years, there is no consensus as to whether we really need one.

The principal arguments against an industrial strategy have been articulated as follows. First, an industrial strategy has been perceived in some quarters as opening the way to massive government intervention in the private sector,thus interfering with free market forces. If a firm or industry cannot withstand the challenge of foreign competition then, goes the argument, it does not deserve to survive. Second, an emphasis on industrial strategy offends those who identify 'industrial' with the manufacturing sector and who feel that the important changes of the future are post-industrial.

The argument for an industrial strategy are, in our view, more convincing. First, the assumption of a free market in the international economy borders on extreme naiveté. Every major

contender for industrial leadership in the world economy, either utilizes very intricate forms of government business cooperation (private subsidies, non-tariff barriers, procurement policies, etc.) or possesses huge oligopolistic multinational firms or both. As will be seen in the next chapter, the first category includes Japan, France, W.Germany, and the U.K. The U.S. is in the second category. It possesses giant multinational corporations which it helps through R&D grants and government procurement. The vision of a laissez-faire world with individual small firms competing freely against each other belongs to the nineteenth century. A national government which refrains from helping its private sector is, in a sense, masochistic. In spite of GATT, the governments of the leading industrial nations lend considerable assistance to their private sector and Canadians must acknowledge this fact.

Second, as noted in the last chapter, we use the term 'industrial' to mean a technology-intensive, highly rationalized mode of production which can be used in many sectors, not just the manufacturing one. Thus, it is possible to speak of the industrialization of agriculture or even conceive of an industrial strategy for the cultural industries.

Third, the high interdependence and linkages associated with major industrial projects require planning and assessment by public bodies. The geographic location of economic activity, the social, environmental, cultural and income-distribution effects of any major industrial decision involve so many intended

and unintended spill-overs that they cannot escape the domain of public policy. The choice of a fighter plane for the Canadian armed forces took, it will be remembered, many years before all the consequences of each alternative could be assessed. To make major decisions without a coherent industrial strategy is to run the risk of producing a white elephant. We note that the lack of policy coordination between the federal and Québec governments was one of the principal factors which contributed to making the Mirabel Airport an unsuccessful economic venture to date. The Mirabel project was never part of a full scale industrial strategy for the simple reason that there was no agreed strategy.

TABLE 2-1

THE PROS AND CONS OF AN INDUSTRIAL STRATEGY.

CON	PRO
1. A government sponsored industrial strategy interferes with the free market and the principle of international free trade.	1. International trade is not free and almost every major industrial contender in the world economy has some kind of an industrial strategy based on Government/Business concertation.
2. "Industrial" refers to manufacturing. The real challenge is 'post-industrial'.	2. 'Industrial' refers to a technology-intensive highly rationalized mode of production applicable to any sector.
	3. The strong intersectoral independence of the national economy requires a coherent policy of economic development-which can be achieved best through a carefully thought out industrial strategy.

2.2. THE KEY VARIABLE OF INDUSTRIAL LEADERSHIP: THE TECHNOLOGY LIFE CYCLE.

If 'industrial' refers to a technology-intensive mode of production, then it is obvious that technology itself is a key variable in determining global industrial leadership. It is important to realize that technological change moves in complete life cycles from the birth of an invention to its ultimate death. The economic history of the last two hundred years bears witness to the shift in international leadership which was brought about by the emergence of new technological generations. Germany's mastery of the Siemens-Martin method of processing steel allowed that country to seize the industrial leadership from Britain in the 1880's. The age of electricity allowed countries with large geographical areas such as Canada to industrialize at the turn of the century whereas previously they were unable to do so under the 'old' rules of the mode of production based on the steam engine. The first industrial wave demanded geographical proximity between coal and iron in order to take full advantage of the highly concentrated factory system. The second industrial wave, using electricity which can be transported over long distances, allowed the decentralization of production, giving large countries like Canada a fighting chance.

What is important to recognize is that,first, there are clearly demarcated technological generations built around a basic scientific principle and, second, that each generation has a life-cycle comprising seven stages as described in table 2-2.

TABLE 2-2

THE HYPOTHESIS OF A TECHNOLOGY LIFE-CYCLE.

Life-Cycle Stage.	Description
1. Discovery.	Discovery of a resource or of a scientific principle.
2. Invention.	The scientific principle or resource is given a practical application.
3. Innovation.	The invention becomes commercially feasible and is marketed.
4. National Diffusion.	The invention is disseminated within the national economy.
5. International Diffusion.	The invention is disseminated internationally.
6. Decline.	The invention is gradually phased out and its use is declines.
7. Obsolescence.	The invention is phased out altogether.

The first stage in the life cycle of technology involves the discovery of a scientific law, of a chemical reaction or of a natural resource. The process of discovery is partly random and partly the result of directed research. Financial resources may be consciously allocated toward discovery but this in no way guarantees that such a discovery will in fact take place. The long search for a cure for cancer, for instance, has not yet delivered meaningful results. However, the desired discovery may become more or less probable by the magnitude of the research funds allocated to that particular endeavour.

The second stage of the cycle is invention. This implies devising a practical application of the scientific principle which has been discovered.

The third and crucial stage is innovation. Here the invention becomes commercially feasible and profits can be generated from its marketing.

The fourth and fifth stages may be interchangeable. They involve the national and international diffusion of the particular innovation. In the normal case, national dissemination precedes international. However, in those countries with an export bias, some inventions may be exported before they are put to use within the nation. This has been the case with some Japanese exports which have been deliberately made available to the foreign clientēle before being delivered to the Japanese consumer.

The sixth stage is one of decline. The technology is now showing its age and,is most probably beginning to be replaced by a new and separate technological generation. The seventh stage spells the complete obsolescence of the invention, which is totally phased out and replaced by a more advanced system based on a completely new scientific principle or resource.

An important point to note is that the gestation time between stages within the technology life-cycles and the transition time between technological generations may vary from one case to another. For instance, the technology life cycle of the steam engine spanned a period of more than two thousand years. The possibility of producing useable energy through steam was known in ancient Greece. The first steam engine (the invention stage) was constructed by Hero of Alexandria in the Fifth Century A.D. James Watt's commercially operational steam engine, heralding the first industrial revolution (the innovation stage), came twelve hundred years later at the end of the eighteenth century. The national and international diffusion of the steam engine occupied the whole of the nineteenth and part of the twentieth centuries. Finally, the sixth and seventh stage of decline and extinction started at the beginning of the twentieth century with the emergence of the petroleum-based internal combustion engine as an alternative.

2.3 THE CRITICAL ROLE OF GESTATION TIME AND TRANSITION TIME

Gestation time is, as we have noted, the time which elapses in passing from one stage to another within the technology life cycle. Transition time is the time that elapses in passing from one technology generation to the next. Both are crucial variables in determining industrial leadership and as full an understanding as possible of the factors which affect their length is indispensable for industrial planning.

We submit that there are three leading factors determining gestation and transition times (see Tables 2-2 & 2-4). The first is technical. Although a particular technological process may be operational, it may still not be rid of all its bugs. The technological fine tuning of an invention may be a very long process with no immediate solutions available. This will delay the passage to the next stage in the life cycle. A fortiori, it also takes time for the passage from one technology-generation to the next.

The second factor determining gestation and transition time is relative cost. This applies to alternate technologies and/or the natural resources used by these alternate technologies. For instance, changes in the relative price of petroleum vis-à-vis other energy sources may accelerate or decelerate the development

TABLE 2-3

THREE DEFINITIONS RELATING
TO TECHNOLOGICAL CHANGE.

A Technology Generation: The full life cycle of an invention from the early discovery of the scientific principle upon which it is based to its ultimate phasing out.

Gestation Time: The time that elapses between stages within a technology generation.

Transition Time: The time that elapses in the passage from one technology generation to the next.

TABLE 2-4

FOUR FACTORS DETERMINING

THE LENGTH OF TRANSITION AND GESTATION TIMES.

I. Technical Considerations: The removal of remaining "bugs" and bottlenecks of a technical nature.

2. Relative Costs: What are the costs of alternative technologies and the natural resources they use?

3. Institutional Acceptance Rate: The rate of acceptance of the new technology by key institutions.

4. Consumer Acceptance Rate: The rate of acceptance of the new technology by consumers.

of inventions using alternative fuels. In fact, the steady increase in the price of petroleum has opened up a series of new avenues in the field of energy production and consumption hitherto not feasible.

The third and fourth factors determining gestation and transition times relate to the rate of acceptance of the new technologies by institutions and by individual consumers.

It is obvious that acceptance by the users is the ultimate variable that will 'make or break' the invention. Consumers may either resist the introduction of the invention (i.e. postpone ultimate acceptance) or reject it (i.e. refuse ultimate acceptance thereby condemning it to irrevocable obsolescence).

The intricate psychological factors which may affect the rate of consumer acceptance have been extensively studied by W.L. Gardiner in GAMMA paper I-9(1) and his results will be summarized in Chapter 4.

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(1) W.L. Gardiner, op.cit.

As for the rate of institutional acceptance, it is usually based on the degree of compatibility between the relevant inventions and the institution's goals. For instance, if a particular institution is interested in maintaining high employment, it will delay or reject altogether a technology which will be labor-saving, etc. The position and power of labor unions is an example of the important role of institutions in determining gestation and transition time.

2.4. THE ELEMENTS OF AN INDUSTRIAL GAME-PLAN.

Given the relevance of the various factors likely to determine industrial leadership, we can now formulate the questions which must be answered by any industrial society. (Table 2-5)

In effect, a game-plan must respond to five categories of questions, as follows:

GOALS: Here a choice and an ordering of competing national objectives must be accomplished. The usual competing goals include:

- full-employment
- wealth creation
- price stability
- balance of payments considerations
- regional balance
- income distribution
- national sovereighty

TABLE 2-5

THE ELEMENTS OF AN INDUSTRIAL GAME PLAN

UNDERLYING QUESTION	ALTERNATE ANSWERS
1. GOALS.	- full employment first; - wealth-creation first; - regional balance; - national sovereignty - national unity; - price stability, etc.
2. TIME HORIZON.	- short-run; - medium-run; - long-run.
3. CHOICE OF SECTORS.	- specialization in components; - specialization in complete products; - specialization in complete systems; - specialization in marketing only.
4. CHOICE OF STRATEGY RELATING TO TECHNOLOGY CYCLES.	See Table 2-6.
5. ROLE OF ACTORS.	See Table 2-7.

TABLE 2-6

CHOICE OF STRATEGY

RELATING TO TECHNOLOGY

LIFE-CYCLES.

STRATEGY	DESCRIPTION
1. Basic Research and Development.	Object is to advance frontiers of knowledge. Concentration on discovery and invention stages.
2. Adopt and Adapt.	Imitation of foreign technology or outright purchase of patents. Concentration on national diffusion stage.
3. Adopt and Adapt.	Emulation with improvements. Concentration on innovation and diffusion stages.
4. Minor Leap-Frog.	Skip a stage within a particular technology life-cycle.
5. Major Leap-Frog.	Skip an entire technology generation and go on to the next.

CHAPTER 3

THE GAME PLANS OF CANADA'S COMPETITORS.

TABLE 2-7

ROLE OF ACTORS.

ACTORS	ALTERNATE ROLES
1. BUSINESS.	- Maximize competition with other firms. - Horizontal integration. - Vertical integration. - International integration. - Concertation with public sector.
2. LABOR.	- Confrontation with business. - Cooperation with business. - Confrontation with government, etc.
3. GOVERNMENT.	- Regulation. - The state as arbiter. - The state as innovator. - The state as investor. - The state as coordinator. - The state as nurse.
4. CONSUMERS.	- Acceptance. - Resistance. - Rejection.

TIME HORIZON: The choice of a time horizon is important since it is directly related to the pattern of technology life cycles. Too short a time horizon may be insufficient to permit systemic changes. Too long a time-horizon leads to a country running the risk of 'missing the boat'.

CHOICE OF SECTORS: The selection of sectors for industrial expansion is important. To effect such a selection a set of criteria has to be developed. They in turn depend on the hierarchy of goals within the industrial game plan itself. Once the criteria are clearly established, the choice then becomes one of sectors. In general, one can choose to specialize in:

- components
- products
- integrated systems
- marketing foreign products.

CHOICE OF STRATEGY IN

RELATION WITH TECHNOLOGY CYCLES (See table 2-6)

This is the most crucial decision since it involves the choice of where to 'jump in' in the pattern of technological change. The tempting answer is to say 'at the beginning' and invest heavily to develop an indigenous R&D capability. However, this strategy may not always be optimal. As the next chapter will show, significant benefits can be reaped by choosing more aggressive strategies such as are listed in Table 2-6. These may be:

- adopt (concentrating on buying or imitating someone else's technology);
- adopt and adapt (imitating and improving someone else's technology);
- minor leap-frog (skipping a stage within a technology generation);
- major leap-frog (skipping an entire technology generation and arriving first at the next one).

The choice of strategy will obviously require very accurate forecasting of:

- technological change and its timing
- relative costs
- institutional acceptance rates
- individual acceptance rates.

ROLES OF ACTORS. (See Table 2-7)

Finally, the game plan requires that the various socio-economic actors adopt optimal roles to implement the required strategy. The four principal actors are business, labor, government and consumers although, depending on the country, there may be permutations and combinations. The range of possible attitudes for each is listed in Table 2-7. Generally speaking, these attitudes may vary from the extreme of outright confrontation in a classical adversary face-off to one of complete cooperation (see Japanese model).

Before we look at the Canadian experience and a possible game plan for Canada, let us now turn to an examination of the strategies of Canada's international competitors.

3.1 INTRODUCTION

In this chapter we would like to clarify the national, governmental "game plans" of Canada's present and potential competitors vis-à-vis the emerging information revolution. In our opinion the most important countries to study at this time are: the United States, Japan, France, West Germany, the United Kingdom, and Sweden. Rather than analysing each country's game plan individually, we believe that comparative analyses along a number of important dimensions will be more fruitful. We have chosen the following dimensions of the issue for analysis at this time:

3.2 Overall Awareness of the Information Revolution

3.3 Overall Governmental Policy Approaches to the Information Revolution

3.4 Degrees of Concertation Present

3.5 Technological Strategies Chosen

3.6 Human Resources Strategies

3.7 Apparent Time Horizons Chosen

Given budgetary and time constraints this analysis is based primarily on the study of documents although several interviews were conducted with high ranking U.S. civil servants from the

Congressional Office of Technology Assessment, the Federal Communications Commission, and the Department of Commerce, National Telecommunications and Information Administration. In addition one author attended Viewdata '80 in London (March, 1980), the first international conference on videotex. The vital importance of the multinationals' plans in the information/communications area is clear but we will not deal with them in depth in this report since our focus is on public policy options.

3.1 OVERALL AWARENESS OF THE INFORMATION REVOLUTION.

In our experience governments are deeply affected in their policy making activities by the degree to which governmental, industrial, and labor elites and the general public are aware of and educated about an issue. In an effort to place the United States, West Germany, the United Kingdom, Japan, France, and Sweden on "a spectrum of awareness" we believe the spectrum would appear as in Table 3-1. Zero represents little or no awareness among governmental, industrial, and labor elites while one represents some awareness among these elites and two represents high awareness among these elites. Our assumption is that explicit definition, consciousness, and knowledge of a broad issue such as the information revolution begins with these elites and then

TABLE 3-1

THE INFORMATION REVOLUTION: AWARENESS

THE SPECTRUM OF AWARENESS

	0		1	2,3	2,3	2,4	2,4	
LEAST	U.S.		W. GERMANY	U.K.	JAPAN	FRANCE	SWEDEN	MOST

DEGREES OF AWARENESS

0: Little or No Awareness Among Government, Industry, & Labour Elites

1: Some Awareness Among Government, Industry, & Labour Elites

2: High Awareness Among Government, Industry, & Labour Elites

3: Some Awareness Among General Public

4: High Awareness & Debate among General Public

spreads outward through the media to the general public. Thus three represents some awareness among the general public and four represents high awareness and debate among the general public. Active policy formulation and action by governments, as opposed to just awareness among the government elite, comes only when awareness has spread to other elites and to the general public, we believe. This scale is tentative and is not a definitive statement.

With these criteria in mind the United States demonstrates the least degree of awareness among the six countries we have chosen for study. This judgement is confirmed by our interviews with American civil servants. Naturally there is an awareness of dramatic changes in computers and communications circles. What is not present is any coherent, overall understanding of the scope of these changes and that together these changes constitute the beginning of a second industrial revolution. To the extent that U.S. concerns are articulated they are focused on specific technological changes and their potential impact on individuals, on one hand, in terms of privacy, and, on the other, the free flow of information across international borders.

This point is well illustrated by the speech of Zbigniew Brzezinski on September 18, 1979 to the week-long French

conference, "Informatique et Société". It is also documented by a number of U.S. government studies, reports, and commissions, most notably the Privacy Protection Study Commission which culminated in a "Presidential Privacy Initiative" and a series of legislative enactments. There has been no comparable official attention paid to other aspects of the Information Society either individually or as they relate to each other.

West Germany appears to be similar to the United States in lacking an overall approach to the information revolution although they too have taken significant initiatives in the privacy area and demonstrated some governmental and private sector concern in other areas, notably potential disemployment effects, training for data processing occupations, and support for domestic computer manufacturing. West Germany then ranks approximately at '1' on the scale: some awareness among governmental, industrial, and labor elites.

Much further over on the awareness spectrum we find the United Kingdom and Japan, in that order but both having high awareness among elites and some awareness among the general public. Public awareness in the United Kingdom of the information revolution was initially stimulated by the BBC production "When

the Chips Are Down". However other developments such as full fledged public offerings of teletext (Ceefax and Oracle) and videotex (Prestel) services and a large commitment of governmental funds to silicon chip manufacturing (Inmos), to software development and international marketing (Insac), to the use of microelectronic technology in industry and to direct aid for both process and product applications show that this event was not an isolated expression of the elites' concern for the broad issue. Media articles, conferences on viewdata, the impact on labor, and other related subjects have further increased public and elite awareness.

The case of Japan is so well known so as to require relatively little discussion at this point. Governmental commitments on the order of billions of dollars, for example the recently completed public-private research program on Very Large Scale Integrated Circuits (VLSI) which lasted four years and cost $400 million U.S.(1), a videotex trial of the "Captain" system which involves 1,000 homes and is expected to penetrate 90% of Japan's households by 1990(2), and the fibre optic trial in Hi-Ovis are but a few of the initiatives indicating elite awareness of the

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(1) The Economist, April 5, 1980.

(2) K. Yasuda. 1980. "Conception of CAPTAIN System-Background, Experiment and Future Plans." In: Viewdata '80, pp.107-111. Online Conferences Ltd.

issues while wide public discussion in the media and two daily newspapers dedicated to technological developments provide examples of the level of public awareness.

Nevertheless, although the U.K. and Japan share a high level of elite awareness with France and Sweden, it is these latter two countries who display the broadest overall awareness because the level of public awareness is also high and characterized by debate about the issues.

Indubitably the report commissioned by President Giscard d'Estaing, L'Informatisation de Société by Simon Nora and Alain Minc with all of its supporting documentation,followed by the conference convened by M. Giscard d'Estaing in September, 1979, "Informatique et Société" (which we have already noted) are the pivotal events which triggered widespread debate on the whole range of issues throughout all sectors of French society - government, labor, education, business. One cannot pick up a newspaper or magazine in Paris without seeing two or three articles or interventions relevant to the Information Society, which is conceptualized in a coherent fashion and perceived as a revolutionary phenomenon.

In Sweden reports and editorials about robotics, the use of computer terminals and their potential effects on users' physical and mental heath, and similar topics feature regularly in the media. The presence of Swedish government commissions and study groups, about fourteen in number currently we are told, indicate the deep involvement which the elites have with this issue. Again as in France there appears to be a profound appreciation of the overall dimensions of the issue ranging from privacy (where Sweden is a leader with its innovative Data Act and Data Board) to vulnerability, disemployment effects, psychological impacts, and techno-economic policy.

Summarizing then, at this time we perceive France and Sweden as having the highest degree of awareness of the information revolution as a revolution with Japan and the U.K. close behind, while West Germany and the United States have the least overall societal consciousness of the issue as an issue as opposed to awareness of particular discrete aspects of it.

3.2 OVERALL GOVERNMENTAL POLICY APPROACHES TO THE INFORMATION REVOLUTION.

The first distinction we should make in considering overall governmental policy approaches to the information revolution is the distinction between "proactive and "reactive." (Table 3-1). The proactive approach is an anticipatory approach. This approach involves high level governmental attention, study and analysis of potential problems at the first indication of their existence followed by sensitization of the populace at large and relevant groups within it. Once the public is educated then coherent governmental policies are formulated and action is taken to forestall, ameliorate, or moderate the impact of the anticipated problems. The reactive approach is the "Fire Fighting" approach. This approach implies governmental action vis-à-vis problems only when they have become so acute that they are visible enough to all and sundry for significant pressures to be brought to bear upon the government by industry, labor, citizens, or foreign governments.

Considering the six governments in question we would classify France, Japan, the United Kingdom and Sweden as pro-active in their overall approach and West Germany and the United States as reactive, with the United States being at the extreme.

TABLE 3-2

OVERALL GOVERNMENTAL POLICY APPROACHES TO THE INFORMATION REVOLUTION

REACTIVE - THE "FIREFIGHTING APPROACH."

THIS APPROACH IMPLIES GOVERNMENTAL ACTION VIS-A-VIS PROBLEMS ONLY WHEN THEY BECOME VISIBLE ENOUGH FOR SIGNIFICANT PRESSURES TO BE BROUGHT TO BEAR UPON THE GOVERNMENT BY INDUSTRY, LABOR, CITIZENS, OR OTHER GOVERNMENTS.

PROACTIVE - THE "ANTICIPATORY APPROACH."

THIS APPROACH IMPLIES HIGH LEVEL GOVERNMENTAL STUDY AND ANALYSIS OF POTENTIAL PROBLEMS AT THE FIRST INDICATION OF THE PROBLEM FOLLOWED BY SENSITIZATION OF THE POPULATION AT LARGE & RELEVANT GROUPS WITHIN IT. THEN COHERENT GOVERNMENTAL POLICIES ARE FORMULATED AND ACTION IS TAKEN TO FORESTALL, AMELIORATE, OR MODIFY THE ANTICIPATED PROBLEMS.

Clearly one factor which accounts for being proactive as opposed to being reactive is public awareness in that if the public is educated and concerned about an issue it is not dangerous for politicians to act in that area. Naturally the process is interactive but all of the proactive governments seem to have explicitly set out to build awareness of the issues through the personal involvement of the Prime Minister or President with the issue, through focusing media attention with films, conferences, and commissions, and through international initiatives in the OECD, the EEC, and the Council of Europe.

Another factor which appears to be important in affecting the policy approach of a country is governmental involvement in the telecommunications business through operation of a governmentally owned PTT department or corporation providing postal, telephone, data, and telegraph services. This kind of involvement gives the government a "window" into the communications/information world.

Naturally yet another factor, which is closely related to the previous point, is the degree to which the state intervenes directly in the economy. Japan, France, the U.K. and Sweden all intervene significantly in the economy in various ways in the information/communications area as well as in other areas. Lets consider briefly now the policies of these four countries, the

U.S. and West Germany along several analytic dimensions which we believe to be extremely important in terms of industrial strategy: concertation, time horizon, technological strategy, and human resources strategy.

3.3 DEGREES OF CONCERTATION PRESENT

The word concertation comes from the Latin verb conserere, "to join together". In Chapter 4, we note there are four kinds of concertation or confrontation possible:

1. Public Sector - Private Sector.
2. Private Firm - Private Firm.
3. Labor - Management.
4. Government-Labor-Management.

When we examine the information revolution area for the six countries under study, we discover that Japan, Sweden and West Germany appear to have concertation mechanisms in place for all four kinds of concertation while France appears to have concertation in the public - private & private-private area while the U.K. seems to have concertation only of the public-private type. The United States appears to have almost no explicit concertation mechanisms in place for any of the four potential types of cooperation.

Examining each country in turn, we observe that Sweden and West Germany have public sector - private sector and private-private cooperation in the sense that there is explicit governmental support for the domestic computer industry and attempts by government to assist in the rationalization (mergers, joint ventures) of the industry, as for example in the case of Data Saab, which resulted from government directed mergers and which is partly owned by the state at present. The Swedish government also has, in conjunction with the other members of the Nordic Council, sponsored studies of Nordic industrial and research needs in the microelectronics area.

Swedish Government - Labor - Management concertation for the last seventy years (until this month's general strike) has been widely admired around the world while West Germany has legislated worker participation on corporate boards. Because of the close relationship between labor and the political parties in Sweden and West Germany another avenue of government-labor-management concertation is open and extensively employed. Sweden also has labor-management concertation without government through corporate committees, worker participation on boards, and joint research groups as West Germany does.

Nevertheless, recognising the broad scale of concertation in West Germany and Sweden, it should be noted that Japan and France, driven by explicit governmental technological policies, have focused their concertation mechanisms more sharply and more actively on the information revolution area. Taking France's public-private and private- private concertation areas, we can cite for example the forced rationalization of the computer industry so as to create national champions such as CII - Honeywell - Bull and Compagnie General d'Electricité, which operates the largest computer software services company in Europe, La Generale de Service Informatique. We can also cite the development of CGE's inexpensive digital facsimile machine which was developed with government aid and which will be marketed by Burroughs in the U.S. These electronic mail machines will also be sold by Matra and Thomson-CSF, through distribution deals in Europe with Olivetti, in the U.S. with Qwip (Exxon), in Japan, and with 3M in the U.S.(1)

At the same time, driven by a market trial of 250,000 electronic telephone directories commencing December, 1981, the French market for this kind of terminal, is expected to be 34 million by 1992! At a projected price of under $100, with the

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1. The Economist, March 15, 1980

potential to access the PTT's videotex services, and with a protected market, CIT-Alcatel (CGE), Matra, Thomson-CSF and a French subsidiary of Philips will have the economies of scale necessary to export at a very low price indeed. As noted elsewhere in this document plans are also afoot to develop a communicating word processor at around $3,000, one fifth of today's price. This machine would use software developed by Canada's AES Data via a licensing agreement.

Other initiatives in the public-private area include optical fibre trials, EFT, and a French competitor to SBS using France's Telecom-1 satellite.

Meanwhile the French government has stimulated and encouraged private-private concertation as for example in the joint venture between National Semiconductor and the glass firm St.-Gobain-Pont-à-Mousson in the manufacture of chips. St. Gobain's purchase of a 10.3% share in CII-Honeywell-Bull (from CGE) and its attempts to purchase the French government's 20% stake, along with its recent purchase (for $230 million) of 20% of Olivetti,positions that company well in the market for the office of the future. Meanwhile St.-Gobain is planning further acquisitions in the U.S., while CGE has already bought Telecommunications Switching Systems and Friden in the U.S. and Roneo Vickers in the U.K. A joint research company is on the

boards for Olivetti and CGE as well(1). All of these examples of private-private concertation instead of competition will streng - then France's position immensely as the information era unfolds. Instead of invoking anti-combines regulations, the French government has encouraged and, probably, even promoted many of these private cooperative ventures.

Turning to Japan now we see an even more explicit set of concertation mechanisms in the information/communications area. Labor-management and government-labor-management concertation as in Sweden is assisted by the political links between parties and unions, while at the factory level the concensus and harmony oriented values of Japanese culture ensure close, continuous consultation at all levels of the firm. In addition many problems such as lay offs, reduced hours, and firings are obviated by a commitment by the employer to lifetime employment for the employee. In addition corporate provision of social and recreational services, corporate anthems, and employee-employer relationships outside of the production sphere build the close labor-management ties which allow for cooperation rather than confrontation.

Considering now the concertation in the public-private and private-private domains, we find even more than in France. The VLSI project cited previously shows nicely how Miti, the Ministry

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(1) Business Week, May 5, 1980; The Economist, November 17, 1979

of International Trade and Industry, orchestrates public-private and private-private concertation. In this particular case a laboratory was established at Kawasaki where two principal groups of companies worked: Nippon Electric Company, Toshiba Information Systems and Computer Development Laboratories (Fujitsu, Mitsubishi, and Hitachi). Although the researchers from each company generally worked together there was some contact and the general manager of NEC'S VLSI development division stated that without the scheme big companies would have spent five times as much for research on the electron-beam technology used for tracing circuits.(1) Four hundred million dollars were spent, over four years one third by government directly, so that otherwise $2 billion U.S. dollars would have been spent, i.e. concertation saved Japan 1.6 billion dollars U.S. on this project alone!

As with the PTT in France the Nippon Telephone and Telegraph Company too is stimulating industrial development by undertaking ambitious videotex, electronic mail, facsimile, and fibre optic programs. As with France the NTT will be supplying terminals to residential customers at little or no extra cost vis-à-vis today's prices which will create enormous possibilities for development of services, software, and hardware which can then be

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1. The Economist, April 5, 1980

produced in quantity to serve export markets since the domestic market provides the necessary scale for quantity production of such products as mass fax. Another force behind mass fax is that it is seen by many Japanese newspapers as the way out of their problem with rising distribution costs. To develop the domestic computer market and retain a majority share of it (the only country other than the U.S. to do so), the government loaned funds to companies so they could lease computers. We have noted previously the NTT's prediction at Viewdata '80 that, by 1990, 90% of Japan's households will be served by a videotex service.

Furthermore we should state that Japan does not allow foreign control of its companies and, through the Central Bank, influences banks to give capital to Japanese companies to the extent that debt-equity ratios are highly geared, frequently even 85% equity - 15% debt. One concrete result is that companies have adequate long-term capital for R&D and foreign market development and can afford signnficant losses for several years in new areas.

Many other examples of public-private and private-private concertation could be described as Japan strives to become the dominant economic power, Dai-Ichi, Number One, by the year 2000 A.D. but instead we refer the reader to the IRPP report by Zavis Zeman, The Men with the Yen and such works as Ezra Vogel's Japan as Number One. The extraordinary emphasis placed on cooperation

in Japanese culture in general has been deployed in the information/ communications context superbly. Undergirding the Japanese thrust is Japan's profound understanding that these opportunities will allow continued growth on the back of this new industrial revolution as automobiles, ship building, and steel decline in Japan and the West, while burgeoning in the NICS, the Newly Industrializing Countries (Korea, Taiwan, Brazil, etc.).

Turning now to the United Kingdom the lack of labor-management and government-labor-management concertation is a fundamental symptom of the "British Disease", as recently seen in the British Leyland and British Steel strikes, from which the U.K. is still reeling.

There also appears to be relatively little evidence of private-private concertation within the U.K. with the exception of some joint ventures with American firms such as the GEC - Fairchild chip making facility. Paradoxically for tax reasons GEC, which is only middle sized ($6 billion U.S. per year) compared to such groups as Thomson, General Electric, Siemens, or Westinghouse, may well be broken up into six companies.(1)

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(1) The Economist, February 9, 1980

Meanwhile Plessey and GEC's Marconi division, for example, are each too small to compete effectively with such companies as Westinghouse. The principal thrust of U.K. concertation then has been in the public-private sector area. We have already mentioned the British Post Office's Prestel videotex service, which was the first to be developed and the first to be offered as a full public service, the creation of Insac and Inmos, and the government's schemes for the dissemination of microelectronic technology and the development of software. All of these but Prestel are part of a 400 million pound commitment by the U.K. government in this field. As with France non-tariff barriers and close relationships between British Telecommunications and its suppliers ensure a secure domestic market, field trials, and R&D contracts. Because British Telecommunications controls attachment standards so tightly, many firms wishing to install, for example, high speed modems, cannot do so and are forced to export their more sophisticated products. A similar situation exists in Canada because of the present attachment policy.

Considering now the United States, we see no governmental attempt to develop concertation in the public-private, private-private, labor-management, or government-labor-management areas.

The U.S. government, according to all of those interviewed and other sources, operates on the assumption that government's direct intervention in the economy should be minimal except in the areas requiring regulation because they are monopolies. Those interviewed unanimously perceived the U.S. government as "polycentric" in its decisionmaking, i.e. without a coherent overall policy or strategy, concerning the information revolution. All agreed that the phenomenon broadly defined is not visible at present at the highest levels of decisiomaking. Some decried this and felt that the impacts will be substantial on the U.S. and need policy attention, while others felt that U.S. technological leadership will create new industries and employment even if some present industries are negatively affected by microelectronic developments.

Many would contend that not only is there a lack of concertation in the United States but indeed an adversarial system. A well known American consultant, Dr.J. Baranson, said at an IRPP seminar on world technological leadership for example, "The adversary relationships between government, industry, and the public are becoming a three way free-for-all and it is exacerbated by the lawyers...The basic contrast between Japan and the United States is the supportiveness in Japan, while adversary relations prevail in the United States."(1)

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(1) Zavis P. Zeman, David Hoffman, eds. 1980. The Dynamics of the Technological Leadership of the World, pp. 15-16. IRPP.

Some would argue that U.S. Defense Department support for electronics is evidence of concertation but according to Ted Conant, at the same seminar, working in the Defense area corrupts one's ability to keep costs down and often prevents commercial development of ideas for security reasons. Dr. Conant also stated that the U.S. government has not aided the consumer electronics industry in the U.S. and is not serious about encouraging venture capital to move into high technology industries.(2)

In the labor-management area we also see little evidence of concertation inspired by the government or undertaken without government stimulation.

3.4 TECHNOLOGICAL STRATEGIES CHOSEN

Continuing our discussion of the United States from the previous section but turning now to technological strategy it appears that the U.S. government does not have an explicit strategy, again depending on American based multinationals' technological leadership to prevent problems from arising. The dangers of this approach are apparent in the examples cited by Dr. Conant at the IRPP seminar referred to above, i.e. that an

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(2) Op. Cit., pp. 22,23,24.

American developed the Sony Trinitron VTR, it was bought by Paramount and then sold to Sony because "Paramount decided it was too expensive to do anything about", while other VTR technology was sold to Sony by I.B.M.(1)

VTR technology, the digital watch, main frame computers, robotics and some kinds of silicon chips are all examples of the Japanese technological strategy of "adopt and adapt" coupled with minor or major leap frogs depending on the case. The just completed VLSI research programme appears to be an attempt at a major leap frog based on basic R&D in a field where the Japanese have acquired great expertise since choosing chip manufacture, robotics, and fibre optics as key technologies for development several years ago. These fields are characteristic of the Japanese penchant for choosing (on the basis of good technology forecasting) the development of technologies which they believe to be crucial over the next 10-20 years, as opposed to supporting specific companies or product development. Thus three elements of the Japanese technological strategy are use of the leap frog technique, use of the adopt and adapt technique, and funding R&D on specific generic technologies chosen scientifically on the basis of forecasts. Linked intimately with this technological

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1. Op. Cit., p.21

strategy is export oriented business planning which builds on captive domestic markets, long range financing for export market development based on the famous "learning curve", and governmental assistance in the collection of foreign market intelligence.

Although the Japanese emphasis in electronics traditionally has been on consumer electronics they are being threatened in this area even in their own domestic market (for example in digital watches) and have clearly opted to develop chips, fibre optics, and robotics as a way of keeping ahead of Hong Kong, Korea, Taiwan and others, both in terms of lowering production costs for traditional products (via robotics and computer controlled design) and in terms of new products based on advances in these new areas. A starting figure is that of the estimated 17,500 industrial robots in the world today 13,000 are in Japan, 2,500 in the U.S., and 2,000 in Europe(1). The article from which these figures are taken goes on to state "Most Japanese robotics rely on basic computer 'hardware' and 'software' pioneered in U.S. Laboratories."

Part of the reason these adopt and adapt tactics have been so successful is that Japanese quality control is so much better

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(1) Technology Review, February, 1980, p.78

than other countries. This gives them a competitive advantage even when selling chips or other products originally developed and commercialized by others. One recent example comes from a Hewlett Packard study comparing the product quality of three Japanese and three American chipmakers' 4k and 16k rams(1). One problem the Americans have is the slow depreciation rates for capital equipment vis-à-vis taxes, while others are the consultative character of Japanese work patterns, the Japanese practice of putting three to four times as many engineers on to designing a new circuit as the Americans can afford, and the use of highly automated test equipment.

Turning away from the hardware side of the equation we can also perceive a technological thrust toward strategic development of telematics as a vital business for the future and the associated products such as mass fax and videotex terminals and the software to support this "wiring of Japan." The fibre optics R&D programme is of course part of this thrust as well and one can expect Japanese initiatives in EFT, electronic mail, and the office area to parallel their present strength in retail point of sale terminals.

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(1) The Economist, April 26, 1980.

Considering the United Kingdom now, their strategy is not as coherent and well integrated as the Japanese strategy, and it is not nearly as well funded. Four hundred million pounds over several years as opposed to several billion dollars U.S. per year in Japan constitutes a significant difference. The British strategy does seem to have four distinctive thrusts however - VLSI chips through Inmos, software development and training supported by international marketing through Insac, Prestel, and funding industry to study the uses of microelectronics in improving their products and production practices. Inmos represents an attempt to do with VLSI what Intel did with LSI and, thus, represents a major leap frog attempt rather than, for example, taking LSI technology and developing products based on it (which many conponent companies are trying to do, Texas Instruments for example). More leap-frog initiatives could result from government funded consultants' work for British firms, depending on their reactions to the studies.

We have already discussed in some detail in the concertation section the many French initiatives in chips, videotex, the office of the future, satellites, etc. As with the Japanese case these appear to indicate an overall emphasis on telematics and the related products, systems, services, and software. By making terminals available free, initially, and then for very low rates the networks are being constructed which then will encourage

development (with solid economic viability) of new services and products. This strategy parallels the Japanese while these two differ substantially from the U.K., W. Germany, the U.S., and Sweden.

A recent example of French policy in action is, in my opinion, the French government's intervention to prevent Thorn's take over bid for the largest T.V. rental company in France, Locatel. A CGE subsidiary, Alcatel, bought it in the end. Obviously if one has a network oriented national strategy one does not want a British company to control the purchase and rental of the most important electronic means of accessing the home, the family television set.

Briefly considering W. Germany and Sweden now, neither seems to have an overall technological policy in the information/communications field informing their actions, although both support their domestic computer industries. In addition W. Germany is spending $24 million dollars U.S. in 1980 to support R&D in the chip area at AEG - Telefunken, Siemens, and a Philips subsidiary, Valvo, and has supported robotics R&D in the machine tool industry.

3.5 HUMAN RESOURCES STRATEGIES CHOSEN

As in other areas the United States does not seem to have an official policy or action programme responding to the impact of the information revolution on education, employment, retraining, technical manpower needs, and so forth.

Sweden has had an explicit set of computer training programs and retraining programs for those affected by automation, while W. Germany and the United Kingdon been active in developing training programs for computer related occupations.

The French approach has been much more focused on the long term in the sense that the government has established the goal of placing 250,000 microcomputers in elementary and high schools so that students would come to understand and use the new technology of informatics.

We are unaware of specific Japanese plans in this area but according to one report one half of the seven billion dollars spent each year in the computer area is spent on training and education(1). Other sources indicate that a major advantage that

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1. Christopher Evans.1979.The Mighty Micro. Victor Gollancz Ltd.

the Japanese have vis-à-vis other countries is their extremely high ratio of technical to non-technical people in their factories and their practice of rotating technical people into marketing and other non-technical jobs so they have a better feel for the needs of the user. The high ratio is of course possible because of the number of graduates they are turning out in engineering and the sciences.

3.6 APPARENT TIME HORIZONS CHOSEN

Congruent with the integrated strategies they display Japan and France appear to have opted for medium to long term time horizons in planning for the information revolution. This is betrayed by their emphasis on education and their efforts to use concertation to increase the effectiveness of their corporate entries into the race for world markets.

This is especially sensible in light of the many predictions that, worldwide, only a very few huge computer companies will survive to the end of the 1980's.

Their apparent thrust toward telematics with a rapid time scale is another indication since the immediate market appears to be oriented to privatics - home computers, video games, consumer

products such as Speak and Spell, and so forth.

W. Germany and Sweden appear to be near-term in their techno-economic orientation but, in Sweden's case especially, long-term in their orientation toward social policy question.

The United Kingdom seems to be near to medium-term in its techno-economic orientation, but edging toward a longer term policy orientation.

Having discussed the game plans of Canada's competitors let us now consider a possible game plan for Canada.

CHAPTER 4

TOWARD A GAME PLAN FOR CANADA

4.1 INTRODUCTION

The construction of a game plan for Canada in the face of the information revolution must be an evolutionary iterative process. Accordingly, this chapter, indeed this paper, must be perceived as a tentative first approximation of such a game plan and in no way a definitive statement. In addition, we want to clearly communicate that the notion of a game plan is a strategic concept which provides a framework within which individual sectoral tactics may be incorporated. It is not a substitute for specific policies to deal with particular situations.

Following the analytical model developed in Chapter 2 on the determinants of industrial leadership we present the tentative game plan in terms of the five dimensions namely:

- Goals
- Choice of Sectors, Time Horizon
- Choice of an Appropriate Technological Strategy
- Optimum Role of Actors.

4.2. GOALS

The complexity of Canadian goals makes this dimension particularly difficult to deal with. In order to simplify the problem, we will assume that overall 'final' goals for Canada include national sovereignty, identity, and unity in the socio-political field, a high level of material affluence in the economy, and a satisfactory quality of life. Since this report focuses primarily on techno-economic issues, we shall relegate the discussion of the non-economic goals to other papers in the GAMMA Information Society series and concentrate on the optimum objectives for an industrial strategy.

The following four potential goals will be considered:

(1) Full employment.

(2) Income and wealth generation.

(3) Import substitution.

(4) Export orientation.

The temptation of course is to choose all four but that would obviously be missing the point. The goals are to some extent competing and we must make choices between these goals.

First trade-off: Full employment vs wealth-creation.

Creating income and jobs is no longer synonymous. The thrust of the informediation revolution is the capital/labor substitution. In Zavis Zeman's overview of the effect of computers on employment(1), estimates vary as to the final impact but there is substantial agreement on the short-term implications: information technologies are labor-saving. In France, the Nora-Minc report forecasts 30% unemployment in the financial sector within 10 years. In the U.K., the 1978 University of Warwick study mentions 10% unemployment by 1982, the Barron-Curnow report 16% by 1990, and the Jenkins-Sherman study 25% by 1990. In Canada, Peitchinis is quoted as saying that employment is not yet substantially affected by automation but that 60% of workers affected by technical change will require re-training(2). Further, the rate of disemployment appears to be on the point of outstripping new employment.

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1. Op. Cit.
2. S.Peitchinis quoted in Shirley Serafini and Michel Andrieu. The Information Revolution and its Implications for Canada. Department of Communications, Forthcoming, p.20.

It must be emphasized that the disemployment is taking place without reduction in wealth-creation. On the contrary, productivity is increasing and real income is rising. The president of GM has been quoted as saying that within 10 years, 90% of all new machines in GM assembly plants will be computer controlled(1). Computer aided manufacturing (CAM) and computer- assisted design (CAD) are rapidly making fully automated factories possible. Computer graphics for design, computer generated parts lists, vendor ordering, production scheduling, inventory control, computer control of numerically-controlled machine tools, quality inspection, automatic test equipment, are all displacing human participation. In addition, in the service sector, computers have already achieved a very high penetration rate. In Canada, 204 or 7.6% of all computers in 1970 or 13% (1,074) of all computers in 1978 were in the service sector(2). Electronic funds transfer, electronic mail, electronic publishing, electronic word & data processing, etc, are all productivity boosters and disemployment creators.

Because of international competition and the adoption of robotics by other countries, Canada cannot afford to ignore the new technology on pain of losing not just a few jobs, but entire

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1. M.Prentis. 1979. Micro-Electronic Revolution and its Policy Implications. Department of Communications.
2. S.Serafini and M.Andrieu, Op. Cit. p.21.

industries. Accordingly, we make the following recommendation:

Recommendation 1:

Canada's industrial policy should give first priority to wealth-creation coupled with a redistribution policy which will ensure that workers losing their jobs will share in the benefits of automation by being retrained while not losing their income.

Giving priority to wealth creation is more fruitful than merely creating artificial jobs because the added real income will allow everyone to benefit. Artificial job creation in the face of international competition is ultimately self-defeating.

Second trade-off: Export-orientation vs Import-substitution.

An import substitution aproach would have as its objective increasing Canadian purchases of domestic production at the expense of imports or, in other words, protecting the home market. This defensive strategy would be justified if either Canada had a large internal market affording economies of scale and economies of scope or had consciously chosen a 'scaled-down' intermediate technology. One version of import-substitution is to develop industrial standards which are particular to the Canadian market and which would therefore favour domestic production. Because of Canada's small market, foreign competitors would just 'write-off' the Canadian market and not try to penetrate it

on account of the high cost of adaptation to the Canadian standards. This policy is essentially a form of protectionism.

A scaled-down 'small is beautiful' highly decentralized Canada using intermediate technology and adopting a life-style of 'voluntary simplicity' or 'doing less with less' would also be served by an import-substitution strategy(1).

On the other hand, if Canada wishes to maintain a high standard of living and compete in the family of nations, an export-orientation is necessary for the well-known reasons of economies of scale and of scope. The former implies reductions in unit-costs resulting from the volume of production. The latter refers to cost reduction as a result of vertical and horizontal integration which provide a series of complementary inputs thus reducing the total cost of doing business. We therefore believe that an export-orientation will provide the necessary market for Canada's industrial expansion in the information age.

Recommendation 2: Canada's industrial strategy should give priority to the penetration of international markets in those fields where Canada has or can develop a comparative advantage. Accordingly, the development of its information technology should reflect that priority and be outward looking.

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1. As in GAMMA's Conserver Society 3: The 'Buddhist Option'. See K. Valaskakis, P.S. Sindell, J.G. Smith, I. Fitzpatrick-Martin. 1979. The Conserver Society. Harper & Row and Fitzhenry & Whiteside.

4.3. CHOICE OF SECTORS/TIME-HORIZON:

One of the characteristics of the world economy, largely brought about by the growth of multinational firms, is the increased mobility of factors of production across international borders. Since a national comparative advantage in the production of a certain commodity depends on that nation's stock of productive factors, the latter's international mobility creates foot-loose industries willing to emigrate almost at a moment's notice. The result is the emergence of a transient pattern of comparative advantage and an international product cycle where a particular product may initially be exported by country A to country B and later, imported by country A from country B. In other words, A can lose its comparative advantage to B.

The implication concerning the choice of sectors upon which to construct the industrial strategy is that planning for the medium run is the best possible approach. A selection of sectors must be made not only on the basis of present comparative advantage but also on future comparative advantage. Here, medium run planning closely linked to the technology cycle (see next section) would allow the country in question to choose the sectors in which it can successfully compete. Too short a time-horizon tends to give a static view of events. Too long a horizon is riddled with uncertainties, including the possibility of losing of previously secure industries and factors of production.

A key issue in industrial strategy, therefore, is the ability to pick 'winners' and avoid backing losing ventures. This requires a careful assessment of demand considerations, relative costs, technological trends and, above all, an aggressive marketing approach. The information revolution is spinning off dozens of new products and services which include among others:

- "smart" telephones and PABX's
- videotex and teletext
- electronic funds hardware/software
- Pay T.V.
- electronic mail hardware/software
- word processors
- intelligent copiers
- stand-alone home computers
- specialized microcomputers and terminals
- video-tape recorders
- video-disc players
- cultural products
- satellites, earth stations, and satellite systems
- industrial robots
- silicon based microprocessors
- remotely controlled security and fire protection services

The actual process of selecting sectors should, in our view, involve the key actors of industry, labor, and government. In France's system of indicative planning, the private sector sets

its plans after receiving valuable information from the government concerning macro-economic trends, market potential, and possible government support in the evolution of comparative advantage. We contend that a similar process of concertation is needed for the optimum selection of sectors and to avoid the trap of choosing 'losers'. (see section 4.5.)

In addition to joint selection of sectors, concertation is required to develop an explicit national human resources strategy. Canada already lacks the engineers and software programmers (especially in the microprocessor field) we need currently, not to speak of the retraining which will be needed for those displaced by information machines.

Vis-à-vis sectoral choices we would observe, however, that specialization in components requires that the country be 'plugged in' to an international pattern of vertical integration, usually controlled by multinationals. This increases the vulnerability of the country to possible sudden realignments of international production and the emigration of its industry abroad. For this reason, a specialization in final products and/or integrated systems is more desirable, first because of the decreased vulnerability and second because stronger spin-off effects will arise from integrated systems compared to spin offs from components.

We would also argue that it makes eminent good sense in choosing sectors for development to build on our existing strengths in telecommunications, cable television, office communications, satellites, and computer systems, software, and services. We have described elsewhere in more detail some of our particular strengths(1). Let us repeat here only the core of our argument that, blessed as we are with a "wired nation" through telephone, data, telegraph, cable, satellite networks of the first standard, we should use these networks to develop network-oriented products using Canada as a "test bed". We must also provide a regulatory environment which encourages rather than discourages innovation. A proposed Saskatchewan law preventing numerous attachments to the Sasktel network, and a CRTC policy which has inhibited the development of new services offered by the cable television industry so badly that the companies have had to do their R&D on purchased U.S. systems, are examples of action damaging in the extreme to the further development of products, systems, and services which we could export. In the cable industry, where we have led technologically for many years, we are rapidly losing our position to the Americans. This is particularly important if one believes, as we do, that the information society in the United States will penetrate the average home via cable television utilizing economies of scope made possible by the success of Pay T.V. in the U.S.

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1. Peter S.Sindell. 1979. Public Policy and the Canadian Information Society. Paper I-4. GAMMA.

There also appears to be a discernible trend emerging wherein stand alone computers such as video games, language dictionaries, learning aids of all kinds, and others are increasingly being built with key boards and modems. This allows connection to both the television set and the telephone network. Privatique then will be moving toward telematique. If this technological forecast is correct then network oriented products, systems, and services which we develop here can then be exported quickly to our largest trading partner.

At present our telecommunications and office communications industries are also world leaders (N.Telecom and Mitel with their digital switching systems and PABXs; AES with the largest installed base of non-mag card word processors in the world, etc.) We should build here too on our networking expertise and develop the integrated systems which will be required for the offices of the future. Fiber optics, computer service networks, satellite systems, and many other areas of Canadian expertise will be invaluable here if we can concert our efforts to compete with Exxon, Volkswagen, IBM, etc. Concertation is clearly needed when Alberta Government Telephones gives a major design contract to Harris Corporation of the U.S. which firm promptly subcontracts the most important parts back to a Canadian consulting firm; a Canadian government department contracts with SRI (California) for a software job which then subcontracts it back to a Canadian university; and Bell Canada chooses U.S. terminals from Exxon (Vydec) and Teletype Corporation in preference to Canadian

products reputed abroad to be far better than those chosen.

With or without concertation, basic R&D in the areas where we presently lead must continue at a high level in order to prevent others from leap-frogging us. But based on excellent technology forecasting and market studies, we should also plan our, hopefully concerted, leap-frog strategy in areas which government and industry identify together. Some of the most promising areas appear to be robotics, the cultural industries, and such generic technologies as voice sythesis and voice operated machines and pattern recognition. Our present work in remote manipulation systems and image analysis in the space area give us some help here. There are many options to explore in leap-frogging but one which deserves particular attention, we feel, is acquisition of companies in areas such as robotics leaving the R&D where the company is but moving production, administration, marketing, and sales to Canada.

We would recommend therefore that:

3. Canada's choice of sectors for explicit support and development should be chosen jointly through concertation between the federal and provincial governments, on one hand, and industry on the other. The specific sectors chosen should:

   (1) build on the precise strengths Canada possesses in telecommunications, office communications, cable television, computer systems, software, & services, and satellites;

(2) focus on network oriented integrated systems and products using Canada as a "test bed";

(3) take into account the forecast development of the cultural industries, robotics, and other areas where we could leap-frog.

4.4 TECHNOLOGICAL STRATEGY.

The choice of an appropriate technological strategy is perhaps the most important element in our industrial game plan. The usual indicator of technological policy is the amount that is spent on R&D. We submit that this indicator is highly unsatisfactory because it does not show how the money is actually spent(1). If the hypothesis of a technology life-cycle and technology generations is valid, then much more important is the question of the stages in the cycle which are being pursued.

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1. An interesting analogy is Defense Policy. The U.S. government usually measures defense effort by the spending approach. Increasingly, this approach is being criticized because wasteful or even totally useless expenditures can masquerade as 'defense' without increasing in real terms the defense capability of the country. Expenditure is no guarantee of efficiency.

Even if R&D is taken as a measure, Canadian performance is not very impressive. In 1975, the R&D effort of the OECD countries amounted to the following(2):

U.S.:$36.7 billion or $165 per capita.
Germany:8.8 billion or $143 per capita.
France:6.0 billion or $114 per capita.
U.K.:4.6 billion or $ 83 per capita.
Canada:1.8 billion or $ 75 per capita.
Sweden:1.2 billion or $140 per capita.
Switzerland:1.2 billion or $187 per capita.

Italy and Canada spent only 1% of their GNP on R&D, the U.S. 3%, Britain 2.6%. The most interesting case is that of Japan. Surprisingly, in the seventies, Japan only spent about 1.5% of its GNP on R&D, a small proportion, yet managed to secure technological leadership in many areas. The Japanese strategy has been based on a much more efficient expenditure of its R&D funds including the acquisition of foreign technology by the purchase of patents (for example the Wankel engine), licensing and industrial emulation. In effect, they have been very successful in implementing an 'adopt and adapt' strategy coupled with calculated 'leap-frog.' Some of these lessons should be useful for Canada.

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2. C. Norman. 1980. Knowledge and Power. Global R&D Budgets. Worldwatch Institute.

The Adopt and Adapt Strategy.

The Science Council has made a strong plea in its various publications for technological sovereignty by restricting the importation of foreign technology in order to encourage local R&D. We submit that, in many cases, this is an ineffective strategy. Rather than concentrate resources on fundamental research already completed elsewhere, an adopt and adapt strategy is often the better policy. This means that the technological effort should focus either on stage 3 of the technology cycle (stage 1 being discovery, stage 2 invention, stage 3 innovation) or stages 4 and 5, national and international diffusion).

In Canada, technological diffusion seems to follow an 'epidemiological' pattern with its origin in the 'TOM' (Toronto-Ottawa-Montreal) region. Following the successful example of other countries, the adoption and adaptation of foreign invention may well be a more dynamic strategy than pursuing an illusory technological sovereignty by starting from scratch with basic R&D.

Basic R&D as a technological strategy is, in our view, the optimum policy only when the country is ahead of the competition and wants to remain that way. Catch-up strategies on the other hand are either adopt and adapt or, better still, the leap-frog.

Major and Minor Leap-Frogs.

Since technology moves in generations, each of which is composed of stages of development, very interesting possibilities arise from leap-frogs. As we have seen in Chapter 2, a major leap-frog means skipping the current generation and going to the next. A minor leap-frog is skipping a stage in the current generation.

There are many enlightening examples of international leap frogs.

Example 1:

As late as 1970, France had one of the most antiquated telephone systems in Europe. The standard joke was that half of France was waiting for a telephone and the other waiting for a dial tone. The French system was so backward that it was unencumbered the by need to amortize a large investment in equipment and, therefore, it could easily change its system.

Today, France is in the process of developing the most advanced telephone system in Europe. Experimenting with optical fibres in Biarritz, France intends to operationalize them very soon. Videotex systems (Antiope-Titan), tēlē-alarm, and electronic phone directories will soon be standard. Hundreds of thousands of CRTs will be distributed to households to put the infrastructure in place and create a demand for new services. There is a plan to export electronic mail hardware (Mass Fax), with 100,000 machines as an export target, at about $500 each. Another plan is to market a communicating word processor by 1982 at $3000 or 1/5 the price of present machines. The Transpac packet switching network and the greater use of satellites are all part of the French master plan(1).

By skipping the generation of traditional telephones, France is arriving first in the next generation of "smart" telephones (a major leap-frog).

Example 2:

Swiss watchmakers are trying to react to the Japanese leap-frog in the watchmaking business. Previously possessing a quasi-monopoly in quality watches, the Swiss watchmaking industry was leap-frogged by Japanese digital watches. Today, watchmaking is a $10 billion industry with Switzerland still No.1 ($81 million)

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1. The Economist, March 15, 1980.

Japan No. 2 ($62 million), the Soviet Union No. 3 ($40 million) and the U.S. No. 4 ($37 million). As we have mentioned, Texas Instruments actually developed the first digital watch technology but the Japanese had much better marketing expertise.

The Swiss government is currently planning a counter leap-frog. Two hundred and fifty million francs will be spent to redeploy the industry and create a new generation of digital watches designed to upstage the Japanese. The new watches will be a combination credit-card, electronic funds transfer device and tiny TV-camera unit (à la James Bond). They will be marketed by the mid-eighties.

Example 3:

Canada's Telidon is in the opinion of technologists, one generation ahead of the British Prestel Ceefax-Oracle and the French Antiope-Titan, because of its tele-software potential. This is, therefore, a potential leap-frog in the making, if Telidon can be successfuly marketed in time.

We may see a counter leap frog coming from Japanese and/or U.S. manufacturers in generation three. The 3rd generation of videotex could be on the market at cheap prices before Telidon which would make our videotex machine stillborn.

The leap-frog strategy must be used decisively and audaciously and above all with perfect timing. This latter observation refers back to the optimum time-horizon which we claim, once again, is neither the very short nor the very long run, but the medium run which corresponds to the life-expectancy of the appropriate stage in the technology cycle to which we wish to leap frog.

The resistance/rejection syndrome and its relevance to the leap frog strategy.

One of the reasons why a technological strategy can fail, including one which features a leap- frog is giving inadequate attention to the resistance-rejection syndrome. Recognizing the importance of this phenomenon, GAMMA paper I-9 analyzes it at some length.(1). Telidon may become a casualty of this phenomenon if, as many feel, there is not adequate market demand at this time for videotex technologies.

The individual consumer, the ultimate arbiter of success or failure of a technology, may react to a new invention in one of three ways a) by adopting it, b) by rejecting it, c) by resisting it temporarily, (i.e., delaying its final adoption). Resistance-rejection may, in the opinion of Dr. Gardiner, be based on the following subjective perceptions of the person-machine interface:

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(1) W.Lambert (Scot) Gardiner. 1980. Public Acceptance of the New Information Technologies:The Role of Attitudes. Paper I-9, GAMMA.

(1) "The technology may replace me." (OBSOLESENCE. This is a legitimate fear of the capital-labor substitution which is characteristic of the information revolution.)

(2) "The technology may be used to invade my privacy." (PRIVACY)

(3) "The technology may involve too much." (TECHNOPHILIA)

(4) "The technology may be used to exploit me." (TECHNOPHOBIA/EXPLOITATION)

(5) "The technology may become a 'crutch'." (DEPENDENCE. Many teenagers are unable to multiply without a pocket calculator).

(6) "The technology may generate too much information." (INFORMATION OVERLOAD)

(7) "The technology may depersonalize me." (FEAR OF INFORMEDIATION)

(8) "The technology may change me." (MEDIA AS MESSAGE)

(9) "The technology may take too much time." (OPPORTUNITY COST. To learn to use a word processor or a computer requires time and effort. The time allotted to this endeavour might have a high opportunity cost. Other things would have to be given up. If the opportunity cost is high then people will not bother learning to use the new machine.)

(10) "The technology may force me to change my habits." (FORCE OF INERTIA & HABITS)

In addition to individual rejection, there are also cases of institutional rejection. This aspect was not covered in Gardiner's paper but may be articulated as follows:

(1) Mistakes are expensive to institutions. It is often safer not to risk using a new machine.

(2) Infrastructure costs may be prohibitive (amortization-depreciation rules may reduce these costs).

(3) Performance gains from the new machines may be cost-effective in the long but not the short-run. If the profit turnover horizon is short-term, a firm will not adopt new equipment which only becomes effective in the long run.

(4) Resistance by vested business interests (producers of the displaced technology).

(5) Resistance by labor unions.

(6) Regulatory delays in securing the necesary approval to operationalize an invention. In the early '60s, for instance, it cost $1 million and 5 years to get a drug through the U.S. Federal Drug Administration.Today it takes $18 million and up to 10 years to gain approval for general use.

(7) Technology assessment delays innovation. Much of the research a firm must conduct in this era of limits to growth is defensive research, i.e. pollution abatement, environmental protection, energy conservation , how to meet federal standards, etc.

(8) Many 'small' ideas do not interest large firms. A $100,000 idea may fire the enthusiasm of its inventor but a large firm pays as much in paper clips and is not likely to be impressed. Therefore, 'small' ideas may be institutionally rejected by large firms.

In his study on 'great planning disasters', Peter Hall(1) develops an analytical model of industrial failure. He identifies three kinds of uncertainties in planning which lead to industrial failure. These uncertainties are a) exogenous, (over estimation of effective demand seems to be the standard case together with underestimation of cost), b) based on other people's decisions (lack of coordination in planning bodies),and c) related to value systems (shifts in paradigms may render a particular invention unmarketable).

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(1) 1980. Great Planning Disasters. Weidenfeld and Nicholson.

We conclude from this analysis that a well-planned leap-frog must take into account the whole pattern of rejection-resistance syndromes. We, therefore, formulate the following recommendations:

Recommendation 4: Canada's technological strategy should be based on the leap-frog idea whenever possible. However, a potential leap frog must be throughly examined in the light of attitudes, consumer behaviour, institutional reaction and the possibility of resistance and/or rejection. Appropriate steps must be devised to counteract the resistence-rejection.

Recommendation 5: Case studies of failed innovations should be conducted in order to enlighten us on the nature of resistance-rejection.

Some of the innovations which didn't "take" and could be studied with profit include:

- quadraphonic sound
- 'polavision' (Polaroid's instant movies)
- picture phones
- the Edsel
- the Concorde

A sound understanding of the mechanics and dynamics of the leap-frog will enable us to accurately forecast the duration of 'gestation time' (the length of time between stages within a technology cycle) and 'transition time' (the time it takes to launch a new technological generation).This forecast will ensure the success of the leap frog.

4.5 ROLE OF ACTORS.

A game-plan is, in the final analysis, implemented by a team of players. Unles the role of each player is well defined, however lofty the objectives of the game plan may be and however subtle its underlying strategy, it is not likely to succeed. The role of actors is a particularly crucial question in Canada because, in our view, the failure of Canada's economy to realize its full potential is intimately connected to it.

4.5.1 Canada's contemporary economic performances.

Canada's contemporary economic performance has not been brillant in terms of its potential, yet it has been adequate in absolute terms. The postwar years from 1945 to 1973 were a period of great growth. But, after 1973, although resource-rich in a resource-starved world, the Canadian economy has not succeeded in establishing a strong external competitiveness. It has, in effect, shared the decline of the U.S. on the world scene. Both countries have lost part of their technological edge. Within North America itself, Canadian innovativeness, although present in many sectors, has rarely enjoyed the follow-through neccesary to disseminate and market new products or ideas. The economic history of Canada in the last twenty years (indeed some will say the last century) is one of missed opportunities, still-born projects and unimplemented good ideas.

However, because of the generous cushion of natural resources that we enjoy, standards of living have remained among the highest in the world. This has served to mask the crisis of poor innovativeness (as opposed to inventiveness because studies have shown that Canada has more than its share of brilliant inventors).

4.5.2 The various diagnoses of Canada's incomplete development.

The dominant explanations of Canada's incomplete development center around the work of two public agencies affiliated to the federal government. The Economic Council's Looking Outward(1) report, diagnoses Canada's structural weakness in the absence of economies of scale. An export-orientation, best achieved through free trade is the solution, argues the report. Therefore, the removal of tariffs, even unilaterally, becomes in its view the best 'industrial strategy'.

For the Science Council, Canada's weak performance stems from technological weakness, in turn caused by Canada's branch-plant economy status vis-à-vis the U.S. The multinationals allegedly stifle R&D in Canada. Only the development of an indigenous technological capability will improve the picture.(2)

The Fraser Institute, a private non-profit institution whose politics are right of centre and which has given itself a mandate

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(1) 1975.

(2) John N.H. Britton and James M. Gilmour. 1978. The Weakest Link. Science Council of Canada.

to defend the free enterprise system, attacks the Science Council's diagnosis and implicitly supports the economic Council's.(1) Not only should there be fewer tariffs, goes the argument, but fewer instances of internal government intervention. A completely free economy, à la Milton Friedman, is then the best 'industrial strategy'.

The Canadian Institute of Economic Policy, a private non-profit research institution whose politics are left of center, argues in the same vein as the Science Council but adds a plea for more state intervention in the economy.(2) From their point of view the best industrial policy then is state-directed.

4.6 A NEW DIAGNOSIS.

While accepting elements of each of the above diagnoses, lack of economies of scale, lack of technological innovativeness, too much government intervention (in some sectors) and too little government intervention (in other sectors), we propose a somewhat different one, namely that the overriding reason for Canada's sluggish performance in the international economy is our adversary system, which stifles innovation and prevents follow-through.

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(1) K. Palder. 1979. Science Council's Weakest Link. Fraser Institute.

(2) 1979. Out of Joint with the Times.

Canada possesses a multifold adversary system with at least four major confrontation-systems:

(a) The public sector vs private sector confrontation system.

(b) The federal vs provincial confrontation system.

(c) The labor vs management confrontation system.

(d) The firm vs firm confrontation system aided and encouraged by anti-combines legislation.

We therefore suggest that:

<u>By maximizing internal competitiveness, Canada has minimized its external competitiveness.</u>

This, in essence, is our diagnosis. The remedy is easily deduced. The first step towards industrial strategy is to replace our 'confrontation economy' by a 'concertation economy' where the four actors, the federal government, the provincial governments, labor, and management work together rather than perpetuating eternal stalemates.

Canada's adversary system is both formal and informal. It is largely based on the Anglo-American concept of checks and balances; it is embodied in the U.S. constitution and present as a convention in British constitutional law. It is also reflected in the Smithian view of a competitive market, which was the very essence of nineteenth century capitalism. The adversary system is central to our judicial system, to industrial relations, to

political life itself. In a fundamental sense, it is Protestant ethic capitalism, as envisioned by Max Weber (1) glorifying individualistic entrepreneurship.

Opposed to capitalism based on the Protestant ethic is a new capitalism, born and bred in Asia. It is post-Confucian capitalism, where collective action based on the national interest replaces the adversary system of Western capitalism. As we have seen in Chapter 3, the Japanese 'concertation economy' has one supreme objective for Japan; the achievement of Dai-Ichi, the number one position. Japan's industrial strategy is, as far as the role of actors is concerned, quite simple: it is Japan Inc., 100% team work to face external challenges. Other South East Asian countries imbued with the post-Confucian ethic (Taiwan, Korea, China) are now in the process of repeating the Japanese experience.

In the West, the European equivalent of post-Confucian capitalism is neo-mercantilism. France, West Germany, Sweden, and Switzerland have developed elements of a 'concertation-economy' and many of their successes are based on this concertation. The state directs the economy in partnership with the private sector.The British economy, on the other hand, is ailing

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(1) Max Weber. 1930. The Protestant Ethic and the Spirit of Capitalism. Scribner.

and is afflicted by what some people call the 'British disease', a labor/management adversary system marked by bureaucratization of the entire economy and rewards to inefficiency. The U.S. and Canadian economies show elements of the same 'British disease'. In order to substantiate our diagnosis to the effect that it is Canada's adversary system which is indeed its 'weakest link', we must examine in some detail the four confrontation-systems that sap Canada's vitality, in our opinion.

4.6.1 The Public Sector vs Private Sector Confrontation System.

A mutual distrust and apprehension seems to mark public/private sector relations in Canada(1). The private sector resents government intervention in the economy and wishes to minimize it because it sees it as a threat to private enterprise. At the same time, elements of the public sector believe that government's role in the private sector is to regulate. Business' attempt to minimize regulation and government's attempt to impose it sets the two on a confrontation course.

In contrast the Japanese system is based on complementarity between the two sectors with proven success, as was shown in the previous chapter. The same is true of the German and Swedish systems. Yet, when the Canadian government begins to explore the possibility of creating a Canadian version of the Japanese Sogo Shosha, who manage Japan's exports and imports, there is an

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1. Roy MacLaren, Executive Publisher of Canadian Business has described this distrust forcefully in Science Council seminar The Politics of an Industrial Strategy, 1979. pp.89-104.

immediate outcry. One noted columnist(1) called it "another white elephant planned by Ottawa" and attacked it with gusto. His article ended with a typical admonition: "we would want to see very serious study of the proposal before anything is done". One can imagine the rest: A committee is set up to study the proposal which then presents it to another committee. After X years, it is presented to the government and the public in a press conference - and then shelved. Meanwhile, our competitors are implementing long-range plans with concerted harmony, harvesting the resources of their public and private sectors.

In order to break the stalemate of public/private confrontation, a new approach is needed. This approach would be based on the following principles:

a) The government's role in the economy should neither be blindly minimized by excessive privatisation nor blindly maximized on ideological grounds. Instead, it should be optimized.

b) Optimum government policy is one that stimulates maximum performance from the private sector which should remain the principal dynamic agent in the economy.

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(1) Don McGillivray in The Montreal Gazette, March 26, 1980.

c) Regulation is but one of many forms of government intervention. R&D support, facilities provided to business for industrial redeployment, adopt and adapt strategies, leap-frog strategies are all in the domain of useful government intervention. In addition, government procurement and joint public-private ventures must be envisioned.

d) The guiding principle of the public/private relationship should be the notion of a partnership rather than an adversary relationship. Establishing lines of communication between business and government is critically important.

Recommendation 6:

The feasibility and desirability of a public-sector/private sector partnership is a top research priority which should be undertaken on the initiative of both of these sectors. Close attention to foreign experiences is important in order to identify where Canada can 'adopt and adapt' certain successful foreign techniques of concertation.

4.6.2 The Firm vs Firm Confrontation-System: Competition Policy.

An indisputed theorem of micro-economics is that perfect competition promotes efficiency in a static world, with fixed

technology and constant returns to scale. The existence of increasing returns to scale (i.e., decreasing unit costs) technological innovation, economies of scope and inter-industry linkages profoundly changes the above conclusion. Under such dynamic conditions, firms develop strong incentives to coalesce and form trusts or cartels (horizontal integration) and/or to control suppliers along the production chain (vertical integration). As a result, an internal contradiction arises.

The logic of the competitive system leads to industrial concentration giving rise to oligopolies and monopolies. Yet, institutional and legal restrictions, such as anti-combines legislation prevents such mergers from taking place. Consequently, the firm vs firm adversary system results in a necessary stalemate:

a) Competition between firms is strongly encouraged even at the expense of efficiency.
b) No one is allowed to "win" If a firm captures a large part of the market and is in the process of establishing a monopoly, it is broken down.

The net effect is that Canada's firms are condemned to remain small and divided, yet are expected to successfully compete against giant multinationals. In 1975, Canada's electro-

nic industry comprised over 700 firms with 89,000 people employed. In Europe,the U.S. and Japan, the electronics industry tends to be dominated by one or two firms. Even our leading contender, Northern Telecom is small in comparison with Siemens (Germany) Thomson-CSF (France), G.E.C. (U.K.) and is only about half the size of L.M. Ericsson of Sweden.(1).

The success story of Northern Telecom has been explained as follows: First, during the fifties and sixties, it benefited from continuous technical support from Western Electric and second, it developed its clientèle within the protected market of Bell Canada territory. Yet, Northern Telecom's further development is hampered by attacks by the Restrictive Trade Practices Commission which is preventing further vertical integration between Bell and Northern and reinforcing its tendency to migrate toward its ever more important U.S. market.

One of the interesting counter-examples to the Canadian firm vs. firm enforced stalemate is the French concept of a 'national champion'. The French government initially encourages intense competition between contending firms in a key sector. This competition is designed to weed out inefficient or insufficiently

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(1) J.M. McLean. 1979. The Impact of the Micro-Electronics Industry on the Structure of the Canadian Economy. IRPP.

motivated firms. Later, as one firm begins to demonstrate high vitality and wins the national competition, it is declared 'national champion' and the other firms are encouraged to merge or associate with it. The final result is a system of advanced horizontal and vertical integration under the watchful and helpful eye of the state, with an eye to both securing the home market and penetrating foreign markets. Again, Canada could profit by 'adopting and adapting' some of these successful foreign initiatives.

Recommendation 7:

In those sectors, where the conditions of production, distribution and consumption favor vertical and horizontal integration, anti-combines legislation and competition policies should be re-assessed. If important efficiency gains are to be reaped from such integration, a regulated monopoly may be a better vehicle both for internal cost-reduction and external competitiveness than the perpetration of wasteful competition by maintaining the fragmentation of producers.

As a corollary to the above recommendation, some attention should be devoted to the question of whether it is desirable to encourage small firms to remain small (which is the case under present fiscal law) or, on the contrary, to increase in size and benefit from economies of scale.

4.6.3 The Labor vs Management Adversary System.

One of the most cherished aspects of Canada's adversary system is the assumption that wages and working conditions are best determined by the confrontation of labor and management through either negotiation or strikes, lock-outs and other pressure tactics. This system is shared with Britain, Italy and some of the other members of the OECD. The result is interesting. Every year, the countries with the most intense labor/management strife compete for the dubious world championship of work-days lost to strikes. Canada, Britain and Italy regularly recycle that 'championship' between them.

The labor strike is now as much a part of this country's everyday life as "Hockey Night in Canada." Strikes in the public, para-public and private sectors regularly inconvenience the general public. When the strike is in a key sector, the indirect effect may be much more serious, causing serious dislocation in the economy. A public transit strike may bankrupt small businesses making their living from urban traffic near bus and subway stations. A postal strike may bankrupt companies which do business by mail-order, etc.

In a system where both labor and management are willing to use all the weapons in their arsenal to 'go for the jugular', structural change is difficult and industrial redeployment often

impossible. In addition, organized labor's hostility to technological innovations which save labor severely hampers the adoption of new inventions.

A marked contrast to the Canadian experience is the Swiss. In 1973, 70,000 work-days were lost to strikes in Quebec alone, a region comparable in size to Switzerland. From 1961 to 1973, not one day was lost to strikes in Switzerland and in the only 'bad year' of the seventies, 1976, 19,600 days were lost in strikes in that country. Switzerland boasts of no unemployment (on the contrary foreign workers are imported to fill jobs) and a 4% inflation rate. It also enjoys the highest standard of living in the world and very low taxes(1).

The Swiss concertation-system between labor and management is not the result of strict laws but of convention and self-discipline. 'La paix sociale', as it is called in that country, was voluntarily achieved in 1937. In that year, the unions and management voluntarily 'disarmed' by offering not to use their strike and lock-out weapon but instead to resort to compulsory arbitration. The restraint and self-discipline of the Swiss has since, been even more dramatically expressed in a

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(1) Le Devoir, "La paix du travail est une réalité en Suisse." 12 mars 1980.

recent referendum where a great majority of voters refused to reduce the work-week to 40 hours from 45. Such a referendum outcome would be inconceivable in Canada.

Recommendation 8:

Given that the labor-management confrontation-system is a major impediment to innovation and a source of waste, the modalities of an alternative system of concertation should be jointly explored. In particular, labor's institutional resistance to technological innovation should be reduced by including labor representatives in the planning of industrial strategy. Once again, the study of foreign experiences may be enlightening.

4.6.4 The Federal vs Provincial Confrontation-System.

Because the present Canadian constitution is the 1867 BNA Act, which was notoriously silent on many areas of jurisdictional allocation between Federal and Provincial governments, a large grey area of contested jurisdiction has emerged. The information-communication sector is in that grey area. Furthermore, since Canada is a confederation rather than a federation and a confederation implies divided sovereignty between federal and provincial governments, the seeds of a permanent confrontation-system have been sown.

This adversary relationship expresses itself at every federal-provincial conference and whenever important national issues are at stake, (energy-prices, control of national resources, regional expansion, etc)(1).

Every province is now in a frame of mind of 'the costs and benefits' of confederation. Every province wishes to maximize the benefits and unload the costs on the others. This attitude and its negative effects have been documented in detail recently by Judith Maxwell and Caroline Pestieau in their excellent study Economic Realities of Contemporary Confederation. They state for example, "A Competitive approach to economic policy was observed in all Canadian provinces during the 1970's. The predictable result has been that policies have tended to offset each other, and the operation of the common market in Canada has been impaired."(2). Very often, the provinces see the federal government as the common enemy and form various coalitions against it.

Cultural and regional diversity are positive and desirable objectives and these centrifugal forces in Canada are now prevailing. Quebec is leading the way with its sovereignty-association movement, but other provinces are also taking such approaches. A decentralized confederation is desired by many provinces with a linear increase in provincial jurisdiction at the expense of the federal government's power.

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1. See Richard Simeon. 1979. "Federalism and the Politics of a National Strategy." in the Science Council seminar The Politics of an Industrial Strategy, pp.3-43 for an excellent discussion of this issue.

2. 1980, p.27. C.D. Howe Research Institute.

Although laudable in cultural terms, we contend that this excessive decentralization is not advisable if Canada wishes to compete in the international economy. The existence of eleven antagonistic governments with multiple fiscal, linguistic, energy, technology and regional expansion policies to manage less than 24 million Canadians spread out over the second largest country in the world is, we contend, counter-productive. To attempt under these conditions to tackle Japan Inc., the U.S. multinationals and French and German neo-mercantilism is utterly unrealistic. Jurisdiction over communications, for example, has become a mere counter in the federal-provincial confrontation. There will be grave consequences for Canada if nationally concerted policies needed to face foreign competition are destroyed to achieve temporary political goals.

We must also note we are not making the value judgement that Canada should tackle Japan Inc. and the U.S. multinationals in the world economy. What we contend is that if Canada wishes to play in that league, the strategy of having eleven generals is not the best one. Luckily, this last statement is not an unverifiable metaphysical proposition but a testable hypothesis. Ultimately, the proof is in the pudding. If there are those who argue that confrontation-federalism is the best industrial strategy, let them demonstrate it.

The observable facts are that Canada has not been doing well in the international economy against its major competitors. Whether it will do better in the future without team-work is a proposition which needs to be proven. One need only use the metaphor of our national sport, hockey, to realize that individual uncoordinated super-stars will not make a winning team. The

humiliation suffered in February, 1979 by the National Hockey League All-Stars at the hands of the Russians is an illustration of that fact. (It will be remembered by hockey aficionados that the same Russian teams were defeated by the Montreal Canadiens in December, 1979, and, more dramatically, by a highly motivated well-knit team of U.S. youngsters, when the American Olympic Team took the gold medal from the Russians in February, 1980.)

4.7 Is a Canadian 'Concertation-Economy' Possible?

The feasibility of a Canadian concertation economy is not evident and certainly, even if feasible, not easy to achieve. It may well be that the institutional changes required will be impossible because of resistance and rejection. However, we believe that such concertation is probably the only way to implement an industrial strategy of the leap-frog variety, which calls for dynamic, well conceptualized, highly integrated initiatives.

If the analysis we present in this report is perceived as valid, then the next step is to identify the bottlenecks and obstacles impeding the emergence of a concertation economy. We may well discover that a large majority of these obstacles may be circumvented by appropriate policies. Yet, the very process of discovering operational modalities of a concertation economy requires a concerted action research effort. Therefore, the investigation itself must be jointly undertaken by the public and private, federal and provincial, labor and management actors themselves. This, in our view, is the immediate next step.

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