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PHASE I

Information Society Project

Projet: Société Informatisée

PAPER NO I

THE MICROECONOMICS OF
INFORMATION: STRUCTURAL
AND REGULATORY ASPECTS

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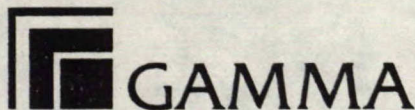
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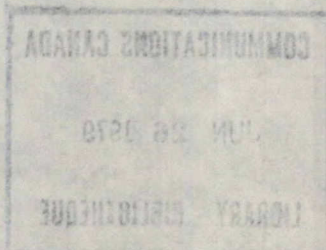


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Executive Summary

Contemporary society is characterized by the manner in which individuals have developed information-related institutions such as vast educational systems and conglomerate business enterprises.

The information structure contains two interrelated facets. Firstly, there is the information commodity, for example current events news, scientific research and knowledge in general. This commodity is quite unlike standard agricultural and manufacturing products in that information can be consumed by everyone without decreasing its availability to others. Hence it is like the product called national defense, in that information has public good characteristics.

Secondly, the information structure contains the channeling process, which is the complete set of elements utilized to carry information from the producer to the consumer. In general the use of different information channels (whether by technology or person to person contact) tends to define the manner in which society becomes segmented into distinct groups. For example the problem of income distribution is essentially one where different groups access different channels, such as different types and levels of education, thereby creating information and income asymmetries in society.

The public good nature of information and the use of specific channels by different parts of society, cause the information structure to not only be produced in the market place, but also to be provided within large organizations. Indeed we find that corporations will engage in applied, low risk information, while non-profit organizations (like research centres) will undertake basic, high risk information generation. In addition, corporations must attain a certain threshold level in terms of size and industrial concentration in order to be able to internally generate appropriate information structures. Consequently, we expect that the degree of vertical and horizontal integration, in production, organization and ownership structures, will increase. Large corporations or consortia of corporations (both privately-owned and Crown) will become more involved in information generating and channeling - such as data processing, databanks, microprocessors, and new terminal devices which combine the telephone and television.

Integrated ownership structures are also methods to diversify the risks of complex, basic research. In particular, this diversity can be a solution to the education crises brought on by financial constraints and lower enrolment levels. Research groups, independently funded by organizations, can be subsumed within or loosely connected to universities. This can provide for sharing agreements for professional and

administrative functions without enlarging university overhead costs. Thus universities may become more adaptable to fluctuations in enrolments and public funding.

The enlarged integrated network of the information economy will mean more government involvement, in order that an efficient and equitable development will occur. Questions of the appropriate degree of horizontal and vertical integration will have to be answered, as we find insurance companies, leasing companies and newspapers becoming more and more involved in databank and dataprocessing services. Indeed we can witness the pressing need for a new competition bill, new telecommunications legislation and revisions to the Bank Act, as reactions to the reality of greater integration. Various scenarios must be studied to determine realistic industrial structures. One thing seems clear, that the degree of integration must be compared to that of the North American scene, if Canada is to be internationally competitive. In fact what might appear to be too high a level of integration for domestic markets may well be appropriate for continental markets, as evidenced by the success of Canadian Pacific, Northern Telecom and various firms in the metal industries.

The regulatory aspects of the information economy are genuinely complex. It is useful to characterize the information structure along the lines of content (the information commodity) and carriage (the information channels).

Although this is an important distinction, we must be clear that within each of these sectors are many types of products and services being provided by many organizations. In fact corporations involved in the carriage sector produce services in a multitude of dynamic monopoly and competitive markets. Regulatory environments must enhance and adapt to this changing industrial structure. In fact there are a whole host of solutions that must be analysed which lie between the confinements of present regulation and complete deregulation. The impacts of different types of regulation must be clarified, if the growth of the information economy is not to be hindered but rather encouraged.

Lastly, in line with our notion that the content and carriage sectors are not homogeneous units, it is not necessarily detrimental to society not to have a distinct separation of information generating and channeling. It appears that the issue of separation of carriage from content centres around the demand properties for different kinds of information and the technological characteristics of various channels. If demand for specific kinds of information is broad based throughout the population, then there may be a case for separation of content and carriage. For instance, television programming is an example where the demand for forms of leisure information is so pervasive that carriage and content should be separated. On the other hand there is no reason why research organizations who produce very specialized information

for a limited demand may not be permitted to publish and disseminate their own studies.

As we have described there are important regulatory and structural issues which must be confronted and their societal impacts determined in order that there can be an orderly development of the information economy. These latter concerns should be on the agenda for future research.

1. General Introduction

The complexity of modern society is highlighted by the manner in which individuals have developed information-related institutions, in order that they can carry out the everyday business of living. These institutions play key roles in the organization of our contemporary economic, social and political existence. Indeed, because events are so complex and are changing so rapidly, it becomes imperative for individuals and groups to handle and channel increasing amounts of information through various mechanisms. Specifically, the sizeable public expenditures to education, the rise of the conglomerate business enterprise, and the rapid technological advances, all indicate the proliferation of information. It is not surprising then that contemporary society is often referred to as the information society.

In this paper we are concerned with a particular aspect of the information society - namely the information economy. Our central interest pertains to the structural and regulatory issues involved in being able to characterize the nature of the information economy. Thus we are essentially in the realm of microeconomics, because the explanation of the nature of the information economy must be grounded in the applications of fundamental economic principles.

We address four basic questions which are of immediate

concern in understanding the information economy. Firstly, we look at the problem of the nature of the information structure. We distinguish between information generation on the one hand and information channels on the other, in order that we can separate the commodity called information from the means of diffusing it throughout society. Indeed, by information channels we mean the totality of elements necessary to bring information from the primary producer to the final consumer.

Secondly, we analyse how information affects the manner in which transactions or exchanges are organized. In this fashion we can show how the important properties of information, namely the fact that it is difficult to exclude individuals or groups from consuming it, and that it must be obtained in indivisible quantities, lead to particular kinds of industrial structures and government policies.

By focusing on industry structure and behavior patterns, we can discern probable scenarios for the development of organizations involved in information generating and channeling. We will tend to observe specialized profit oriented firms engaging in many forms of information dissemination. However, accompanying this trend will be an increase in the concentration of ownership among these specialized enterprises. These firms will be controlled by much larger corporations or indeed even by a consortium of firms. The consortium can

also consist of a mixture of privately-owned and Crown corporations, who are in need of the services of information banks, databases, specialized computer equipment, data-processing and research organizations. In general the services which will be provided by the specialized profit oriented firms will be non-basic kinds of information generation and their channels will be the highly technological instruments needed to disseminate a wide variety of services, rapidly, and with relatively easy accessibility.

The organizations which embark on basic kinds of information production will be non-profit centres. However, these groups will not only be funded by public expenditures, but also by corporations. In this way corporations can obtain the needed information and spread the risk of the generation process among a few other groups. For example, the importance of these research groups could have an impact on the future of the education system, which faces tight budgets because enrolments are settling at a lower long-run level. The professionals with the independently financed research organizations can be jointly engaged in lecturing, without contributing to the fixed overhead costs of universities.

Lastly, by the nature of the characteristics of information and the vertically integrated structural scenario we feel that the degree of regulation will in general increase

in the economy. Moreover, in particular we believe that the regulation of information will be much more intensified. The regulation of the latter will not necessarily be along the lines pertaining to the carriage (information channels) and content (information generation). This is because the carriage and content facets are not themselves homogeneous sectors. There are many different kinds of channeling activities which are interdependent in a horizontal sense (such as voice and data telecommunication services) and in a vertical sense (the manufacturing of products and distributing of services in the computer industry). The appropriate regulatory policy must take, not only technological factors, but also market and internal organization factors into consideration. The detailed horizontal and vertical network of corporations in the carriage sector does not permit general rules of thumb but points to the need for detailed analysis of alternative scenarios.

In fact the separation of the carriage and content sectors for policy purposes is not always a relevant segmentation. No doubt in certain industries this separation may be warranted, such as those in which the demand for particular kinds of information is broad based - as found on television. However, with regards to specialized information production, for example scientific research, there is no reason for the separation of carriage and content. Regulatory policy must encourage appropriate structural and behavioral

conditions within and between the carriage and content sectors.

2. The Information Structure

2.1 Introduction

The production and exchange of information in an economy differs in a number of fundamental ways from transactions involving "non-information" commodities. The very concept of a commodity is dependent upon the transactions process and its mode of organization within society. Clearly information is part of every transaction and as such its explicit definition has been rather elusive.

The reason for this we believe is the failure to recognize the dual role of information in society. Firstly, individuals, groups, corporations and other organizations demand and supply information as a commodity - albeit an extremely heterogeneous one. Information is utilized by these organizations in their decisions processes in determining whether or not they should undertake various transactions - for example the consumption of food, the portfolio allocation of funds, the hiring of labour, the production of automobiles, the exploration for energy. Secondly, the pervasiveness of information comes about by the channeling process connecting the appropriate groups to the information commodity. Thus we have to distinguish between the information generating and the information channeling processes. It is this omnipresence of information in transactions which justifies characterizing the economic system as the information economy.

We can focus on two types of information generation, generally referred to as the screening and researching processes. These processes may be considered polar cases in the following sense. Usually screening is conceptualized as a mechanical kind of learning whereby there already exists predetermined classifications for the information and one solely places it into a particular category. On the other hand, research involves the development of new classifications or categories. An example illustrating the two cases can be pointed out by noting the difference between the requirements of writing an undergraduate term paper in a bachelor's programme and the requirements for completing a doctoral dissertation. The differences are not just of degree but of kind - one involves surveying the existing literature and the other entails providing an original contribution to knowledge. Before we begin our analysis of screening, researching and channeling, a few remarks should be mentioned concerning the existing literature.

Most of the work has centred around the problems encountered with imperfect information in a number of specific markets (education, Stiglitz [36]; labour, Spence [32]; product, Salop [28]; financial, Stiglitz [34]). From these studies it appears that the existence of imperfect information necessitates important modifications to conventional economic analysis. For example, the traditional approach would entail an analysis

of the act of producing a given "quantity" of information. An immediate question concerns the meaning of the quantity of information. As Marschak [21], Stiglitz [35] and Arrow [2] state, the Shannon measure of the amount of information (as defined in Jenner [15]), which has proved most useful in other disciplines does not appear to be relevant to economic analysis. In the words of Arrow, "The quantitative definition which appears in information theory is probably of only limited value for economic analysis... Let A and B be any two statements about the world, for neither of which is its truth or falsity known a priori. Then a signal that A is true conveys as much information, in the sense of Shannon, as a statement that B is true. But the value of knowing whether A or not is true may be vastly greater than the value of knowing B's truth-value." Thus the quantity of information in an economic sense is much different than the quantity in a technological sense.

The importance of information in economic processes is brought out by the realization that transactions in non-information and information commodities are so interwoven that an attempt to construct a theory of information leads to a reconstruction of part of conventional analysis. Although a general theory has not been developed, nor may it be necessary or possible to develop one, some general conceptualizations and conclusions do emerge.

2.2 The Characteristics of the Information Commodity

The information commodity reflects important differences from the usual kinds of private commodities produced, exchanged and consumed in markets. Firstly, a given piece of information is an indivisible commodity, which leads to fundamental concerns for economic organization. The information producer must supply a commodity whereby the consumption of any one demander does not diminish the amounts available to others. In a sense the consumption of any individual is independent of everyone else's demand. Moreover, once the information is produced, this activity does not have to be repeated - information exists and it cannot be readily destroyed. Hence the indivisibilities are prevalent both for consumption and production. This fact refers to what is often called the fundamental problem of non-convexity.

Closely akin to the problem of non-convexities is the problem of appropriation. In the absence of institutional restrictions, the producers may find it difficult to sell in the market place, because demanders can readily resell the information. Thus there is the ever present threat of an arbitrage process which can undermine the incentives to embark on information production. We find that it becomes very costly to exclude individuals from consuming information which already exists. For example, just note how difficult it is to enforce

reprinting rules on the copying of books or parts of books that are found on library shelves.

Therefore, due to the realization that information is indivisible and that individuals cannot be excluded from its consumption and reproduction, purchasers will not reveal their true value of information. Why should a potential customer reveal the price that he is willing to pay, when there may be other sources (not directly from the producer) from which the information can be more cheaply obtained. These characteristics of the information commodity point out that it is not like the usual private commodities - such as agricultural and manufacturing products - but has the properties of collective (or public) commodities - like national defense. It is the mixed public-private nature of information which leads to important questions for institutionalizing information transactions, which we shall have to address. At this point, though, we must look more closely into the types of information generating processes.

2.3 The Screening Process

Screening (as Stiglitz [36] states) is the process of distinguishing things which, in the absence of screening would for economic purposes be treated the same. For example, it may be known that some automobiles are better than others, but it requires information and a mechanism to ascertain

which automobiles are which. Consequently anything which distinguishes among entities may be used as a screening process, for example a grading system in school screens individuals, or in another context ranking different firms by their terms of employment. The screening process can be classified into two sub-groups: examination screens and self-selection screens.

2.3.1 Examination Screens

Suppose we are interested in the information which is produced by the observation of particular characteristics of groups or commodities. These characteristics are observable at different costs and the characteristics which are not observable may be correlated with some that are observable. Essentially agents are examining in order to produce information. This is what happens when potential customers search out different firms to determine the one with the lowest price.

Another example occurs in insurance markets when the problem of moral hazard is present. Suppose individuals purchase insurance, say fire insurance, and later a fire breaks out. The fire may be caused by the careless behavior on the part of the individual, so the policy has altered the individual's actions and thus the fire is not an insurance against an unforeseeable event. The insurance company must attempt to screen out individuals (if that is possible) based on a set of predetermined characteristics.

2.3.2 Self-Selection Screens

Information emanating from this process is based on the behavior of actors in the economy. The individuals are observed in the process of carrying out transactions and according to their actions, they are appropriately categorized. We can distinguish two kinds of observations; one set pertains to those derived in a controlled environment and the others come from uncontrolled situations.

There are numerous examples of observations from uncontrolled behavior. For example, performance on a job conveys information about the individual's ability in order that it can be evaluated. Controlled situations can arise when an individual is confronted with a structured set of choices and from the selections information is obtained. Such is the case in certain marketing surveys and psychological tests.

The problem of adverse selection in insurance markets can suffice to illustrate the nature of self-selection screens. Suppose the insured knows the risks of having an accident better than the insurer. The insurer may start by choosing his rates on some actuarial basis. This will lead the high-risk group to buy more insurance than the average and the low risk group to buy less insurance, i.e. to effectively "buy" some self-insurance relative to the average. This will raise insurance rates and drive even more "less risky" individuals out of the market. A situation can be created where the risks of many are inadequately insured. What is occurring is that the

individuals through their behavior are supplying information by self-insuring.

2.4 The Research Process

It is obvious that the process of invention is devoted to the production of information, which by its nature can never be known with certainty. To compare the screening process with the research process, it is clear that the former consists of placing entities into a set of known categories and thus can be viewed as a repetitive process. On the other hand the purpose of research is to develop new categories in which to place the objects.

The riskiness in the research process brings to bear the same type of moral hazard problem as in the fire insurance case. If some kind of insurance can be obtained against the failure to produce the desired "output" - such as a cost-plus contract which stipulates payment for the cost of production and a fixed mark-up - then there is a tendency to modify and indeed weaken the incentive to succeed. The risks that are involved are directly related to the size of the research process undertaken. In a survey by Booz, Allen and Hamilton [5] of 120 large companies doing a substantial amount of research, they found that 60% of the projects never resulted in a commercially used process. Notwithstanding the fact that the proportion of funds spent in these abortive projects may not be the same as the percentage of abortive projects, the

failure rate is quite high.

However, the reason for such a failure rate can arise from the fact that there are usually sequences of research processes undertaken by any one group. In the initial phase there is little information concerning the direction to be taken and so by embarking on numerous parallel projects and as information is obtained, one can select the appropriate sequences and discard the less desirable projects. As Mansfield [20, p. 10] states, "Contrary to popular belief, conducting parallel efforts may produce results more quickly and more cheaply than attempting in advance to choose the optimal approach and concentrating all one's efforts on pursuing it." Thus because of the random element in the research process, we cannot discern how the benefits of research will reduce the costs of various activities, but we may be able to describe the appropriate sequence of cost reductions.

Hence as we have described them, screening involves mechanistic learning and researching involves innovative learning. Manifestly most processes involved in the production of information are mixtures of these two classes.

2.5 Information Channels

The information structure, as we stated, is comprised of two aspects, the information itself, the characteristics of which we have already described, and the information channel. Channel, in this context, refers to the totality of

elements necessary to bring the information from the producer to the consumer. These elements can be created or abandoned and their characteristics are subject to choice based on a rational comparison of benefits and costs; i.e. the existence of specific types of channels is not exogenously prescribed to society.

2.5.1 The Costs and Benefits of Channels

In order to understand the nature of the benefits and costs arising from channels, it is necessary to decompose the different parts. A channel is comprised of four elements: accessing, coding, storing and transmitting. Essentially the information producer accesses the channel, and in order to get the information to the consumer it must be encoded; this means that information must be converted to a signal in order to be processed within the channel. The signal can then be stored (eg. put in a computer memory bank) or transmitted (eg. through loops, trunks and switching centres of a telecommunication system). Upon reaching the other "end" the signal can be stored or decoded from transmission into replicated information, which the consumer extracts by means of a terminal. The channel conceptually can then be viewed as a coordination of a set of terminals and a network.

The benefits from the information channel are quite clear, for as long as there is value in the information which has been produced then the means of getting this commodity to consumers also has value.

Manifestly the usage of information channels entails the incurrence of capital costs. These costs are not only from the physical capital associated with the machinery and other equipment but also human capital. The human costs are either fixed or quasi-fixed because immediately or ultimately information enters the individual's brain through sensory organs, and both the brain and sense organs are limited in capacity. Indeed, the individual's limited capacity for producing and channeling information must be viewed as a fixed or quasi-fixed input. Consequently, as the other inputs (or factors) in the information structure are increased, diminishing returns to the variable factors will set in. The reasons for not always observing diminishing returns are two-fold. Firstly, humans are not generally operating near their capacity, and secondly the types and characteristics of the non-human factors in the information structure (due for example to the research process) can dramatically change. These two reasons can set back the onslaught of diminishing returns.

The role of human capital costs is particularly acute in the coding aspects of information channels. Individuals must have the ability to understand the information. For example, if scientific material is disseminated in foreign language periodicals, the ability to decode the signals requires an investment to learn the foreign language, as well

as the scientific material. In addition, this investment on the part of the individual is irreversible, for it remains in the possession of the individual and of course subject to depreciation. This type of capital accumulation leads to the possibility that once the investment has been made and an information channel exists, it can be cheaper to use the existing channel than to invest in new ones. In the words of Arrow [3, p.41], "Thus it will be difficult to reverse an initial commitment in the direction in which information is gathered. Even if the expected value of the differences between two possible channels was relatively small and even if subsequent information suggested that the initial choice was wrong, it would not pay to reverse the decision later on". With this conclusion in mind, a corollary is that the development of new information channels will generally be complementary to existing ones; for example, individuals will learn languages of similar origin, as is evident by many multi-lingual persons from eastern Europe.

Finally, it is cheaper to channel information to individuals who are familiar with the code. In this sense, then people with similar life experiences tend to gravitate (informationally) to each other. Coleman [6] has found that transmission which involves person to person contact is apparently the most important method of diffusing information.

Moreover, these personal contacts are not randomly distributed in the population. Consequently the channels are only accessed by specific types of individuals thereby limiting the diffusion of the information. An example of this latter point can be seen from the failure of government policies to effectively reduce income inequality. It could be that a particular group of individuals have a higher productivity (and therefore income) because of efficient information channeling within the group.

3. Institutionalizing the Information Structure

3.1 Introduction

The interaction of groups in commodity exchange occupies a fundamental, if not the most important, position in the functioning of the economic system. Yet until recently little was known concerning the transactions process and the means of organizing this process in institutions other than markets. In order to understand the modes of organization and the role for information, let us look at the general transactions process.

Agents in an economic system (i.e. individuals or groups) are usually classified according to their preferences, the alternatives which confront them and their probabilities concerning the relative strength of belief in the occurrence of the various alternatives. The role of information is to alter the nature of uncertainty confronting any agent. This is overcome not solely by the information itself but also by the existence of information channels, that is by the receiving, coding, storing and transmitting of information. In a transactions framework it is the information and the information channels connecting the groups which have important bearings on the methods of organizing the transactions. This point is not generally emphasized; that it is the combination of the two which cause agents to overcome their rationality limitations (Simon [31, p. xxiv]).

Limitations on the rationality is referred to as bounded rationality. The importance of this concept arises out of the characteristics of individuals and their interaction, which gives bounded rationality its crucial role. To quote Williamson [40, p. 23]: "When, however, transactions are conducted under conditions of uncertainty/complexity...the bounded rationality constraint is binding and an assessment of alternative organizational modes, in efficiency respects, becomes necessary".

Therefore the coordinating device which allows groups to interact and fulfill their transactions is the information channel, while the information is used in determining whether it is profitable for the transaction to take place.

3.2 The Methods of Organizing Transactions

The importance of information and channels is distinct in the different types of organizations used in institutionalizing transactions: the market, the hierarchy and the constituency. The market is obviously very familiar and we shall not dwell on it except to describe it in very general terms. There are three types of agents in the market: the buyers, sellers and arbiters (a special case of this type is the auctioneer) who interact through bargaining in forming the contract. The coordination of bargaining is through the price, so that if any agent buys or sells then a price must

be bid or asked. In this way the information requirements in a market organization are quite minimal, because individuals need only know the things that affect their own consequences. Any repercussions triggering reactions by others in the economy will manifest itself through prices.

The hierarchy, examples of which are the large corporations, universities and government departments, is the second form of organization we shall discuss - hierarchies have also been called administrations and bureaucracies. There are also three kinds of agents operating in a hierarchy: the supervisor, the subordinate and the auditor. Clearly as the classification of the agents suggests there is some kind of ordering of the agents which reflects itself in the transactions process. Indeed, the interaction is not through bargaining but rather through delegation; orders are devised by those above and executed by those below. Thus the coordination of the transactions is through authority, and this authority encompasses both the parallel sets of supervisors who plan the orders and the parallel sets of subordinates who in general must comply to the orders set at higher levels. With authority as the coordinating device in hierarchies, there is also the need for checks and balances in the exercising of power - this is the function of the auditor. The auditor's role is to see that the proper scope for authority is retained, so that the supervisors are responsible for their orders.

Before embarking on a more detailed analysis of the corporation as a hierarchy and the relative costs and benefits of organizing information production and channeling through the market or hierarchy, we will describe the constituent organization and show by its very nature that it is ill-suited to be the general institutional framework which organizes complex transactions.

The agents in a constituent organization may be referred to as candidates, electors and monitors. The interaction between the candidate and the elector is coordinated by consensus through voting procedures. Voting is the alternative to authority in non-market organizations. However, there are fundamental problems connected with consensus in large groups, unless electors have identical motivations and beliefs concerning the different alternatives (that is identical information). This relative unanimity may be feasible in groups such as committees and professional associations where uncertainty can be overcome because of the existence of similar information channels and the objectives or preferences of the group are sufficiently alike. Nevertheless, in general if there are transactions costs involved in overcoming information differences the cost of organizing transactions by consensus is generally greater relative to other means.

3.3 Information in Markets and Hierarchies

Previously we described the general nature of hierarchical organization (in particular firm organization) and showed that as a means of organizing transactions it was generally superior to constituent organization. The relevant comparison now is between firms (or in general hierarchies) and markets as modes of transaction organization. To be more precise, under which conditions will firms be more efficient providers of information rather than obtain it through the market?

The answer to this question lies in the transaction costs of contract formation. Basically if transactions costs are sufficiently low then information will be provided in the market place, otherwise hierarchies will be established as the transaction medium. In a world where transactions costs are negligible then a complete set of spot, futures and contingent markets could be formed, but as these costs increase the greater becomes the degree of market imperfections. Moreover, there is a threshold level - which differs over time and space and can be influenced by government policies such as patents and copyrights - when the firm becomes a substitute for incomplete market contracts, due to the high cost of negotiating, implementing and enforcing these contracts.

In the extreme when the transactions costs are large then market transactions cannot be fulfilled and so the

contract is internalized. For example, the problem of vertical integration of industries can be explained by the existence of contractual costs and the comparison of the relative costs of specifying interfirm and intrafirm contracts. It must be highlighted that the threshold level in shifting transactions from the market to the firm or vice versa is not a universal constant across all commodities or even for specific commodities. Thus in some countries television services are provided by firms producing the program and the channel while in others this vertical integration is not as prevalent. Moreover, over time the organization can change, which has been the case in Canadian communications with the advent of cable television companies, so that certain firms produce the programs while others provide the channel.

Another example is found in the telecommunications field. Traditionally there was and is vertical integration regarding the access to the network (the terminal equipment) and the use of the network. However, recently in Canada and the U.S. (Microwave Communications Inc. is one example) independent firms have been arising who provide telephones and related types of equipment. In our framework (apart from the regulatory and legislative implications) the reason for this occurrence can be traced to the increasing costs associated with contract enforcement when coordination is conducted by authority rather than prices. It is becoming more expensive

for firms to internalize the production of terminal equipment rather than buying them in the market. Alternatively, the telecommunications firm can stop buying the terminal altogether and let independent companies sell directly to the customers (i.e. convert the terminal from an intermediate to a final product). If we accept that the reason for this phenomenon is due to the increase in the costs of contract enforcement, then it is not surprising that we find independent companies entering the industry now that the network has achieved almost complete penetration.

Up to now the description has compared the firm to the market. Yet, in the same manner as we admit the existence of various market forms there are different organizational structures for firms. By organizational differences among firms, we are not just addressing the question of size but rather the whole spectrum of structural considerations. The point is that transaction costs do not just determine the trade-off between market and firm, but they also pinpoint the specific type of market or type of firm. In the next section we discuss the issues involved in the provision of information by different kinds of firms. In addition because the firm is only one type of hierarchy, we also discuss information production and channeling by non-firm hierarchies such as research centres and universities.

4. Industrial Structure and the Production and Channeling of Information

4.1 Introduction

The production of information and the organization of channels depend on the quantity and prices of the resources devoted to it, the firm's product mix, and the relationship among existing firms and potential entrants into the industry. In addition the demand conditions for information and related commodities play an important role in the characterization of the industrial organization and development. Shifts in demand toward information producing and channeling activities clearly lead to their increased profitability and greater proliferation in the economy. However, although it would greatly simplify matters if there existed a particular pairing of industrial structure with the conduct of firms involved in information production and dissemination, it appears that this link cannot be unambiguously established in the theoretical literature nor observed from empirical analysis.

4.2 The Production of Information

In this section we examine the issues which pertain to the production of information.

In the theoretical literature Arrow [2] has shown that the production of information in competition exceeds that in monopoly. However, he assumes that the appropriation question, which we have shown to be crucial to an understanding of the

characteristics of information is non-existent, or at least poses the same degree of difficulty under the two polar market structures. This has also been pointed out by Demsetz [10] who claims that incentive differentials disappear when the question of appropriation enters the analysis. As a middle ground Kamien and Schwartz [17] show that an intermediate degree of rivalry, by that exhibited in oligopoly structures, appear to provide a greater production rate for information. Indeed this case is further highlighted by the conjectures of Galbraith [12, p. 91] representing a neo-Schumpeterian view that, "...the modern industry of a few large firms...is admirably equipped for financing technical development". Let us though beware not to draw general conclusions from the specific models developed and the conjectures of various researchers concerning information production.

Matters are quite different in the empirical literature. The question centres on the relationship between the size of the firm and industrial concentration on the one hand and information production on the other. Generally it has been found that size and information production are not correlated, as exemplified by the studies of Mansfield [20] and Scherer [29]. The influence of industrial concentration, expressed generally as a four-firm concentration ratio, on information production is generally inconclusive as Scherer [29], and Mansfield [19] show. Indeed Mansfield [19, p. 245] states "there is no

statistically significant relationship between an industry's concentration and its estimated rate of technological change".

In order to translate these results to the Canadian scene we must be clear as to the concept of concentration. Due to the proximity of Canada and the U.S., the appropriate degree of concentration for Canadian industry must take into consideration the relevant North American market. This is especially true in light of declining tariff and non-tariff barriers to trade and the readily accessible international capital markets. To relegate concentration to political rather than economic boundaries can be misleading. In this context, the ability of the Canadian corporation to be competitive in the North American scene, in general, and in particular in the production and channeling of information, necessitates comparable relative size. Hence when we refer to corporate size we must mean in the larger arena of North America.

The empirical results must therefore be interpreted in light of a threshold effect on corporate size and industrial concentration. Once firms reach a certain size and industries a certain degree of concentration then information production is not correlated with size and concentration. However, before the threshold is attained too small a size and insufficient concentration may be inhibiting factors in the production of information. Moreover, the evidence also suggests

that extremely large firms in concentrated industries may well promote envious information producing records. In the U.S., Bell Laboratories, General Electric and Du Pont each possess impressive research facilities and personnel. In the Canadian context, in light of the historical connection between Bell Labs and Bell-Northern Research, presumably the same statement can be suggestive of Bell-Northern as to Bell Labs in the U.S.

4.2.1 The Quality of Information

Information is not a homogeneous commodity and so one can distinguish the nature of the differentiability by focusing on its physical characteristics. In defining the characteristics of information so that they are operational one can focus on the "purity" and "complexity" characteristics. In particular, is research basic or applied and is it an extension of existing processes or does it involve new processes? Let us first deal with the purity issue.

It is usually felt that most of the information production by large corporations, universities, governments, research centres and other public or semi-public sector institutions is of the basic variety. While this may be true of the public and semi-public organizations it does not seem to be true for large corporations. Indeed, large firms tend

to sponsor semi-public research organizations, while little basic research is carried out internally in the firm. In a study by Mansfield et al. [20] of the R & D programs of twenty-two major firms in the chemical and petroleum industries they found that "the largest firms in the sample devote a larger proportion of the R & D budget to more basic, less risky, and longer term projects than their smaller competitors...the differences between the largest firms and firms one-half their size are seldom large, if they exist at all".

Turning to the complexity of information, the argument is that complex research is usually a high risk activity and consequently the large corporation is not prepared to take these risks. The vast majority of complex research had its source outside of the large corporations. Hamberg [14] examined twenty-seven inventions made during the period of 1945-1955 and found that seven emanated from large firms, twelve from independent inventors and the other eight were from small firms and universities. This finding confirms the fact that the bulk of research is rather safe and involves continuous modifications of the state of the art. Thus it appears that complex, basic research is not generally carried out by large corporations and as such Arrow [2, p. 162] states that: "There is really no need for the firm to be the fundamental unit of organization in invention; there is plenty of reason to suppose that individual talents count for a good deal...".

It appears then that research institutes and other semi-public organizations may come to play a strong role in the generation of information services in the economy.

4.3 A Structural Scenario for the Information Economy

We have shown then that size of corporations and industrial concentration after reaching a threshold are not related to the production of information. Moreover, the type of information production by large corporations is fundamentally different from that of more specialized firms, be they privately or publicly owned. That is basic, complex information production is generally produced by non-profit organizations such as university research groups.

With the advent of greater demands for the generation and channeling of information as well as the technology needed to carry out such tasks, we will see more and more specialized profit oriented firms as well as research organizations providing these services; services such as databanks and information search, data processing and the production of specialized technological commodities (like microprocessors). However, accompanying this specialization, because of the costs of transacting, especially the costs of negotiation and enforcement of contracts, the ownership structure and financing of these structures will play an important role.

We will observe specialized firms and non-profit organizations involved in the production but the ownership will

involve much larger corporations or a consortium of corporations. By this we mean that a large corporation or a group of large corporations or indeed a mix of privately owned and Crown corporations will own and thereby utilize the specialized services of the information producing firms. For example insurance companies, leasing companies and newspapers will become very involved in databank and dataprocessing services. Moreover, by the nature of profit oriented enterprises we would expect these specialized firms to be engaged in non-basic kinds of information generation. We would expect that the services will be more of the screen variety rather than the research type.

The organizations that will embark on research generating services will be non-profit centres. However, these groups will not only be funded by public expenditures but by large corporations. Indeed, we will find that large corporations, sometimes in totally independent industries, will finance or maybe jointly own these research institutions. This will be true not only of physical scientific and engineering research centres, but with the growing involvement of government in the industrial structure, we will find social scientific research centres proliferating.

This phenomenon will be further encouraged by existing research and teaching organizations such as universities, which because of the recent demographic trends have falling student enrollments. These enrollments will gravitate and

remain at lower levels than in the past, and coupled with stringent government budgets will place dire financial burdens on the universities. Thus research groups privately funded and subsumed within university hierarchies or loosely connected, through the use of professionals for lecturing purposes, can be a noteworthy and potential solution to the "education crisis".

In conclusion then we have developed a structural scenario for the information economy with respect to the size and ownership characteristics of screen and research producing organizations. Immediately we can observe that a combines and regulatory problem emerges; that is the degree of industrial integration will intensify. This fact will pose policy concerns for competition and (in the Canadian tradition) for the formation of Crown corporations. In addition, questions will emerge as to the adequacy of present regulatory mandates, not just in matters for increased regulation or deregulation, but also for the introduction of new kinds of regulation in this vertically integrated information economy. In the next section we look at the nature of the regulatory process - the informational aspects of regulation - and the regulation of information.

5. Regulation and the Information Structure

5.1 Introduction

Regulation in contemporary economies is not relegated to specific industries or sectors, rather it is a pervasive process whose presence elicits impacts - either directly or indirectly - throughout society. Recently there have been discussions concerning the general nature of the reasons for the existence of regulation (Posner [27] Owen and Braeutigam [25]) and the manner in which the process fits into the overall political and economic system (Doern [11], Cutler and Johnson [7]).

The regulation process is a transactions process which is coordinated by a number of mechanisms; persuading, delegating and bargaining. One can view it as a set of transactions relating the legislature, executive, judiciary and tribunals with non-governmental groups such as corporations, consumer groups, and other interests. The framework which we shall develop points to the information structure of the actors involved in characterizing regulation and focuses on the coordinating mechanisms of voting, authority and prices used in different organizations.

5.2 Information and the Characteristics of Regulation

To observe that regulation is supplied by segments of government and demanded by different participants representing different interests, does not answer the question of why this

demand (and supply) arises. In other words what effects on the incentives and constraints of groups operating in society lead them to undertake regulatory transactions?

Traditional economic answers arise from a framework which attempts to gauge the functioning of the economic system in terms of welfare satisfaction that is derived from the independent behavior of individuals. Consequently, when market organizations fail in this regard various regulatory interventions are brought onto the scene. These are the so-called efficiency rationales for regulation. However, as is well known (Trebilcock [37], Demsetz [9]) efficiency considerations do not explain the existence of all regulation, for example in the trucking industry where fixed costs are low, there are minimal economies of scale and entry restrictions are associated with higher prices. Thus if efficiency objectives cannot explain the characteristics of regulation what can?

The increased complexity and interdependence in the economy tends to exacerbate the likelihood that market failures will be prevalent and persistent. This has been especially true because of the many kinds of hierarchies, such as banks, insurance companies, large manufacturing concerns, holding companies and agricultural conglomerates, interacting with each other through markets. The deepening organizational independence has placed great stress on the informational

nature of transactions and information channels. As the economy becomes more interwoven the characterization of atomistic self-interested agents being guided solely by prices ceases to be an adequate description of events.

Hierarchical organization supplants the market because it allows for sequential information transmission and efficient information channeling by uniform codes. Essentially when individuals operate in an administration, information is channeled and rechanneled so that at each stage the quantity is diminished without essential loss of value. There is also the emergence or utilization of a common language which is mutually understandable for the information channeling.

Therefore the shift from market to hierarchy, that is from price to authority coordinating transactions, alters the information channels of the individuals. Moreover, in the same way that we can define many types of market structures, we can also point to diverse hierarchical organizations - for example firms, families and regulatory processes. The regulatory process is a hierarchy arising from the interplay of firms and markets in situations where the problems of bounded rationality and strategic manipulations lead to transaction failures. Firms, irrespective of how large cannot successfully adapt because of increased interdependencies. Indeed, due to the important and changing nature of information

and channels, firms and markets have become increasingly subject to public regulation. In addition the size and number of agents in the market are not a determining factor of regulation in this framework. For example health care is regulated generally with respect to price, entry and quality yet there are many individuals involved and each one with a relatively small share of the market.

The regulatory process is a response to transactional failures between firms and markets. The process can indeed be an effective underwriter of risk. Instead of allocating resources to perform various activities which would not be forthcoming in requisite quantities, the regulator manages information and acts as a supervisor over parties who cannot contract. Thus because of information inadequacies leading to contract failure the government sets a policy which changes the institutional environment permitting contract implementation. In order for this process to be effective, that is reducing the transaction costs, it must be adaptive like markets and other hierarchies, such as corporations. A rigid set of fixed rules may indeed increase the cost of adjustment toward equilibrium, thereby creating a destabilizing influence.

In this framework regulation is viewed as process-oriented with a special role of alleviating contract failures between the firms and markets. It must be responsive to the

authority relationships within the firm and the bargaining mechanisms within the market. Examples of this growing involvement on the part of the agencies is exemplified by the NEB's hearings on oil and natural gas supplies, the telecommunications cost inquiry by the CRTC, and the vertical integration inquiry of Bell and Northern Telecom by the Restricted Trade Practices Commission. This type of responsive regulation of course is quite complementary to the Canadian practice of creating government corporations, for example the CBC, Petrocan, Air Canada, CNR and now also the post office. The former are examples of an "intermediary" type of hierarchy and the latter are examples of a "final" form hierarchy in that the Crown corporations deal directly with the markets.

In Canada there has always been a tradition of direct government intervention in the relationships between firms and markets. This intervention is quite interesting because it can be viewed as a response to information asymmetries in the economy. Consequently the regulatory process as a hierarchy is unlike other bureaucracies because of its intermediary role between firms and markets as well as its ties to the political arena or constituent organization. In the next section we briefly discuss the explicit ties of the regulatory process with the political system and show that the process is one of vertical integration.

5.3 Vertical Integration in the Regulatory Process

The regulatory process, as we have previously explained, permits the completion of contracts - the provision of fair rates of return, safety standards, entry requirements, etc. - between firms and markets which otherwise do not exist. At the same time the regulatory agency is intimately tied to the political organization.

The legislature and executive or Parliament and the cabinet are not really separated in Canada so that the agency appointments, budgets and statutory powers are derived from the political system. In addition, in some instances the decisions of the agencies have to be approved by the Governor-in-Council, such as by section 44 of the National Energy Board Act which specifies that the Board may issue a certificate in respect of a pipeline subject to approval of the Governor-in-Council. Decisions of the agencies can also be appealed to Cabinet, not on a question of law but on any other ground; for example section 64 of the National Transportation Act permits appeal to Cabinet, allowing it to vary, rescind any order, decision, rule or regulation of the CTC and in its stead make any order that the Governor-in-Council may decide. Lastly the Cabinet may issue directives by means of a direct order to a particular agency; for example sections 18, 22, 23 and 27 of the Broadcasting Act permits the Governor-in-Council to issue directives to the CRTC by means of an order published in the Canada Gazette and the Commission is bound

by such order.

These relationships between the Parliament and the agencies, coupled with the fact that the decisions of the agencies can be appealed on errors in law and jurisdiction to the Federal Court, point out the vertical connections in the system. Manifestly the agencies are vertically integrated with Parliament and to a degree with the judiciary. Thus the novel feature in this framework of a regulatory agency is that it is the supervisor in the hierarchical process arising from contractual failures within firms, markets and between firms and markets. Recalling that hierarchies have three types of actors - supervisors, subordinates and auditors, then, in this context the firms, consumers, and other groups are the subordinates, while the Parliament is the auditor of the process. We have established that through decision approvals, appeals, and policy directives, Parliament can be effectively viewed as an auditor. The final interesting point about characterizing the regulatory process as a hierarchy is that it involves all three forms of transaction organization - constituencies (Parliament), hierarchies (firms) and markets, it is this complex interconnection of organization forms in the regulatory arena which makes it unlike any other kind of administration.

5.4 The Regulation of the Information Structure

We can now see that by the nature of the information commodity, its appropriability and indivisibility characteristics, and the vertically integrated structural scenario concerning information production that, in general, regulation will occur. This regulation may be of the intermediary form arising through agencies or of the final form through the establishment of Crown corporations.

In discussions of policy - legislative and regulatory - concerning the information economy, a separation of carriage from content is sometimes suggested (Ouimet [24]). This is an important distinction, but we must bear in mind that the carriage aspects (channels) and content (the information commodity) are not themselves homogeneous units. That is, the rationalization of the carriage and content segments does not imply that the corporations involved in these activities be similarly treated nor aggregated into a single monopoly.

There are many different facets to channeling activities both in a horizontal and vertical sense. Horizontally there are firms engaged in providing multiple types of channeling of the same kind of information, such as the telephone industry where there are a myriad of distinct services. Moreover, there are different firms providing different channels for the provision of the same kind of information (e.g. microwave versus satellites). The complex question of regulation of

horizontally related firms cannot be answered by simply lumping all firms into one - whether it be a publicly-owned or privately-owned corporation. In other words is the general solution the integration of telecommunication and computer firms - I believe not.

Even looking at firms which in a distribution sense are more similar, such as cable and telephone companies, technological conditions alone do not suggest the extent of monopoly nor the degree of public intervention. One must focus on detailed technological, market and transaction cost considerations before determining the solution. Quick reference to the "public interest" can justify virtually any reasonable policy, so that discussions of solutions tend to become divided along the lines of the "vested interests". Thus impact scenarios must be developed which will deal with the degree and type of horizontal regulation and its implications for the evolution of the economy - technological similarities and the public interest are not sufficient reasons for any one policy.

Vertically related firms involved in information channeling pose even more complicated regulatory problems than ones horizontally interdependent. Besides the questions of price discrimination and entry barriers (Stigler [33]) which have important anticommon implications, it is well known that vertical integration can under certain circumstances

be used to circumvent regulation. Dayan [8] has shown that backward integration of a rate of return regulated monopoly will permit supra-competitive profits if either physical capital transfer prices or the rate of return on physical capital supply is unregulated. Notwithstanding the fact that the Dayan analysis may not be applicable to all situations, it does show that regulators must be cognizant of the possibility of regulatory failure due to vertical integration.

There are many reasons for vertical integration to occur (based on market failure considerations) which we have described in the structural aspects of the paper. We have stated that because of these advantages vertical integration will play a key role in the development of the information economy. Consequently one must look at the different legislative and regulatory issues, not just on general principles, but in specific cases. For example if a firm owns many downstream information channeling firms, should regulation be imposed on the upstream firm or on some or all of the downstream firms or some combination of upstream and downstream activities.

Hence one cannot treat the carriage sector as a homogeneous unit. In developing policies the government must realize that there are important distinctions between the different industries in the sector and the different firms in the industry. In particular the horizontal and vertical

integration of the industries must be explicitly recognized in policy formulation. For example to advocate the integration of cable and telephone companies implies important structural and regulatory changes, especially in regard to the extent of the monopoly at the service level and the degree of vertical integration at the manufacturing level.

We are not saying whether or not this policy is correct, only that in order to be able to make such judgments a detailed analysis of market, technological and internal organizational issues must be performed. Specifically, it may not be sufficient to regulate product prices, rates of return, quality characteristics but in addition the degree of horizontal and vertical integration, whatever that degree may be.

The general issues over content regulation arise from the nature of the information commodity. The characteristics of information suggest that regulation will be needed or at least some form of government intervention required. Specifically these characteristics call forth policies on the quantity and quality of information. If certain types of information are virtually available to everyone then the government might want to regulate the quality of information. On the other hand if market barriers are set up to prevent information accessibility, because of the high cost of channeling, then the government might want to regulate the quality of information. On the other hand if market barriers are set up to prevent information accessibility, because of

the high cost of channeling, then the government may want to step in and ensure that individuals have access to the information.

Lastly, although we have examined the channeling (carriage) and generation (content) segments separately, there is no reason why the march of events will not lead to the integration of the two sectors. Indeed we find that cable companies are developing their own television programs, and newspapers own firms engaged in establishing the creation of information banks. In light of the fact that the content and carriage aspects are not homogeneous units, it is not necessarily detrimental to society not to have a distinct separation, through regulatory and legislative statutes, of content and carriage. In industries such as television, separation may be warranted, but why should research organizations not be permitted to publish and disseminate the works of their staff and other professionals.

It seems that the issue centres around the demand for different kinds of information and the technological conditions for channeling. If there is a broad base demand for information then there should be a separation of carriage and content by government regulation. However, if the demand is of a specialized nature, say scientific research, then there is no a priori reason for there to be separation. Thus it seems

that technological and demand conditions should play important roles in delimiting the appropriate regulatory and legislative policies in dealing with carriage and content issues.

6. Policy Implications and Recommendations

In this section we will list the policy implications and recommendations that can be drawn from the analysis on the structural and regulatory aspects of the information economy.

1. Policy-makers have to recognize that there are two aspects to the information structure. Firstly, there is the information itself which is a commodity produced or generated. However, its properties are quite distinct from such things as agricultural and manufacturing products. Information has public or collective commodity characteristics; that is, once it is produced the consumption of any one does not decrease the remaining quantities available to others, and it is difficult for groups in society to exclude one another from consuming it. Thus information is similar to the good "national defense" in that everyone consumes equal amounts.

The analogy points out the difficulty of producing information through the market place. Once national defense exists everyone benefits from it whether they paid for it or not. Consequently it becomes difficult to induce groups to reveal their valuation, so that they attempt to reap the benefits without incurring the costs. In our context the existence of books in libraries which can be photocopied or summarized by the readers points out the public good nature of

information, in that one does not have to pay for the book in order to have access to it. Copyright laws, although useful, in no way can be precisely enforced so that the rights of the author can be completely protected.

2. The second aspect of the information structure is the channeling process. Channels consist of all the elements which are necessary to bring the information from the producer to the consumer. The costs of information channels are, not only those associated with physical capital, but also consist of important human capital costs. Indeed, education is an information channel where individuals undertake large investments in acquiring certain abilities. In general the use of different information channels tends to define the manner in which society becomes segmented into different groups. The accessing of particular channels by specific individuals limits the diffusion of information. The problem of income distribution is essentially one where different groups access different channels which creates information asymmetries in society. For example, different levels of education or different productivity levels through the use of distinct information are causes for income to be unequally distributed.

3. The inherent tendency for markets to undersupply information and for channels to be asymmetrically distributed

in society will imply that government will become more involved in information generation. This involvement will not only be indirectly through legislative and regulatory policies, but directly through active participation and funding. We encourage the steps taken in the area of research and development which focuses on the technological and material capital. However, because capital interacts with labor in production processes, a one-sided bias in favor of new technologies can create inefficiencies. Thus there should be government programmes on the development of human capital - such as enlarging the development of specialized colleges, encouraging and financing on the job training, training individuals who are out of work or who desire a change in careers.

In other words the use of funds and other government resources should be directed towards the development of individuals and not just the maintenance of income levels. A more thorough analysis of these and other programmes pertaining to the alternatives of the information structure of labor markets has to be undertaken in order to more closely evaluate the efficacy of alternative scenarios in human capital development.

4. The public good nature of information and the use of specific channels by different groups cause the information structure to be internalized within organizations or hierarchies in society rather than left solely to markets. Hierarchies, such as government departments, universities, and corporations

are as diverse as markets, and therefore provide distinct kinds of information. Corporations will engage in applied, low risk information generating processes, while non-profit organizations produce basic, high risk information. In addition corporations must attain a certain threshold level in terms of size and industrial concentration in order to be able to internally generate complex research processes.

Hence due to the fact that corporate size and industrial concentration play important roles we expect that the degree of vertical and horizontal integration in the economy will intensify. At the very least the ownership structure in the information economy will involve a complexity of interwoven links. Large corporations or consortia of corporations will own the more specialized firms involved in the channeling of information, such as data processing, databanks and information search. Moreover, information generation will be financed by a mixture of privately-owned and Crown corporations, with the basic, high risk production performed by research institutes, universities and other non-profit institutions.

In this way the risk of complex research can be diversified. We will observe that collections of corporations will play a greater role, through financing and risk pooling in the production of information. In particular this can be a long-term solution to the education crisis brought on by constraints on government financing and lower enrolment levels.

These research groups who will be independently funded can be subsumed within or loosely connected to university administrations such that there can be sharing agreements for professional and administrative functions without enlarging overhead costs. Thus universities may be able to be more adaptable to changing enrolment and public funding situations.

5. The information economy will consist of greater direct involvement of government and large corporations in information generating and channeling. Consequently important combines and regulatory issues must be confronted. The degree of horizontal and vertical integration in our industrial structure will increase. For example we find insurance companies, leasing companies and newspapers becoming more and more involved in databank and dataprocessing services. The issues of not only the appropriate degree of government involvement but also the degree of industrial integration that will foster efficient and equitable development of the information economy must be thoroughly analysed.

It is clear that existing combines legislation and regulatory mandates will have to be changed in light of the more integrated economy. Indeed we can witness the pressing need for a new competition bill, new telecommunications legislation, and revisions to the Bank Act as reactions to the reality of greater integration. Various industrial scenarios

must be studied to determine appropriate industrial structures.

One thing is clear that the degree of integration must be compared to that of the North American scene, if Canada is to be internationally competitive in the information economy.

In fact what might seem to be too high a level of integration for Canadian markets may well be quite appropriate for continental markets, as evidenced by the success of Canadian Pacific and Northern Telecom. It is the markets under consideration (such as transnational ones) which play an important role in determining acceptable levels of integration. Finally, labor market impact studies cannot be independently analysed from scenarios depicting industrial strategies, because the development of human capital must be complementary to the type of industrial network we desire.

6. The regulatory aspects of the information economy are particularly complex. We view the content aspects of the information structure as the information commodity and the carriage aspects as the information channel. This is an important distinction, but we must be clear that the carriage and content sectors are not themselves homogeneous units.

There are many horizontal and vertical levels of channeling activities. For example in a horizontal sense there are many firms producing data communications services, for example Bell Canada, CNCP Telecommunications and IBM. Clearly we must

treat carriage firms as distinct entities providing services in both monopoly and competitive markets. The potential rigidity of contemporary regulatory environments must be altered to allow for the development of the carriage sector. There are a whole host of interesting solutions between the confinement of present regulation to complete deregulation. For example one can allow competition on entry and price, but control quality standards. In addition direct subsidies can be paid to needy individuals to make sure they have access to the basic information channels. These subsidized channels do not have to be just telephone services, especially in light of the new home services which are on the forefront such as videotext. The handicapped, poor and in general the disadvantaged need a great deal more than just the potential ability to make and receive telephone calls. They must have access to channels in order that they can become constructive members of society, for example various home educational courses that can be delivered over the television (or some other terminal) without undue time constraints.

Another example can be the formation of federal or provincial corporations supplying the basic communications services, while private firms openly compete to supply services which society feels are not of the basic variety. These are just two possible scenarios. Clearly it is important in maintaining needed regulation over the carriage sector that the

impacts of different regulatory environments must be clarified if the growth of the information economy is not to be hindered but rather encouraged.

Lastly, there are no general reasons why markets will develop or should be encouraged to develop along the lines of the separation of carriage and content. In keeping with our notion that the content and carriage sectors are not homogeneous, it is not necessarily detrimental to society not to have a distinct separation, through legislative and regulatory statutes, of information generating and channeling.

It appears that the issue of separation of carriage from content basically centres around the demand properties for different kinds of information and the technological characteristics of various channels. If there is a broad based demand for specific kinds of information then there may be a case for separation of content and carriage. The principle rests on the premise that if sufficient members of the population are affected by particular information production then the information generators should be separate from the channelers to permit appropriate competition in this form of information production. Television programming is an example where the demand for sports and other leisure information forms is so pervasive that carriage and content should be separated. On the other hand there is no reason why research

organizations who produce very specialized information for a limited demand may not be permitted to publish and disseminate the works of their staff and other professionals. Thus it seems that technological conditions and transaction costs (i.e. market and administrative conditions) can be used to select the regulatory policies towards the degree of integration within and between information generating and channeling.

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