



MARITIME Series

MONOGRAPHS

Maurice Beaudin
Sébastien Breau

**Employment,
Skills, and
the Knowledge
Economy
in
Atlantic Canada**



INSTITUT CANADIEN DE RECHERCHE SUR LE DÉVELOPPEMENT RÉGIONAL
THE CANADIAN INSTITUTE FOR RESEARCH ON REGIONAL DEVELOPMENT



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If capital is borrowable, raw materials are buyable and technology is copyable, what are you left with if you want to run a high-wage economy? Only skills, there isn't anything else.

Lester Thurrow (1993)

Our collective challenge is to design a sustainable, socially inclusive and internationally competitive infrastructure that ensures equal opportunity for all Canadians to develop, to enhance and to employ in Canada their skills and human capital, thereby enabling them to become full citizens in the information-era Canadian and global societies.

Tom Courchene (2001)

Above all, the *amount* of knowledge, that is, its quantitative aspect, is not nearly as important as the *productivity* of knowledge, that is, its qualitative impact. And this applies to old knowledge and its application, as well as to new knowledge.

Peter Drucker (1993)



About the Monograph

Dysfunctions in labour markets are a vital concern of governments and businesses, regardless of the country or region. To realize this, one only has to look at the large number of studies and reports dealing with labour market characteristics, trends, and requirements. The reason for this is clear: a skilled labour pool enables businesses to function efficiently and competitively, while governments must be in a position to respond to their electorate's employment aspirations and ensure a proper balance between labour supply and demand. In fact, the competitiveness of the entire economy depends on an effective labour force, and, therefore, so do our economic prosperity and collective well-being.

Labour market imbalances or dysfunctions are quite normal and give rise to frictional unemployment, that is, unemployment caused by the comings and goings of workers changing jobs, being temporarily laid-off, migrating to other sectors or regions, etc. Just like the business world, the labour market is in a constant state of change, and large numbers of jobs are being both eliminated and created. These changes are naturally amplified during the pronounced phases of economic cycles, periods when we see either a rise in unemployment or a serious lack of workers in expanding sectors.

Added to these cyclical patterns are strong trends that have been labelled structural factors. They are the result of profound changes in the economy, the adoption of new production methods, the appearance of new communication tools, an evolution in thinking, the aging of populations, etc. Such structural changes are nothing new, of course, but sometimes they happen suddenly and at an alarming rate. In the last two decades, for example, the computer revolution has disrupted the established order of things by considerably altering the parameters of production, marketing, transportation, management, communications, etc. The result has been to disturb labour markets with rapid changes in both manpower requirements and qualifications.

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This situation has given rise to such questions as, do our economies have the necessary capabilities and means to respond to these structural changes, and are workers, businesses, and training institutions able to adjust? We shall try to provide some of the answers in this report, the purpose of which is to identify the skill requirements in Atlantic Canada, a region that is highly oriented towards resource development but is rapidly developing into a knowledge-based economy.

About the Authors

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Sébastien Breau joined the CIRRD in 1999 as an economist and researcher. He has a bachelor of social sciences degree (specializing in economics) from the Université de Moncton and a master's degree in economics from l'Université Laval. Before joining the CIRRD, Mr. Breau worked for the Conference Board of Canada, an independent, national applied-research institution, where he gained wide experience in economic analysis and forecasting, especially in the field of provincial economies. His work has dealt above all with the economy from a regional perspective as well as with the knowledge economy. Recently, he has been focusing his attention on the development of innovative industrial clusters and the structural evolution of Atlantic Canada's economic activity. In this connection, he recently

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published, in the Maritime Series, a study on the pharmaceutical industry. Mr. Breau is currently working on a Ph.D. degree in regional political economy at the University of California at Los Angeles.

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Foreword and Methodology

Any attempt at analyzing the evolution of the labour market and the skills requirements of a labour pool calls for extensive quantitative and qualitative information. Whether evaluating the effect of technological progress on manpower demand or the importance of education and training in an economy that is increasingly based on knowledge, various sources of information, both qualitative and quantitative, are necessary.

Our analysis of the recent labour market trends rests on various statistical sources that are generally recognized and accepted. At the international level, we used data published by the OECD, the U.S. Department of Commerce, the U.S. Department of Labor, etc. In Canada, at the regional level, we relied mostly on statistics and studies published by Industry Canada, Human Resources Development Canada (*National Occupational Classification*), and Statistics Canada (1991 and 1996 census data, *The Labour Force Survey*, *The Adult Education and Training Survey*, etc.).

In order to collect as much information as possible on skills development in the Atlantic region, we interviewed several analysts, government officials, and industrial association representatives. In particular, we conducted a series of interviews with business leaders from the biotechnology sectors and the offshore oil and gas industry so as to better understand, from a regional perspective, the latest human resource trends in these emerging sectors.

This study, which is part of a collaborative project between the CIRRD and the Atlantic Canada Opportunities Agency (ACOA), has benefited from the assistance of a number of people. In addition to all those who volunteered for interviews, we wish to acknowledge the contribution of Samuel LeBreton and Jacques Daigle, at Human Resources Development Canada, Iwona Jankowska at the Université de Moncton library, and Malcolm MacBeath of ACOA's documentation services. We are also grateful to Ginette Benoit at the CIRRD for her painstaking editing and logistical support. Finally, we wish to thank Wade Aucoin, policy analyst with ACOA, for his invaluable

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comments and for inviting us to participate in the round tables organized by ACOA. It was on these occasions that we received several important suggestions that greatly improved our study.

It only remains to say that the authors assume sole responsibility for any errors that may be contained in this book.

Introduction

For several years now, the provinces of Atlantic Canada have been going through a period of rapid transition. Beyond such worldwide phenomena as globalization and the explosive expansion of the information and communication technologies, some cyclical, structural, and political changes have converged in the last decade that have challenged each of these provinces as well as their subregions. The maturing of resource capital, the shrinking of the manufacturing base, and the resumption of out-migration — these and other developments have resulted not only from the economic recession of the early 1990s but from factors such as the globalization of markets and the new direction of the federal policy on regional development and regional service delivery.

The vitality observed in certain regions, which manifests itself mainly through the modernization of the resource sector, the emergence of new sectors such as call centres and communications, and the development of offshore oil and gas fields, has contributed to diversifying the regional economy and to maintaining its position relative to Canada as a whole. Furthermore, the development of these new activities — combined with the proliferation of small- and medium-sized businesses in the areas of varied manufacturing and new technologies (e.g., biotechnologies), along with the growing tourism potential — hints at promising opportunities for the entire region.

The effects of *structuring* and *destructuring* changes¹ are reflected in the labour market, whose indicators are evidence of a reality that is often different at the regional level. Certain sectors or areas have been

1. By *structuring* and *destructuring* changes, we mean mutations in the economy and international trade (creation of commercial blocks, reduction of import tariffs, and industrial and environmental regulations) within businesses themselves (organization of work, just-in-time production, and introduction of advanced technologies), and in government policies (transfer of programs to peripheral regions, industrial and technological policies, and government expense management) which force businesses and regional economies to adjust. The maturing of a resource capital, for example, forces businesses to rationalize their production and management tools, abandon the quantity approach in favour of a differentiated value-added production, and rethink their raw material procurement networks.

able to capitalize on these changes and respond to the demands of the modern economy. The new economy, which has become globalized, is more oriented towards knowledge and skills, and requires a good organizational structure as well as an integrated management not only of human and material resources but also of production processes. Healthy management, technological competence, and innovation — these more than a ready supply of natural resources now constitute the necessary conditions for competitiveness.

As we will see later, however, only a few urbanized areas have the critical mass necessary to sustain the adjustment process in a rapidly evolving economy. Socio-economic indicators clearly show a two-tiered regional economy, and the gap keeps widening between the more urbanized area of the Maritime Belt² and the other regions that are more dependent on natural resource development.

Furthermore, the labour market has been transformed over the last two decades in a context of technological change, the expansion of international trade, and the search for new ways to organize work. The better-skilled workers get most of the new jobs, and the wage gap widens between them and workers with fewer skills. Self-employed workers are becoming more numerous, and new, more flexible forms of work are appearing in response to the pressures of business rationalization and the aspirations of an aging workforce.

Thus, several questions are being raised about the implications of the new economy and the emergence of a knowledge-based economy. Undoubtedly, we must first ask ourselves, what are the effects of the knowledge economy and the spread of knowledge on employment? This review of the changes in structural employment will then bring us around to look at their effects on the demand for skills. In fact, these are the reasons behind our analysis, the chief aim of which is to identify the real issues governing the relationship between skills and the economic transformation, something we will do by focusing on Atlantic Canada. First, we will look at the changes that are happening now within modern economies. The first two chapters examine the factors that beneath the surface of the knowledge economy, define its parameters, and see how this still-recent phenomenon imposes major changes on manpower training. In this way, we will assess the influence of the knowledge economy on the nature and

2. This area is historically recognized as the industrial and financial heart of the Maritimes. It extends from Saint John to Halifax and includes the metropolitan municipalities (and bordering areas) of Fredericton, Moncton, Truro, and New Glasgow.

organization of work, on the professional structure, and on the medium-term evolution of labour markets, especially as regards the supply of and demand for skilled workers. This overview will allow us to conduct a more detailed analysis of the dynamics of the knowledge economy and its impact on regional labour markets.

To fully comprehend employment dynamics and skills requirements, we must take into account macroeconomic considerations and demographic trends. The third chapter looks at the effect of these factors on the provincial and regional labour markets. Since demography is a fundamental aspect of labour market dynamics, we will examine it more closely in order to identify all of its dimensions, particularly at the subregional level (i.e., the economic regions), where migratory flows seem to have a considerable impact on the recruitment of skilled workers. This chapter also deals with the regional characteristics and trends of employment, unemployment, and GDP.

The structural evolution of employment and earned income warrants special attention. Using large industrial groups as a basis, we gathered together data at the subgroup level (e.g., by combining the manufacturing industry with the wood, pulp and paper, fish-processing sectors, etc.) in order to get a detailed profile of employment within the regions and subregions, and within the rural and urban areas. This chapter also explores the recent changes (changes of a conjunctural and socio-political nature) that have occurred in the Atlantic provinces, as well as their effects on the regional economies. It will be seen that these changes are not liable to radically alter the structure of employment and wages, at least not for the time being. Our analyses nevertheless show the important mutations which are happening within the large industry sectors, especially with respect to skill requirements.

Chapters 4 and 5 deal with the knowledge economy in the Atlantic provinces. Here we try to identify the main types of employment according to whether they belong to the new economy or to the new or dynamic activities, at the same time paying special attention to jobs found in the dynamic industries, in particular in the industrial and business services, as well as jobs found in services related to the new activities. As will be seen, there is a certain polarization of the activities and jobs related to the knowledge economy, something that has different implications for every region.

Keeping in mind the evolution of the employment structure in the 1990s, we outline the skills required in the knowledge economy as well as the trends that are emerging in this area. We also determine to what degree the skill level of the present workforce responds to the needs both of the traditional sectors in transition and of the emerging sectors of the new economy. For this we have chosen two emerging sectors in the region, namely, biotechnology and oil and gas development.

In the sixth and final chapter, we address the changing nature of jobs and skills. Although many studies have dealt with the issue of skills in the new economy, very few, if any, provide a perspective that reflects the needs and characteristics of the labour market in Atlantic Canada. To better understand the implications of these trends on investment in human capital, we also look at the evolution of training activities in the Atlantic region.

To conclude, we make some tentative suggestions about programs and policies which could be implemented to reduce the dysfunctions in regional labour markets. We also outline the roles and responsibilities of the various players — workers, employers, teaching institutions, and governments — in this transition to the new economy and define their functions in skills training and development, the purpose of which is to provide the local workforce with the tools required to fulfill the needs of an economy that is increasingly coming to rely on knowledge.

I

Knowledge as the Engine of Economic Growth

The view that we are presently witnessing the emergence of a “new economy” is finding acceptance among more and more economists. It is also a view that is giving rise to much debate, as confirmed, for example, by a recent issue of the *Observer*, a magazine published by the OECD, that was entirely devoted to the study of the new-economy phenomenon.³

What is surprising, however, is that even if there is a certain consensus among economists who recognize the advent of a new economy, no formal, precise definition of the phenomenon has yet been formulated. We see this reflected in the authors writing for the issue of the *Observer* mentioned above, each of whom has his own idea of what that definition should be. In fact, in reading the existing literature on the subject, one realizes that this is the case with most economists writing on the subject. In a recent speech, the former U.S. treasury secretary Lawrence H. Summers summarized the situation as follows: “The new economy is both palpable and amorphous — more often declared than defined.”⁴

But why is there such a grey zone in our modern economic theory? Although there may certainly be questions concerning the personal interpretation of researchers, the answer is to be found in the fact that we have yet to develop an economic theory that explains the role of *knowledge* as a source of economic growth. Moreover, at an empirical level, the present configuration of national accounting systems and socio-economic indicators makes it impossible to grasp the real scope of knowledge in economic activity — all the more so since the *degree* of knowledge integration and its development within existing economic structures varies considerably from one nation (or even region) to another.

If there is one country that is the standard-bearer par excellence of the new economy and keeps its eyes peeled for studies on the subject,

3. OECD, *Observer*, no. 221/222 (Summer 2000).

4. Lawrence H. Summers, “The New Wealth of Nations”; speaking notes for the Hambrecht & Quist Technology Conference, San Francisco, CA, 10 May 2000.

it is certainly the United States. In the last decade, the U.S. has noted many signs that point to a new economic current, the most significant being its rapid economic growth following the 1991–92 recession. The GDP average annual growth rate rose from 2.7 percent for the period 1973–93 to 4.0 percent for the period 1993–2000.⁵ Furthermore, this growth was accompanied by a whole series of economic successes. In particular, there has been an impressive increase in the productivity growth rate (especially from 1995 onwards), exceptionally low inflation and unemployment rates (which contradict the classical economic theory), the disappearance of federal budget deficits, and a relatively strong economic performance as compared with other industrial economies.⁶

At the centre of this economic metamorphosis are three generally recognized triggering mechanisms: technological progress, globalization, and the emergence of a knowledge-based economy. We will now take a brief look at each of these.

■ The Impact of Technological Progress

Who would have thought that Gordon Moore (one of Intel’s founders and the father of the microprocessor) was right when he predicted in 1965 that the processing capacity of a microchip would double every eighteen months (with prices remaining constant, of course). Today, Moore’s law (as it has come to be known) regulates the life cycle of hardware and software products, and its implacable dynamism has given birth to completely new industries (the best known being the Internet service industry) while changing the structure of traditional ones.⁷

To better understand the impact of technological progress and of knowledge in general on economic (and employment) growth, a whole new generation of growth theories has surfaced. The works of Romer and Lucas, to name only a few, are among the most innovative in this field of study. In fact, the problem faced by researchers

5. *The Economic Report of the President* (Washington, DC: Government Printing Office, 2001), 19–53.

6. In Canada, except for productivity performance (which grew at a much slower pace than in the United States), many of these characteristics are evident.

7. To understand something of the extent and speed of technological progress, one need only consider the microprocessor. By itself, a microchip’s memory can hold over 250,000 times more information today than it could in the early 1970s. Similarly, the cost of storing one megabyte of information (i.e., the equivalent of approximately a 320-page book) has drastically decreased, falling from US\$5,275 in 1975 to US\$0.17 in 1999 (from “Innovation in the New Technology,” *Observer*, no. 221/222 [Summer 2000]).

is to determine the link between technological progress and human capital, and its influence on economic growth. Even if economists have long incorporated technology in physical capital, it is only recently that they have begun to understand how it increases the marginal productivity of human capital through labour force education and training, R & D investment, and the creation of new structures governing management and the organization of work.⁸ Based on the information and communication technologies, figure 1 enables us to trace the effect of technological progress on production factors (see also box 1). We will return to this later in our analysis.

Box 1

Importance of the ICT Sector to the New Economy in Canada

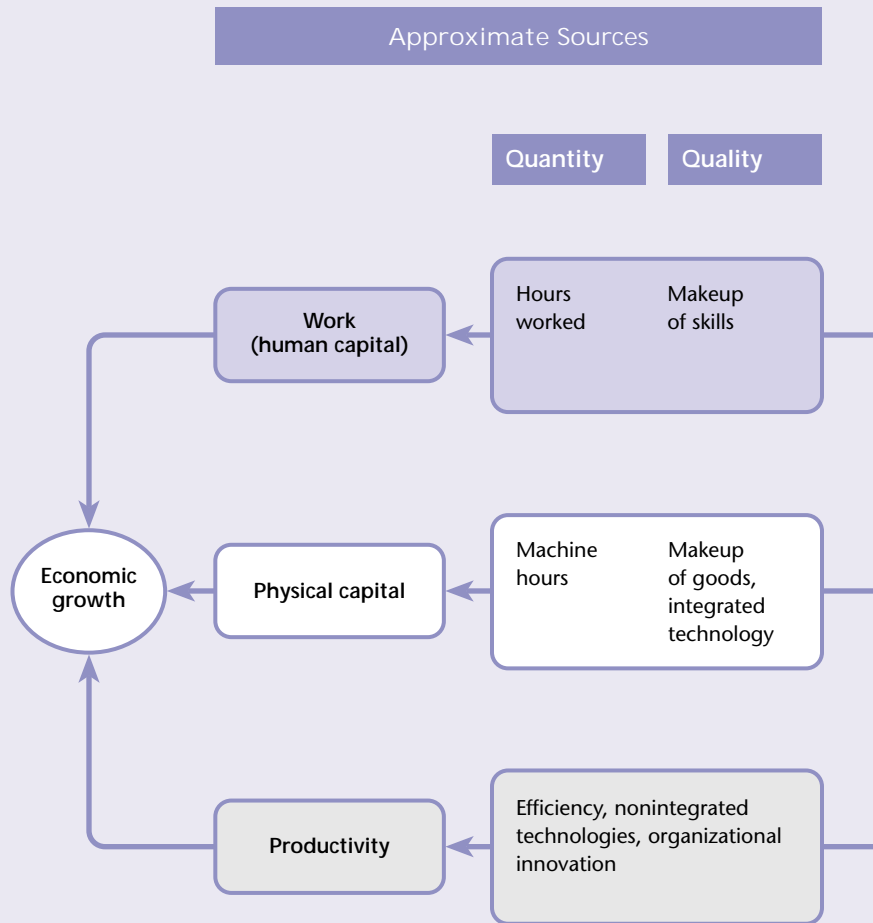
In the 1980s and 1990s, ICT investments in modern economies increased significantly. At the time, however, most studies conducted on economic growth failed to establish a clear link between these investments and productivity gains, which compared to the 1960s and 1970s kept slowing down, a phenomenon that Robert Solow called the *productivity paradox*. But in the last few years, new studies have shown that ICT investments played a major role in the long period of expansion experienced in the United States and Canada towards the end of the last decade.

The Conference Board of Canada recently published one of the first studies of its kind in Canada. It shows that the contribution of ICT capital to economic growth and productivity in Canada was negligible from the 1970s up to 1990, at which point it increased slightly from 1990 to 1995. Its impact was much more significant from 1996 to 1999, when ICT-capital stock contributions represented about 0.4 percent of the average annual economic growth (2.9 percent). What is even more significant is that the contribution of ICT capital to economic growth was almost as important as the contribution of non-ICT-related capital, since ICT-capital stock represented only 5 percent of the total physical-capital stock in the country. These results point to only one conclusion — that the ICT impact on economic growth in Canada was very real and considerable.⁹

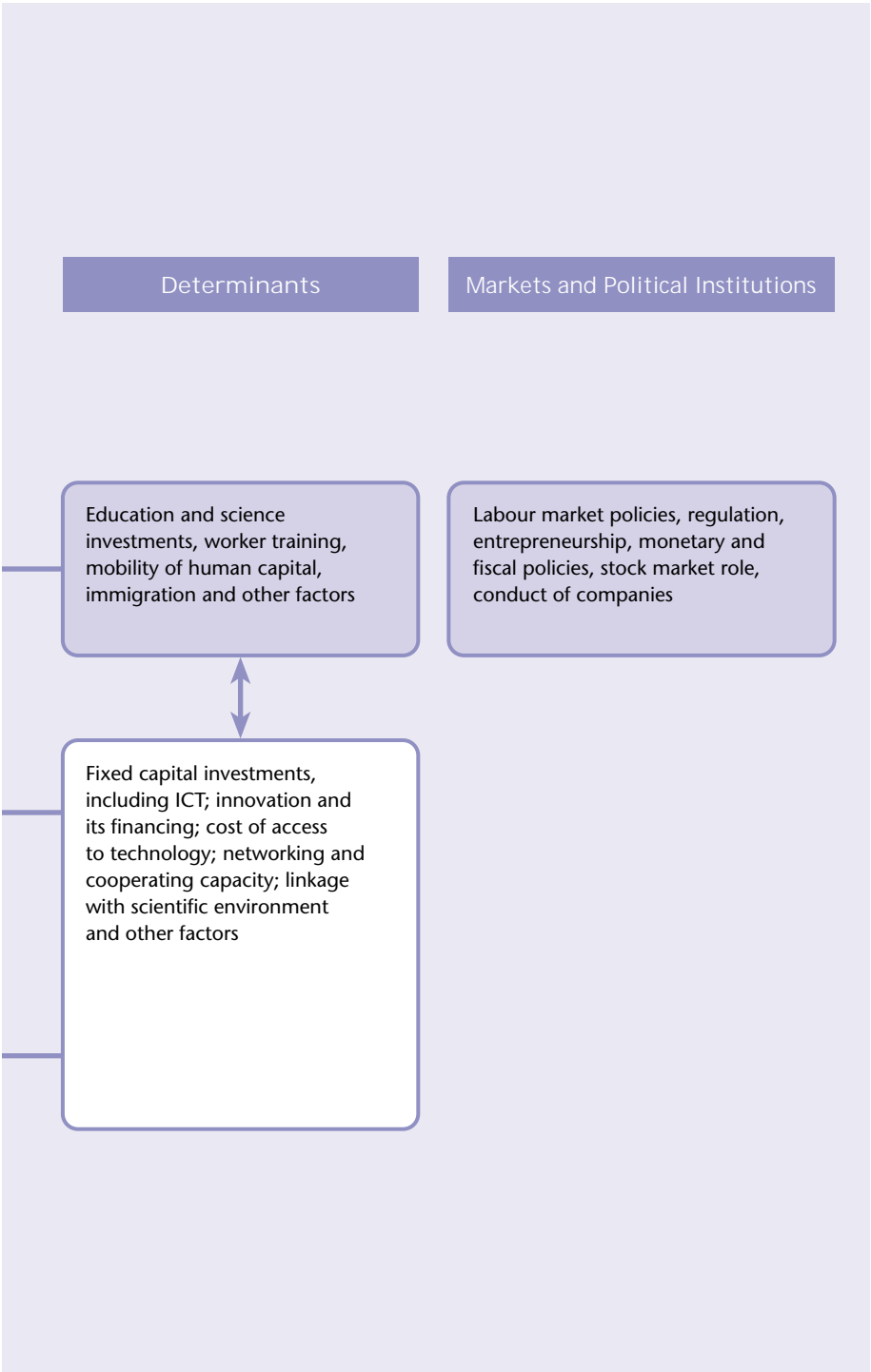
8. OECD, *The Knowledge-Based Economy* (Paris: OECD, 1996).

9. Conference Board of Canada, *IT and the New Economy: The Impact of Information Technology on Labour Productivity and Growth* (Ottawa: Conference Board of Canada, 2000).

Figure 1
Impact of Knowledge on Economic Growth:
The Case of the Information
and Telecommunications Technologies



Source: OECD, *A New Economy? The Changing Role of Innovation and Information Technology in Growth* (Paris: OECD, 2000), 18.



■ Globalization

A direct consequence of technological progress has been to reduce the cost of communication and accelerate the process by which information travels throughout the world. It has thus become easier and more efficient to produce, exchange, and distribute goods and services globally, thereby completely transforming the net worth and geographic distribution of businesses. There has also been an explosion in the number of satellite and subsidiary production units, which are being established wherever production costs are lower. The result of these developments has been the creation of transborder mega-companies.

The trend towards globalization is drastically changing whole industries. The world of finance, for example, is now an almost self-sufficient entity, relatively free from any national (state) regulations. Global markets are also taking shape in the communication and transportation fields, where the number of take-overs, mergers, and alliances has reached new heights.

In this new world order, driven mainly by supranational organizations, attempts have been made to introduce certain regulatory frameworks through conventions, multilateral agreements, etc. The World Trade Organization (WTO), for instance, was established to better control the ever-increasing flow of international exchanges and to compensate for the absence of any regulatory framework in the commercial and industrial fields.¹⁰ And though other similar institutions have also emerged for the purpose of reviewing issues relating to intellectual property, health, and environment, there is still much to do in this area.

The role of the state has also changed. Today, the world is no longer organized in a collection of sovereign states exercising an almost absolute power over their national economies. With the trend towards globalization, international relations have become more complex, and traditional geopolitical borders have been transcended, blurred, and redefined.¹¹ New multinational entities are being set up to fill the need for a growing economic interdependence, of which the European Economic Community (EEC) and the North American Free Trade Agreement (NAFTA) are but two examples. And within these multinational blocks, capital and manpower now circulate much more freely than ever before.

10. The WTO was established on 1 January 1995, following the Uruguay Round of negotiations (1986–94).

11. James Mittelman, "How Does Globalization Really Work?" in *Globalization: Critical Reflections*, ed. James Mittelman (Boulder, CO: Lynne Rienner Publishers, 1996), 229–41.

Yet inasmuch as the opening of markets has freed exchanges and increased opportunities, it has also led to greater competition. John Gray wrote that socio-economic systems are gradually being forced to break up in order to compete more evenly with economies where environmental, social, and manpower costs are lower.¹² In such a context, there will inevitably be winners and losers. It is true that globalization leads to an increase in trade and productivity and consequently in the standard of living of some. But it also has the effect of increasing revenue (wealth) disparities between economies, nations, and individuals, and unfortunately that process seems to be accelerating.

■ A Shift in the Source of Economic Value

If technological progress and globalization are important elements in the new economy, its true cornerstone is the changing nature of goods. Increasingly it is being realized that we are moving from an economy in which goods are based on material resources to one where goods are more knowledge-based (e.g., a computer programming line or a genetic sequence decoding). In other words, goods in future will be valued more for their *knowledge* content than for their body weight. According to Alan Greenspan, “Almost all the rise in value added relative to physical input has reflected the substitution of ideas — new insights — for brute human effort and material bulk.”¹³

This transformation has been studied by many great thinkers in the twentieth century. One of them, Peter Drucker, devoted a large part of his research efforts to the study of this phenomenon and its impact on society, the economy, the business world, and policy-making. According to him, the move from the industrial to the information era (indeed to the “information capitalism” era) began in the years following World War II and has continued to grow ever since, especially in the 1980s and 1990s. Throughout this period, industries which moved towards the centre of the economy are producing and distributing knowledge and information rather than goods. In addition, the traditional industries which succeeded in developing are those which were able to reorganize and restructure themselves around knowledge and information. As will be seen later, such is the case in Atlantic Canada with certain industries in the field of natural

12. Quoted in Paul Hirst and Grahame Thompson, *Globalization in Question: The International Economy and the Possibilities of Governance* (Cambridge, UK: Polity Press, 1999), 163.

13. Alan Greenspan, “Trade and Technology”; speech given at the Minnesota meeting, Minneapolis, MA, 30 September 1999. (Alan Greenspan is chairman of the board of governors of the Federal Reserve System.)

resources. Thus more than ever, added value is based on knowledge: “Increasingly, performance is decreasing on traditional resources like work, capital (money) and land. Information and knowledge are the main producers of wealth.”¹⁴

The emergence of a knowledge-based economy has come, therefore, from the growing recognition of the use and spread of knowledge and technology in modern economies. As we already indicated, the OECD is very much interested in the crucial role of knowledge in the economic sector and has focused much of its recent work around this issue.

The OECD’s studies have shown in particular that the economies of its member countries are more dependent on the production, spread, and use of knowledge than ever before. An indication of this is the report that production and employment are growing fastest in high-tech industries like computing, biopharmaceuticals, and aerospace. From 1970 to 1994, the contribution of advanced technologies to manufacturing output (with respect to value added) increased by more than 30 percent in most OECD member countries. In some countries like the United States, Japan, the United Kingdom, and Germany, advanced technologies represent over 20 percent of the value added in the manufacturing sector. As for exports, the statistics are even more surprising. In the OECD zone, the proportion of advanced technology exports relative to total manufacturing exports has more than doubled in the same period, reaching nearly 25 percent. Moreover, expertise-intensive service sectors such as education, communications, and information have developed even more rapidly. It is estimated that over 50 percent of the gross domestic product (GDP) of the major OECD economies now depends on knowledge.¹⁵ The OECD goes even further by stating that “nations which develop and manage effectively their knowledge assets perform better. Firms with more knowledge systematically outperform those with less. Individuals with more knowledge get better paid jobs.”¹⁶

In short, all these trends taken together constitute the basis for a new economy. And among the elements underlying its development, knowledge is now clearly recognized as the engine of economic growth.

14. Peter Drucker, *Post-Capitalist Society* (New York: HarperBusiness, 1993), 183.

15. OECD, *The Knowledge-Based Economy*.

16. OECD, *Jobs Strategy: Technology, Productivity and Job Creation*, vol. 1: *Highlights* (Paris: OECD, 1996), 13.