Institute for
Competitiveness & Prosperity

A View of Ontario:
Ontario's Clusters of Innovation

The Institute for Competitiveness & Prosperity
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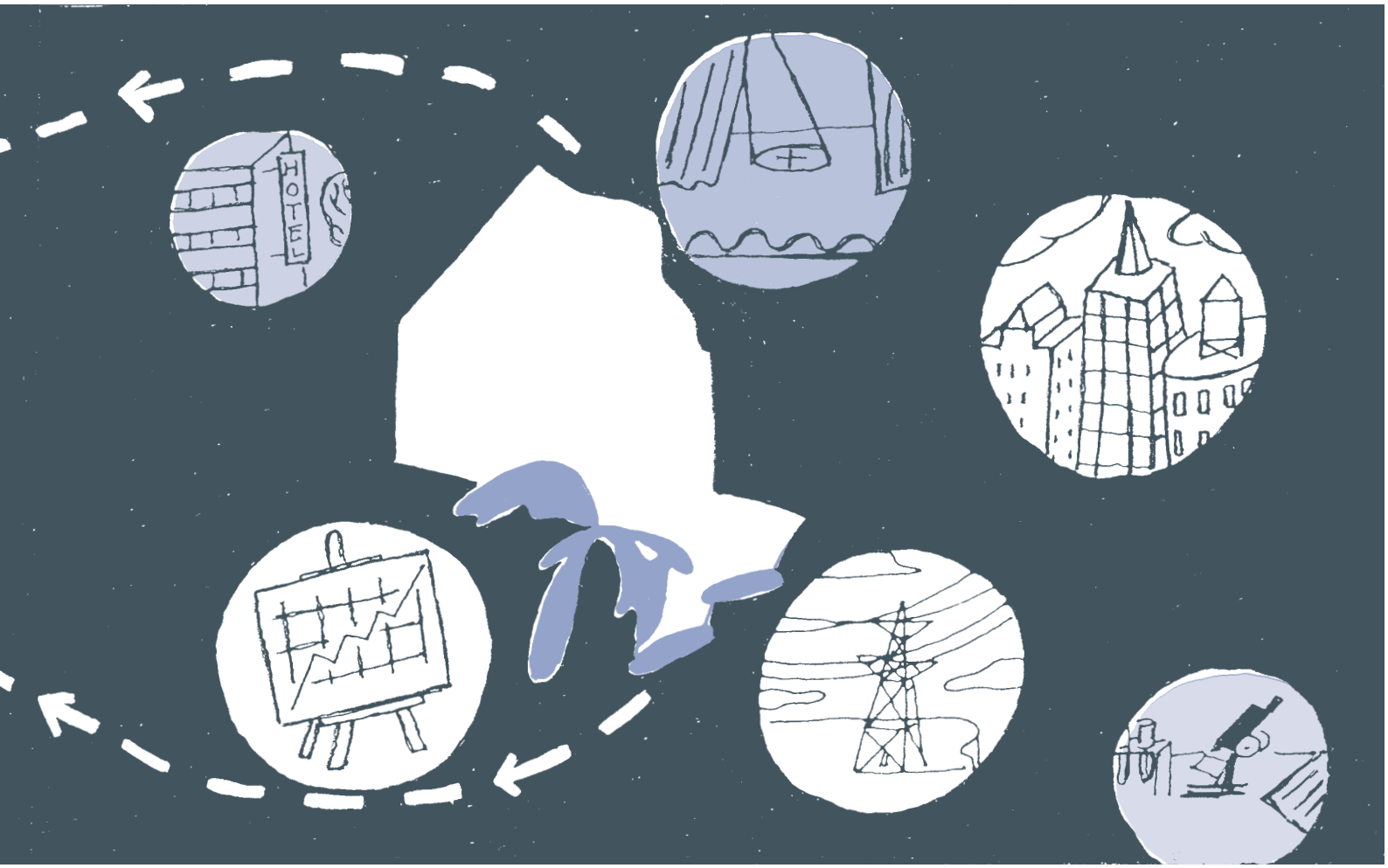

Institute for
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The Institute for Competitiveness and Prosperity is an independent not-for-profit organization established in 2001 to serve as the research arm of Ontario's Task Force on Competitiveness, Productivity and Economic Progress.

Working papers published by the Institute are primarily intended to inform the work of the Task Force. In addition, they are designed to raise public awareness and stimulate debate on a range of issues related to competitiveness and prosperity.

The mandate of the Task Force, which was announced in the April 2001 Speech from the Throne, is to measure and monitor Ontario's competitiveness, productivity and economic progress compared to other provinces and U.S. states and to report to the public on a regular basis.

It is the aspiration of the Task Force to have a significant influence in increasing Ontario's competitiveness, productivity and capacity for innovation. This, they believe, will help ensure continued success in the creation of good jobs, increased prosperity and a high quality of life for all Ontarians. The Task Force intends to seek breakthrough findings from their research and to propose significant innovations in public policy which stimulate businesses, governments and educational institutions to take action.

The Task Force's first report to the people of Ontario is to be published in the fall of 2002.

Comments on this working paper are welcome and should be directed to the Institute for Competitiveness & Prosperity (see inside rear cover for contact information).

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Foreword and Acknowledgements

I am pleased to present the first working paper of the Institute for Competitiveness and Prosperity in support of the Ontario Task Force on Competitiveness, Productivity and Economic Progress.

The Institute's working papers are intended to help the Task Force to benchmark Ontario to other provinces, territories and states in North America and to provide the foundation for a policy framework that will help stimulate action by governments, firms and individuals.

This first paper establishes the basis for the initial work of the Task Force by articulating the case for linking productivity and competitiveness with economic progress. The paper then focuses on Ontario's clusters of innovation and builds upon recent work by the U.S. Council on Competitiveness,[1] thereby tapping into a rich source of comparative data that will help us to compare the performance of Ontario's clusters of traded industries with that of similar clusters south of the border.

Relentless innovation and upgrading of productivity are the keys to international competitiveness in the modern economy. While Ontario has some firms that belong in the ranks of the world's best, the overall economy is not where it needs to be. Ontario firms have to set high goals and aspire to be global players by serving the most demanding customers at home and abroad.

At a time when it is increasingly important for all levels of government to be aligned as they work to serve the common goals and aspirations of individuals and groups in our society, it is heartening to see this reflected in a range of initiatives focused on clusters of traded industries. The cities of Toronto and Ottawa have already done considerable work in this area. The Ontario Jobs and Investment Board made strengthening firms, economic clusters and industry sectors a priority in their report *A Road Map to Prosperity*. The federal government, in its recent white paper on innovation *Achieving Excellence*, includes specific reference to supporting the development of "globally competitive industrial clusters."

We are indebted to the Institute for Strategy and Competitiveness, Harvard Business School for collaborating with us and thereby ensuring the greatest degree of comparability between our respective initiatives. We also gratefully acknowledge the ongoing assistance being provided by Statistics Canada.

Roger L. Martin, *Chairman*
Institute for Competitiveness and Prosperity

[1] For more information about the Council on Competitiveness, please visit: http://www.compete.org

Executive Summary

Executive Summary

A goal of Ontario's Task Force on Competitiveness, Productivity and Economic progress is to create a framework to measure and assess Ontario's economic progress in a North American context. This paper establishes that framework on the assumption that economic progress and the resulting increase in the standard of living of individuals is built upon growing our Gross Domestic Product (GDP) and that GDP per capita is a key indicator we need to monitor and investigate.

Despite being well-positioned within Canada, Ontario is not an economic leader in North America. When the provinces and states are considered together, Ontario's labour productivity is ranked 32nd of the 60 jurisdictions. Thirty of the fifty U.S. states outperform Ontario.

An analysis of the component parts of GDP per capita, leads to the conclusion that to increase productivity and sustain long-term growth in GDP per capita there is a need to focus on increasing the amount of output per hour worked, for which we use the term *effectiveness.* At the same time, it is important to attract people to seek jobs and to create jobs for all job seekers, for which we use the term *utilization.* Focusing on *effectiveness* and *utilization* recognizes the need to ensure that the maximum number of people are working and employed in highly productive jobs.

In this paper, these two components of GDP per capita, *effectiveness* and *utilization*, are associated with productivity and competitiveness. Ontario's competitiveness may be viewed as an ability to sell the same product as someone else but produce it at a lower cost or to create superior products at the same cost. Either route can lead to increased market share, increased output and thus provide more and better jobs, making up for any job loss due to increased *effectiveness.*

It is argued that competitiveness is influenced by innovation and upgrading, which in turn require investments (financial capital) in buildings and equipment (physical capital), the skills of individuals (human capital), in bringing new ideas to market (research and development) and in building linkages and partnerships that make the whole system function more efficiently (social capital). Initial evidence suggests that Ontario does not provide a sufficiently good environment for upgrading to underpin a high and rising standard of living.

Evidence cited by the U.S. Council on Competitiveness suggests that productivity does not depend so much on what industries a region competes in, but on how it competes and that innovation is vital for long-term increases in productivity. This evidence comes from the enduring work pioneered by Professor Michael E. Porter of the Harvard Business School. Porter developed a concept of the microeconomic business environment in which a combination of pressure and support is created that drives the clustering of industries.

The U.S. data show that when industries are divided between those in clusters of traded industries, in which more intensive innovation and upgrading occurs, and local industries, in which the forces for upgrading are muted and the possibilities of expanding by selling outside the region are limited, the traded cluster industries have distinctly higher levels of innovation, productivity and wages.

Traded clusters provide opportunities for growth and *utilization* that surpass those in the local economy. However, the presence of traded clusters in a region has a spill-over effect and typically generates opportunities for increased success of the local industries as well.

Applying the same approach using Canadian data, our initial results show that Ontario has a high proportion of employment in clusters of traded industries, which is encouraging but at the same time mystifying, because it suggests that the context for traded clusters in Canada may differ in some respects from that in the U.S. We need to understand why Ontario's traded clusters overall appear to have lower productivity than similar clusters in the U.S.

It is important to note that traded clusters are not only about "high technology." In the U.S. ranking, Information Technology, the first cluster among what would generally be considered "high technology industries," only enters the table in 14th place. Also interesting is Ontario's relative strength in the technology clusters. A familiar pattern emerges: Ontario is a leader in Canada but only an average player when compared with the U.S.

Moving from the provincial level of analysis to the regional level, we have identified the leading clusters of traded industries by employment in each of Ontario's ten Census Metropolitan Areas (CMAs). We also present sample data for specific clusters in which Ontario possesses particular strength.

For example, we confirm Ontario's known strength in the automotive and financial services industries. While employing fewer people, Toronto's Entertainment cluster is shown to rank third in North America. An even less dominant cluster in which Ontario is well-positioned to compete with the U.S. based on employment strength would appear to be Pharmaceuticals and Biotechnology. We have also observed, qualitatively, a number of instances where the attributes of traded clusters are evidenced in new and emerging "sub-clusters." These provide opportunities to understand better the nature of economic opportunity in areas that may lack strong traded cluster activity, such as rural, remote and resource industry-dominated regions of the province.

Our evidence suggests that competitively priced, innovative products that can be traded outside of local borders provide the driving force for increasing GDP per capita in Ontario, thereby increasing our standard of living and the number of well-paid jobs.

These initial findings require deeper analysis to identify the specific factors that will allow Ontario to increase its productivity and competitiveness. Future research will focus on comparisons with cluster activity in select provinces and states such as Alberta, Illinois, Massachusetts and Michigan.

Introduction

Like other North American provinces and states, Ontario is facing global, national and regional challenges that affect the social and economic environment of all its residents. The manner in which individuals, firms, organizations and governments respond to these challenges will be a determining factor in the province's ability to achieve ongoing growth and prosperity.

A goal of Ontario's Task Force on Competitiveness, Productivity and Economic Progress is to create a framework to measure and assess Ontario's economic progress in a North American context.

Ontario continues to be one of the best places in the world to live, work, and invest. In absolute terms, the economies of Ontario and Canada as a whole have performed well in recent years, and many of the macroeconomic fundamentals are sound. For example, between 1991 and 1999, the Canadian government managed to eliminate the federal budget deficit having started as second worst among G7 countries and ending up as the best. Also in 1999, a sustained effort by the Ontario provincial government resulted in the elimination of its deficit. Over the same decade, Canada's economy became more export oriented with exports as a share of Gross Domestic Product (GDP) increasing from 25.2 per cent in 1989 to 45.3 per cent in 2000. Ontario's exports in 2000 were at a record level of $207 billion – more than 50 per cent of GDP – having grown every year for 9 years. Compared to the G7 countries, Ontario leads all of them in exports as a share of GDP and on a per capita basis.

However, Canada's prosperity relative to other countries has been weakening over the past decade. During the 1990s, Canada's GDP growth averaged only 2.6 per cent, a rank of 15th in the Organization for Cooperation and Economic Development (OECD) countries. This was well below the United States, which ranked 11th, with a rate of 3.1 per cent and below that of the OECD average, which was 2.7 per cent.

Had Canada maintained its ranking in economic performance, it has been estimated that per capita income would have been as much as $2,000 higher in 2000.[2] As much as 90 per cent of the income gap between Canada and the U.S. has been ascribed to an overall productivity gap (Rao et al, 2001).

While GDP per capita measured at purchasing power parity (PPP) grew at a compound annual rate of 2.6 per cent between 1990 and 2000, that growth has been accompanied by a significant depreciation of the Canadian dollar. A weak Canadian dollar and the ability to supply a strong U.S. economy are not the way to raise the quality of life for Ontarians. On the contrary, as Rao et al (2001) and Laidler and Aba (2002) have observed, the depreciating currency may actually erode the living standards of Canadians and only superior productivity performance will improve Canada's international cost competi-

Table 1: GDP Per Capita at Purchasing Power Parity in $US (2000)

RANK	COUNTRY	GDP per Capita at PPP
1	Luxembourg	$47,053
2	United States	$35,619
	Ontario	$30,929
3	Norway	$30,166
4	Switzerland	$30,138
5	Iceland	$29,302
6	Irelend	$29,174
7	Denmark	$29,061
8	Canada	$27,998
9	Netherlands	$27,836
10	Austria	$27,001

Source: OECD Main Accounts (National data), CANSIM

[2] Amounts quoted are in Canadian dollars, unless stated otherwise.

tiveness on a sustained basis, raise the standard of living and close the real income gap between Canada and the U.S.

This paper has been developed on the assumption that economic progress and the resulting increase in the standard of living of individuals is built upon growing our Gross Domestic Product and that GDP per capita is a key indicator we need to monitor and investigate (Baldwin et al, 2000). It is this indicator that signals what can be spent on, or invested in, each person in Ontario.

In 2000, Canada's GDP per capita slipped to eighth place in the OECD survey at U.S. $27,998 well below the United States in second place at U.S. $35,619. If the tiny countries of Luxembourg and Iceland are removed, Canada ranks sixth among substantially-sized countries, but has been passed by Norway, Ireland and Denmark in the past decade (see Table 1). Within Canada, Ontario lags behind Alberta in GDP per capita.

Table 2: Provincial GDP in $CDN and $US at PPP (2000)

RANK	PROVINCE	GDP per Capita in Nominal $CDN	GDP per Capita at PPP, $US
1	Alberta	$47,659	$40,016
2	Ontario	$36,837	$30,929
3	Saskatchewan	$32,775	$27,519
4	British Columbia	$31,452	$26,408
5	Quebec	$30,307	$25,447
6	Manitoba	$29,493	$24,763
7	Newfoundland	$26,166	$21,970
8	New Brunswick	$26,092	$21,908
9	Nova Scotia	$25,552	$21,455
10	PEI	$24,236	$20,349

Source: Statistics Canada, CANSIM

However, if we compared Ontario to Norway, Switzerland, Ireland and Denmark – all countries smaller in population than our province – Ontario would rank ahead of all of them and second in the world to the United States in GDP per capita (in PPP). Yet, Ontario lags 13 per cent behind the U.S. overall.

Of course, GDP per capita cannot be considered in isolation. It is a proxy measure that reflects a number of contributing factors and it can be positively influenced by factors that improve as well as some that diminish our quality of life.

Clearly all these factors need to be taken into account and there is an ample source of indicators to help us in this regard.

For example in 2001:

• On the UN Human Development Index, sometimes taken as an indicator of "quality of life" Canada ranks third, behind Norway and Australia, and ahead of the U.S. ranked sixth;

• On the World Economic Forum's 2001 Environmental Sustainability Index Canada placed third, behind Finland and Norway, and ahead of the U.S. in eleventh place;

• However, on the UN's new Technology Achievement Index, a possible proxy for the "knowledge-based" component of the economy, Finland was ranked in first place, the U.S. second and Canada eighth.

Canada and Ontario thus occupy an enviable position in the world in overall quality of life but cannot ignore the signals that show our position is at risk if we do not pay close attention to our economic fundamentals as represented by our GDP per capita.

The following sections of this paper explore the component parts of the GDP per capita identity and attempt to provide context for an understanding of productivity and competitiveness as drivers of our economic performance.

Having reviewed the issues relating to Ontario's overall productivity, we consider the microeconomic foundations of competitiveness and, building on the work of Professor Michael E. Porter of the Harvard Business School, compare the clusters of traded industries in Ontario and select U.S. states that promise the greatest insights for further analysis.

Productivity and Economic Progress

As indicated above, the Canada-U.S. GDP per capita gap has increased significantly over the past two decades. In order to understand what underlies this trend, it will be useful to consider the following breakdown of GDP per capita into its component parts or "identity."[3]

$$\text{GDP per capita} = \underbrace{\frac{\text{GDP}}{\text{hours worked}}}_{\text{Effectiveness}} \times \underbrace{\frac{\text{hours worked}}{\text{jobs}}}_{\text{Intensity}} \times \underbrace{\frac{\text{jobs}}{\text{potential labour force}}}_{\text{Utilization}} \times \underbrace{\frac{\text{potential labour force}}{\text{population}}}_{\text{Profile}}$$

Effectiveness: Represents the average value of output that is produced by an average worker in an hour. This term is the most widely used measure of labour productivity.

Intensity: Represents the average number of hours a typical employed person works. This term is a measure of how long employees work.

Utilization: Represents the ratio of the number of people who have jobs to the number of people who are of working age in the region. This measure combines two features – the share of those seeking a job who are able to attain a job, and the share of those able to work (i.e., are of working age) who seek to work.

Profile: Represents the ratio of the working age population to the total population. This is often referred to as a region's dependency ratio and is primarily determined by demographics.

Increasing the growth rate in any one component will increase growth in GDP per capita and subsequently result in economic progress. However, not all the components offer the same potential to increase GDP per capita.

The key characteristic revealed by *profile* is the age distribution of a region's population. At a time when Statistics Canada is reporting slower population growth, it is worth noting that this does not necessarily translate into an immediate slowing of the growth of Canada's work force (Foot, 2002). In most respects, *profile* is largely static, changing only slowly over time and therefore does not provide a jurisdiction with great leverage in improving the standard of living. However, opportunities to affect *profile* do include attracting working age individuals to the region and encouraging them to stay.

Encouraging employees to work longer hours increases *intensity* but does not result in long-term sustainable growth. It also comes at a cost to leisure and the quality of life. Both *profile* and *intensity* thus provide limited opportunities to improve economic progress in the long run.

The remaining two components are the ones with real leverage potential to increase GDP per capita. Attracting people to seek jobs and creating jobs for all job seekers is at the heart of *utilization*. This factor does indeed provide a point of leverage and can be very effective when used to create opportunities for highly skilled and able talent. The component with the highest long term potential for leverage is *effectiveness*. Increasing the amount of output per hour is the best way to increase productivity and sustain long-term growth in GDP per

[3] This analysis is based on the treatment proposed in Baldwin, J., Maynard, J.P., and Wells, S.(2000). "Productivity Growth in Canada and the United States." Isuma. Vol. 1, No. 1 (Spring 2000). Ottawa: Policy Research Initiative.

capita. Focusing on *effectiveness* and *utilization* recognizes a need to ensure that the maximum number of people are working and employed in highly productive jobs.

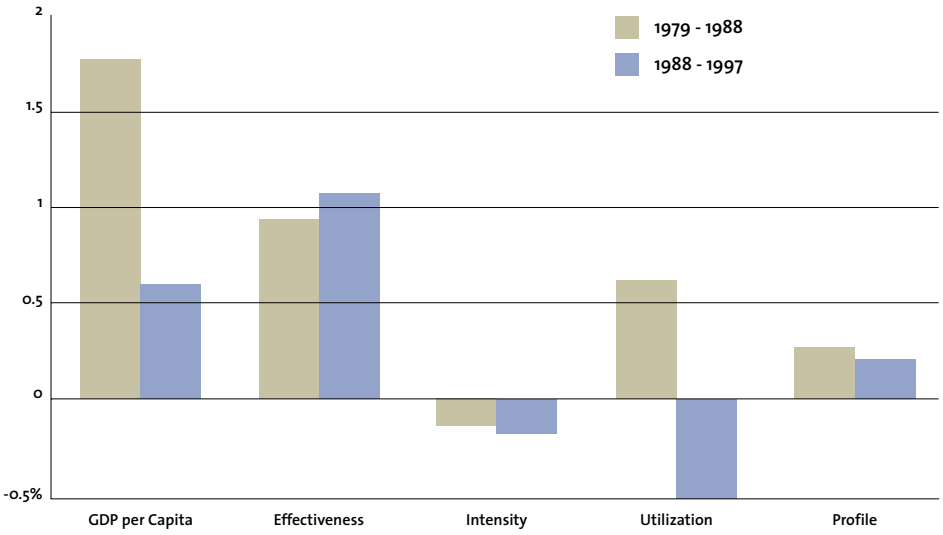
Utilization and the Reduction in Canada's GDP per capita Growth

Since the growth in GDP per capita is a function of *effectiveness, intensity, utilization* and *profile,* it is natural to consider how each component may have contributed to Canada's declining growth rate in GDP per capita. John Baldwin of Statistics Canada has studied this question carefully. Using data over the 1979 to 1997 period, he highlights the dramatic reduction in the growth rate in GDP per capita that occurred over the 1990s as compared to the 1980s. Baldwin's results are shown in Figure 1.

What is clear from Figure 1 is that three of the four components, namely *effectiveness, intensity* and *profile* are very similar in the two sub-periods. This suggests that since their growth rates have not changed significantly over the two sub-periods, they are not the cause of the decrease in growth in Canada's GDP per capita. In sharp contrast, the growth rate of *utilization* has fallen dramatically. Baldwin suggests two reasons for this: Canadians increasingly deciding not to take jobs or not enough new jobs being created to accommodate the natural increase in the working age population. Baldwin suggests that this decrease in *utilization* is the underlying cause of the decrease in the growth rate of Canada's GDP per capita and therefore economic progress. In contrast, growing *utilization* in the U.S., particularly in the 1990s, has been a key contributor to its increase in GDP per capita and standard of living (Statistics Canada, 2000; Bureau of Labor Statistics, 2000).

Figure 1: Growth in Real GDP per Capita in the Canadian Economy

1979–1988 versus 1988–1997



Source: Adapted from "Productivity Growth in Canada and the United States," John Baldwin, Jean-Pierre Maynard and Stewart Wells, ISUMA, Volume 1 No. 1, Spring 2000

Effectiveness and the Reduction of Canada's GDP per Capita Growth

The other point of leverage is through *effectiveness.* Although Canada's *effectiveness* has been growing consistently, it has not been able to keep pace within the G7 community. In 1976, Canada was second to the United States among the G7 in its *effectiveness;* two decades later, it stood in fifth place. The two contributing factors for this are that Canada has not been able to increase the growth rate of its *effectiveness* and that other G7 members have (Sulzenko and Kalwarowsky, 2000).

This point was clearly articulated by Pierre Fortin in the C.D. Howe Benefactors Lecture:

> [T]he problem with the growth rate of Canadian productivity in the 1990s is not so much that it declined from the 1980s – it changes very little – but rather that it remained at best equal to the growth rate of U.S. productivity, so that Canada's productivity level stopped catching up with the higher U.S. level as it had done in the 1960s and 1970s, as most other countries have been doing (Fortin, 1999, p. 102).

Canada's inability to close this productivity gap means that the GDP per capita gap between Canada and the United States has continued to widen. In 1998, the gap in GDP per capita was about $7,500.[4] Of this, $6,200 (83 per cent) is attributed to lower Canadian labour productivity (*effectiveness*) and $1,300 (17 per cent) is attributed to a lower effective employment rate (*utilization*) (Sulzenko and Kalwarowsky, 2000). Despite the fact that Canada's productivity growth rate has been keeping apace with international standards, it has not been increasing. In order for Canada to close its GDP per capita gap with the U.S., it needs to increase its *effectiveness.*

[4] Statistics are based on PPP, if real exchange rates were used, the gap would be $17,355

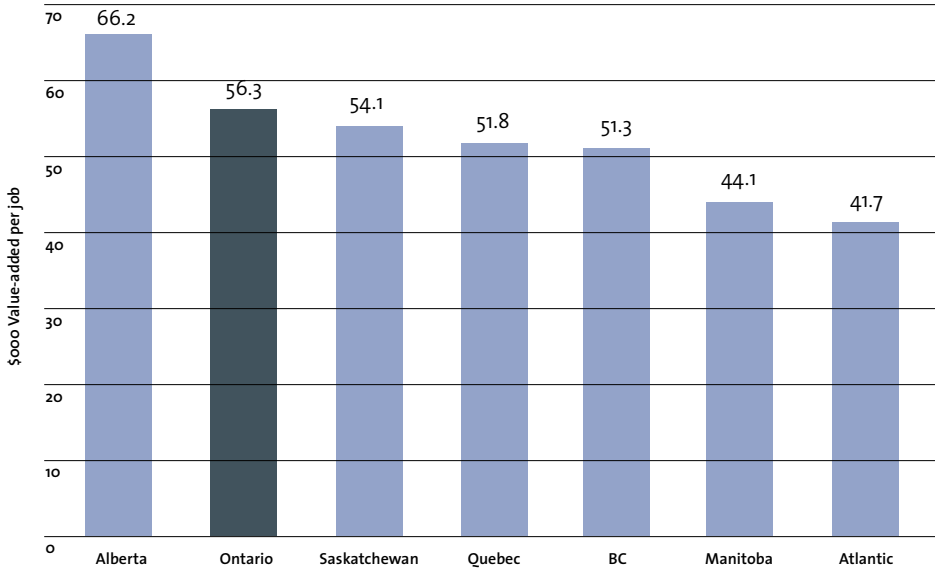
How Ontario Compares with other Provinces and States

Spanning 10.8 per cent of Canada's land, and accounting for 38 per cent (11.7 million) of its population and 42 per cent ($405.6 billion) of its GDP, Ontario has a notable presence in the heart of Canada. When considered in a Canadian context, Ontario fares relatively well. With the exception of Alberta, Ontario leads in most areas reflecting economic progress. Alberta leads Canada in effectiveness as measured by the value of output that each worker creates. In this respect, Alberta outperforms Ontario by a significant margin as can be seen in Figure 2.

Despite being well-positioned within Canada, Ontario is not an economic leader within North America. Ontario's labour productivity (*effectiveness*) is ranked 32nd of the 60 jurisdictions in Canada and the U.S., Alberta is 23rd and Quebec is 49th.

Figure 2: Value-Added Productivity by Province

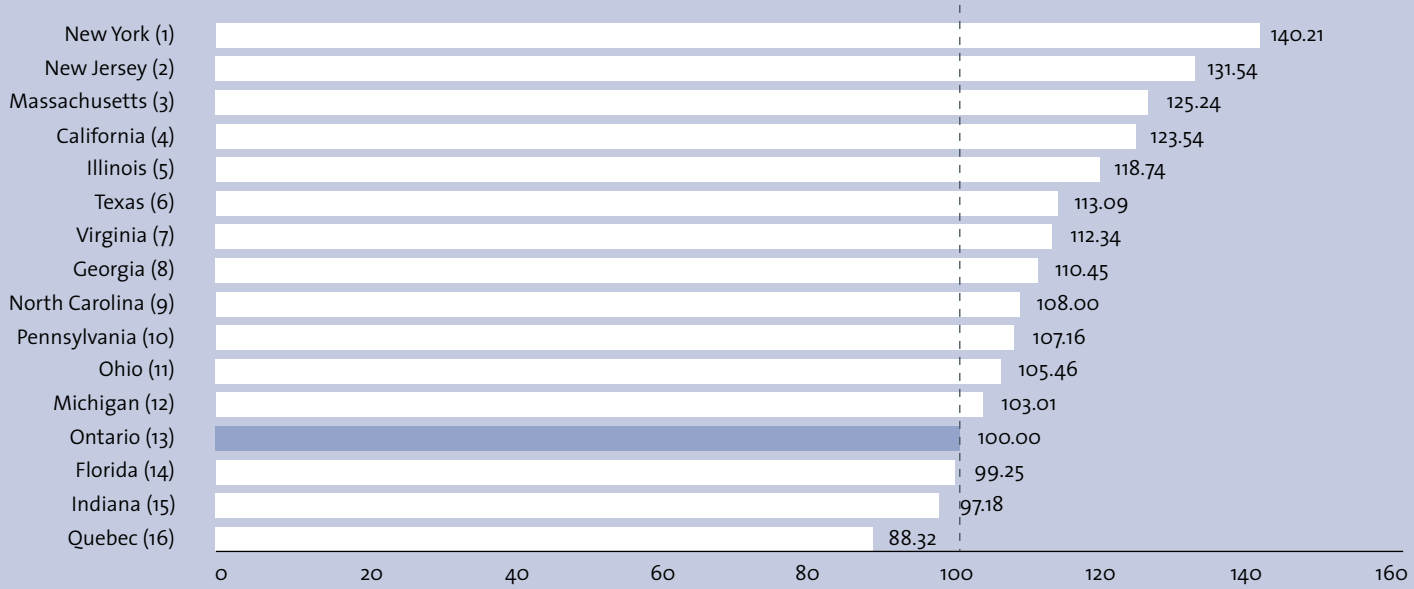
(1996 - 1997 Average)



Source: Zeitsma, D. and Sabourin, D. (2001) "Interprovincial Productivity Differences. "Canadian Economic Observer. August, 2001. Statistics Canada

Figure 3: Relative Labour Productivity for Provinces and States with over 6 Million Population

(1996–1997, Ontario = 100)



Source: Letourneau, R. (2000). "A Regional Perspective on the Canada-U.S. Standard of Living Comparision." *Occasional Paper No. 22.* Ottawa: Industry Canada.

However, the more appropriate comparison is Ontario against other substantially-sized North American jurisdictions. Figure 3 shows Ontario's ranking among the sixteen states and provinces in North America with population greater than 6 million (i.e. half Ontario's size and above).

Thus, although Ontario is the driving force of the Canadian economy it is not as productive as most U.S. states. This is cause for increasing concern given our export-oriented economy and the fact that we are competing directly with these states for investment and growth.

Effectiveness and Utilization in Ontario

Increasing *effectiveness* can be achieved through process innovation and product innovation. In the first instance the process of work can be made more efficient so that the same output is achieved with fewer hours of labour. Performed in isolation this can potentially lead to job losses and thereby reduce *utilization*. However, improving *effectiveness* in this way can make firms more competitive and provide them with the opportunity to serve new markets. In turn they can expand their productive capacity and thereby create new opportunities to increase *utilization*. These increased opportunities may indeed be in the new more effective jobs that were created. Therefore, the upgrading of skills and knowledge is essential for the value of process innovation to be maximized.

Product innovation increases *effectiveness* by adding value to products and services that are important and recognizable to customers. Creating value in products and services results in more opportunities to expand production capacity and hence *utilization*. These approaches require, and in fact define, innovation and upgrading. Both product and process innovation provide important ways to create value. Taken together they reinforce each other in a healthy positive cycle of innovation and upgrading.

Innovation and upgrading require investments (financial capital) in buildings and equipment (physical capital), the skills of individuals (human capital), in bringing new ideas to market (research and development) and in building linkages and partnerships that make the whole system function more efficiently (social capital). [1]

Box 1: Productivity and Innovation

The core measure of *effectiveness* is labour productivity. The calculation of labour productivity is typically output per hour worked, although output per days worked or the number of jobs (full-time and part-time) are used as well.

Labour productivity captures the productive capacity of the economy because it reflects the value of the output an employee can produce given various other contributing factors such as the nature of the industry, the strategy of the firm, investment in capital, investment in R&D and investment in the skills and training of the individual. All these factors combined reflect the productivity of labour in the value of the output produced.

However, the fact that productivity is influenced by such a wide variety of factors creates challenges in determining causality. For example, if higher productivity is observed, is it possible to determine if this is the result of an employee being more skilled or because the firm invests in capital to enhance the worker's environment to make him or her more productive?

In an attempt to unravel this causality, economists turn to a measure called Total Factor Productivity (TFP), which is designed to discern the return to all factors of production. It is usually measured as the excess of output over what can be accounted for by the stock of capital and labour.

Although useful and informative in many respects, TFP can be confusing and is challenging to measure consistently across countries. As such, in this paper we focus on labour productivity and turn to TFP only when it is particularly appropriate and the data are available.

A key determinant of the productivity of a region is Innovation. Innovation is typically thought of in terms of product innovation and process innovation. Both are essential to growing GDP per capita as they are intimately linked, and more often than not, reinforcing. Both product and process innovation have the effect of raising the *effectiveness* of labour.

Competitiveness and Economic Progress

Ontario's competitiveness may be viewed as an ability to sell the same product (or service) as someone else but produced at a lower cost, or to create a superior product (or service) at the same cost. Either route can lead to increased market share, expanded output and thus provide more and better jobs, making up for any job loss due to increased *effectiveness*.

In turn, the development of superior products and processes requires innovation and upgrading of the sources of competitive advantage by firms. Thus we require an understanding of what causes firms to invest in physical capital, human capital, R&D and social capital.

There is a well-established body of work that provides the evidence that a specific set of conditions drives this investment behaviour. This work was pioneered by Professor Michael E. Porter at the Harvard Business School (Porter, 1998), and was put in a Canadian context in the April 2001 paper "Canadian Competitiveness: A Decade After the Crossroads," by Michael E. Porter and Roger L. Martin.

The Competitiveness of Firms

Porter's original work focuses on the way in which firms compete. It sees productivity as being determined by the interplay of three broad influences: a nation's political, legal and macroeconomic context; the quality of the microeconomic business environment; and the sophistication of company operations and strategy.

Stable political and legal institutions combined with a sound macroeconomic context featuring low inflation, low and stable interest rates and a taxation policy favourable to savings and investment create an environment in which competitiveness is possible. However, a favourable macroeconomic context only creates the potential. Wealth is actually created by the microeconomic foundations of competitiveness: the workers, firms, markets and associated institutions in which competition actually takes place.

The quality of the microeconomic business environment is a function of four interrelated features captured in what is frequently referred to as Porter's "diamond model" (Porter, 1998). Porter shows how these four features work together in a self-reinforcing dynamic to drive the clustering of competitive industries that are highly effective because they serve markets outside their local area and are able to grow through trade.

While the macroeconomic context and the microeconomic business environment create the conditions for prosperity, ultimately companies need to take advantage of these conditions to make sophisticated choices consistent with innovation, upgrading and competitiveness.

Research on firm-level competitiveness has revealed the critical importance of a distinctive strategy. Firm-level competitive advantage rarely results from benchmarking against competitors and replicating their choices. Rather, competitiveness results from making a set of choices that produces a distinctive positioning and is manifested in a tailored system of activities. This activity system creates customer value distinct from competitors and makes replication by competitors difficult by confronting them with painful trade-offs (Porter, 1997).[5]

Firms can make choices that are incompatible with upgrading and global competitiveness or supportive of innovation, upgrading and competitiveness. As shown in Figure 4, the key choices tend to be in three domains: the aspirations and goals of the firm, the decisions as to where and where not to compete, and the decisions as to how to win competitively. The incompatible and compatible choices can also be seen in Figure 4.

[5] Michael E. Porter, "What is Strategy?" Harvard Business Review, November-December, 1997.

Figure 4: Strategic Company Choices

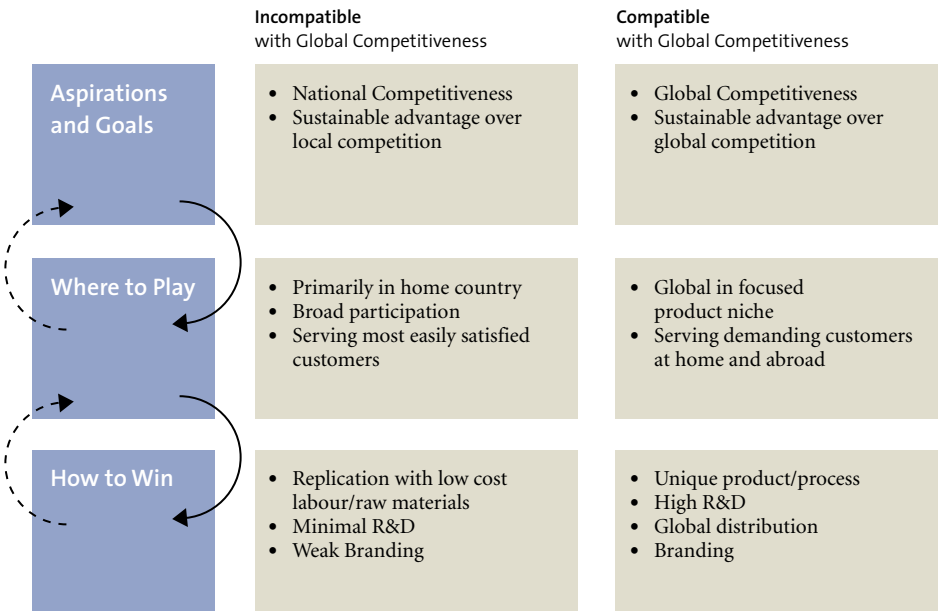
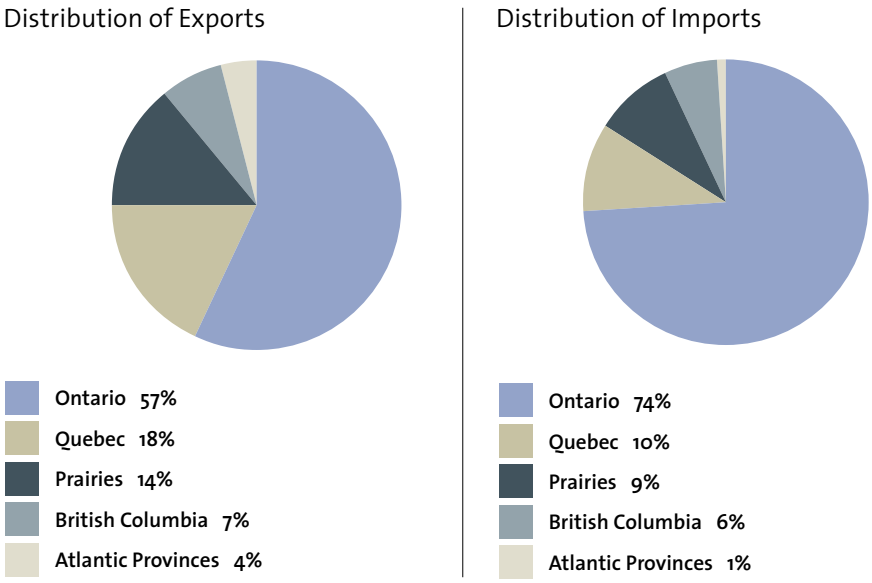


Figure 5: Patterns in the Distribution of Canada's Trade with the U.S., 2000



Data from Trade Update 2001, Department of Foreign Affairs and International Trade

A high-quality microeconomic business environment will encourage firms to migrate towards the right hand column. However, regardless of the environment, firms can make strategy choices that are more or less sophisticated.

Thus Porter's self-reinforcing dynamic leads to the creation of more high quality jobs which raises *effectiveness* and *utilization.*

None of this is possible without trade outside the local economic region, and here Ontario is strategically well-positioned in North America and already possesses a highly traded economy.

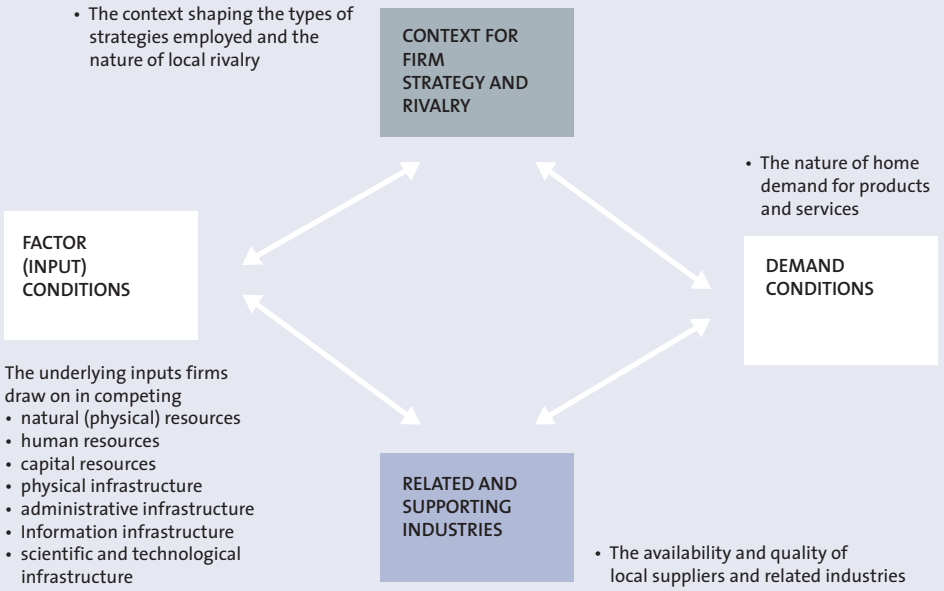
Canada's openness to international trade (the share of GDP that can be attributed to trade) has increased steadily over the past decade: in 1990, Canada's total trade (exports plus imports) relative to GDP stood at 51.4 per cent. By the year 2000, this ratio stood at 86.6 per cent.[6] Canada's dependence on international trade, however, hides tremendous regional variations within Canada. As seen in Figure 5, Canada's trade with the U.S. is concentrated in Ontario.

In 2000, Ontario was the U.S.'s third largest trading partner after Japan and Mexico with total trade of over $360 billion (Armbrister, A. and Meyers, D., 2002), bigger than the rest of Canada combined. Trade between Canadian provinces and the U.S. states has been steadily increasing since the Free Trade Agreement (FTA) was signed in 1988 and expanded to include Mexico with the creation of NAFTA in 1994. Michigan has long been the largest U.S. exporter to Canada and Ontario's leading trade partner (see Figure 6 on page 17).

[6] The share of Canada's exports of goods and services to the U.S. for 2000 was 82.9% and its share of imports was 72.1%.

The Microeconomic Environment and the Role of Clusters

Quality of the Microeconomic Business Environment



A favourable **Microeconomic Business Environment** is one that creates pressure for firms continuously to upgrade the source and sophistication of their advantage and at the same time supports the upgrading process with the appropriate factor inputs and supporting institutions. The combination of pressure and support is created by the interaction of four features as shown.

Pressure for upgrading is supplied by *demand conditions* featuring sophisticated and demanding customers, whose demands spur local firms to innovate in order to upgrade their product/service offerings. Particularly valuable is customer pressure that anticipates the nature of demand elsewhere in the world. Beneficial pressure is also supplied by a *context for firm strategy and rivalry* that causes local competitors to feel the need to continuously seek unique and better ways to meet the needs of customers. Such a context typically requires active rivalry among firms competing in the same jurisdiction.

Support for upgrading is provided by the abundant supply of *factor (input) conditions*, including basic factors such as natural resources and capital resources, as well as advanced and specialized factors such as scientific infrastructure and pools of specialized labour. As countries become more advanced, the quality of their microeconomic business environments is increasingly determined by advanced and specialized factors (e.g. research universities) rather than basic factors (e.g. raw material supply) because the basic factors can be readily purchased from abroad. Finally, support for upgrading is enhanced by the presence of high quality *related and supporting industries*. Clusters of such industries can help competing firms innovate and create more unique ways of meeting customer needs without needing to make all the investments themselves.

The four features work together in a self-reinforcing dynamic to drive the clustering of industries. The presence of demanding and sophisticated customers encourages the formation of multiple local rivals. The presence of a number of local rivals encourages the local establishment and growth of supplier industries and other related industries. The presence of local rivals and supplier industries spurs the creation of specialized local infrastructure and educational institutions. These in turn help the local rivals innovate and upgrade their capacity to serve the local customers even better, spurring even more sophisticated demand.

A Summary of Productivity & Competitiveness Issues

Despite being well-positioned in North America, Ontario's prosperity and economic progress is not what it could be. Initial evidence suggests that Ontario does not provide a sufficiently good environment for innovation and upgrading to underpin a high and rising standard of living.

To close the GDP per capita gap between Ontario and the leading U.S. states, Ontario needs to increase both *effectiveness* and *utilization*. Improving *effectiveness* will make Ontario more competitive.

Cluster theory argues that improved *utilization* will follow as the result of increased *effectiveness* because the growth provided through increased trade will generate more, highly productive jobs.

Thus, investments in innovation and upgrading produce higher productivity per hour worked – which drives competitiveness – and these two combine to drive economic progress. 1

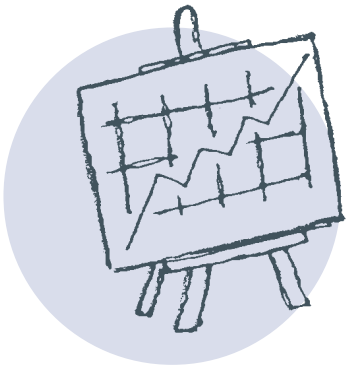
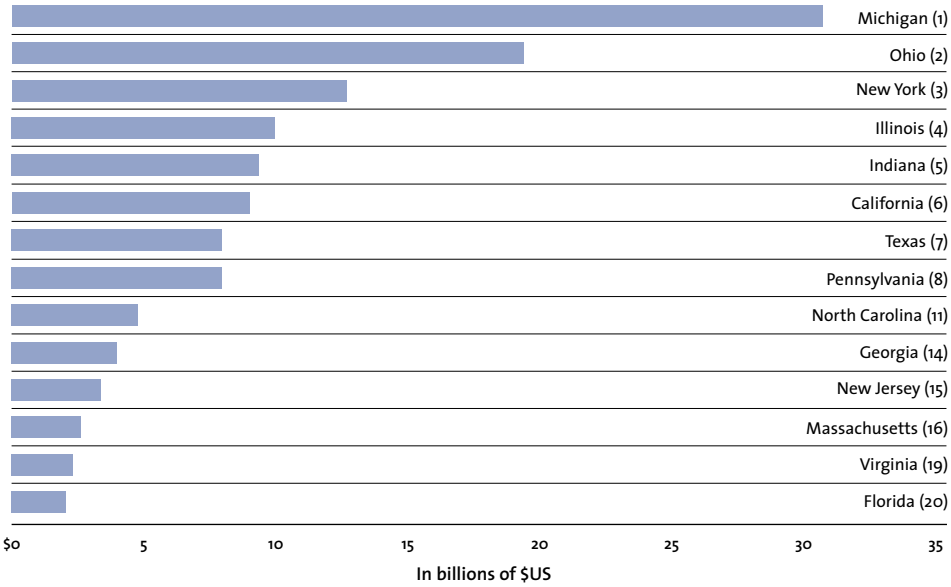


Figure 6: Imports to Ontario From Selected U.S. States (2000)

In rank order



Source: Armbrister, A. and Meyers, D. (2002). *United States-Canada-Mexico Fact Sheet On Trade, Migration and Border Crossings.* Washington: Migration Policy Institute.

Clusters of Innovation

Trade among regions was traditionally understood as being motivated by the advantage one region had in producing particular goods or services over another. The primary source of advantage was thus the resources that a region had in abundance and the region's ability to offer them to other regions at a competitive price. However, advantages that are predominantly determined by a region's natural resource endowments are not always sustainable.

As discussed in the previous section, strategies of innovation and upgrading are more successful in achieving competitive advantage. The idea that a region can succeed without an abundant endowment of natural resources has been around since David Ricardo theorized that even if Portugal can produce wine and cloth cheaper than England, productivity and economic results in both countries are maximized when Portugal focuses on wine and England on cloth because of the two countries' comparative advantages in these commodities.

A more recent example is Japan's success in consumer electronics, such as televisions, and video cameras, despite a lack of any specific endowment for competitive advantage. Local firms operating in Japan's domestic marketplace of sophisticated customers and strong local rivals responded by investing continuously in innovation and upgrading. This relentless pursuit of unique product and process advantages resulted in international competitive advantage.

Important themes for regional competitiveness identified by Michael Porter at the recent U.S. National Clusters of Innovation meeting in Washington D.C.[7] can be summarized as follows:

- the most important sources of prosperity are created not inherited;
- productivity does not depend on what industries a region competes in but on how it competes;
- the prosperity of a region depends on the productivity of all its industries; and
- innovation is vital for long-term increases in productivity.

More recent work on regional innovation systems supports the view that local synergies amongst firms, suppliers, consumers, producers, employees, and university researchers are important. A group of Canadian researchers, the Innovation Systems Research Network (ISRN), is examining how these interrelationships between institutions assist in the process and diffusion of innovation. Of particular interest is the influence of geography on creating and sustaining these links.[8]

There is thus a broad and growing consensus that an understanding of the clustering of traded industries provides a valuable framework for the evaluation of a region's competitive advantage.

Results from the U.S. Cluster Mapping Project

When industries are divided between those in clusters of traded industries, in which more intensive innovation and upgrading occurs, and local industries, in which the forces for upgrading are muted and the possibilities of expanding by selling outside the region are limited, the traded cluster industries are seen to have distinctly higher levels of innovation (patents), productivity and wages.

[7] For complete conference proceedings, visit: http://www.compete.org/innovate/conference_index.html
[8] For more information about ISRN, visit: http://www.utoronto.ca/isrn/

Box 2: The U.S. Cluster Mapping Project

The Cluster Mapping Project, led by Professor Michael Porter of the Institute for Strategy and Competitiveness, Harvard Business School, has assembled a detailed picture of the location and performance of industries in the United States, with a special focus on the linkages or externalities across industries that give rise to clusters.

The primary source of data for this project is the U.S. County Business Patterns database. This database contains a wealth of information on employment, establishments, and wages for all industries with the exception of the agricultural and government sectors. The database is exhaustive in its geographic coverage of the U.S. with statistics at the state and county level.

Using this database, industries were separated into "traded" and "local" based on the degree of industry dispersion across areas. Local industries are typically present in most geographic areas and primarily serve the local market. Traded industries are those that are typically concentrated in specific geographic areas and sell to markets beyond their local region.

Among traded industries, clusters were identified using the correlation of industry employment across geographic areas. The principle is that industries normally located together are those that are linked by some external economies. This externality is reflected in the degree to which the occurrence of groups of industries in particular geographic areas is correlated. Industries that are highly correlated constitute clusters[9]. Within clusters, groups of industries whose correlation is particularly strong are identified as sub-clusters. Sub-clusters can be "narrow" or "broad" depending on the degree of their correlation and their importance to the cluster. Narrow sub-clusters and the industries comprising them are components that most strongly define the cluster and can be regarded as the core of the cluster. Narrow sub-clusters are unique and can only be associated with one cluster in this capacity. Broad sub clusters and the industries comprising them can be part of more than one sub-cluster and are thought to be supporting or peripheral industries.

Using these definitions, the Cluster Mapping Project has identified 41 clusters of traded industries.

[9] For more information on the Cluster Mapping Project, see: http://www.isc.hbs.edu

Clusters of US Traded Industries

Upstream Materials and Products

- Metals and Materials
  - Construction Materials
  - Metal Manufacturing
- Forest Products
  - Forest Products
- Petroleum/Chemicals
  - Oil and Gas
  - Chemical Products
  - Plastics
- Semiconductors/Computer
  - Information Technology

Industrial and Supporting Functions

- Multiple Business
  - Education and Knowledge Creation
  - Business Services
  - Heavy Machinery
  - Financial Services
  - Motor-Driven Products
  - Prefabricated Enclosures
  - Production Technology
  - Analytical Instruments
  - Heavy Construction Services
- Transportation and Logistics
  - Automotive
  - Distribution Services
  - Transportation and Logistics
- Power
  - Power Generation
  - Power transmission and Distribution
- Office
  - Publishing and Printing
- Telecommunications
  - Communications Equipment
- Defense
  - Aerospace Engines
  - Aerospace Vehicle and Defense

Final Consumption Goods and Services

- Food/Beverages
  - Agricultural Products
  - Processed Food
  - Fishing and Fish Products
- Housing/Household
  - Building Fixtures, Equipment & Services
  - Lighting and Electrical Equipment
  - Furniture
- Textiles/Apparel
  - Textiles
  - Apparel
  - Footwear
- Health Care
  - Medical devices
  - Pharmaceuticals and Biotechnology
- Personal
  - Sporting and Leather Goods
  - Jewelry and Precious Metals
  - Tobacco
- Entertainment
  - Entertainment
  - Hospitality and Tourism

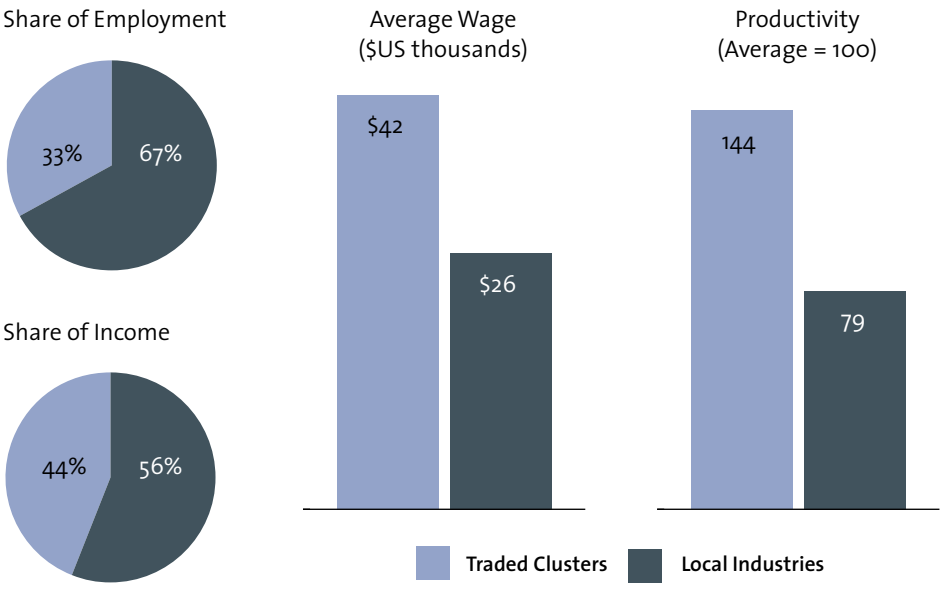
Source: Porter, Cluster Mapping Project, Institute for Strategy and Competitiveness, Harvard Business School

Regions in which there is an above average level of employment in clusters of traded industries tend to be more competitive, productive and prosperous than other regions. Results from the Cluster Mapping Project show that for the U.S. as a whole, although employment in traded clusters amounted to 33 per cent of total employment, they commanded 44 per cent of income, and productivity was found to be 82 per cent higher in traded clusters than in the local economy.

Traded clusters provide opportunities for growth and utilization that surpass those in the local economy. In addition, the presence of traded clusters in a region has a spill-over effect and they typically generate opportunities for increased success of the local economy. The "tide" of traded clusters raises the prosperity level for both local and traded industries and everyone benefits. Evidence presented at the National Clusters of Innovation meeting in 2001, showed a high correlation between traded cluster and local industry wages, implying that the high wages associated with traded clusters positively influence wages for those in local industries in the same region.

The urban nature of clusters is inherent in the U.S. methodology, and a synopsis of recent research on urban issues is provided in Box 3. l

Figure 7: Results from the U.S. Cluster Mapping Project (1999)



Source: Porter, Cluster Mapping Project, Institute for Strategy and Competitiveness, Harvard Business School
Note: Productivity based on 1997 data.

Box 3: The Growing Importance of Cities

Ontario's cities are growing both in size and density (see Table 3 below). The 1996 Canadian Census found that 62 per cent of Canadians lived in the country's urban areas (Gertler, 2000).

According to the recently released 2001 census, just over 64 per cent of Canada's population, or about 19 million people, lived in the nation's urban areas.[10]

This increase in density is indicative of a global trend toward urban living, a trend that has attracted much recent attention from policy-makers and researchers.

Cities are emerging as an increasingly important geographic entity, making national and provincial or state boundaries less significant than regional boundaries in some cases.

Contrary to popular belief, new information and communications technologies (ICTs) are making geographic location more important, not less. While ICTs allow for the exchange of knowledge without regard for time or space, it is increasingly apparent that where firms are located (particularly in relation to each other) affects economic outcomes for a region.

The globalizing forces of ICTs are changing the way that economies work, with more emphasis now being placed on the city. This has particular importance for the way federal, provincial, and municipal governments work together. Policy researcher Thomas Courchene asserts that there is a "reshuffling" of government responsibilities because, in part, "Nation states have become too large to tackle the small things in life and too small to tackle the large things" (Courchene, 2000, p. 17).

[10] For more information about how Statistics Canada measures urban areas, please see Box 4 (Page 34).

Table 3: Changes in Population Density in Ontario's Urban Areas

CMA	Population in 2001 ('000s)	Population Density (Persons per km² 2001)	Growth in Population Density 1996 – 2001 (% change)
Hamilton	662.4	483	4.8
Kitchener	414.3	501	7.2
London	432.5	185	-2.2
Oshawa	296.3	328	8.4
Ottawa – Hull	806.1	246	14.0
St. Catharines – Niagara	377.0	268	0.8
Sudbury	155.6	44	-39.6
Thunder Bay	122.0	47	-14.2
Toronto	4,682.9	793	8.4
Windsor	307.9	301	-7.4

Note: For a complete definition of the CMA as a geographic entity, see the glossary.
Source: 1996 Census, 2001 Census, Statistics Canada

The Growing Importance of Cities cont'd.

This trend has not been met by changes to patterns of governance, however. Geographer Meric Gertler writes that as urban areas become increasingly important economically, they have become relatively less potent politically. As Gertler writes, "[G]iven the already established centrality of cities to the current and future prosperity of the country, then all the great social policy questions of the day – education, health, poverty, housing and immigration – become urban policy questions" (Gertler, 2000, p. 128).

Focusing on the "micro" level of government allows for nimble and specific policymaking. There is a recognition of this shift among policymakers, as is evident in Ontario's recently announced "Smart Growth Panels," which aim to improve local economies, transportation and environments.

Increasing urbanization is a positive portent for the province's economic prosperity, in that it has been linked to economic growth in several ways.

The Benefits of Urbanization

There are positive economic spin-offs from urbanization. Clusters of traded industries, located in and around urban areas, share in these benefits.

The critical factor in reaping the benefits of urbanization is not simply "more people," but more density. A high-density neighbourhood costs less to maintain than a low-density one. Compare the dense inner city with the less dense suburban neighbourhood: less land is used to support the same amount of people; and relatively less tax money must be spent to extend roads, sewers, and other infrastructure for use by the same number of people (Slack, 2002).

A high-density neighbourhood has a further economic benefit in that it becomes the centre of both commerce and community. Increased density allows for a pedestrian culture – an essential component to a thriving urban economy, according to urban theorist and Toronto resident Jane Jacobs. A dense urban area includes an optimal mixture of high-rise apartments, townhouses, store-front businesses, office buildings and other services. However, dense neighbourhoods need not be confined to cities either: Main Street was once the core of every small town, where businesses were the locus of social interaction.

Dense neighbourhoods become micro-cities where economic and social activities intermingle. The natural blending of economy and society is one of the reasons dense neighbourhoods are more conducive to economic growth. When commerce and community coalesce, conditions are ripe for harnessing the full potential of social relationships for economic benefit.

Social Capital, Innovation and Economic Growth

Economic relationships are intertwined with social relationships. Economic researchers have begun to borrow from sociological perspectives to understand how social relationships affect economic growth.

This borrowing gave rise to the notion of social capital, defined as the social networks and norms that facilitate collective action. A region with a high degree of social capital is likely to support effective collaboration between customers and suppliers (and even between competitors). Social networks tend to be conducive to shared ideals, norms, and values, fostering a sense of trust and thereby facilitating economic activity. Trust lubricates the gears of the economic engine. Social

"capital," therefore, is an important input in economic growth and the concept correlates well with our understanding of what drives the clustering of industries.

Urbanization, Innovation and Economic Growth

One factor that has been linked to density growth is the percentage of foreign-born residents. An area with a high number of immigrants tends also to be an area with high density (Fulton et al, 2001).

In addition to encouraging commercial activity, increased urbanization has been linked to innovation and innovative people are highly mobile people (Smith, K., 2001).

As owners of sought-after skills, innovative people choose where to live, some theorists argue, based on the cultural diversity of the region. Indeed, innovation has been linked to high numbers of foreign-born residents and of musicians and actors, as well as to high levels of tolerance for diversity (Florida, 2001).

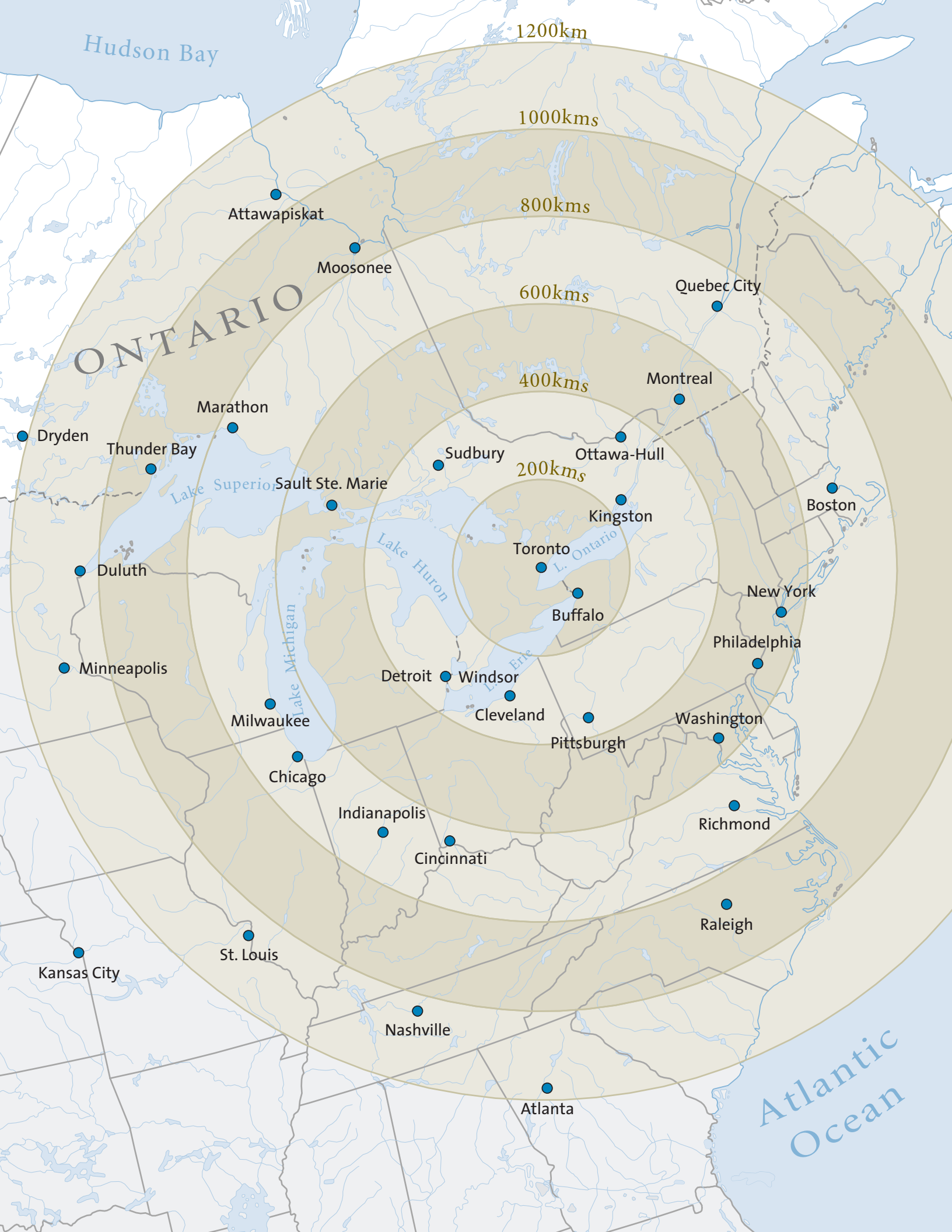
Ontario's cities, with their high rates of immigration and cultural diversity are ripe for this growth that fosters innovation. Toronto, in fact, has the highest number of foreign born residents, 42 per cent, of any urban area in all of North America (Gertler, 2000).

Cities themselves have been identified as centres of learning. Innovation has been found to be fundamentally a geographic phenomenon, in part because innovation relies on the exchange of tacit, rather than codified knowledge. A "learning region" is conducive to innovation and cities, with their sheer volume of people and events, are likely centres of innovation (Wolfe, 2001).

Table 4: The Immigrant Population Ontario's Urban Areas (1996)

CMA	Immigrant Population 1996	Immigrants as a Percentage of Total Population
Hamilton	145,660	24%
Kitchener	82,760	22%
London	75,975	19%
Oshawa	148,065	20%
Ottawa – Hull	44,110	17%
St. Catharines – Niagara	67,290	18%
Sudbury	12,030	8%
Thunder Bay	15,275	12%
Toronto	1,772,905	42%
Windsor	56,995	21%

Source: 1996 Census, Statistics Canada


Hudson Bay
1200km
1000kms
800kms
600kms
400kms
200kms
ONTARIO
Attawapiskat
Moosonee
Quebec City
Montreal
Marathon
Dryden
Thunder Bay
Sudbury
Ottawa-Hull
Lake Superior
Sault Ste. Marie
Kingston
Boston
Toronto
L. Ontario
Lake Huron
Duluth
New York
Buffalo
Philadelphia
Minneapolis
Detroit
Windsor
L. Erie
Lake Michigan
Cleveland
Milwaukee
Pittsburgh
Washington
Chicago
Indianapolis
Richmond
Cincinnati
Raleigh
St. Louis
Kansas City
Nashville
Atlanta
Atlantic Ocean

Ontario's Clusters

Ontario's Clusters

This paper reports the preliminary results of the application of the U.S. Cluster Mapping Project methodology to Canada and Ontario. The analysis was conducted using the cluster definitions developed by the Cluster Mapping Project at the Institute for Strategy and Competitiveness, Harvard Business School (see Box 2, page 19). These definitions will allow us to benchmark Ontario's traded clusters with those the Council on Competitiveness identified in the U.S. The U.S. Cluster Mapping Project provides us with a rich data set of state and MSA cluster statistics for comparison. Although the U.S. analysis was conducted using 1999 data and the analysis for Ontario was conducted using 2000 data, the comparative analysis is still considered to be relevant.

Share of Employment in Traded Clusters

Observing the share of employment in traded clusters provides insight into the industrial composition of a region and its capacity for innovation, competitiveness and the creation of well-paid jobs. Our initial results show that Canada and Ontario have a higher share of employment in traded clusters than the U.S. However, unlike the U.S. analysis, the Ontario analysis does not include any wage or patent data and therefore it is not yet possible to confirm the full set of correlations between traded clusters, wages and patents observed in the U.S. In addition, before too much significance is accorded to the exact percentages, further analysis is needed to assess the implications of differences in public and private sector employment patterns in Canada and the U.S.[11]

The initial finding that Ontario has a high proportion of employment in traded clusters is encouraging but also mystifying because it suggests that the context for traded clusters in Canada may differ in some respects from that in the U.S. We need to understand why this is so and if indeed Ontario's traded clusters have lower productivity than similar clusters in the U.S.

In following up on these initial results we will be seeking indicators that allow us to monitor and measure Ontario's clusters so that we can understand the wage and productivity patterns associated with Ontario's clusters as compared with those in the U.S.

The fact that Ontario and Canada appear to have a higher proportion of employment in traded clusters may be attributed to the fact that our economies are much more open to international trade. Another reason could be that Ontario's smaller domestic markets may not be able to support their local industries to the same degree that larger U.S. markets are able to support their local industries.

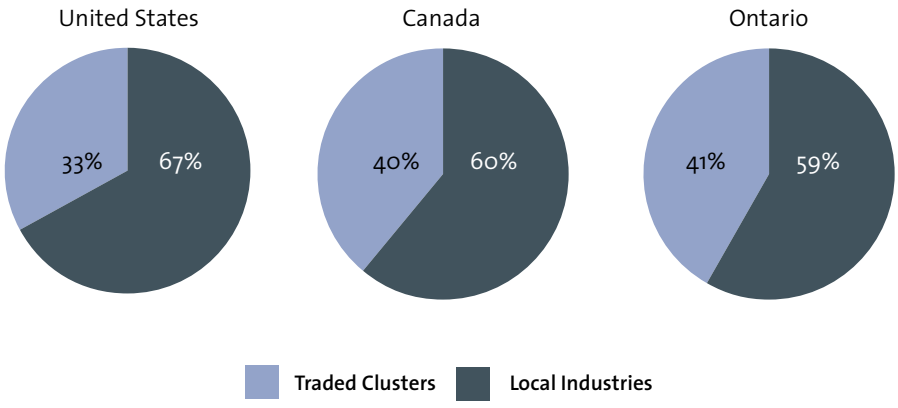
We need to know what traded clusters Ontario has, where they are located, and we want to understand what it is about Ontario's clusters that has not led to a better productivity ranking for the province.

Benchmarking Ontario's Clusters

Our preliminary results identifying relative size of Canada and Ontario's traded clusters are shown in Table 5 along with the U.S. data. The share of employment in each traded cluster relative to employment in all 41 traded clusters is shown in order to convey the relative importance of each cluster in the three jurisdictions. The cluster rank within each jurisdiction is included and the clusters are ordered in relative size for Ontario.

The Automotive cluster is one of the "top ten" by employment in both the U.S. and Canada. Not surprisingly Ontario's Automotive cluster employment, ranking as the provinces's 3rd highest, stands out as being significantly above the national average. Related to this is the fact that Metal Manufacturing is a top ten cluster for Ontario (6th) and the U.S. (8th) but is only the 11th largest for Canada. The significance of this and other similarities between Ontario and selected U.S. states will inform our work going forward.

Figure 8: Share of Employment in Traded Clusters



Source: Canadian Business Patterns, Cluster Mapping Project, Institute for Strategy and Competitiveness, Harvard Business School

[11] These data were derived from the Canadian Business Patterns database. Additional analysis will be posted on the Institute's Web site available at: http://www.competeprosper.ca

Table 5: Employment Share and Rank of Traded Clusters U.S. (1999), Canada and Ontario (2000)

	United States		Canada		Ontario	
	SHARE	RANK	SHARE	RANK	SHARE	RANK
Business Services	12.46%	1	12.86%	1	13.50%	1
Financial Services	8.50%	2	10.24%	2	10.47%	2
Automotive	3.80%	10	4.15%	9	7.27%	3
Education and Knowledge Creation	6.31%	4	7.02%	4	6.62%	4
Hospitality and Tourism	7.30%	3	7.27%	3	5.89%	5
Metal Manufacturing	4.08%	8	3.53%	11	5.43%	6
Transportation and Logistics	4.58%	7	5.63%	5	4.83%	7
Distribution Services	5.48%	5	4.19%	7	4.50%	8
Heavy Construction Services	5.31%	6	5.33%	6	4.24%	9
Publishing and Printing	2.81%	12	3.42%	12	3.88%	10
Processed Food	4.02%	9	4.16%	8	3.84%	11
Entertainment	2.89%	11	3.72%	10	3.51%	12
Building Fixtures, Equipment and Services	1.89%	18	2.32%	13	2.51%	13
Production Technology	1.99%	16	1.68%	18	2.20%	14
Jewelry and Precious Metals	0.45%	36	1.71%	17	1.86%	15
Information Technology	2.47%	14	1.67%	19	1.84%	16
Forest Products	1.15%	26	1.79%	16	1.44%	17
Heavy Machinery	1.22%	25	1.40%	20	1.40%	18
Plastics	2.53%	13	1.01%	24	1.37%	19
Apparel	1.82%	19	1.93%	15	1.34%	20
Communications Equipment	1.28%	21	1.01%	25	1.29%	21
Chemical Products	1.30%	20	0.91%	26	1.09%	22
Agricultural Products	0.82%	31	1.34%	21	0.87%	23
Furniture	1.09%	27	1.29%	22	0.82%	24
Motor-Driven Products	1.24%	24	0.87%	27	0.80%	25
Analytical Instruments	2.17%	15	0.59%	33	0.76%	26
Medical Devices	1.97%	17	0.63%	30	0.71%	27
Textiles	1.25%	22	0.79%	28	0.68%	28
Power Generation	0.78%	32	0.68%	29	0.65%	29
Pharmaceuticals and Biotechnology	0.75%	33	0.53%	34	0.64%	30
Oil and Gas	1.05%	28	2.27%	14	0.64%	31
Lighting and Electrical Equipment	0.98%	29	0.47%	35	0.61%	32
Prefabricated Enclosures	0.93%	30	0.60%	32	0.59%	33
Aerospace Vehicles and Defense	1.24%	23	0.62%	31	0.50%	34
Construction Materials	0.59%	35	0.38%	37	0.37%	35
Leather and Sporting Goods	0.59%	34	0.38%	36	0.34%	36
Power Transmission and Distribution	0.24%	38	0.17%	38	0.24%	37
Aerospace Engines	0.29%	37	0.15%	39	0.13%	38
Footwear	0.08%	41	0.12%	40	0.13%	39
Tobacco	0.13%	40	0.09%	41	0.10%	40
Fishing and Fishing Products	0.15%	39	1.08%	23	0.08%	41

Note: U.S. statistics based on Cluster Mapping Project 1999 data, Note: Canadian statistics based on CBP June 2000 data

Table 6: Share of Employment in Technology Clusters

Technology Cluster	California	Massachusetts	United States	Illinois	Ontario	Canada	Michigan	Alberta
Information Technology	5.44%	4.51%	2.47%	1.38%	1.84%	1.67%	0.67%	1.34%
Communications Equipment	2.10%	2.88%	1.28%	2.20%	1.29%	1.01%	0.30%	0.53%
Medical Devices	2.47%	2.91%	1.97%	2.40%	0.71%	0.63%	1.34%	0.21%
Pharmaceuticals and Biotechnology	0.70%	0.59%	0.75%	0.62%	0.64%	0.53%	0.70%	0.17%
Aerospace Vehicles and Defense	2.45%	0.01%	1.24%	0.25%	0.50%	0.62%	0.21%	0.14%
Aerospace Engines	0.12%	0.70%	0.29%	0.11%	0.13%	0.15%	0.15%	0.04%
	13.26%	**11.59%**	**8.00%**	**6.96%**	5.12%	**4.60%**	**3.37%**	**2.42%**

Note: U.S. statistics based on Cluster Mapping Project 1999 data Note: Canadian statistics based on CBP June 2000 data

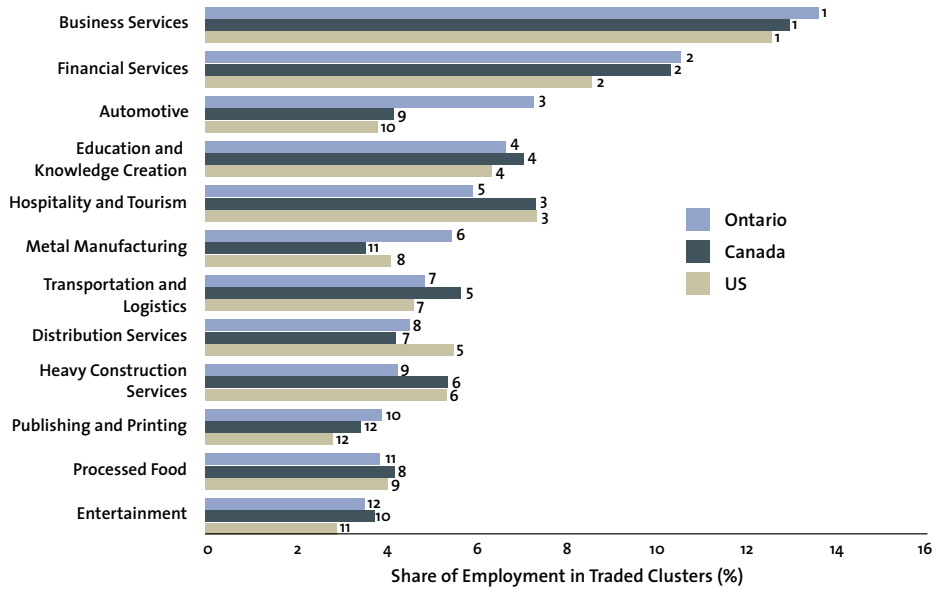
It is important to note that most traded clusters are not "high technology" clusters. For example, in the U.S. ranking, Information Technology, the first cluster of what would generally be considered to be a "high technology industry," only enters the table in 14th rank. Information Technology is also the highest ranking technology cluster for Ontario (16th) and Canada (19th). In the U.S. "high technology" clusters account for 8 per cent of traded cluster employment, whereas in Canada the comparable figure is only 4.6 per cent.

Ontario's relative strength in the technology-intensive clusters is shown above in Table 6. A familiar pattern emerges: Ontario is a leader in Canada but only an average player when compared with the U.S.

California and Massachusetts, two states that are leaders in overall productivity ranking, are both technology cluster intensive: Michigan and Ontario, with lower overall productivity have lower technology cluster intensity.

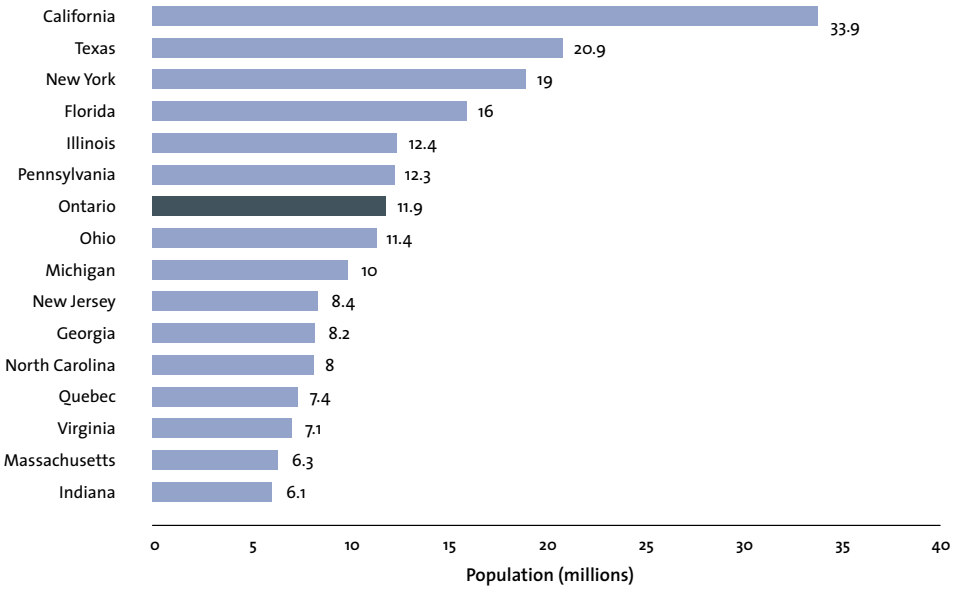
Figure 9: Ontario's Leading Clusters Relative to Canada and the US

Traded Cluster (Rank in Ontario, Rank in Canada, Rank in US)



Source: Canadian Business Patterns, Cluster Mapping Project, Institute for Strategy and Competitiveness, Harvard Business School

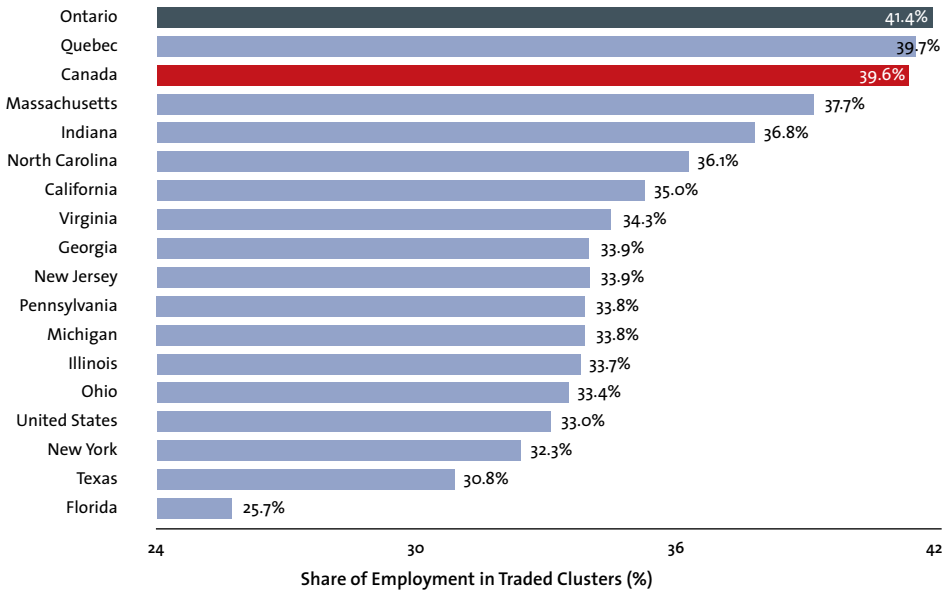
Figure 10: North America's Most Populous 16 States and Provinces



Source: Census 2000 (U.S. Census Bureau), 2001 Census (Statistics Canada)

Figure 11: Share of Employment in Traded Clusters

Canada, United States, Selected Provinces and States



Source: Canadian Business Patterns, Cluster Mapping Project, Institute for Strategy and Competitiveness, Harvard Business School

Alberta's high productivity does not correlate to its technology cluster intensity. This can be explained, however, because Alberta's resource industries have high relative labour productivity due to their high capital intensity.

The Pharmaceuticals and Biotechnology cluster stands out as the only technology-intensive cluster in which Ontario has a comparable employment weighting to any of the major states listed.

Ontario in a North American Context

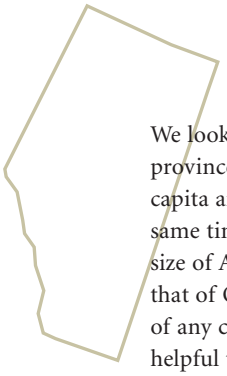
The average population of U.S. states is 5.5 million, well below that of Ontario (11.7 million). However, the U.S. states are diverse in composition and vary in population from under half a million for Wyoming to 34 million for California. If Ontario were to be ranked in population among the U.S. states, it would rank seventh, bounded by Pennsylvania above and Ohio below. Ontario's closest sister provinces in population size, Quebec and British Columbia would rank 13th and 27th, respectively (see Figure 10).

For the purposes of this analysis we will primarily focus on states and provinces with populations of over 6 million. This allows us to observe the diversity of the North American economy while minimizing data anomalies that might arise from small sample sizes.

In some cases we focus our attention on three states (Illinois, Massachusetts and Michigan) which between them include one state that is similar in traded cluster composition (Illinois), one neighbouring state with strong trade links to Ontario (Michigan), and one leading state that differs significantly from Ontario in its traded cluster composition (Massachusetts). Each offers the potential for insights relevant to our interest in monitoring and measuring Ontario's economic progress.

Looking at the selected states and provinces, we find the distribution of employment in traded clusters varies significantly across regions from 26 per cent in Florida to 41 per cent in Ontario (see Figure 11).

A Closer Look at Alberta



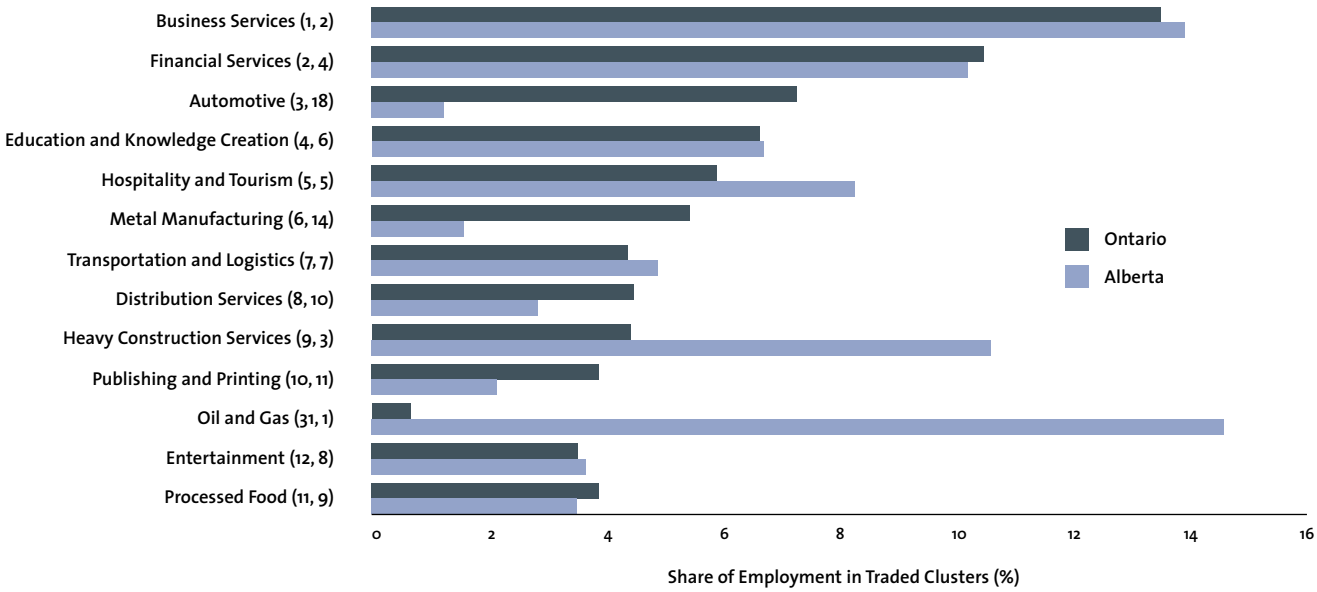
We look at Alberta because it is the leading province in Canada in terms of GDP per capita and productivity (*effectiveness*). At the same time we note that the relatively small size of Alberta's population (only one quarter that of Ontario) may limit the significance of any comparative data. Nonetheless it is helpful to seek insight from a comparison of Ontario and Alberta's mix of leading clusters by employment.

The most significant difference between the composition of the top ten clusters in Ontario and Alberta is the relative importance of the Oil and Gas and the Heavy Construction clusters for Alberta which account for 14.6 and 10.6 per cent of traded cluster employment respectively. Given Alberta's natural strength in the industry, this observation is expected. A second notable feature is that Alberta's share of "high technology" clusters is well below that of the Canadian average and among our comparison states. Overall, the similarities between Alberta and Ontario are striking – the two provinces have in common 7 out of 10 top ten clusters and at 39.7 per cent Alberta matches Quebec and ranks close behind Ontario in terms of share of employment in traded clusters.

Alberta's high labour productivity ranking may be due, in part, to the high capital intensity associated with resource-based industries, such as oil and gas (Zietsma et al, 2001). Further analysis will be required to understand whether the higher productivity stems from its different composition of clusters or better performance within like clusters.

Figure 12: Ontario's Leading Clusters Relative to Alberta

Traded Cluster (Rank in Ontario, Rank in Alberta)



Source: Canadian Business Patterns, Cluster Mapping Project, Institute for Strategy and Competitiveness, Harvard Business School

A Closer Look at Michigan

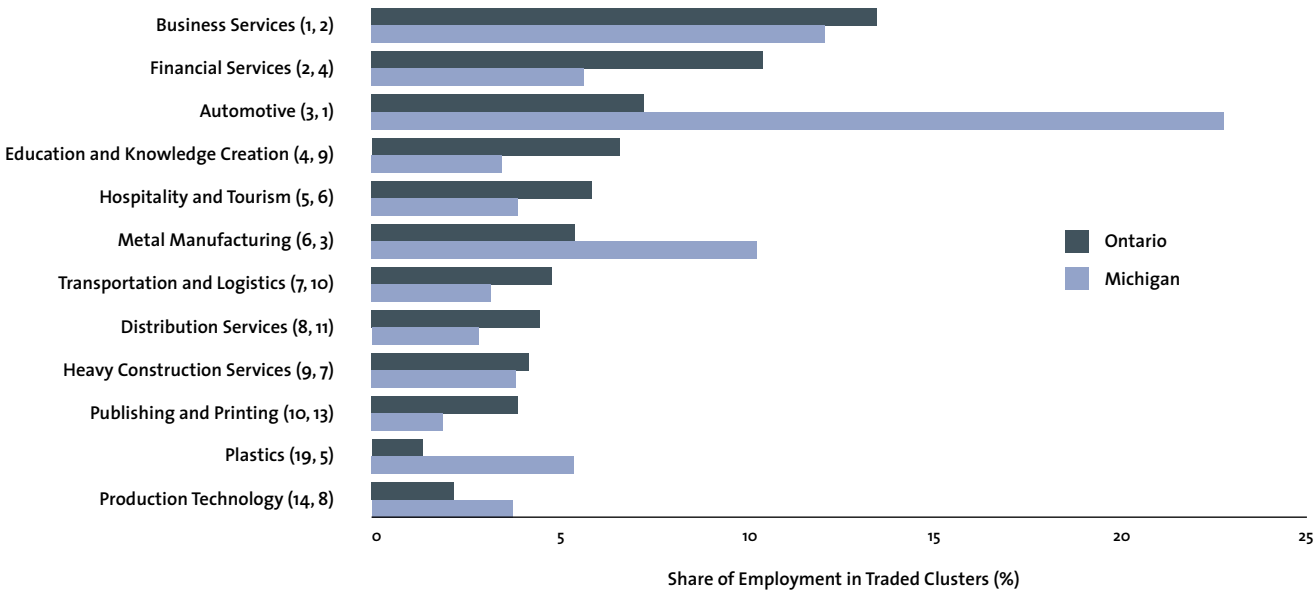
We look at Michigan because it has long been the largest U.S. exporter to Canada and Ontario's leading trading partner. Michigan and Ontario both have strong automotive industries and share relatively low overall productivity.

Not surprisingly, as shown in Figure 13, Michigan's largest cluster is Automotive which accounts for 22.8 per cent of its traded cluster employment. In comparision Ontario's Automotive cluster accounts for 7.3 per cent of traded cluster employment and is the 3rd largest in the province.

Just as Alberta relies heavily on Oil and Gas, Michigan is heavily reliant on its Automotive cluster. Both profiles reveal the greater diversity of the Ontario economy and allow us to compare and contrast Ontario with jurisdictions that rely heavily on one traded cluster.

Figure 13: Ontario's Leading Clusters Relative to Michigan

Traded Cluster (Rank in Ontario, Rank in Michigan)



Source: Canadian Business Patterns, Cluster Mapping Project, Institute for Strategy and Competitiveness, Harvard Business School

A Closer Look at Massachusetts

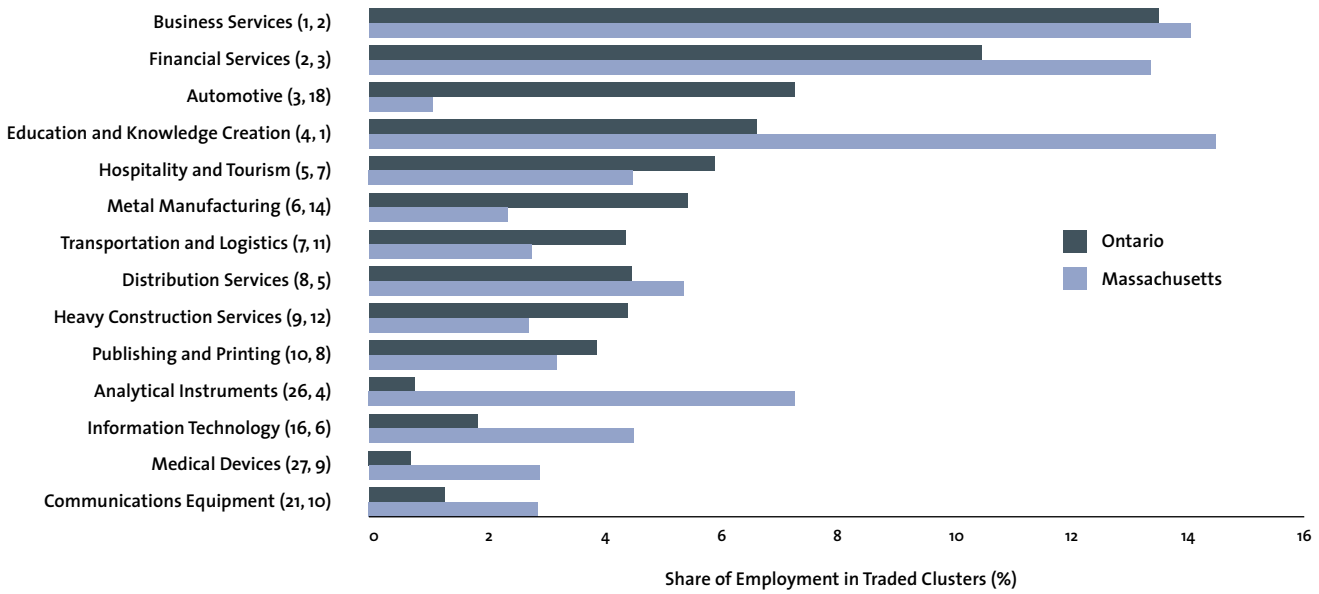
We look at Massachusetts as a leading jurisdiction, ranked third in North America in terms of productivity (among those states with a population of over six million). Notable features are the tremendous strength of the Education and Knowledge Creation cluster as well as the "high technology" clusters. The value of ongoing comparisons with Massachusetts is that this state has an outstanding monitoring and measurement capability for its innovation system and should provide opportunities to evaluate many of the features associated with the importance of intellectual and social capital.

Since 1997, the Massachusetts Technology Collaborative[12] has published its Innovation Index. With each new report, the Collaborative has refined its approach and expanded its coverage. The report now includes updates on nine key industry sectors, as well as detailed reports on the performance of particular state regions. The state now has a wealth of both quantitative and qualitative data, collected over time, which has spurred a number of initiatives. The Index identified gaps in, for example, high-speed Internet access to the state's non-urban regions. The MTC has used this data to facilitate a public-private partnership to extend affordable high-speed access to non-urban regions.

One interpretation of the Massachusetts data is that the state is strong in a group of clusters with high productivity in contrast to Ontario, whose strengths appear to be in less strongly aligned clusters with relatively lower productivity. If true, this might be due to one or more of several attributes of Ontario clusters such as: being narrower in scope and thus lacking robust support systems; or their suffering from government regulation that reduces competitive pressure.

Figure 14: Ontario's Leading Clusters Relative to Massachusetts

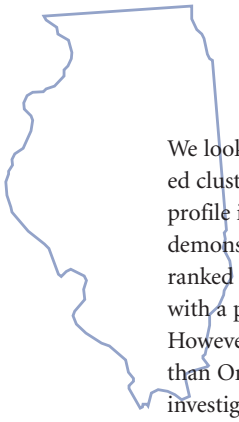
Traded Cluster (Rank in Ontario, Rank in Massachusetts)



Source: Canadian Business Patterns, Cluster Mapping Project, Institute for Strategy and Competitiveness, Harvard Business School

[12] For more information about the Collaborative, visit: http://www.mtpc.org/

A Closer Look at Illinois



We look at Illinois because its pattern of traded clusters mimics to a considerable degree the profile in Ontario but at the same time demonstrates significantly higher productivity, ranked 5th in North America (among states with a population of over six million). However, Illinois is significantly more urban than Ontario and offers an opportunity to investigate the dynamics of a big city (Chicago) on the state's overall competitiveness. Chicago, as the United States' third largest urban area, is a driving force behind Illinois's economic activity.

The City of Chicago has implemented land development policies that aim to capitalize on the density of its urban areas. As part of its urban Capital Improvement Programs, the city has included improvements to the natural environment along with its plans for new roads, sewage and other traditional municipal projects.

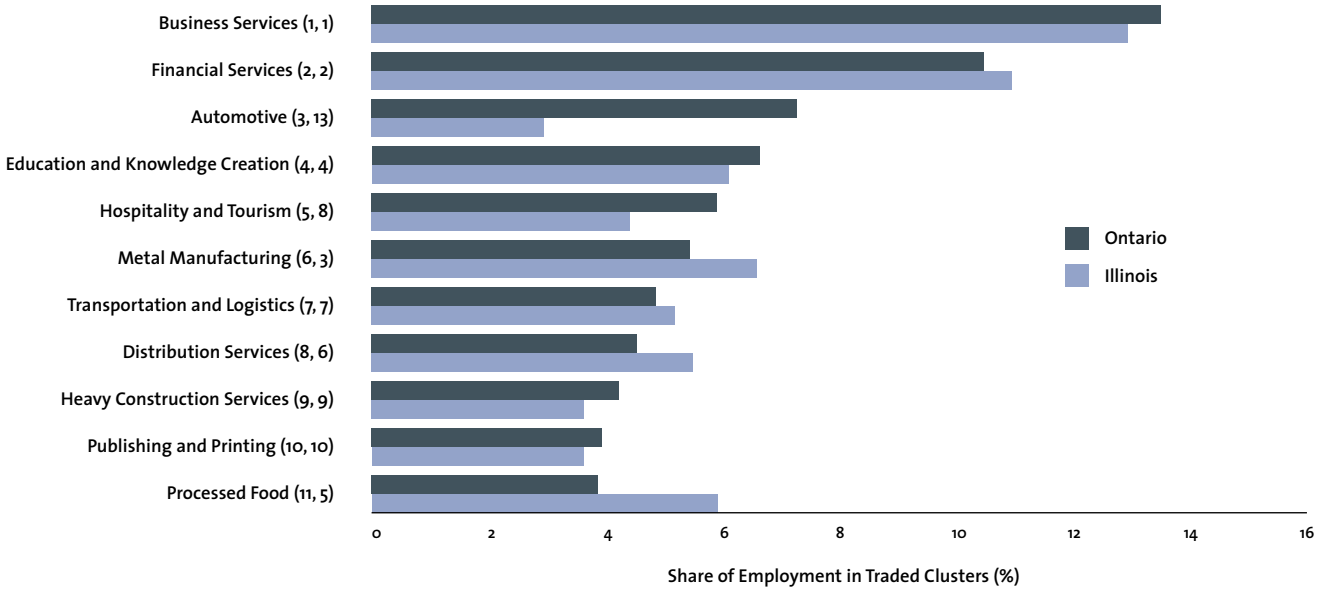
The CitySpace Plan, a strategic plan for urban development released in 1995, created the goal of adding 1300 acres of open land to Chicago's dense neighbourhoods by 2005. The plan aims to revitalize the city's famous riverfront by creating green spaces and walking trails, to turn vacant lots into gardens and community parks, and to replace school asphalt playgrounds with rolling hills and natural grasslands.

Chicago's CitySpace project is supported by a concurrent state policy initiative called Illinois First. The state government directly funds urban infrastructure projects, which include creating public green spaces, throughout the state. The funding for this project of statewide urban renewal comes from a special fund the state created for this purpose.

The above province-to-state comparisons suggest opportunities for further analysis but do not offer any immediate answers to the underlying issues. Accordingly, we need to explore the next level of disaggregation of the data by looking at examples of individual clusters and city regions.

Figure 15: Ontario's Leading Clusters Relative to Illinois

Traded Cluster (Rank in Ontario, Rank in Illinois)



Source: Canadian Business Patterns, Cluster Mapping Project, Institute for Strategy and Competitiveness, Harvard Business School

Box 4: MSAs and CMAs

Metropolitan Statistical Areas and Census Metropolitan Areas

To understand the engines of economic growth is to understand the dynamics of urbanized areas. From a practical standpoint, this requires a geographic definition that is derived more by data collection practices than traditional notions of what entails "a place."

In this study, we typically use Statistics Canada's definitions of areas, in particular, the Census Metropolitan Area (CMA). A CMA is a large urban area that includes what most people understand as downtown, residential areas, as well as the suburbs. Toronto, for example, includes downtown Toronto as well as the communities of Vaughan, Newmarket and Uxbridge (for more information on CMAs and their components, see Table 7 below, and a complete definition of CMAs in the glossary).

There are 27 CMAs across Canada and 11 of those CMAs are in Ontario.[13]

The CMA is related to the American equivalent of the city region, the Metropolitan Statistical Area (MSA), which includes either a city of 50,000 people or a geographic area of that has a population of at least 100,000. In 2000, there were 280 defined MSAs across the United States. [14]

Table 7: Ontario's Census Metropolitan Areas and their components

CMA	Components
Hamilton	Ancaster, Burlington, Dundas, Flamborough, Glanbrook, Grimsby, Hamilton, Stoney Creek.
Kitchener	Cambridge, Kitchener, North Dumfries, Waterloo, Woolwich.
London	Belmont, Delaware, Lobo, London, North Dorchester, Port Stanley, Southwold, St. Thomas, West Nissouri, Yarmouth.
Oshawa	Clarington, Oshawa, Whitby
Ottawa-Hull	Aylmer, Buckingham, Cambridge, Cantley, Casselman, Chelsea, Clarence, Cumberland, Gatineau, Gloucester Goulbourn, Hull, Kanata, La Pêche, Masson-Angers, Nepean, Osgoode, Ottawa, Pontiac, Rideau, Rockcliffe Park Rockland, Russell, South Gower, Val-des-Monts, Vanier, West Carleton. (Note: this CMA includes components in Quebec).
St. Catharines	Fort Erie, Lincoln, Niagara Falls, Niagara-on-the-Lake, Pelham, Port Colborne, St. Catharines, Thorold, Wainfleet, Welland.
Sudbury	Nickel Centre, Onaping Falls, Rayside-Balfour, Sudbury, Valley East, Walden.
Thunder Bay	Conmee, Gillies, Neebing, O'Connor, Oliver, Paipoonge, Shuniah, Thunder Bay.
Toronto	Ajax, Aurora, Bradford West Gwillimbury, Brampton, Caledon, East Gwillimbury, East York, Etobicoke, Georgina Georgina Island, Halton Hills, King, Markham, Milton, Mississauga, Mono, New Tecumseth, Newmarket North York, Oakville, Orangeville, Pickering, Richmond Hill, Scarborough, Toronto, Uxbridge, Vaughan Whitchurch Stouffville, York.
Windsor	Anderdon, Belle River, Colchester North, Essex, LaSalle, Maidstone, Rochester, Sandwich South St. Clair Beach, Tecumseh, Windsor.

[13] Kingston, Ontario was recently designated as Ontario's 11th CMA for the 2001 Canadian Census and as such, has very little data currently available. This paper relies on data from Ontario's 10 previously named CMAs.
[14] There are separate MSA definitions for New England states. For more information see: http://www.census.gov/population/www/estimates/aboutmetro.html.

Examples of Ontario's Clusters

Three facets of Ontario's clusters are provided in this section.

First, the adjacent tables provide profiles of the top five clusters of traded industries listed in decreasing order of employment in each of Ontario's ten CMAs.

Second, four of the traded clusters are profiled in terms of the components that make up the cluster and in terms of Ontario's provincial and CMA rankings as compared to all U.S. states and MSAs. The examples provided are for Entertainment, Automotive, Pharmaceuticals and Biotechnology, and Financial Services. In addition we present a view on the productivity of Canada's Information and Communications Technology Sector (which is related to Porter's Information Technology and Communications Equipment clusters) as it compares with its counterparts in the U.S.

Third, we provide two examples that share many of the attributes of clusters of traded industries but which are not identified in the high level classification of 41 traded clusters. Often these entities can be described as "sub-clusters" because they are component parts of the high level clusters. For example, Porter cites the California Wine Cluster as a classic example of a traded cluster. In much the same way individual regions of Ontario provide examples of cluster behaviour that merit our attention. The two examples selected are the emerging cluster in Timmins for Cold Climate Testing, and the Retail Fixtures and Design cluster in the Toronto-Hamilton region.

OTTAWA
1 Business Services
2 Education and Knowledge Creation
3 Financial Services
4 Hospitality and Tourism
5 Communications Equipment

KITCHENER
1 Automotive
2 Education and Knowledge Creation
3 Business Services
4 Metal Manufacturing
5 Processed Food

OSHAWA
1 Automotive
2 Business Services
3 Financial Services
4 Metal Manufacturing
5 Transportation and Logistics

LONDON
1 Financial Services
2 Automotive
3 Education and Knowledge Creation
4 Transportation and Logistics
5 Business Services

TORONTO
1 Business Services
2 Financial Services
3 Distribution Services
4 Transportation and Logistics
5 Publishing and Printing

WINDSOR
1 Automotive
2 Metal Manufacturing
3 Hospitality and Tourism
4 Financial Services
5 Production Technology

HAMILTON
1 Metal Manufacturing
2 Education and Knowledge Creation
3 Business Services
4 Financial Services
5 Processed Food

SUDBURY
1 Education and Knowledge Creation
2 Hospitality and Tourism
3 Heavy Construction Services
4 Financial Services
5 Business Services

ST. CATHARINES
1 Hospitality and Tourism
2 Automotive
3 Metal Manufacturing
4 Education and Knowledge Creation
5 Business Services

THUNDER BAY
1 Forest Products
2 Education and Knowledge Creation
3 Transportation and Logistics
4 Hospitality and Tourism
5 Heavy Construction Services

Source: Canadian Business Patterns, Cluster Mapping Project, Institute for Strategy and Competitiveness, HBS

The Entertainment Cluster

The Entertainment cluster, as defined by the U.S. Cluster Mapping project, is comprised of six narrow and six broad sub-clusters, totalling 23 industries (see Figure 16). The narrow sub-clusters include the core product and services industries that drive the cluster, while the broad sub-clusters include supporting industries such as radio and television communications equipment and news syndicates.

Although conventionally thought of as part of the entertainment business, broadcasting is not part of the Entertainment cluster at this time because it is considered to be a local industry in the U.S. analysis.

Although only ranked 12th in employment of Ontario's clusters, and in 9th place for Toronto: both Ontario's and Toronto's Entertainment clusters rank 3rd within North America.

Ontario's film and television production industry contributes an estimated $1.0 billion to the province's economy every year. Nearly half of all production dollars ($442.7 million in 1999) spent in Ontario were spent on foreign film and TV production.
Powered by aggressive, export-oriented firms such as Alliance Atlantis Communications Inc., Corus Entertainment, and CHUM Ltd. the city of Toronto is the second largest exporter of television programming in North America. Ontario companies have established a firm position in the global television production market.

Toronto is also now known as an international centre for film, with the highly respected Toronto Film Festival, which celebrated its 25th anniversary in 2000. The Festival is a must-attend event for many of the world's dominant players in the film industry.

Recently, the entertainment industry has been attracting attention as a burgeoning economic power that requires new approaches to economic development, due in part to media convergence. The Ontario Media Development Corporation, launched in February 2001, focuses on building linkages between producers of various media in an effort to further exploit the technological benefits of media convergence.

Table 8 and Table 9: Ranking of Ontario's Entertainment Cluster in North America

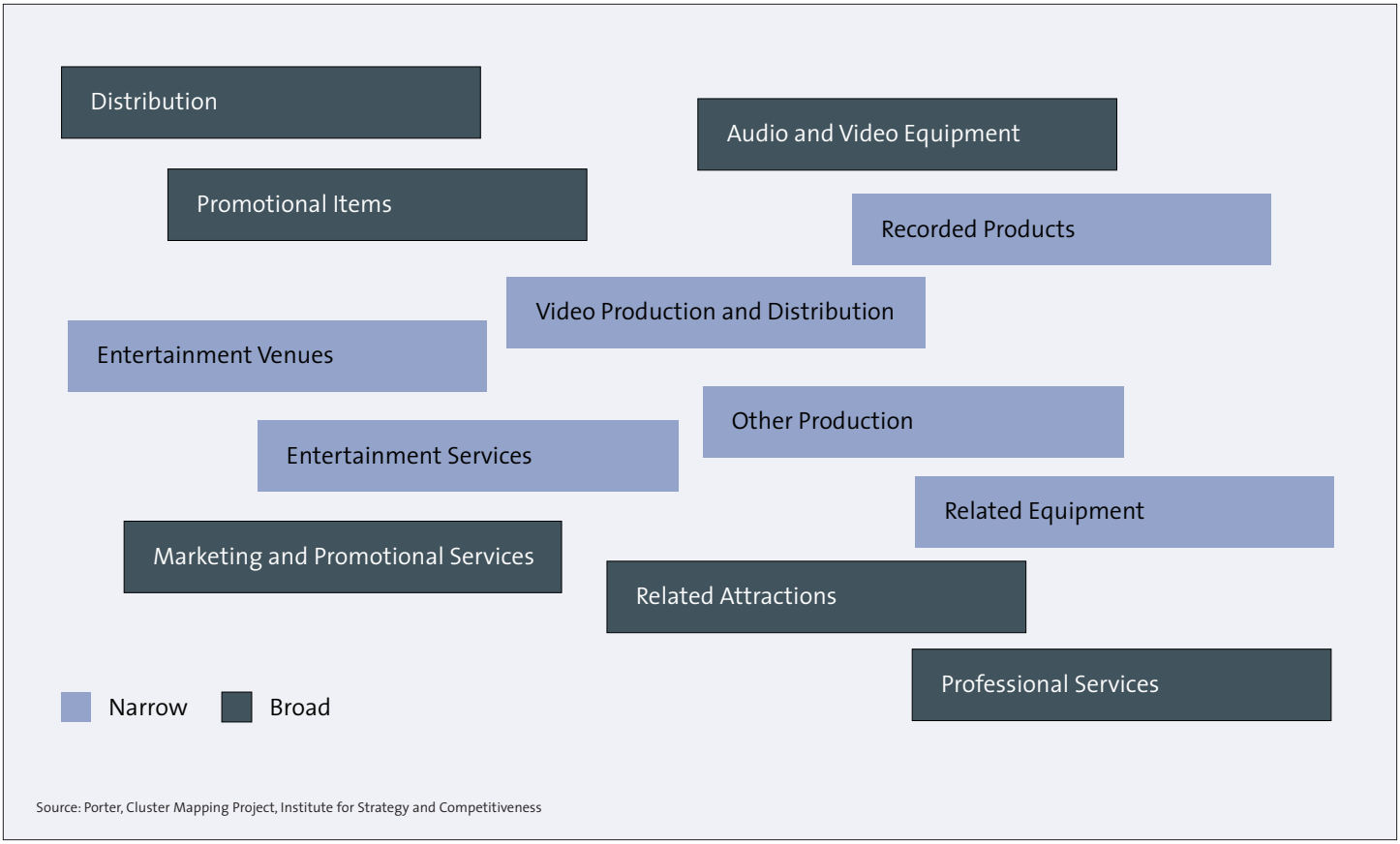
	Provinces and States	Employment
1	California	260,405
2	New York	80,505
3	Ontario	66,943
4	Quebec	39,954
5	Florida	39,537
6	Illonois	36,936
7	Texas	35,927
8	Indiana	32,346
9	Pennsylvania	31,559
10	Colorado	28,871

*U.S. Statistics – 1999; Canadian Statistics – 2000
Source: Canadian Business Patterns, Cluster Mapping Project, Institute for Strategy and Competitiveness, HBS

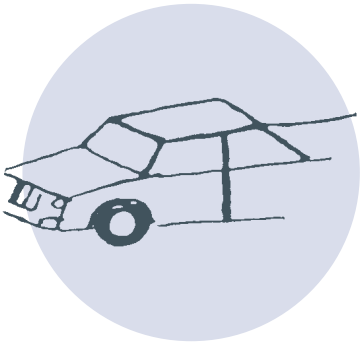
	Metropolitan Area CMA and MSA	Employment
1	Los Angeles- Long Beach CA	167,726
2	New York, NY	61,882
3	Toronto, ON	46,579
4	Chicago, IL	32,441
5	Greater Boston Area, MA-NH	18,196
6	New London-Norwich, CT	17,808
7	Washington, DC-MD-VA-WV	16,894
8	Atlanta, GA	15,828
9	Pheonix-Mesa, AZ	15,204
10	Seattle-Bellevue-Everett, WA	14,615

*U.S. Statistics – 1999; Canadian Statistics – 2000
Source: Canadian Business Patterns, Cluster Mapping Project, Institute for Strategy and Competitiveness, HBS

Figure 16: Components of the Entertainment Cluster



Source: Porter, Cluster Mapping Project, Institute for Strategy and Competitiveness



The Automotive Cluster

The Automotive cluster is comprised of seven narrow and six broad sub-clusters, totalling 32 industries (see Figure 17). The seven narrow sub-clusters are the most important for motor vehicle production including automobiles, light trucks, utility vehicles, heavy duty trucks, other passenger cars and military armored vehicles. Vehicles such as buses and motor homes are not included in this cluster – they are part of the Prefabricated Enclosures cluster, which shares some broad sub-cluster industries such as metal processing. Industries in the broad Automotive sub-clusters range from bolts and gears to welding apparatus and industrial trucks and tractors.

Automotive is Canada's 9th largest cluster and at the province/state level, Ontario ranks 3rd in North America with Toronto, Oshawa and Windsor leading Ontario's CMAs. Toronto, Oshawa and Windsor ranks 2nd, 11th and 14th, respectively in North America.

The Canadian automotive industry is largely an Ontario industry – in 1999, 97 per cent of all light vehicle assembly was in Ontario (Charles River Associates, 2001).

Ontario plants produce almost 3 million car and truck units every year, second only to Michigan, home of "Motor City" Detroit, which produces just over 3 million (Wards Automotive Reports, 2001, and Ontario Ministry of Economic Development of Trade, 2002). The industry is also efficient. According to one study, Canadian auto assembly plants are, on average, 11 per cent more productive than their American counterparts. Canadian automotive manufacturers (the vast majority of which are in Ontario), average 24.4 labour hours per vehicle, while American plants average 27.1 (Harbour and Associates, 2000).

The automotive industry also includes auto parts manufacturers, such as Magna International, Linamar and ABC Group, as well as specialized research centres like Auto21, the federally funded Network of Centres of Excellence headquartered at the University of Windsor.

Table 10 and Table 11: Ranking of Ontario's Automotive Cluster in North America

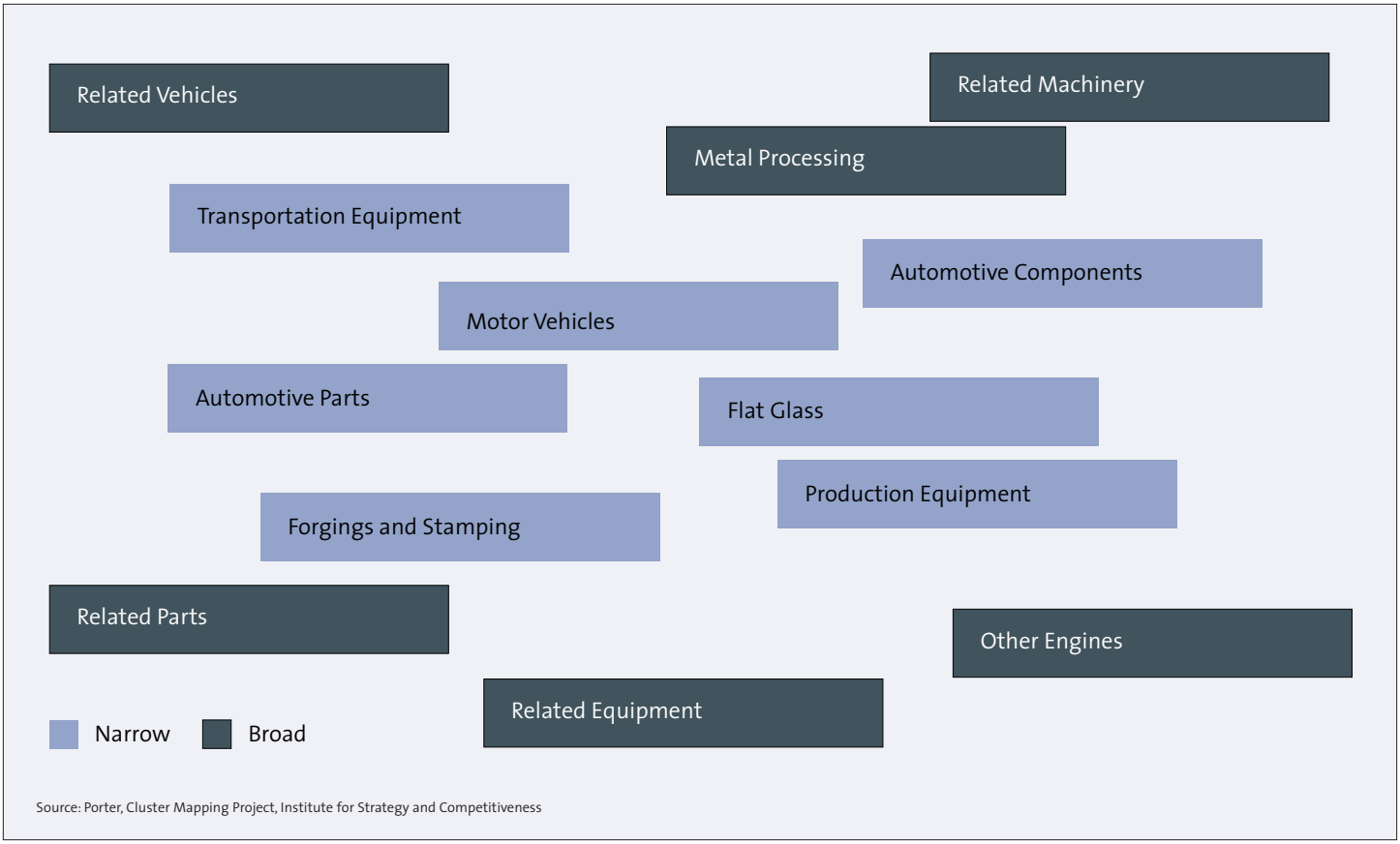
	Provinces and States	Employment
1	Michigan	288,978
2	Ohio	180,643
3	Ontario	138,555
4	Indiana	124,572
5	California	71,060
6	Tennessee	62,970
7	Kentucky	54,110
8	Illinois	50,053
9	Missouri	42,371
10	Wisconsin	42,138

*U.S. Statistics – 1999; Canadian Statistics – 2000
Source: Canadian Business Patterns, Cluster Mapping Project, Institute for Strategy and Competitiveness, HBS

	Metropolitan Area CMA and MSA	Employment
1	Detroit, MI	154,056
2	Toronto	53,023
3	Dayton-Springfield, OH	32,414
4	Grand Rapids-Muskegon-Holland, MI	32,284
5	Chicago, IL	28,956
6	Cleveland-Lorain- Elyria, OH	27,464
7	Los Angeles-Long Beach, CA	27,085
8	Flint, MI	26,717
9	Indianapolis, IN	23,308
10	Ann Arbor, MI	23,191

*U.S. Statistics – 1999; Canadian Statistics – 2000
Source: Canadian Business Patterns, Cluster Mapping Project, Institute for Strategy and Competitiveness, HBS

Figure 17: Components of the Automotive Cluster



Source: Porter, Cluster Mapping Project, Institute for Strategy and Competitiveness

The Pharmaceuticals and Biotechnology Cluster

The Pharmaceuticals and Biotechnology cluster is comprised of three narrow and seven broad sub-clusters, for a total of 26 industries (see Figure 18). The core industries in the narrow sub-clusters include medicinal chemicals and botanical products, pharmaceutical preparations, perfumes, cosmetics and other toilet preparations. These core industries are a relatively small part of the cluster. The broad sub-cluster components include a wide range of products and services from drugs and biological products to medical devices and noncommercial research organizations.

A considerable amount of local infrastructure contributes to the strength of the research-intensive Pharmaceuticals and Biotechnology cluster. Because of differences between Canada and the U.S. in terms of this infrastructure and its involvement in, for example clinical trials, additional work will be needed to confirm the comparability of data between Ontario and U.S. states.

Ontario's Pharmaceuticals and Biotechnology cluster ranks 7th across North America's states and provinces, with Toronto ranking 4th in North America at the regional (CMA) level.

Ontario's burgeoning Pharmaceuticals and Biotechnology cluster has been the focus of many policy initiatives. The Government of Ontario has specifically targeted the industry for support, with the goal of making Ontario the third-largest home of the biotechnology industry in North America, behind California and New England. The Ontario Research and Development Challenge Fund has made significant investments in cancer and genomics research.

The University Health Network in Toronto recently sold a parcel of land near its hospitals to the Medical and Related Sciences Discovery District (MARS), a not-for-profit organization that will build a new research facility. The new facility, with its proximity to both the University of Toronto and the University Health Network Hospitals, seeks to attract researchers from around the world. Given Canada's recently released guidelines on stem cell research (which allow for more extensive research than permitted by regulations in the United States), it's likely that American researchers will find the location attractive.

Ontario's Pharmaceuticals and Biotechnology cluster draws on the technical expertise of researchers working in disciplines other than biopharmaceuticals such as nutraceuticals. At the University of Guelph, for example, food science researchers are creating commercially viable methods of changing the properties of fatty oils in food, possibly making them less likely to clog arteries.

Table 12 and Table 13: Ranking of Ontario's Pharmaceuticals and Biotechnology Cluster in North America

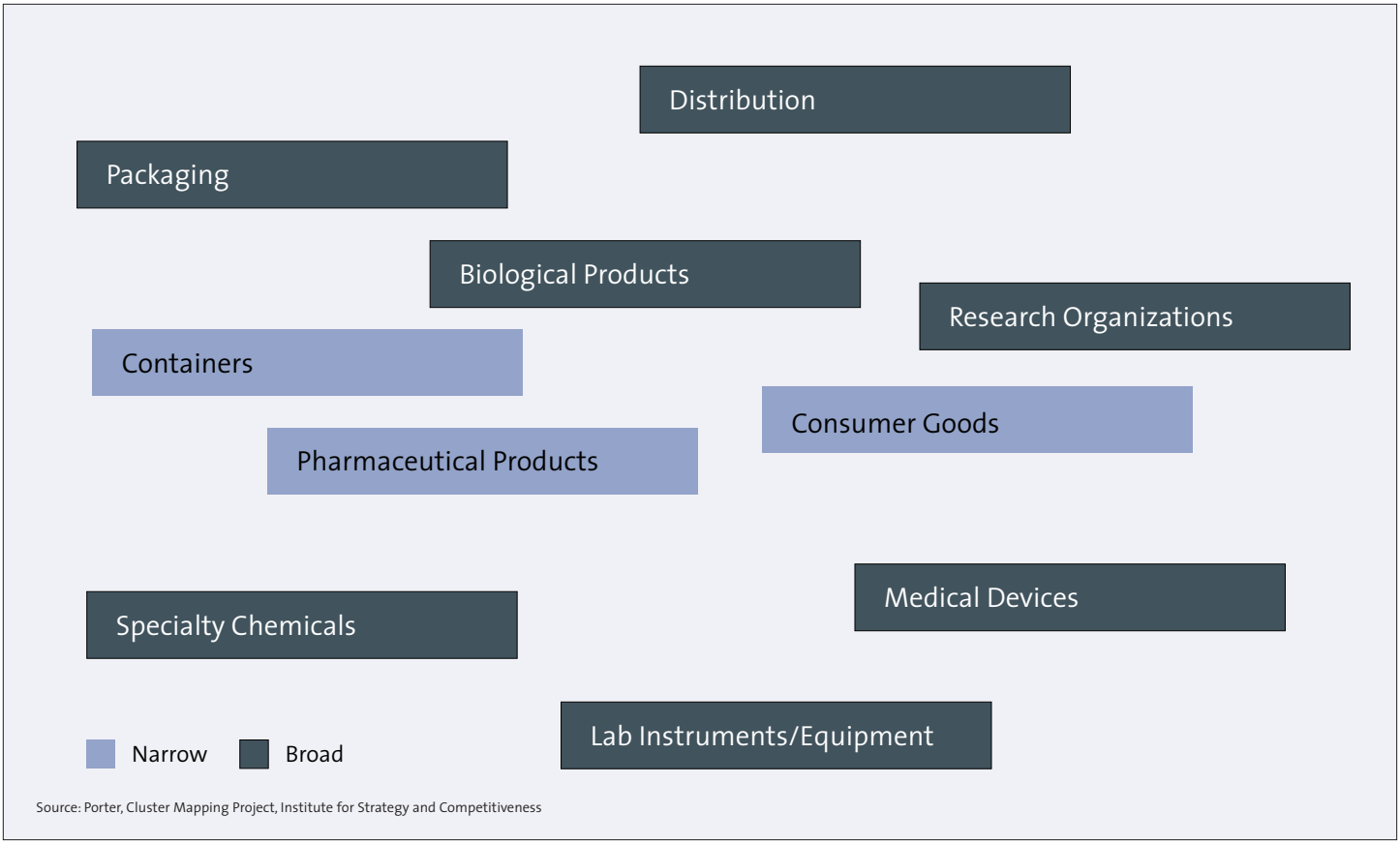
	Provinces and States	Employment
1	New Jersey	41,744
2	California	28,977
3	New York	25,211
4	North Carolina	15,150
5	Connecticut	13,521
6	Pennsylvania	13,425
7	Ontario	12,163
8	Illinois	10,613
9	Texas	10,570
10	Ohio	9,827

*U.S. Statistics – 1999; Canadian Statistics – 2000
Source: Canadian Business Patterns, Cluster Mapping Project, Institute for Strategy and Competitiveness, HBS

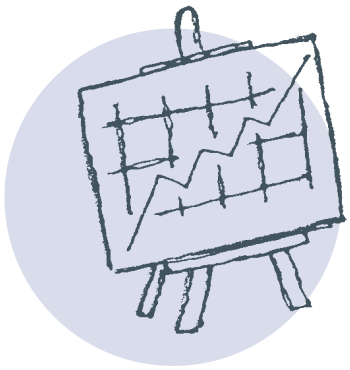
	Metropolitan Area CMA and MSA	Employment
1	Newark, NJ	21,011
2	Middlesex-Somerset- Hunterdon, NJ	13,153
3	Los Angeles-Long Beach, CA	11,420
4	Toronto	10,247
5	Nassau-Suffolk, NY	9,900
6	New York, NY	9,215
7	Philadelphia, PA-NJ	7,575
8	Greater Boston Area, MA-NH	7,525
9	New Haven-Bridgeport-Stamford- Danbry-Wtrbry	7,399
10	Chicago, Il	7,069

*U.S. Statistics – 1999; Canadian Statistics – 2000
Source: Canadian Business Patterns, Cluster Mapping Project, Institute for Strategy and Competitiveness, HBS

Figure 18: Components of the Pharmaceuticals and Biotechnology Cluster



Source: Porter, Cluster Mapping Project, Institute for Strategy and Competitiveness



The Financial Services Cluster

The Financial Services cluster is comprised of six narrow and six broad sub-clusters, totalling 36 industries (see Figure 19). The industries in the narrow sub-clusters include many products and services related to consumer, business and government services including insurers, commercial bankers, savings institutions and monetary authorities. The supporting industries in the broad sub-clusters are diverse and range from information retrieval services and computer related services to commercial printing and patents.

Ontario's Financial Services cluster ranks 3rd across North America's states and provinces in terms of employment with Toronto ranking 3rd at the CMA/MSA level, behind New York and Chicago.

The financial services industry has a strong presence in Toronto but faces significant challenges in maintaining its competitive position, due to the globalization of many parts of the cluster, the increasing costs of technology development and changing regulations.

The banks and insurance and securities companies face considerable pressure to consolidate in order to capitalize on economies of scale and to compete with their much larger global competitors. The Royal Bank of Canada's recent name change to the less-regional RBC signals an increased global focus. In 2001, the Royal Bank – Canada's largest bank – is only 53rd in the world in terms of assets (Canadian Bankers Association, 2001).

Canadian regulation still stands as an obstacle to bank mergers. The industry was shaken by the aborted mergers between the Bank of Montreal and the Royal Bank and between Toronto Dominion Bank and Canadian Imperial Bank of Commerce (CIBC), all of which have major offices in Toronto.

Toronto's competitors include New York's Financial Services cluster along with nearby Stamford, Connecticut, which aggressively recruits companies that have tired of high rents and taxes in Manhattan.

In Britain, London and the emerging centre of Leeds are both buoyed by policy efforts from various levels of government that make them attractive locations for financial companies.

In Europe, Frankfurt is the undisputed banking centre, being home to both the European Central Bank and the enormously influential German central bank, the Bundesbank. Frankfurt has been nicknamed "Bankfurt" in an attempt to market the city as Europe's centre of finance.

The Financial Services cluster is becoming much more global, in large part because the use of information and communications technologies is reducing the limitations of time and distance. Ontario's global presence in this cluster relies heavily on the competitiveness of Toronto as a financial centre.

Table 14 and Table 15: Ranking of Ontario's Financial Cluster in North America

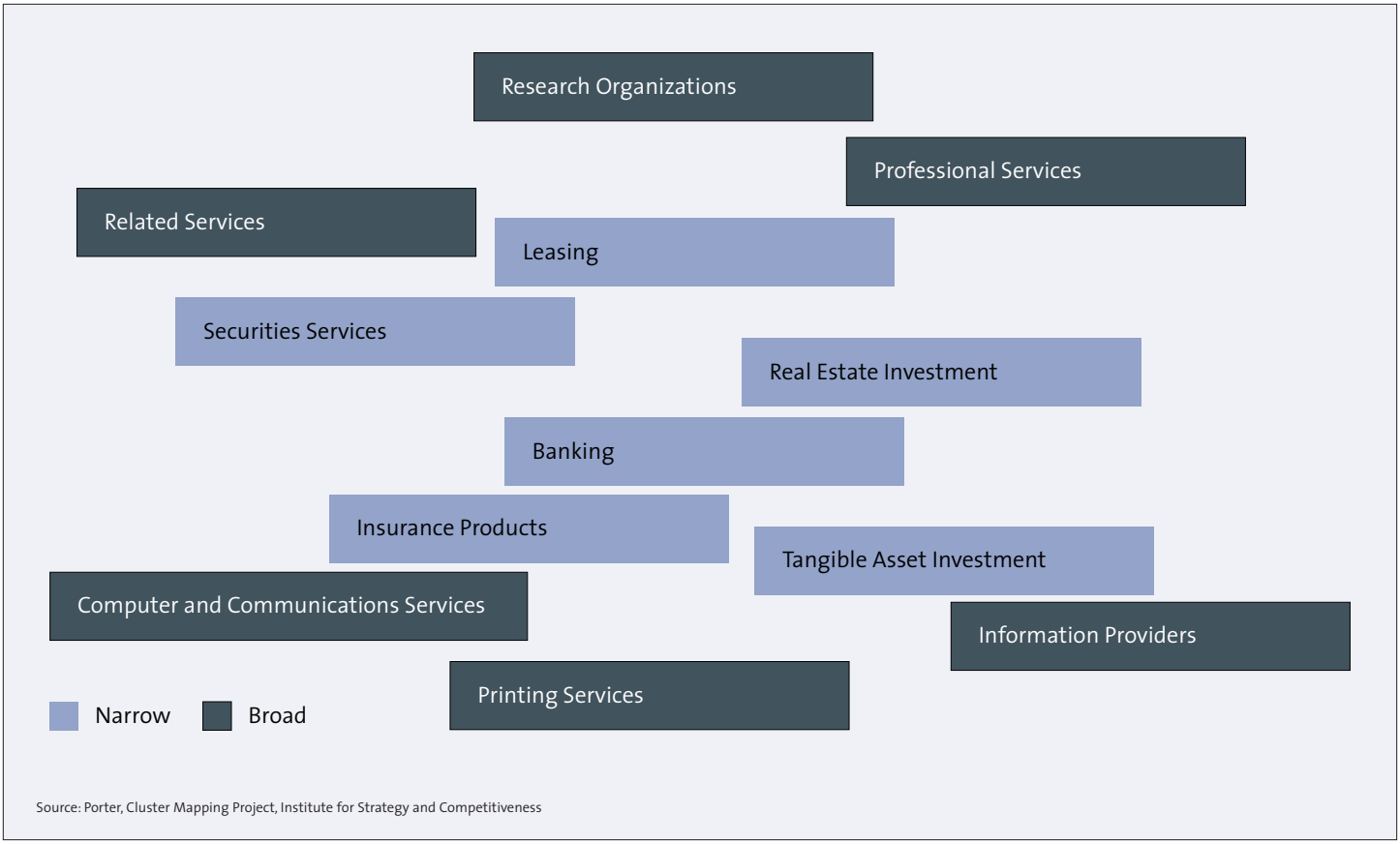
	Provinces and States	Employment
1	New York	362,140
2	California	285,525
3	Ontario	199,761
4	Illinois	188,231
5	Texas	185,367
6	Florida	152,290
7	Massachuesetts	145,939
8	Pennsylvania	144,599
9	New Jersey	132,881
10	Ohio	125,529

*U.S. Statistics – 1999; Canadian Statistics – 2000
Source: Canadian Business Patterns, Cluster Mapping Project, Institute for Strategy and Competitiveness, HBS

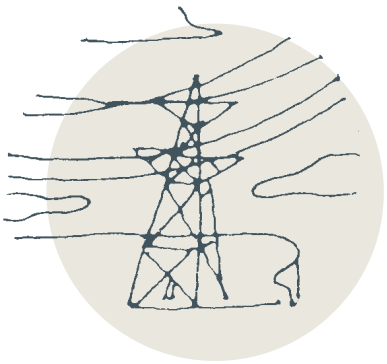
	Metropolitan Area CMA and MSA	Employment
1	New York, NY	278,801
2	Chicago, IL	152,601
3	Toronto	143,500
4	Boston-Worcester-Lawrence- Lowell-Brocktn, MA-NH	139,165
5	Phildelphia, PA-NJ	91,370
6	Los Angeles- Long Beach, CA	90,127
7	Minneaplois-St.Paul, MN-WI	64,788
8	Atlanta, GA	59,264
9	Hartford, CT	57,478
10	Dallas, TX	57,458

*U.S. Statistics – 1999; Canadian Statistics – 2000
Source: Canadian Business Patterns, Cluster Mapping Project, Institute for Strategy and Competitiveness, HBS

Figure 19: Components of the Financial Services Cluster



Source: Porter, Cluster Mapping Project, Institute for Strategy and Competitiveness



Information and Communications Technologies (ICTs)

It is clear that we need to have a better understanding of "how" specific clusters perform in Ontario as compared to other provinces and states. For example, do we have an appropriate mix of traded clusters but that individually they do not have the innovation mechanisms working as well as the U.S.? Or is it a question of scale? The Information and Communications Technologies sector (which approximates to the Information Technology and Communications Equipment clusters) provides a potentially rewarding sector for study, given the recent comparative work of Rao and Tang (Industry Canada, 2001) as summarized below.

Ontario's share of employment in these sectors is not much below the U.S. average, with the greatest concentrations for IT in Toronto, Ottawa, Kitchener, and Hamilton. However our employment is low compared to leading states such as California and Massachusetts (see Table 6). As Rao and Tang report, information and communications technologies (ICTs) played a dominant role in the revival of U.S. productivity growth in the 1990s.

In Canada during the second half of the 1990s real output in the ICT sector grew at an average annual rate of 12 per cent. This is an R&D intensive sector, with highly skilled and well-paid employment, that has demonstrated solid growth in exports. The fact that there is large and growing two-way trade in ICT products implies increasing product specialization and a potential for high productivity growth.

However, the overall labour productivity in the sector is almost 40 per cent below the U.S. level and this, it is claimed, explains why the ICT sector accounts for a larger share of business sector employment in Canada than in the U.S.

And so, despite the appearance of being a dynamic industry on the local scene, the ICT sector as a whole in Ontario is seen as being comparatively less innovative and to have contributed to the widening, not narrowing, of the Canada-U.S. productivity gap in the 1990s.

A future research interest will therefore be the interplay between ICT investments across the economy and the health of the ICT sector itself.

Recent news from Statistics Canada holds out the hope that this situation may be improving and that Canada may be closing the productivity gap due to recent large investments in information and communications technology. According to Statistics Canada, the rate of increase in annual ICT spending by companies more than doubled to 27.6 per cent in the period from 1995 to 2000 as compared to the period from 1988 to 1995 (Little, 2002).

Retail Fixtures and Design Cluster

The design work of Glenn Pushelberg and George Yabu's firm Yabu Pushelberg can be seen all over the world but their office is in Toronto for a good reason: the high-end suppliers the firm works with are in Ontario.

"The quality of what they do is very difficult to find, especially in the U.S.," Mr. Pushelberg said. Clustered industries are tightly networked constellations of companies that have highly sophisticated customers and highly innovative suppliers. Ontario's building fixtures cluster has both.

As Managing Partner of the design company, Mr. Pushelberg frequently works with Ontario manufacturers and cabinet makers to produce high-end cosmetic and display counters for name-brand retail outlets in the United States.

Yabu Pushelberg won the contract to renovate the flagship store of Tiffany & Company, the legendary jewelry store on New York's 5th Avenue. Fixtures made in Ontario are now in designer stores such as Carolina Herrera, Nieman Marcus, and Bergdorf Goodman. Landing contracts like that means having high-value design work and innovative suppliers. Ninety per cent of Yabu Pushelberg's business is outside of Canada, taking them to Japan, Taiwan, New York, and Italy.

"Our advantage is that we have built relationships with craftspeople and manufacturers here in Canada," he said. He notes that the low Canadian dollar is a minor advantage, but their real edge is the skilled craftspeople working here.

"It's just technically very difficult work," he said. Yabu Pushelberg works with Unique Store Fixtures of Concord and Eric Cabinets of Hamilton. He also gave the example of Moss & Lam, a small shop that specializes in exotic plasters and paints. "Their stuff is so superior to what we've seen in other places," Mr. Pushelberg said.

He speculates that Ontario's immigrant craftspeople have maintained the fine quality workmanship of their home countries. The work done here rivals, if not exceeds, the work done in Europe. Their competitors in the United States simply do not have the same quality.

But clustered industries include more than just customers and suppliers. They also include linkages to local research and training institutions. Yabu Pushelberg, for example, works with the local design schools as well. They sponsor events at Ryerson University and the Ontario College of Art and Design. They even do seminars at the schools and invite the students to visit the studio to get hands-on work. These links make for a future work force for the design company.

Cold Climate Testing: A Strategic 'Cluster' Strategy in Northern Ontario

Timmins, Ontario is not exactly known for its international connections. But this northern city is using its unique competitive advantage – its climate – to expand its business into the global scene.

If you're looking for cold weather, Timmins has plenty of it. In January, temperatures average -17 degrees Celsius. This natural gift of the Canadian north has translated into a new industry: cold weather testing.

The city has hosted Jaguar's cold weather testing team for over 20 years, and in 1997, Toyota established a permanent testing facility. Local businesses are now well accustomed to offering services that testers need.

The city is now moving beyond the auto industry and is targeting consumer electronics and other manufacturers. The increased use of digital technologies has moved beyond offices now, and includes people like outdoor forestry workers, who might now use global positioning units that need to function in -20 degree weather. On-board computers for all sorts of vehicles are significantly affected by extreme weather. In order for these electronics to be quality products, they must be tested in cold weather.

The city has made a strategic plan to target manufacturers all over the world. "A lot of Asian countries don't have this weather," explains Kathy Keast, economic development officer for the Timmins Economic Development Corporation, "but when they're trying to break into the North American market, they need to test in cold weather."

Some of the city's competitors for cold weather testing business include Sweden and Finland. But Ms. Keast points out that it's not just the weather that attracts businesses to the city. "Part of it is based on our weather, but there are places much colder. More remote communities just don't have this infrastructure," she said.

Timmins has extensive cellular phone coverage, three fibre optics providers, and access to broadband Internet technologies, all within a day's drive of 7 major U.S. border crossings. Toyota's cold weather testing team alone injects about $1 million per year into the local economy. Future testing teams could expand that impact even further.

The geographic location, the technological infrastructure, and all that wonderful cold weather, all provide for a global economic development strategy.

Summary

This paper establishes a framework to measure and assess Ontario's economic progress in a North American context.

We reassert a widely held view that *"trade, investment and human capital formation are the main drivers of productivity growth, within an overall framework in which innovation creates the opportunities for growth"* (Sulzenko and Kalwarowsky, 2000, p. 125).

We have focused on developing an understanding of how to grow each of the components that comprise GDP per capita and we have seen that the greatest leverage potential lies in the area of *effectiveness* coupled with *utilization.* This means that innovation and upgrading are essential ingredients of competitiveness.

Innovation and upgrading generates competitively priced, unique products that can be traded outside of local borders, which provide the driving force for increasing the number of well-paid jobs. Thus productivity drives competitiveness and together they drive economic progress.

The recent and extensive body of work undertaken by Professor Porter and his colleagues at the Institute for Strategy and Competitiveness, Harvard Business School in conjunction with the U.S. Council on Competitiveness, documents the higher productivity and wages associated with traded clusters in the U.S.

Using the same methodology, we have begun to profile, for the first time, Canada and Ontario's clusters of traded industries.

We have ranked Ontario's clusters of traded industries, based on employment, and within each of Ontario's CMAs we have identified the leading clusters based on their share of local traded cluster employment.

Looking in more detail examples of clusters where Ontario is the leader in Canada, we have confirmed the significance of our Automotive, Entertainment and Financial Services clusters and revealed the relatively high ranking of Pharmaceuticals and Biotechnology.

Next Steps and Further Research

The Institute will build on the framework in this paper to develop a set of indicators to monitor, measure and benchmark key actionable areas of Ontario's economy.

We intend to extend and deepen our analysis of Ontario's traded clusters in a North American context.

At the same time we will seek to understand better the nature of economic opportunity in areas typically lacking strong traded cluster activity, such as rural, remote and resource industry-dominated regions of the province.

We will seek feedback and perspectives on this work from a broad range of stakeholders to help inform the ongoing work of the task force.

Having recognized that while Ontario has many competitive strengths, it remains behind leading U.S. jurisdictions, we have identified a series of questions for further analysis.

For example:

Given the finding that Ontario has a high proportion of employment in traded clusters and yet suffers from overall poor productivity growth, is the context for traded clusters in Canada different from that in the U.S.?

Do Ontario's traded clusters have lower productivity than similar clusters in the U.S., and if so what prevents Ontario's clusters from achieving comparable productivity growth?

In what ways does Illinois differ from Ontario that allow a similar industrial structure to be much more productive?

How has Massachusetts produced a mix of clusters that appears more capable of generating prosperity than Ontario's?

Seeking answers to these and related questions will form the basis of future working papers and will inform our analytical and consultative work.

Glossary & References

Glossary

Broad Cluster Definition*
See Cluster Definition

Canadian Business Patterns
Canadian Business Patterns (CBP) is a database that reflects counts of business establishments by 9 employment size ranges; geography groupings; province/territory, census division, census subdivision, census metropolitan area and census agglomeration; and Standard Industrial Classification which classifies each establishment in Canada into specific industry. (source CBP website)

Census Divisions
Census divisions (CD) refer to geographical areas established by provincial law. They are created to assist in regional planning and the provision of services that can be more effectively delivered on a scale larger than a municipality. There are currently 288 census divisions in Canada as per the 1996 Standard Geographical Classification.

Census Metropolitan Area
A census metropolitan area (CMA) is defined around an urbanized core having a population of at least 100,000, based on the most recent census. Twenty-five census metropolitan areas have been identified across Canada, ten of which are in Ontario. Once an area becomes a census metropolitan area, it is retained as a CMA even if its population declines afterwards.

Census Agglomeration
A census agglomeration (CA) area is defined as a smaller urban area than a CMA with a population of at least 10,000. The census agglomeration is retired if the population of the urban core drops below 10,000. Currently there are 112 census agglomerations in Canada.

Census Sub-Division
A census sub-division (CSD) applies generally to municipalities or their equivalent. There are currently 5,984 census sub-divisions in Canada as per the 1996 Standard Geographic Classification.

Census Tract
Census Tracts (CT) are equal neighbourhood-like areas of 2,500 to 8,000 people (preferably close to 4,000) within all CMAs and CAs that contain an urban core with a population of 50,000 or more in the previous census. The CT boundaries generally follow permanent physical features such as major streets and railway tracks and attempt to approximate cohesive socio-economic areas. One unique feature of CTs is that their boundaries are generally held constant from one census to the next, so that CTs are comparable over time.

Cluster*
A cluster is a geographically proximate group of interconnected companies and associated institutions in a particular field, including product producers, service providers, suppliers, universities, and trade associations. Clusters arise out of the linkages or externalities that span across industries in a particular location.

Traded Cluster*
Traded clusters are made up of traded industries. Traded industries sell products and services across economic areas, so they are concentrated in the specific regions where they choose to locate production, due to the competitive advantages afforded by these locations. Employment levels in traded industries thus vary greatly by region, and have no clear link to regional population levels.

Broad Cluster Definition*
Broad Cluster Definition relates only to traded clusters. Broad cluster definition defines industries not unique to the cluster. These industries may fall into and overlap with other traded clusters. For example, Electronic Computers, Computer Storage Devices, and Computer Peripheral Equipment fit the Broad Cluster Definition of the Communications Equipment Cluster. But, these industries fit the Narrow Cluster Definition of the Information Technology Cluster only.

Narrow Cluster Definition*
Narrow cluster definition relates only to traded clusters. Narrow cluster definition defines industries that are unique only to the cluster. For example, Telephone and Telegraph Apparatus, Radio and TV Communications Equipment are unique to only to the Communications Equipment Cluster. Every U.S. industry is uniquely allocated in a cluster.

Local Cluster* (Local Industries)
Local clusters are made up of local industries. Local industries provide goods and services almost exclusively for the area in which they are located, which explains why they must spread all across the country. Indeed, local industries show employment in every region, regardless of the natural or competitive advantages of a particular location. As a result, their regional employment should be roughly proportional to regional population, so that the most highly populated states like California, New York, Texas, and Florida will figure as the top local employment states.

County Business Patterns Database
The County Business Patterns Database is a U.S. database with statistics about counties, MSAs and States that includes statistics by 4-digit 1987 SIC. Beginning in 1998, the data were tabulated by industry as defined in the North American Industrial Classification System. The patterns are useful for studying the economic activity of small areas and in analyzing economic changes over time.

Discouraged Workers
Discouraged workers are workers who have given up searching for work. These individuals would not be counted as part of the labour force, and hence are not reflected in the unemployment rate.

Economic Region
In Canada, an economic region is a grouping of complete census divisions. Economic regions are used to analyze regional economic activity.

Effectiveness
Informal term used within this paper – see page 10

Employment*
Paid employment consists of full- and part-time employees, including salaried officers and executives of corporations, who are on the payroll. Included are employees on paid sick leave, holidays, and vacations; not included are proprietors and partners of unincorporated businesses.

Establishment*
An establishment is a single physical location at which business is conducted or services or industrial operations are performed. It is not necessarily identical with a company or enterprise, which may consist of one or more establishments. When two or more activities are carried on at a single location under a single ownership, all activities generally are grouped together as a single establishment. The entire establishment is classified on the basis of its major activity, and all data are included in that classification.

Gross Domestic Product**
The Gross Domestic Product (GDP) is the unduplicated money value of goods and services produced within the boundaries of Canada, available for final domestic consumption, export or investment.

Human Capital
Human capital encompasses all education and skills held by those people in the labour force.

Intensity
Informal term used within this paper – see page 10

Labour Force
The labour force represents the sum of individuals that are considered employed or unemployed. In order to be considered unemployed by government statistical agencies such as Statistics Canada, an individual must be available and looking for work but has been unable to find work.

Local Cluster*
See Cluster definition

Narrow Cluster Definition*
See Cluster definition

North American Industrial Classification System
The North American Industrial Classification System (NAICS) was introduced in 1997 to classify businesses throughout countries according to their activity. NAICS was developed by three North American Free Trade Agreement trading partners; Canada, United States and Mexico. The system is based on production.

Openness to trade
Openness to trade is the share of Gross Domestic Product (GDP) that can be attributed to total trade (Imports & Exports). Openness to trade = (Imports +Exports)/GDP

Participation Rate
This participation rate reflects the proportion of the population that is in the labour force.

Profile
Informal term used within this paper – see page 10

Purchasing Power Parity
Purchasing Power Parity (PPP) reflects the notion that the price of internationally traded commodities should be the same in every country, and therefore the "notional" exchange rate used to compare purchasing power for consumers in different countries should be the ratio of price levels in the two countries. Thus although the currency exchange rate between Canada and the U.S values the Canadian dollar at approximately $0.63 U.S. on a PPP basis the rate is $0.84.

Research and Development
Research and development is creative work undertaken on a systematic basis in order to increase the stock of knowledge and the use of this stock of knowledge to devise new products and processes.

Standard Industrial Classification Codes
The Standard Industrial Classification (SIC) system is used to describe industry by classifying each statistical establishment in Canada into a specific industry. The industry counts contain all establishments primarily engaged in the same or similar kind of economic activity. Each establishment is assigned an industrial code based on its principal industrial activity as described in the classification manual.

Traded Cluster*
See Cluster definition

Unemployment Rate
The unemployment rate is defined as the percentage of the labour force that is unemployed. It is important to note that this is not the percentage of Canadians that do not have jobs since it does not include discouraged workers and people who are not in the labour force.

Utilization
Informal term used within this paper – see page 10

Note: All definitions marked with an asterisk (*) are taken from Harvard Business School's Institute for Strategy and Competitiveness cluster mapping project http://data.isc.hbs.edu/isc/cmp_data_glossary.jsp. All definitions marked with a double asterisk (**) are taken from Statistic Canada.

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THE GLOBAL COMPETITIVENESS REPORT

The Global Competitiveness Report, which has been published annually since 1979, (http://www.weforum.org/site/homepublic.nsf/Content/Global+Competitiveness+Programme) is a worldwide research project, completed in cooperation with Harvard University's Michael Porter, Jeffrey Sachs, and John McArthur. An important part of this annual research report is the Executive Opinion Survey. Working with partner institutes around the world the World Economic Forum surveys senior executives from a cross- section of businesses in 75 countries. Results of the Executive Opinion Survey provide much richer country-specific information than is available through "hard" data sources and are key components of the competitiveness indices developed by the Forum. Effective 2002, the Institute for Competitiveness and Prosperity, in partnership with the University of Toronto's Rotman School of Management, is the Canadian partner for the World Economic Forum's Global Competitiveness Report.

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