

IV

The Knowledge Economy in the Atlantic Provinces

Changes in the 1990s to the economy of the Atlantic provinces had, as they continue to have, significant repercussions on the nature of jobs people were seeking, on the level of demand for products and services, and therefore on the kinds of skills that were required by industries and organizations. Although the regional economy remains closely tied to traditional resource-based industries, we are witnessing its relative diversification owing to the emergence of new sectors such as energy resource development as well as sectors created by the new economy. Indicators show that the region's average education level still ranks below the nation's, but they also show that the labour force is making progress towards raising its standards in this area. Thus, the jobs which were eliminated in the resource sectors are gradually being replaced by jobs requiring greater skills, a response to the demands of management and of the new technology. And the development of oil and gas resources and of the new-economy sectors is contributing even more to the training and retention of skilled workers in the region. However, if unemployment remains at critical levels, a growing number of businesses will not be able to recruit the skilled workers they need, although this is a problem that varies across the subregions.

■ **Measuring the Knowledge Economy in the Atlantic Provinces**

In order to measure the scope of the knowledge economy in Atlantic Canada, we chose the definition and methodology developed by Lee and Has.⁵⁵ As was seen in the first chapter, Lee and Has used several criteria (related to human capital and R & D investments) to classify industries according to their level of knowledge concentration. An industry can thus be considered as being high-, moderate-, or low-knowledge-intensive.

55. Lee and Has, "Quantitative Assessment of High-Knowledge Industries versus Low-Knowledge Industries."

This classification includes all activities of the private sector and of commercial public sector enterprises (which totalled about 611,000 jobs in Atlantic Canada in 1996). Public sector noncommercial activities were thus ignored, including the public service, public teaching, and health and social services systems (which represented about 210,000 jobs in 1996). Non-commercial activities were not considered, partly for methodological reasons, such as the use of R & D investment criteria relative to production.

It will be remembered that high-knowledge-intensive industries are characterized by the dominance of intangible assets, by activities with a high knowledge content, and by the use of highly skilled workers. Simply put, this classification system defines high-knowledge-intensive industries as those related to innovation and new technologies, namely, bioindustries, information and communication technologies, corporate services, aerospace, etc. Medium-knowledge-intensive industries generally correspond to large-scale producers and fully mature sectors (e.g., the production of automobiles, primary metals, food, electrical products, etc.). Finally, low-knowledge-intensive industries generally include high-labour-intensive activities such as the fisheries, the wood industry, retail trade, transportation and storage, and lodging and food services.

To get an idea of the distribution and concentration of knowledge at the regional level, we turned to the 1991 and 1996 census data. This is the only reliable source of information at the subregional level, and it provides a breakdown by various industries (according to the standard industrial classification). Although other studies have used modelling or extrapolating methods to estimate the scope of knowledge activities (and even to project their future impact), we believe such approaches only serve to increase the margin of error.

By applying the Lee and Has method to the Atlantic provinces, it was established that in 1996 high-knowledge-intensive economic activities accounted for 8.7 percent of private sector and commercial public sector employment, i.e., a total of just over 53,000 jobs. Medium-knowledge-intensive activities for the same year represented 39.2 percent of employment (239,700 jobs), while low-knowledge-intensive activities made up 52.1 percent of employment (318,200 jobs). Table 8 shows the distribution and evolution of high-knowledge-intensive jobs per province. These represented about 9 percent of the private- and public-commercial employment in New Brunswick and Nova Scotia, 8 percent in Newfoundland, and 6 percent in Prince Edward Island.

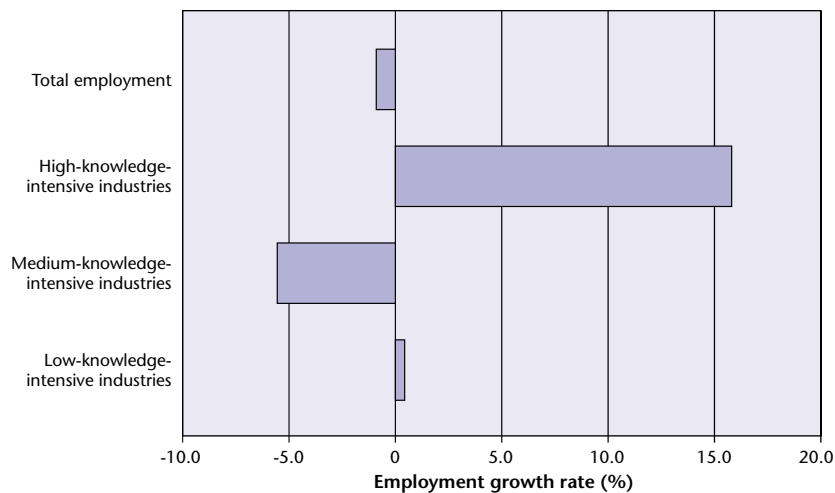
Table 8
Importance of High-Knowledge-Intensive Employment
per Province, 1991 and 1996

	High-Knowledge-Intensive Jobs		Private- and Public-Commercial Employment (%)		Evolution 1991-96	
	1991	1996	1991	1996	Number	In %
Canada	1,078,915	1,253,480	11.8	13.7	174,565	16.2
Atlantic Canada	45,855	53,110	7.4	8.7	7,255	15.8
Newfoundland	8,535	9,705	7.1	8.0	1,170	13.7
Nova Scotia	20,105	22,595	7.9	8.9	2,490	12.4
New Brunswick	15,465	18,415	7.7	9.1	2,950	19.1
Prince Edward Island	1,750	2,395	4.4	6.1	645	36.9

Source: Specially compiled by the authors.

Compared to the 1991 census data, these results indicate that high-knowledge-intensive industries are quite different from the other two. While total employment dropped by 0.9 percent from 1991 to 1996, the number of jobs in high-knowledge-intensive industries grew by almost 16 percent: a total of 7,255 jobs were created in the knowledge industries (see figure 14). Meanwhile, the medium-knowledge-intensive industries lost almost 15,000 jobs (a decline of 5.6 percent), while low-knowledge-intensive industries stagnated, posting a modest growth rate of only 0.4 percent.

Figure 14
Employment Growth in Atlantic Canada, by Type of Industry, 1991-96



Source: Statistics Canada, 1991 and 1996 census data; compiled by the authors.

■ Knowledge and the Regions: A Contrasting Profile

There is a significant gap between the Atlantic provinces and Canada as a whole regarding their relative share of high-knowledge-intensive economic activities. In 1996 the Atlantic region, where over 13 percent of jobs were in the high-knowledge-intensive sectors, was about 4.6 percentage points below the national average. This mostly reflects the region's greater dependence on natural resources (see chapter 3).

In spite of this gap, high-knowledge-intensive activities have continued to grow in all Atlantic provinces. Considering its economic weight, it is not surprising that Nova Scotia accounts for close to 43 percent of employment in the high-knowledge-intensive industries (22,595 jobs). Next are New Brunswick, with 35 percent (18,415 jobs), Newfoundland, with 18 percent (9,705 jobs), and Prince Edward Island, with 5 percent (2,395 jobs).

The knowledge industries are rather unevenly distributed among the fifteen economic regions that make up Atlantic Canada (see map 1). In Nova Scotia, knowledge industries are concentrated in the Halifax area. As eastern Canada's largest city it is the regional leader in the life science industries, comprising about 40 percent of all biopharmaceutical firms.⁵⁶ The industrial cluster of biotechnology activities revolves around R & D facilities in the Halifax area, such as those at Dalhousie University and the Institute for Marine Biosciences (National Research Council of Canada), as well as around InNOVAcorp's all-new BioScience Enterprise Centre, a business incubator which helps to establish and develop biopharmaceutical firms.

The information technology (IT) sector is growing just as fast in the Halifax area, where the Atlantic Provinces Economic Council reported that in 1998, about 146 firms made up the nucleus of businesses specializing in software production.⁵⁷ Among these are MT&T (which is now part of the Aliant consortium), InfoInterActive, and Digital Image FX.

However, the highest knowledge concentration is to be found in Central New Brunswick, primarily in Fredericton. Indeed, the provincial capital has been experiencing a real boom in the IT sector for

56. Sébastien Breau, *Profile and Prospects of the Biopharmaceutical Industry in Atlantic Canada* (Moncton: Canadian Institute for Research on Regional Development, 2001).

57. APEC, *IT and the Knowledge Economy in Atlantic Canada*.

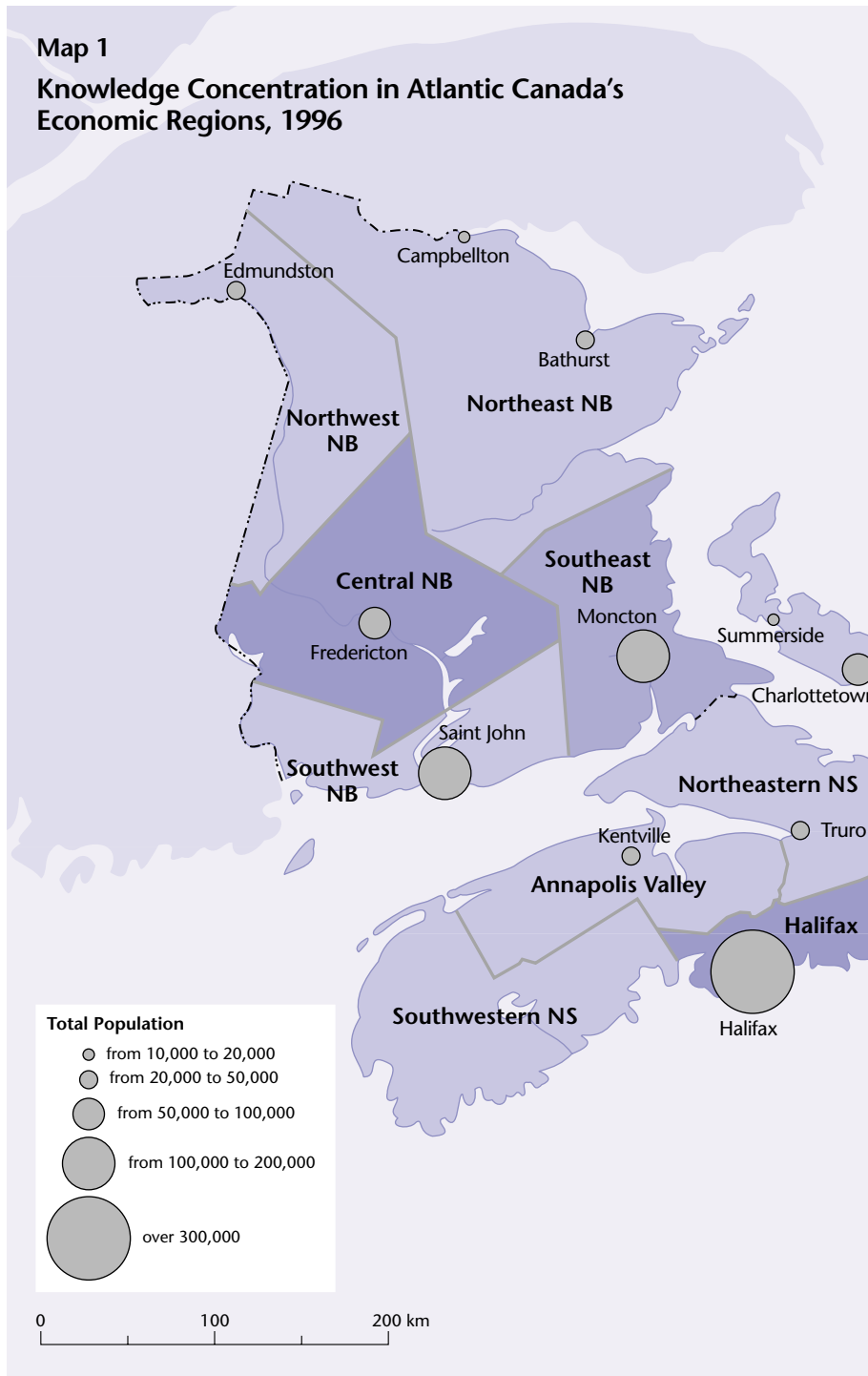
several years⁵⁸ and is ranked first among the regional urban centres for its concentration of knowledge jobs (see map 2). Over a hundred companies from the computer sector are located there, including large ones like Xwave, CrescentStudio.com, LearnStream and CGI. The establishment of a new IT research centre, recently announced by the NRCC, will certainly contribute to the further expansion of the region's technological cluster in electronic commerce, as will the satellite offices that are expected to open in Saint John and Moncton.

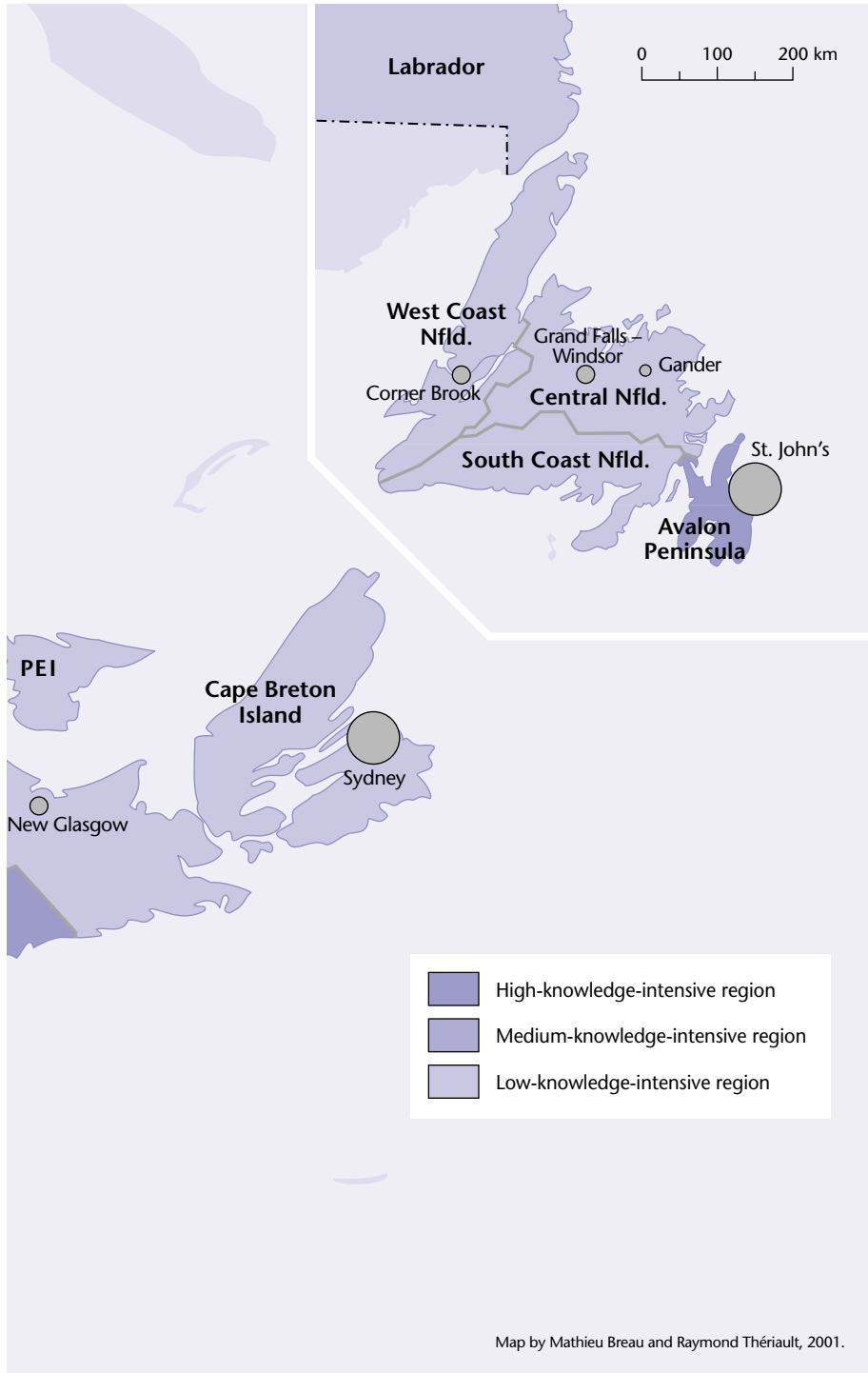
Because of their industrial structure, Southwest and Southeast New Brunswick are medium-knowledge-intensive regions. Even though the Moncton urban area has seen impressive growth in the number of jobs in the knowledge industries during the period 1991–96 (with employment rising by 30 percent in this sector, thanks mostly to the surge of corporate services, including call centres), the fact remains that these industries account for only a little over 9 percent of the total employment in both regions. This low proportion is due to the relative economic diversification of Saint John (which has a strong industrial base and service sector) and Moncton (a retail and transportation centre). Several important sectors in the economies of Moncton and Saint John consist, in fact, of medium- and low-knowledge-intensive industries. For example, 21 percent of the jobs in Southeast New Brunswick are concentrated in the retail trade sector.

In Newfoundland, the knowledge economy is centred in the Avalon Peninsula, particularly in St. John's. Here also, IT and telecommunication industries have grown considerably in the last few years. After joining the Stratos Global Corporation, NewTel Enterprises (which is also part of the Aliant consortium) became a leader in mobile satellite communication services in North America. Furthermore, an increasing number of SMEs have exploited the province's geographical location by specializing in marine technologies. Companies like Nautical Data International (a supplier of digital hydrographic charts) and International Communications and Navigation Ltd. (producing computer-assisted marine navigation systems) are helping to solidify an already visible nucleus in the St. John's area.

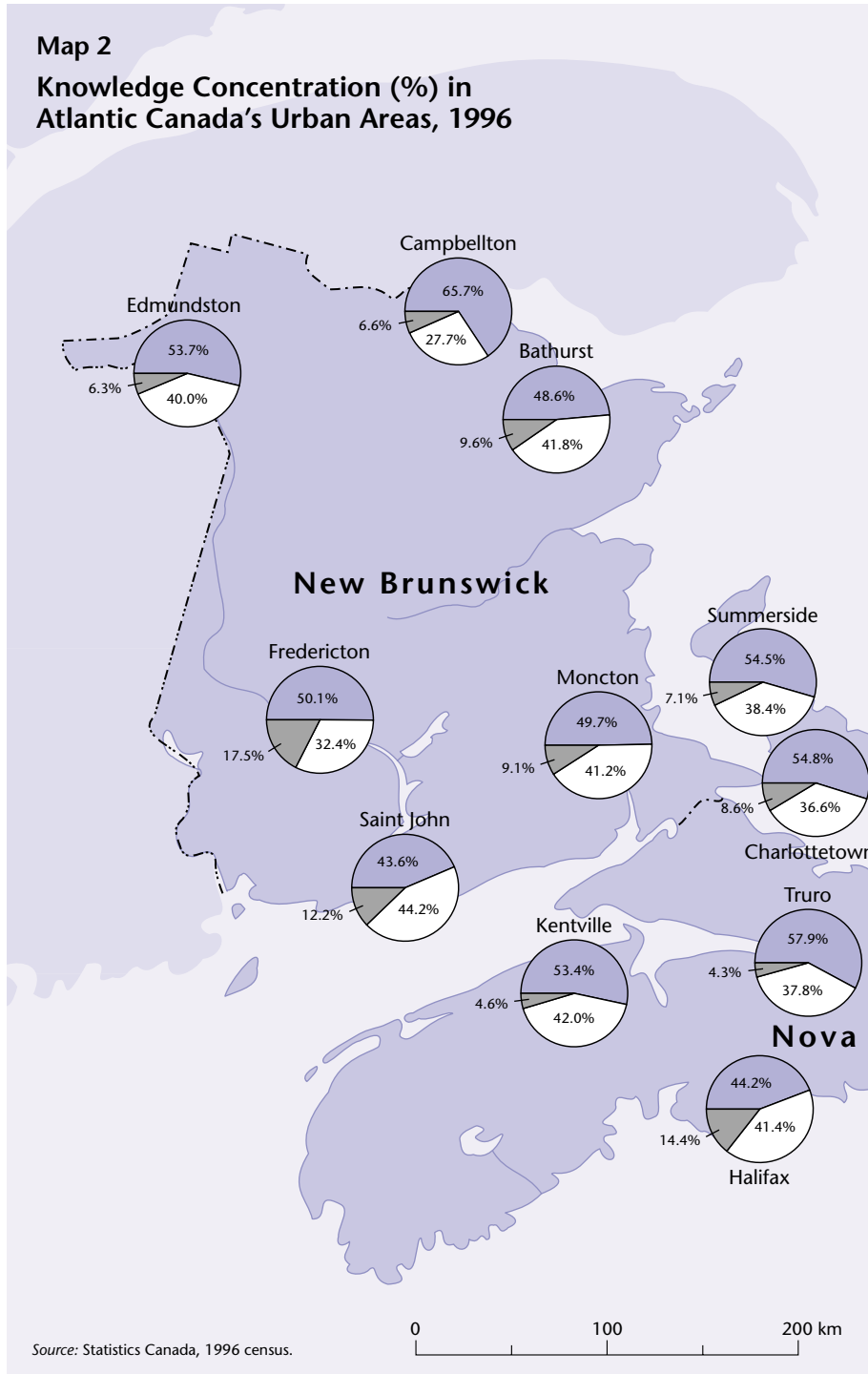
58. Chris Turner, "High 5: Postcards from Canada's New Tech Boomtowns," *Report on Business Magazine* (April 2001): 75–86.

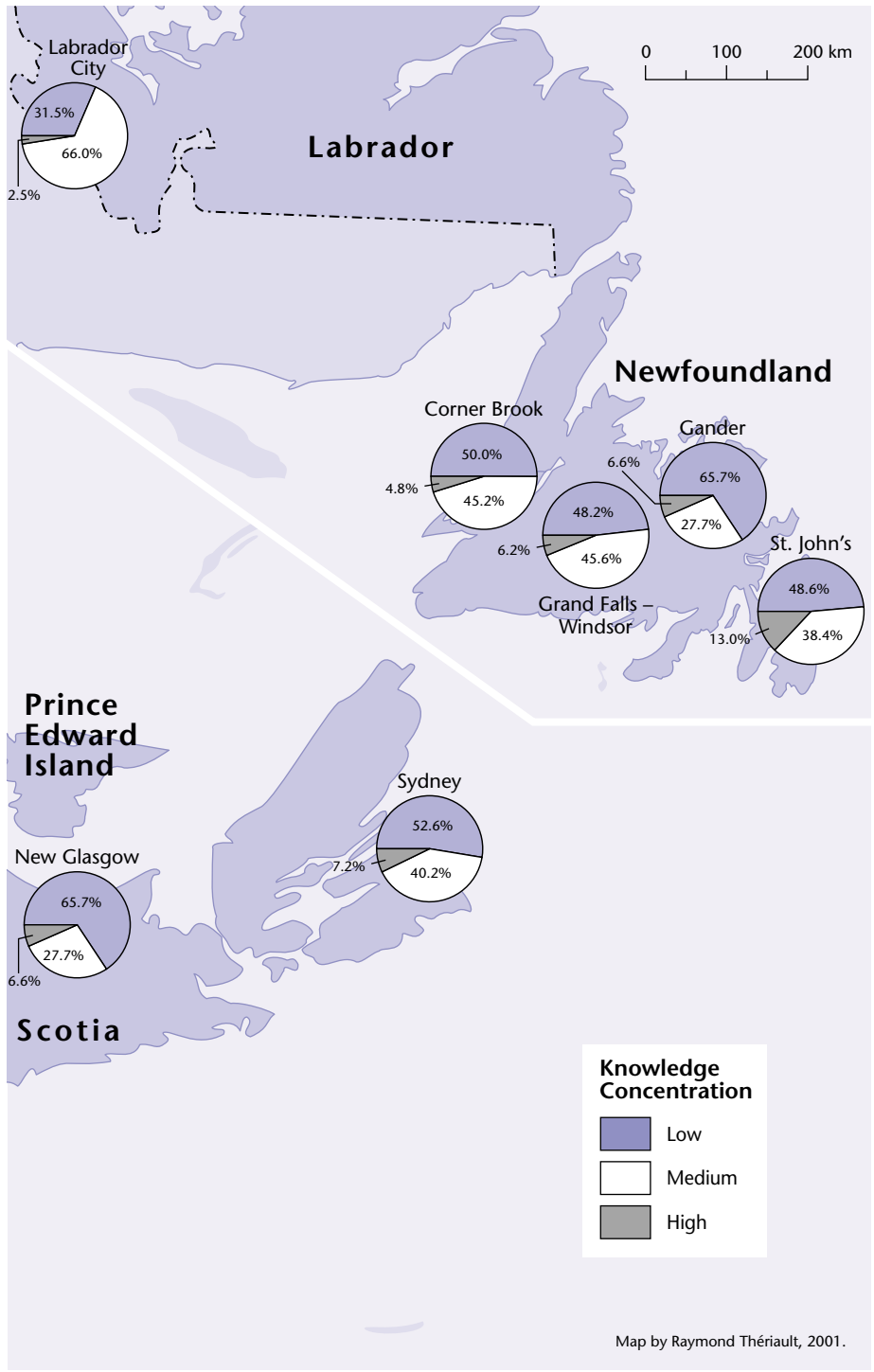
Map 1
Knowledge Concentration in Atlantic Canada's Economic Regions, 1996





Map 2
Knowledge Concentration (%) in
Atlantic Canada's Urban Areas, 1996





Although Prince Edward Island is considered as a low-knowledge-intensive region, it has clusters of high-knowledge-intensive activity in the Charlottetown and Summerside urban areas. The IT industry in Charlottetown is demonstrating a growing vitality, and the arrival of the Atlantic Technology Centre will consolidate the province's technological infrastructure and help it attract new investments while improving the access of local businesses to export markets.⁵⁹ The biotechnology industry is also well established in Charlottetown, and companies like Diagnostic Chemicals, Aqua Health Products, and Cobequid continue to benefit from close ties to the University of Prince Edward Island.

In addition to the Charlottetown nucleus, the Island has been able to set up a knowledge-related industry. The aerospace sector, for example, has completely transformed Summerside's economic landscape: converting Slemmon Park, the former military base, into an aerospace and industrial park has opened up new growth opportunities in the area. It is presently estimated that aerospace-related activities in the Summerside area generate spin-offs of over \$150 million in the provincial economy each year.⁶⁰ To ensure that a properly skilled workforce is available, Holland College is now offering programs in aircraft maintenance technology and in the overhaul and repair of gas turbines.

As one might expect, the knowledge economy remains an essentially urban phenomenon. High-knowledge-intensive activity largely comes from manufacturing and corporate service-related activities, which are concentrated, in most cases, in urban centres. In Atlantic Canada, three out of four jobs in high-knowledge-intensive industries are found in urban areas. In fact, it seems that the rural-urban split in knowledge activities has intensified between 1991 and 1996.

It is not by chance that the development of Atlantic Canada's knowledge economy has followed a typically urban pattern. The explanation lies with the structural economic differences between urban and resource-centred areas. At this stage in our analysis, it might be useful to draw a comparative profile of the urban and rural areas for the fifteen economic regions as a whole. To better understand the regional differences in jobs and their quality, some aggregate indexes are given in table 9 for each of the categories considered,

59. Julie Watson, "History in the Making: Canada's Smallest Province Emerging as IT Giant," *Atlantic Business* 12, no. 3 (June–July, 2001): 11–20.

60. Kevin Yarr, "Airborne," *Atlantic Progress* (May 1999): 78–82.

Table 9
Characteristics of the Labour Market in Atlantic Canada's Urban Areas Relative to Rural Areas, 1996

	Employment		Sectoral Share (%)		Sectoral Rate (%)		Labour Force Education Level (%)			
	Number of Jobs	Average Earnings (\$)	Employment	Employment Aggregate Earnings	Unemployment	Seasonal Work	Grades 9-12, No Degree	High School Certificate	Post-secondary Occupational	University Degree
Total, Atlantic Canada										
Total labour force	908,790	24,396	100.0	100.0	13.2	21.5	30.0	14.0	4.2	18.6
Goods-producing industries	207,810	25,741	22.9	24.1	23.0	37.4	45.2	14.4	5.4	6.8
Primary industries	61,620	23,878	6.8	6.6	24.7	50.2	57.1	14.1	4.6	7.0
Manufacturing industries	95,390	27,795	10.5	12.0	18.9	27.3	40.4	16.3	4.9	8.0
Dynamic industries	184,360	29,049	20.3	24.2	9.3	15.1	23.6	14.4	4.2	18.2
Corporate services	36,895	28,842	4.1	4.8	8.6	16.6	12.1	8.6	3.0	38.1
Public sector	272,630	29,229	30.0	35.9	7.2	13.6	14.9	9.0	3.5	37.2
Atlantic Canada – urban areas										
Total labour force	540,945	26,215	100.0	100.0	9.2	14.2	20.2	12.4	3.6	22.0
Goods-producing industries	87,600	29,259	16.2	18.1	16.8	23.9	29.6	12.4	5.6	10.4
Primary industries	17,290	29,851	3.2	3.6	18.7	30.2	36.7	10.6	4.6	12.6
Manufacturing industries	43,520	31,539	8.0	9.7	11.4	15.7	26.2	14.3	5.2	12.4
Dynamic industries	127,800	30,820	23.6	27.8	6.8	11.6	17.7	13.5	3.5	21.2
Corporate services	28,920	30,410	5.3	6.2	6.9	13.8	9.0	7.6	2.6	39.2
Public sector	174,240	31,049	32.2	38.2	5.9	11.0	10.4	7.8	2.9	38.1
Atlantic Canada – rural areas										
Total labour force	367,845	21,723	100.0	100.0	18.5	31.2	42.8	16.1	5.0	14.2
Goods-producing industries	120,210	23,176	32.7	34.9	26.9	46.0	55.1	15.7	5.2	4.5
Primary industries	44,330	21,549	12.1	12.0	26.8	57.3	64.2	15.3	4.7	5.1
Manufacturing industries	51,870	24,654	14.1	16.0	24.3	35.7	50.5	17.8	4.8	4.8
Dynamic industries	56,560	25,049	15.4	17.7	14.6	22.3	35.9	16.0	5.6	11.8
Corporate services	7,975	23,157	2.2	2.3	14.2	26.0	22.2	11.8	4.4	34.8
Public sector	98,390	26,005	26.7	32.0	9.6	18.0	22.5	11.1	4.5	35.6

Source: Statistics Canada, 1996 census; compiled by the authors.

i.e., the urban and rural areas. As demonstrated there, a significant gap exists with respect to earned income, unemployment, and education. These interrelated indexes betray the structural deficiencies of the rural and semirural resource-based economies. It should be noted also that these areas are particularly subject to seasonal cycles, regardless of which sector is targeted. Significant gaps can also be seen in education, especially in the lower grades.

The changes under way have also brought about the revitalization of the most urbanized area in the southern Maritimes, including St. John's, which is benefiting fully from developments related to megaprojects and increasingly from concentrated investments in high-tech industries and the new economy. Meanwhile, peripheral rural areas and small resource-based regional centres are at the mercy of the ups and downs of economic cycles, continuing to lose traditional jobs while lacking the necessary tools to expand into the new sectors. Thus, two parallel economies are seen to be at work, each one in possession of half the regional labour force. The inevitable result is the out-migration of young workers from peripheral resource-based areas to regional or provincial centres. While CMAs and CAs increased their numbers by 26,000 people (9.9 percent) from 1991 to 1996, the rest of the region lost 14,200 people (-1.3 percent) (see table 10).

■ The Knowledge Economy and Rural Areas

Our skills analyses suggest that innovation and the spread of knowledge are an essentially urban phenomenon and are confined to new-economy activities. This is generally true, except that the definition and scope of what is designated as the knowledge economy have to be clarified. Once that is accomplished, however, it appears that the economies of the peripheral rural and semirural areas are not to be outdone.

First, it will be noted that the structure of economic activity in rural areas is quite different from that in urban areas. As mentioned in a recent Industry Canada study, the goods-producing industries, particularly the resource-based ones, own a larger share of the labour force in rural areas.⁶¹ On the other hand, the corporate and professional services, finance, real estate, and nonresource-based manufacturing industries hold a relatively larger proportion of jobs in

61. See Industry Canada, *Rural Canada in the Knowledge-Based Economy*, special report prepared for the Micro-Economic Policy Analysis Branch, under the direction of Raynald Létourneau and Alison McDermott, in cooperation with the Rural Secretariat (Ottawa, 2001).

Table 10
Comparative Indexes for Regional Labour Markets
in Atlantic Canada, 1996

	Employment Rate (%)	Unemployment Rate (%)	Average Employ- ment Earnings Canada = 100
Canada	61.4	6.8	100.0
Atlantic Canada	53.8	11.2	85.9
Newfoundland	46.5	16.7	88.7
Avalon (ER)	52.4	13.0	93.1
<i>St. John's (CMA)</i>	59.5	9.4	95.8
Central Nfld. (ER)	38.8	19.9	81.2
<i>Grand Falls–Windsor and Gander (CA)</i>	47.5	14.2	91.2
West Coast Nfld. (ER)	45.3	17.8	89.8
<i>Corner Brook and Labrador City (CA)</i>	48.8	13.8	102.1
South Coast Nfld. (ER)	38.4	28.8	74.5
Prince Edward Island	58.9	12.0	79.7
<i>Charlottetown and Summerside (CA)</i>	59.3	9.4	82.9
Nova Scotia	56.1	9.1	86.7
Halifax (ER)	65.7	6.2	94.7
<i>Halifax (CMA)</i>	66.4	6.0	95.1
Northeastern NS (ER)	53.5	9.9	78.8
<i>Truro and New Glasgow (CA)</i>	51.5	9.7	81.0
Cape Breton (ER)	42.7	17.5	82.0
<i>Sydney (CA)</i>	39.0	17.0	81.3
Annapolis (ER)	53.6	8.2	79.2
<i>Kentville (CA)</i>	55.2	9.6	81.0
Southwestern NS (ER)	51.1	9.8	82.4
New Brunswick	55.4	10.0	84.6
Southeast NB (ER)	59.2	8.6	84.3
<i>Moncton (CA)</i>	58.5	7.5	89.1
Northeast NB (ER)	46.3	16.1	82.4
<i>Bathurst and Campbellton (CA)</i>	49.7	14.1	86.1
Southwest NB (ER)	58.8	7.7	89.4
<i>Saint John (CMA)</i>	60.6	7.3	92.2
Central NB (ER)	58.4	8.3	89.0
<i>Fredericton (CA)</i>	62.4	7.7	93.0
Northwest NB (ER)	55.8	8.9	72.4
<i>Edmundston (CA)</i>	52.4	10.8	79.5

Source: Statistics Canada, 1996 census; compiled by the authors.

urbanized areas. And with good reason. There is a strong correlation between urban size and the presence of so-called dynamic industries.⁶² Dynamic services are not only an essential component of goods and services production and distribution; they also provide products that are used in almost all economic sectors. In addition, innovations in dynamic services often trigger a surge of innovation and change in other sectors, including the manufacturing industry.⁶³ That is why knowledge-related skills or jobs are often associated with dynamic industries, since they generally employ a large proportion of highly skilled workers.

Dynamic services tend to favour larger urban centres, where highly skilled workers are more available, and the presence of complementary activities (administration, banking, management, and research functions) facilitates access to information and personal contacts. Urban centres also attract the head offices of large corporations, whether in the goods-producing or service sectors. It is hardly surprising, then, that a smaller proportion of dynamic jobs are found in rural or semirural areas. In Atlantic Canada, dynamic industries employ 19.3 percent of the workforce compared with 24.3 percent in Canada. Our analyses have shown that in Atlantic Canada's rural areas (excluding CMAs and CAs), only 14.6 percent of jobs are in the dynamic industries compared with 22.9 percent in urban areas (see figure 15).

Should it be inferred, then, that rural and semirural areas are excluded from the knowledge economy? For the reasons stated above, it does seem that rural areas have largely failed to assimilate the elements of the information economy. In fact a recent study by Industry Canada provides a whole range of economic-activity indicators linked to knowledge in rural parts of Canada, and most are at serious odds with similar indicators for metropolitan areas.⁶⁴ Here are some of the conclusions reached in this study:

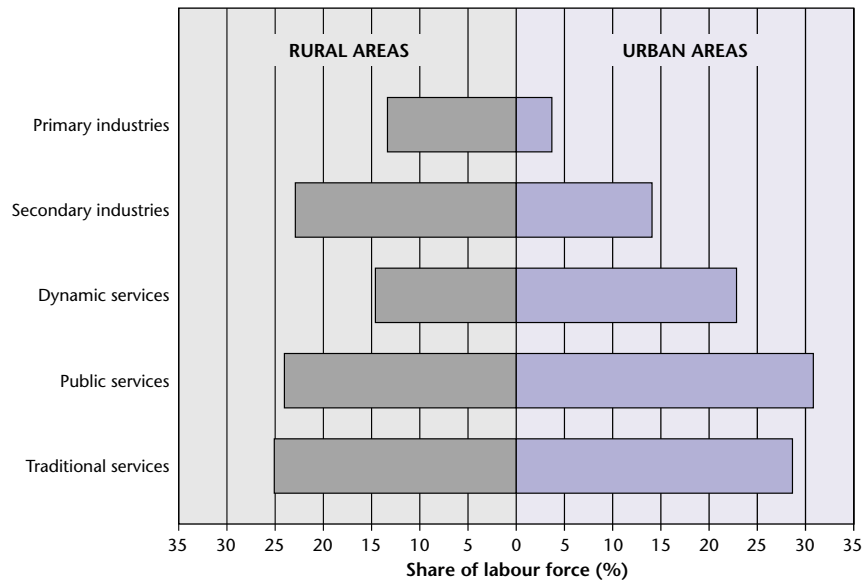
- ▶ Literacy skills are lower in rural areas (figure M-3).
- ▶ There are substantial educational gaps between rural and urban areas (figure M-4).

62. Dynamic services include the following sectors: transportation, communications, wholesale trade, financial services and insurance, real estate, and corporate services.

63. See G. Gellatly and V. Peters, *Understanding the Innovation Process: Innovation in Dynamic Service Industries*, Statistics Canada, Analytical Studies Branch, Research Paper no. 127 (Ottawa, 1999).

64. Industry Canada, *Rural Canada*.

Figure 15
Structural Distribution of Employment in Rural and Urban Areas in Atlantic Canada, 1996



Source: Statistics Canada, 1996 census; compiled by the authors.

- ▶ Rural and semirural areas have a lower proportion of knowledge workers and managers (figure M-6).
- ▶ The training participation rate is lower in rural areas, and the gap between urban and rural areas is wider in Newfoundland, New Brunswick, and Nova Scotia (figure M-8).
- ▶ In the Atlantic region, there is a significant gap between metropolitan and other areas in the use of computers (figure M-11).
- ▶ Businesses in rural areas are concentrated in less innovative industries (figure M-19).

All in all, this Industry Canada study shows that rural areas are lagging behind the more urbanized areas with respect to the knowledge economy. Thus, close to 70 percent of new jobs created since 1992 were in metropolitan areas, which account for 62 percent of the Canadian population.⁶⁵

65. Ibid., figures L-1 to L-6.

This is confirmed by our analyses. We have estimated that the proportion of high-knowledge-intensive jobs in Atlantic Canada is twice as large in urban areas (CMAs and CAs) as in other areas (11.1 percent compared with 5.5 percent). The gap decreases considerably (to only 3 percent in favour of urban areas) for the intermediate group, that is, the medium-knowledge-intensive jobs. As shown in table 11, it is in Prince Edward Island and New Brunswick that the high-knowledge-intensive jobs increased the most between 1991 and 1996.

Table 11
High-Knowledge-Intensive Jobs in Rural and Urban Areas of Atlantic Canada, 1991 and 1996

	1991 Census		1996 Census		Evolution 1991-96	
	Number	Part (%)	Number	Part (%)	Number	Part (%)
Rural Newfoundland	5,715	9.0	6,485	10.3	770	13.5
Urban Newfoundland	2,820	4.9	3,220	5.6	400	14.2
Rural Nova Scotia	15,570	10.1	17,430	11.3	1,860	11.9
Urban Nova Scotia	4,535	4.5	5,165	5.1	630	13.9
Rural New Brunswick	11,095	10.0	13,105	11.8	2,010	18.1
Urban New Brunswick	4,370	4.8	5,310	5.9	940	21.5
Rural Prince Edward Island	1,375	6.6	1,760	8.4	385	28.0
Urban Prince Edward Island	375	2.0	635	3.4	260	69.3
Rural Atlantic Canada	33,755	9.7	38,780	11.1	5,025	14.9
Urban Atlantic Canada	12,100	4.5	14,330	5.4	2,230	18.4
Total Atlantic Canada	45,855	7.4	53,110	8.7	7,255	15.8

Source: Specially compiled by the authors.

■ Resource Sector Industries: Using Innovation

In light of the above analysis, it seems clear that the knowledge economy is primarily an urban phenomenon. And yet the rural, resource-based economies should not be ignored when considering the use of innovation, which is a result of the globalization of markets and the spread of technologies and knowledge. Even if these economies are mainly using knowledge and know-how derived from information technologies in urban areas, they are not far behind when it comes to adopting new technologies or processes.

Rural or semirural areas are turning to innovation for several reasons. First, the prices of commodities (metal, fish, agricultural and wood products, etc.) have a tendency to stagnate and even decline in the face of competition from developing countries, where production costs are lower (low wages) and legislation protecting the environment and ecosystems is weaker. To make up for the comparative advantages of new competitors, Canadian entrepreneurs in the traditional sectors must maximize their declining resources through more efficient management, especially given that environmental legislation has been considerably strengthened in the last decade. That means that more must be done with less raw materials while at the same time meeting environmental and health standards and new ISO industrial standards.

Major changes are also occurring with respect to demand. Traditional businesses must be able to innovate in the areas of content (composition or input, processing, and services incorporated into their products) and production and marketing methods (efficient use of production tools, technologies, and human resources). Businesses in rural areas, in particular those that export, must upgrade their production tools. They have to apply an integrated just-in-time management approach, offer a wide variety of products aimed at specific market niches, develop their marketing capabilities, etc. Such are the conditions created by the new economy, and every business, rural or urban, must meet them. Many succeed too, even businesses in the more traditional sectors. In the fish-processing sector, for instance, there was a decline of 40 percent in the number of hours worked on the Atlantic Coast between 1988 and 1996, but the value added by hour rose by 35 percent (from \$15.43 to \$20.81).⁶⁶ In many other sectors (pulp and paper, the wood industry, peat, horticulture, aquaculture, etc.), productivity has greatly increased owing to the stimulus of new technologies and more efficient management.

Clearly, resource-based economies, are forced by their very nature, to adapt their production and management tools to the constraints of the knowledge economy. As indicated by an OECD document, the cleavage between the traditional and the new economies is becoming increasingly less evident as advanced technologies are assimilated by traditional sectors.⁶⁷ And this adaptation is actually occurring in the resource-based regions. However, as the Conference Board of Canada

66. See Beaudin, *Towards Greater Value*, 158–59, table 27.

67. Martin Baily, "Innovation in the New Economy," *Observer*, no. 221/222 (Summer 2000).

cautioned,⁶⁸ the innovation process in the natural resources sector is different from that observed elsewhere in the economy (see figure 16). These differences are due to the following:

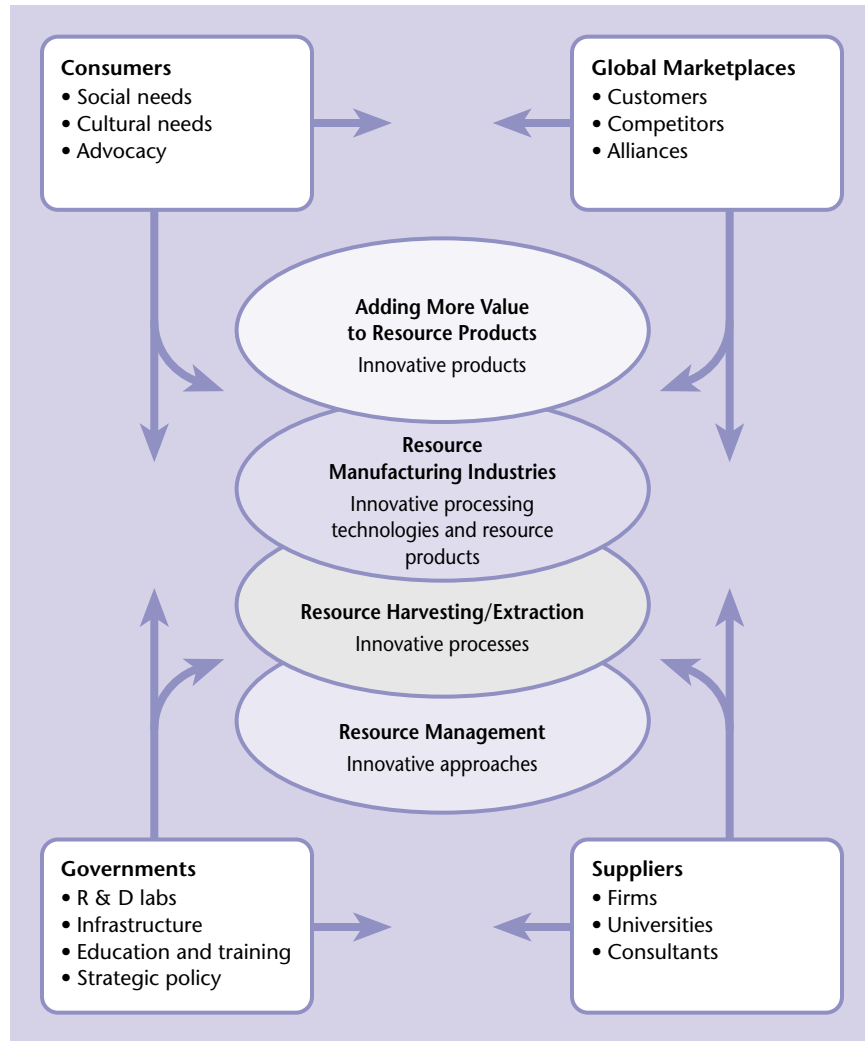
- ▶ The production system of resource-based companies is multidimensional and must take into account resource management, exploration, extraction, and processing. This tends to make the innovation system of these industries more complex.
- ▶ Resource-based companies tend to buy innovative technologies instead of developing their own. Capital investments in these sectors are particularly significant.
- ▶ Innovation in primary sector businesses is mostly generated by the links formed by businesses themselves (cooperative arrangements with clients and suppliers, and interactions with consumers and competitors) as well as by those established with institutional research organizations (governments and universities). This cooperation is essential for maintaining the competitiveness of traditional sectors.
- ▶ Finally, the purpose of innovation in the resource sector is to improve processes more than to develop value-added products. Given the highly competitive climate, businesses in this sector must first control their costs in order to maintain their profit margins.

Clearly, the rural and semirural areas of Atlantic Canada, home to 50 percent of the regional labour force, have not been excluded from the knowledge economy. A conference sponsored by ACOA in June 1999 addressed the technological changes in the region's resource sector and consequently the question of skill requirements. Without ignoring the inherent difficulties in diversifying and enhancing production value, the conference report stressed that traditional businesses, especially those that are resource-based, are forced, like other sectors, to integrate the features of the knowledge economy: "These industries ... have undergone substantial modernization by purchasing and incorporating innovations from a variety of research and development intensive supplier industries, and by maintaining networks of relationships with a science and technology infrastructure."⁶⁹

68. See G. Rhéaume and J. Warda, *Investing in Innovation in the Resource Sector* (Ottawa: Conference Board of Canada, 2001).

69. See Davis and Hulett, *Knowledge-Based Skills Gaps in the Natural Resources Sector in Atlantic Canada*, 1.

Figure 16
Natural Resources Innovation Systems



Source: Conference Board of Canada, based on information from NRCan and Statistics Canada.

In Atlantic Canada, the wood, pulp and paper, construction, and ship-repair industries, as well as the retail trade, transportation, textile, and agri-food (particularly horticulture and aquaculture) sectors, have for the most part modernized their production systems while paving the way for higher-quality products. Businesses in these traditional sectors are indeed forced to innovate with regard to their product

composition, manufacturing processes or techniques (aiming for higher quality by striving to achieve international industrial standards), and packaging of incorporated products or services (packing, display, nutritional information, and customer service). This approach obviously requires the use of diverse human resources compounded with a healthy dose of qualifications and skills.

The move to an economy in line with the new realities was influenced by several technological and organizational factors. In most sectors, a quantity-based strategy (mass production) was replaced in the space of a few years by a quality-based approach that was aimed at maintaining traditional market shares while targeting market niches for more elaborate products. Innovation, both in the management of the means of production and in product composition and packaging, is now more necessary than ever, and so too is access to distribution and marketing networks — hence the multiplication of agreements, partnerships, and strategic alliances, a phenomenon frequently observed even in rural areas.

Another aspect of the traditional sector's modernization is investments in infrastructure and the development of related industries that upstream provide equipment and services and downstream add value to the resource. Related activities multiply the spin-off effects on the economy. A good example of this is the aquaculture sector, an industry that is expanding rapidly in coastal areas. Although this sector is strongly influenced by traditions connected with the fishery, it requires a wide variety of unique inputs (specialized equipment and services) and is therefore greatly supported by innovation. In short, aquaculture has gone high-tech, and its management is modelled more on the new-economy businesses. For instance, a typical salmon-farming business deals with over two hundred suppliers. The aquaculture industry needs a continuous flow of industrial, technological, and commercial inputs at various levels of the system and at each production stage. Logistical support can go from the scientific and technical evaluation of production sites to the supply of specialized equipment and other services such as breeding, reproduction, incubation, stocking, and nutrition. Other services provided to the industry include veterinary care, seed collection, product transportation and marketing, etc. Various sectors, including ocean industry, digital cartography, biotechnology, the environment, and biopharmaceutical products, also demonstrate the opportunities that exist upstream in the natural resources sector in Atlantic Canada.