

NATURAL RESOURCE BASED CLUSTERS

IN THE NEW ECONOMY:

THEORY AND REALITY

Prepared for the 4th Annual International Conference
of The Competitiveness Institute,
Tucson, Arizona, October, 2001

Indira Singh
Director, Corporate Projects
Ministry of Northern Development and Mines
Government of Ontario, Canada
indira.singh@ndm.gov.on.ca

NATURAL RESOURCE BASED CLUSTERS IN THE NEW ECONOMY: THEORY AND REALITY

*"A nation can be prosperous and productive in virtually any field. What matters is how a nation competes, not what industry it competes in . . . we must stop thinking that traditional industries are bad and that the nation must move into high tech."*¹

Summary – Natural resources are themselves neither a curse nor a panacea for the developing economy. Research shows that resource-based economies can be poorer and less dynamic than the economies of their less endowed neighbours. At the same time, many of today's developed countries have used their natural resources as a springboard to accelerate economic development and to expand their economic base.

This paper suggests that clusters based on natural resources have the potential to create sustainable economic development, and to provide a springboard for enhanced productivity, even in today's technology-driven economy. The assertion is supported by a model of competitiveness and practical experience. Furthermore, it is shown that natural resource based clusters can make a vital contribution to promoting positive values. The paper is based on research sponsored by the Ontario Ministry of Northern Development and Mines.²

1. Introduction

The first clusters -- European leather tanning and textiles -- predated the industrial revolution by nearly a century. Since Harvard professor Michael Porter first defined the term, "clusters" have become a very popular concept in national, regional and local

¹ Michael Porter, Address to Wellington Town Hall, New Zealand, 1998.

² The government of Ontario created the Ontario Jobs Investment Board, to develop recommendations to strategically position the province of Ontario to meet the challenges of the 21st century. In its report, *A Road Map to Prosperity: An Economic Plan for Jobs in the 21st Century*, it embraced the concept of clusters and supported the formation of economic clusters in Ontario. The Ministry of Northern Development and Mines is a regional ministry in the Ontario Public Service whose mandate is to work with client groups and other government organizations to "build a Northern Ontario economy and a provincial minerals sector which are healthy, competitive and sustainable." The Ministry established a clustering project to determine the applicability of the cluster approach for Ontario's two primary resource sectors -- forestry and mining.

economic development research and practice. However, it is only with the recent onus on governments to create competitive advantage, that clusters have drawn substantial attention and funding from policy makers, legislatures, and development agencies around the world.³ Cluster development strategies have been developed in various nations/regions to address issues such as cyclical changes in economic conditions, increased global competition, population growth, low growth economies, the residual effects of the 1980s recession, and unemployment. Ultimately, cluster strategies are adopted to make the transition from comparative advantage to competitive advantage.⁴

Silicon Valley in California, Silicon Valley North in Ottawa-Kanata and Route 128 in Boston are regions touted as being vibrant and successful high tech clusters. Information and Communications Technology (ICT) has become so pervasive that regions rich in natural resources, but lacking comparative advantage in the IT industry, aspire to become hubs of the high tech industry. Other contributing factors causing the shift from natural resources to other economic sectors include historic poor performance, purchasing parity power, and declining employment in resource based industries. Research has shown that nations highly dependent on exportation of natural resources have a poorer citizenry in terms of ability to purchase goods and services from within their own country.⁵ Abundant natural resources has also been identified as one of the contributing factors to lack of innovation and upgrading by some of the resource based industries.⁶ The resource based industries in many regions are past their prime employment generating capacity and record significant employment reductions due to intense investment in capital equipment and technological advancements.⁷

³ Thirty countries have implemented cluster programs and policies around the world. Development agencies and other organizations who promote and support cluster based economic development include: World Bank, Agency for International Development, United Nations Economic Commission for Latin America and the Caribbean, Organization for Economic Cooperation and Development, International Development Research Centre, Social Sciences and Humanities Research Council of Canada, the US Council on Competitiveness, the SNS Economic Policy Group of Sweden and the European Union. Countries such as Finland, Sweden, Northern Ireland, the Netherlands, and Mexico have established cluster programs, and states such as Arizona and Connecticut in the US have passed legislation to promote and support cluster programs.

⁴ In a comparative advantage model, the most important competitive assets are natural resources, e.g., sub-soil assets or natural beauty, low cost labour, while in a competitive advantage model wealth is considered potentially infinite and that win-win solutions are possible when firms cooperate and compete with each other.

⁵ M. Fairbanks and S. Lindsay, *Plowing the Sea: Nurturing the Hidden Sources of Growth in the Developing World*, Boston: Harvard Business School Press, 1997. The authors provide historical trade statistics to show that countries which rely solely on export of raw materials have been poor and continue to be poor. This book is an excellent account of barriers, constraints and challenges including cultural, political and institutional, in Latin American countries and provides a framework to make the transition from comparative advantage to competitive advantage.

⁶ Michael Porter, *Canada at the Crossroads - The Reality of a New Competitive Environment*, Boston: The Monitor Company, 1992; Roger Martin and Michael Porter, "Weak Newsprint Makes a Metaphor for Canada," www.specialedition.net, *National Post*, 2001.

⁷ B. Moazzami, *Trends and Analysis of Primary Industries in Northern Ontario*, Lakehead University, 2001. The author notes that due to modernization, mechanization and automation there has been about a 30% reduction in employment in Northern Ontario's two primary resource sectors -- forestry and mining.

This paper contends that natural resources have, throughout history, been a critical part of the economy, and the manner in which they are produced and used has had a profound effect on human society and culture. Natural resources are often the key economic engine of a community. Economic development in many regions has been closely tied to growth of primary resource sectors that comprise the economic base. However, the long-term benefits come not from the presence of natural resources but rather from the value-added products and services developed around them. Natural resource based clusters have the potential to be an effective catalyst for economic and social development. At the national level, development of natural resources has been used to explain the structure of the Canadian economy. Furthermore, the development of natural resources laid the foundation for subsequent infrastructure, i.e., railways, electric power, highways, ports, etc. In the new economy, competitive advantage can be created around natural resources and clustering provides the methodology to accomplish this. It will be demonstrated that many of today's less developed countries have generated enhanced productivity out of their rich natural resource base.⁸ These countries have used their natural resource industries as a springboard to accelerate economic development and to expand their economic base.

On the other hand, a recent report by the Organization for Economic Co-operation and Development (OECD) shows that the ICT sector is not a prerequisite for economic growth. Countries with a strong information technology sector, such as Japan, have recorded sluggish overall growth while, on the other hand, countries like Australia have shown strong growth without the benefit of a large ICT sector.⁹ Moreover, only a few countries have the necessary competitive advantage to succeed in ICT output, especially among developing countries. It is true that a comparative advantage in the natural resources sector does not automatically lead to a competitive advantage, but it can be the basis upon which to build a competitive advantage. Good or poor performance of the sector depends on the macroeconomic and microeconomic foundations and cultural values of a region/nation, not the mere abundance of natural resources.¹⁰

Another consideration in any economic development strategy is that no region/nation can be competitive in everything. A nation's workforce and other resources are limited. It is easier to compete on comparative advantages (inherent strengths) rather than attempt

⁸ J. Ramus, *A Development Strategy Founded on Natural Resource-Based Production Clusters*, CEPAL: Economic Commission for Latin America and the Caribbean, 1998. This excellent article on natural resource based clusters discusses their origins, evolution and contribution to economies, as well as their potential to create sustainable competitive advantage for a development strategy in Latin America.

⁹ Organization for Economic Co-operation and Development, *The New Economy: Beyond the Hype - Final Report on the OECD Growth Project*, 2001. This report provides an analysis of the causes underlying differences in growth performance in OECD countries and identifies barriers, institutions and policies that could frustrate long-term growth prospects. It is suggested that countries resist the IT hype and use ICT as an enabler to make the best use of their inherent strengths.

¹⁰ Roger Martin and Michael Porter, "Canadian Competitiveness: A Decade After the Crossroads," C. D. Howe Institute Working Paper, 2001. The authors emphasize the importance of the microeconomic business environment and demonstrate that where substantial progress has been made in the macroeconomic context in Canada, the progress has not been sufficient in the microeconomic conditions to put Canada ahead in relative terms against other developed economies.

to create entirely new ones.¹¹ Most importantly, as Porter notes, ". . . a nation, state or city's standard of living (wealth) is determined by the productivity with which it uses its human, capital and natural resources."¹²

This paper will be of interest to cluster practitioners in government, private and non-profit organizations and for those regional economic development policy advisors and analysts who are responsible for economic development in areas rich in natural resources. References are made to concepts, without full elaboration, that are commonly known to those who are familiar with the field. The paper makes no pretense of being exhaustive, nor does it attempt to do full justice to the rich literature on cluster theory, practices and applications. Its broad aim is to stimulate and guide interest by highlighting the successes of other natural resource based clusters and their applicability to incipient and emerging clusters.

The paper is structured as follows: Section 2 provides the conceptual framework and discusses trends in the new economy, clusters and their role in creating competitive advantage. It provides analytical techniques and measures to identify and assess cluster success. Section 3 provides examples of successful natural resource based clusters and new initiatives. Section 4 examines the challenges and proposes a strategy associated with developing natural resource based clusters. The paper concludes with an outline of practical implications for government, developmental agencies, the business community and multinationals with respect to advancing the development of economies and promoting positive values by using the cluster approach to maximize the use of natural resources.

2. Conceptual Framework

- a) **The Trends in the New Economy.** It is important to understand and recognize trends in the new economy. In the new economy, capital is mobile, technology can migrate quickly and goods can be made in low cost countries and shipped to developing countries. Transportation and communication costs have been dropping, traditional boundaries and borders are disappearing. Trade barriers are being lowered and communications are growing ever more sophisticated, turning the world into a single intensely competitive market place. Customers are becoming more demanding and are willing to pay a premium for the knowledge embedded in manufactured goods. The regions/nations that export manufactured goods are wealthier than those exporting simply processed or semi-processed materials.¹³ These regions/nations compete by exploiting capabilities that their competitors cannot easily match or imitate. These distinctive capabilities are not

¹¹ Porter, 1998, 2000.

¹² Ibid.

¹³ Ibid. The distinction between mass production of standard products and production and export of sophisticated products is provided. Italians get rich by making shoes because they make shoes in a very special way and sell these shoes for \$150.00 a pair and support high wages and high profits. On the other hand, countries which produce ordinary shoes sell for much lower price and can only support a wage rate of \$.50 to \$1.00 a day. The other example given is for tourism. A region or area becomes prosperous by raising the average spending for the average tourist, not by simply increasing the number of tourists.

raw materials, land or access to cheap labour. Rather, they are the knowledge, skills, creativity and innovative capacity that help to create high productivity and high-value goods and services. ICT is a key catalyst for these developments. In the new economy winners are those firms that have a distinctive strategy to innovate, compete globally, increase exports of value-added products and adapt to fast-paced change.

- b) **The Model of Competitiveness.** The model of competitiveness¹⁴ is based on the theory that prosperity for all citizens is the goal for economic development. Productivity and productivity growth determine prosperity. Innovation is a key driver of productivity growth. Clustering supports both productivity and innovation. Porter's Diamond theory provides a useful concept that can help business, government and other institutions explore improvements to the environment for productivity.¹⁵ This theory stresses that competitiveness involves more than just macroeconomic issues -- deficit, interest rate, political stability and so on. While macroeconomic issues are necessary but not sufficient, the long-term determinants of productivity are rooted in microeconomic conditions in the economy -- human capital, research and development capacity, physical infrastructure, and innovation capacity.
- c) **Clusters.** Definitions exist which describe a cluster as: "a geographically proximate group of inter-connected companies and associated institutions in a particular field, linked by commonalities and complementarities";¹⁶ "a group of inter-related industries that drive wealth creation in a region primarily through the export of goods and services";¹⁷ "a group of industries whose linkages mutually reinforce and enhance their competitive advantage. They can be each other's consumers, competitors, partners, suppliers or research and development sources".¹⁸

Research shows that clusters occur in many types of industries. They are present in economies large or small, urban or rural settings, and at several jurisdictional levels (e.g., nations, states, metropolitan areas, regions and cities). Boosting Innovation: The Cluster Approach¹⁹ by OECD and a number of articles in The World Development Journal,²⁰ show that clusters are present in advanced and developing economies.

¹⁴ Martin and Porter, "Canadian Competitiveness", 2001.

¹⁵ Alan M. Rugman and Joseph R. D'Cruz, "The 'Double Diamond' Model of International Competitiveness: The Canadian Experience," *Management International Review*, Special Issue, 1993/2. While Porter's Diamond model has been applied around the world to determine competitive environments at the local, regional and national levels, it is not without criticism. The authors provide a critique of the Diamond model's applicability to Canada.

¹⁶ Porter, 2000.

¹⁷ San Diego Association of Governments, "Understanding Cluster Analysis," 1999.

¹⁸ Scottish Forest Industry Cluster, *Roots for Growth - A Strategic Framework for Action for the Scottish Forest Industries*, 2000.

¹⁹ OECD, *Boosting Innovation: The Cluster Approach*, 1999. An excellent publication with state-of-the-art cluster initiatives, policies, practices and programs implemented by the OECD countries.

²⁰ Articles in *The World Development Journal*, Vol. 27, 1999.

Clusters are described as concentrators, synergy enhancers and economic development accelerators. Business Network Program in Australia noted that the rate of increase in exports is four times higher in cluster networks than in non-cluster environments. "Clusters are a driving force in increasing exports and magnets for attracting foreign investment."²¹ "Clusters produce global competitiveness, enhanced productivity and a rising standard of living wherever they exist."²² ". . . clusters can provide a stabilizing force and an engine for growth and a positive identity for the region".²³ Porter makes a convincing case drawing on lessons from experience around the world that ". . . government, working with the private sector, should reinforce and build on established and emerging clusters rather than attempt to create entirely new ones. New industries and new clusters emerge best from established ones".²⁴ Evidence for this statement is found in the number of vibrant second generation clusters which developed around natural resource based clusters, for example, mining equipment and services in Finland, ceramic tile services and equipment in Northern Italy, drilling equipment in Kimberly, Australia, machinery and equipment related to dairy and livestock in Denmark, the Netherlands and the United States, and transport and logistics management in the Netherlands related to the flower cluster.

- d) Clusters and Competitive Advantage.** Theoretical and empirical evidence suggests that working in close proximity fosters competitiveness in several ways. Clusters and networks enable firms to exchange knowledge and information that cannot be codified. Such tactics and forms of knowledge are increasingly viewed as important given the rapidly changing global and economic environment.²⁵ The other source of competitive advantage is the mode of co-operation based on trust, familial ties and traditions most often described for industrial districts in Third Italy. They are believed to be the means by which small and medium sized enterprises seek to counter the internal scale economies enjoyed by larger corporations.

One of the key sources of competitive advantage is found in the presence of related and supporting industries that affect an economy's ability to upgrade its competitive advantage. The reasons why home-based related and supporting industries stimulate and facilitate innovation and productivity growth are best explored in Canada at the Crossroads.²⁶ Industries, especially those providing specialized inputs, machinery and services, are sources of technology, ideas and skilled human resources. Home-based suppliers are responsive and deliver inputs in a preferential manner. New generations of products are normally tested first in

²¹ Porter, 2000.

²² Roger Martin, "A Remedy for Canada's Competitiveness Problem," *Toronto Globe and Mail*, December 1999.

²³ Economic Development Administration of US Department of Commerce, "America's Clusters", 1997.

²⁴ Porter, 1998.

²⁵ Bergman and Feser, 1999.

²⁶ Monitor Company and Porter, 1992.

the home market. Suppliers and end-users located in close proximity benefit from shorter lines of communication, a quick and constant flow of information, and an ongoing exchange of ideas and know-how.

In a cluster, it is usually expected that firms subordinate their interests to the larger interests of the community.²⁷ ". . . in the cluster the whole is greater than the sum of the parts"²⁸ and "social capital" is an essential part of the glue that holds clusters together. The existence of social capital depends on the ability of the people to associate with each other. Another academic, Wolfe, adds that "trust is a rare commodity that can neither be bought nor imported, it can only be built through a prolonged process of frequent interactions."²⁹ In many regions, formal mechanisms for cluster participants to interact to share strategic information and engage in ongoing dialogue have been implemented.

It is shown that clusters promote productivity, innovation and competition in a number of ways, e.g., the reduced cost of sharing resources, the critical mass created by having a pool of specialized skills, expertise and value-added products. Clusters enhance economic foundations such as a skilled workforce, research and development capacity and infrastructure and create assets such as trust, synergy, collaboration and co-operation which are all essential for competitiveness. In the context of the foregoing discussion, the development of natural resource sectors using a cluster approach with a distinctive strategy provides comparative advantage/inherent strengths to create sustainable competitive advantage.

e) **Analytical Techniques and Measures.** A range of analytical techniques and measures are employed to identify and assess clusters and their success. The techniques used to identify clusters include the following:

- *Expert Opinion* - probably the most commonly used approach, to identify clusters through the use of interviews, focus groups and Delphi survey techniques;
- *Location Quotient* - a common technique, it is a simple ratio of an industry's share of local employment relative to the industry's share of national, provincial and regional employment;
- *Cluster Power Index* - a DRI/McGraw-Hill study identified 380 leading clusters in the United States. The Cluster Power Index used four factors: employment size; employment concentration; supplier measures and employment growth within a five-year period.
- *Network Analysis* - a relatively new way to identify clusters through an analysis of the linkages between firms and sectors;

²⁷ Of course, this view is not shared by all cluster practitioners. Josie Rowtz, Blueprint Strategy & Policy Ltd., suggests that in her experience "enlightened self-interest" is more likely to occur and that firms expected to subordinate their interests may fail.

²⁸ Porter, 2000.

²⁹ Wolfe, 2000.

- *Input Output Measures* - an approach applied in a number of OECD countries and is based on analysis of innovation interaction matrices rather than traditional production flow matrices;
- *Surveys* - are expensive and relatively rare. However, there seems to be merit for marrying limited survey techniques with other quantitative methods.
- *Porter's Diamond Model* - is applied to assess the competitive environment at the national, state and regional level as well as for particular clusters. The model is based on four factors: a) basic and advanced factors; b) local demand conditions; c) degree of firm rivalry; and, d) the strength of related and supporting industries.

Each technique is useful in terms of identifying the existence of clusters. However, none of these techniques alone is enough to form the basis for assessing a competitive environment and forming a cluster strategy. There are a few international firms such as ontheFRONTIER, Cluster Navigators Limited, ICF Consulting, and Blueprint Strategy & Policy Ltd. who have developed their own methodology to identify and enhance clusters. To the author's knowledge, one of the most comprehensive methodologies developed is by the ontheFRONTIER Group. This methodology includes three distinct levels of analysis: the competitive environment, innovation network linkages and mental models. Following are some of the common qualitative and quantitative performance measures cluster methodologies use to determine a cluster's success in creating and sustaining competitive advantage:

- the presence of upstream and downstream industries;
- the level of competitive inputs such as services, machinery and equipment;
- the level of employment in all business activities related to the cluster;
- the rate of increase in value-added products and services;
- the rate of increase in exports of value-added goods and services;
- foreign investment levels;
- inter-firm co-operation and the quality of the linkages and interactions;
- new start-ups;
- trade performance; and
- corporate profits.

However, more effective and scientific monitoring is required to see how the measures stand up on the long-term.

3. Selected Natural Resource Based Clusters and New Initiatives

This section provides examples of established and new resource based clusters in terms of their contribution to the economy and the critical success factors which were instrumental to their growth.

The Italian Ceramic Tile Cluster - it is well known that Italian companies are the world leaders in producing and exporting ceramic tiles (\$10 billion industry in 1987).

Red clay deposits, a comparative advantage, helped the Italian equipment manufacturers develop and export equipment for use with white clay. Sixty percent of the Italian tile manufacturers are located in the Sassuolo area. The geographic concentration of these manufacturers encouraged the establishment of many other supporting companies. Finally, "the geographic concentration of the entire cluster supercharged the whole process."³⁰ The contributing success factors for the Italian ceramic tile are: sophisticated and demanding local buyers and customers; intense rivalry among local buyers; strong and unique distribution channels; private ownership of the company; highly developed set of local machinery and suppliers; a number of supporting industries; specialized consulting companies; the strong presence of the Tile Industry Association; the roles played by the University of Bologna; and, most importantly, geographic concentration. "Once a cluster begins to form a self-reinforcing cycle promotes its growth".³¹ This point is best illustrated by the Italian ceramic tile cluster.

The Finnish Forestry Cluster - the forestry cluster is thoroughly developed. It generates 25% of the country's exports, 40% of the world plywood market and 25% of the world's market for all types of cardboard and paper. The Finnish forestry cluster includes a machinery import industry for all phases of activities. The cluster continues to increase its proportion of value-added products. The cluster maintains its competitiveness not only through its natural comparative advantage but increasingly through continual improvements in productivity.

The Norwegian Marine Cluster - includes the maritime transport industry, fisheries and shipyards that can accommodate the most highly specialized tankers. These are enterprises producing and exporting machinery and equipment for the fishery industry and the ship building industry. Norway accounts for 10% of the world's seaboard transportation. Its variety of related industries and internal suppliers is the main reason for its success.

The Danish and Dutch Dairy and Livestock Cluster - each country has important dairy and livestock raising clusters. The production and export of related machinery and equipment is one of the key success factors for these clusters.

The Dutch Flower Cluster - is most commonly touted as a leading, flourishing cluster that has created competitive advantage in the growth, production and marketing of flowers throughout the European market. The Netherlands continues to produce flowers, as well as import them for re-export. The comparative advantage lies in the development of new varieties, and the competitive advantage lies in marketing the product outside the country.

³⁰ Michael E. Porter, "Michael E. Porter on Competition and Strategy," *Harvard Business Review*, 1991. An excellent interpretation of how the Diamond works and how geographic proximity and close cooperation between the tile producers and equipment manufacturers contribute to sustainable advantage of the tile companies in Italy.

³¹ Porter, 1998.

The US Poultry Raising Cluster - is now an example of one of the most complete and sophisticated clusters. The focus is not on machinery and equipment, but on developing bio-technological advances to improve the fattening and egg laying capacity of poultry.

The Argentinean Oil Seed Cluster - generates 25% of Argentina's exports and has experienced extremely rapid growth. An important processing industry has grown from converting agricultural inputs such as soybeans and sunflower seeds into oils and oil by-products. A domestic industry has also been established which produces 90% of the machinery required by the processing plants. The international competitiveness of Argentina's oil seed cluster demonstrates success in penetrating the most demanding markets.

The Chilean Mining Cluster - has grown around the extraction of copper ore in which the country has strong comparative advantages. Over 25% of the world's copper ore reserves are located in Chile. Domestic production currently supplies two-thirds of the inputs, 40% of the equipment, 70% of the engineering services and 60% of the costs of input machinery and engineering services for goods and services produced by domestic industries.

The Canadian Materials and Metals Cluster - Canada's mining cluster has generated a number of benefits for Canada. Its fortunate endowment of mineral wealth and a wide range of activities, which have evolved to utilize mineral resources, have been a fundamental building block for Canadian economic growth. Canada's competitive export industries in this important cluster are concentrated in primary metals and ores, with relatively little presence in fabricated steel or metal manufacturing. The cluster generates 386,000 direct jobs and domestic exports valued at \$44.0 billion.³² Sudbury, Ontario, has evolved from a frontier mining town to a significant 'mining metropolis' and the Sudbury area became a technological leader in high productivity and environmental technology.³³ New enterprises producing newer equipment, machinery and parts and providing a wide range of services to the mining sector have emerged. The major firms, Inco and Falconbridge, have maintained and improved their competitive position in the Sudbury basin and support from the provincial and federal governments has contributed to this growth.

The strongest supporting service industry is geophysical contracting in which Canada is recognized as a world leader. The sector has benefited from world class consulting and engineering as well as specialized contracting and engineering firms based in Canada.

The Canadian Forestry Cluster - the forestry sector is a major component of the Canadian economy. Three hundred fifty communities across the country are deemed to be 'dependent upon the forest industry.' Considering direct, indirect and induced jobs

³² "Canada's Minerals and Metals Industry: An Economic Overview," Natural Resources Canada, September, 2001.

³³ Archibald R. M. Ritter, *Mineral Sector Development and the Community: Some Canadian Experiences*, Carleton University, 2000.

together the forestry cluster creates one of every 17 jobs in Canada. Exports are valued at \$39.0 billion CDN and the balance of trade is \$38.1 billion CDN. The value of manufactured shipments is \$56.5 billion CDN.³⁴ This cluster has a strong sawmill industry component. Canadian pre-fabricated housing manufacturers have penetrated the international market with great success. Supporting industries such as forest fire fighting, water bomber aircraft and chain saw blades have an international presence.

The Swedish Forestry Industry Cluster - is an example of one of the strongest clusters. Swedish forestry exports, at over \$10.1 billion USD, were enough to cover all of the country's oil imports, food, clothing and cars. Twenty-three per cent of the Swedish manufacturing sector's turnover and 27% of its added value are created in the country's forestry industry cluster. Twenty-six per cent of Sweden's industrial workers are employed by the forestry industry cluster and, with the companies themselves, they pay \$2.9 billion USD in taxes. Thirty-three percent of Swedish industrial investments are made within the cluster -- the forest industry alone invests \$1.1 billion USD per year in Sweden.³⁵

Volvo and Scania are among the leaders in the global heavy truck industry because the Swedish forestry industry requires these vehicles to transport wood and timber. Eka Chemicals's experience in bleaching and paper manufacturing chemicals enabled the company to build up its expertise and product ranges and become world leaders.

Examples of recent cluster initiatives around natural resources include Scotland's forest industry cluster strategy, South Africa's tourism cluster, Finland's cluster programs (forestry, food and industry) and Ontario's natural health technology cluster.

The South African Tourism Cluster - was developed to make this sector its economic driver for the 21st century. The World Travel and Tourism Council forecasted that within 10 years (by 2010) the economic benefits would include: an increase in travel and tourism from \$737,600 to \$1.57 billion; an increase in exports by 6.3% per year and account for 29.1% of total exports; the share of GDP would double; and, capital investment would account for 21% of the country's total capital investment.

Scotland's Forest Industry Cluster Strategy - was developed by Scottish Enterprise, a government funded non-profit organization and forest industry partners. Together a strategic framework for action for 2001 was developed. Its plan includes specific targets over the next five years such as creation of 1,000 new jobs, new investments of \$145 million USD in processing capacity, and an increase in market penetration from 9% to 15%.³⁶

Ontario's Natural Health Products Technology Cluster - focuses on natural health products such as herbal remedies, vitamin and mineral supplements, aroma therapy, sports nutrition and homeopathic remedies. Technological advances for activities such as

³⁴ "The State of Canada's Forests: The People's Forests 1997-1998, Natural Resources Canada.

³⁵ Press Briefing, Skogsindustrierna, 1999

³⁶ Scottish Forest Industries Cluster, 2000.

harvesting, processing and quality measurement will result in a competitive advantage. This cluster is in a location ideally suited for its growth. The City of Guelph and surrounding areas have core natural health products businesses including growers, manufacturers, processors, importers and exporters, distributors and retailers. The University of Guelph and the Ontario Ministry of Agriculture, Food and Rural Affairs provide research, training and analytical facilities.

Finland has shown how coherent and mutually supportive policies and programs can achieve economic growth, environmental protection and social progress for all its citizens. It is no coincidence that its standard of living was recently ranked as number one in the world. Finland's most recent Cluster Programmes identified seven programs including three natural resource based clusters to: improve the competitiveness of forestry and forestry industries; promote the utilization of renewable resources; and produce more out of less thereby reducing the waste of natural resources.³⁷ Over and above enhancing the competitiveness of Finland, the Finland cluster program will in itself be of vital societal significance.

In Latin America, 16 cluster initiatives are underway to make the transition from comparative advantage to competitive advantage on the basis of natural resource endowments.³⁸ The new development strategy is to strengthen the activities that will create value-added products and services and draw lessons from developed countries with respect to strengthening economic foundations and defining policy options. Some of the new natural resource based clusters that have penetrated international markets are Brazil's coffee industry, El Salvadore's plant cuttings industry, and South Africa's forest and wood products industry.

It is encouraging to note that there are complementary initiatives in place to promote economic progress, protect the environment and promote social equity. The OECD's Sustainable Development Project is aimed at striking a healthy balance between striving for rising income and ensuring due regard to environmental and social issues. The Mining, Mineral and Sustainable Development initiated by the World Business Council for Sustainable Development has as its objective identifying how mining and minerals can best contribute to the global transition to sustainable economic development. The Global Mining Initiative (GMI) was established by mining multinationals to promote sustainable economic development around natural resources. World Bank's Local Economic Development (LED) strategy is about local community (including public, private and not-for-profit sectors) working together through a proactive process to achieve sustainable economic growth that ensures increases in employment, prosperity and quality of life for their communities.

In all the above-mentioned clusters, the real long-term benefits come not from the presence of natural resources themselves (forests, mines, poultry, flowers, seeds, oceans,

³⁷ "Cluster Programmes: Promote the Economy, Employment and Entrepreneurship," 2000. For more information see <http://www.etal.fi/pubbyaut.html>

³⁸ For more information see <http://www.eclac.cl/espanol/Proyectos/clusters/clushome.htm>

etc.), but rather from the other activities which occur around them such as the development and export of related machinery, equipment, services and complex value-added products. Many activities have evolved around natural resources and then survived the depletion of those same natural resources that gave rise to them. For example, the Finnish mining industry became the basis for today's mining equipment and machinery manufacturing industry. In almost all the successful clusters, higher specialized universities, training programs, and regulatory frameworks, as well as close collaboration among educational institutions, research institutions and industry, was an important element for strengthening and intensifying linkages. As the world's export leader, Holland has premiere research institutions in the cultivation, packaging, and shipping of flowers. In Argentina, strong and ongoing increases in yields are largely due to the services offered by the Argentinian research centres and University of Buenos Aires.

The clusters in developed countries and developing countries are different and have evolved differently. In Asia, the Middle East and Latin America clusters are comprised of small and medium enterprises. The economic success associated with small firm clusters has been attributed to collective efficiency and this continues to be valuable in explaining the competitive advantage. Geographic concentration of these clustered firms supports the theoretical argument that geographic proximity enables them to overcome constraints to growth and development.³⁹

4. Challenges and Proposed Strategy

- a) **Challenges.** Heavy reliance on processing and exporting raw material -- unprocessed and semi-processed goods and materials; resource depletion; the emergence of lower cost competitors; and, cyclical demands for raw materials pose some serious challenges to the survival of natural resource based clusters and their capacity to create sustainable competitive advantage. The other challenges are dispersion, low profile, lack of infrastructure, environmental considerations, etc. The dispersion of natural resources can hinder the development of competitively related and supporting industries. For example, for the Canadian forest products sector, pulp and paper mills are scattered throughout Ontario and Quebec. A low public profile or awareness of a natural resource based industry, its sustainability, economic value and the linkages between the resources and the products that flow from them is a factor in creating a competitive advantage or environment. Weaknesses or gaps in logistics, transportation and infrastructure have been found to be limiting factors in the development of business activities around natural resources.⁴⁰ While environmental protection issues are paramount and must be safeguarded and managed on a proactive basis, these do incur a cost in terms of time and money. The development of downstream industries around natural resources that produce value-added products and services requires heavy financing and venture capital investment. Not least of all, foreign ownership

³⁹ *World Development*, Vol. 27, 1999. United Nations Economic Commission for Latin America and the Caribbean website, <http://www.eclac.clespanol/proyectos/clusters/clushome.html>.

⁴⁰ Fairbanks and Lindsay, 1997.

particularly in developing countries, often have corporate offices located away from the production facilities and the decision making is removed from the production facilities. Geographical separation between the multinational head office and the production facilities has been found to be an inhibiting factor in innovation. As Porter correctly pointed out, "failure to develop related and supporting industries is often a symptom of limited investments by core industries in creating advanced and specialized technology, skills and infrastructure In addition, procurement practices that stress price minimization over quality . . . stunt the development of competitive supporting industries".⁴¹ Related and supporting industries are critical for productivity and innovation, which in turn are critical in developing new products and services. Clusters can take a decade or more to fully develop in a new economy where speed is a key factor in achieving competitive advantage. There is an abundance of research on high tech and consumer goods related clusters. Further research is required to determine the specific character of natural resource based clusters and their potential to create a competitive advantage. As well, education and awareness programs are required to understand the indirect benefits of natural resources in terms of capacity building in areas such as education, health care, community development; innovation and the contribution to building sustainable livelihoods of those communities close to the resources.

- b) **Strategy.** In the new millennium, recycling waste from natural resources, unique services and differentiated products around natural tourist sites, the public's demand for a pristine environment, and the demand for health and medicinal products and other factors present countless economic growth opportunities close to the resource base. However, a comprehensive strategy that is suited to each region/country or circumstance is required to seize new growth opportunities.⁴² The strategy should keep in mind the following:

- invest rents earned from extraction and processing of natural resources to create value-added products and services;
- conduct research on the benefits of social, medicinal, health and environmental uses of renewable resources;

⁴¹ Porter, 1992. This study was sponsored by the Business Council on National Issues and the Government of Canada. It provides an in-depth, penetrating analysis of competitive environment and Canada's position in international competition. It examined 16 clusters including natural resource based clusters. It provides an insightful analysis of the role of supporting and related industries in innovation and productivity growth, the implication of government policies, the role of government and why a shift from comparative advantage to competitive advantage is necessary.

⁴² Porter, 1999. In this interview Porter makes a clear distinction between strategy and operational effectiveness. Compelling and convincing reasons are given as to why a strategy is critical in achieving sustainable competitive advantage; Fairbanks and Lindsay, 1999. The authors provide a useful, practical framework to make the shift from comparative advantage to competitive advantage.; OECD, 2000. This document provides a set of practical guidelines for cluster development initiatives and specific steps in a cluster development process.

- invest in strengthening microeconomic foundations -- four determinants of the Diamond;⁴³
- use information and communications technology as an enabling technology and as "a harbinger of growth and economic change" to improve production and innovation;
- cultivate trust, innovation, social imbeddedness and creative milieu;
- understand the differing cultural values and attitudes;⁴⁴ and
- extend innovation and upgrading for the entire value chain and not merely the spin-off industries.⁴⁵

c) **Practical Implications.** The analysis of the above clusters in the new economy has clear practical implications for all involved. Government can encourage clustering by offering an improved infrastructure and other incentives to producers and related service providers to locate in a designated area.⁴⁶ Governments can facilitate cluster development by providing an institutional framework that allows cluster participants to form, grow and discuss mutual needs and interests. The private sector and business associations can identify barriers

⁴³ R. Gutierrez, C. Martinez, A. Sfeir-Younis, M. Fairbanks, S. Lindsay, P. Holden, E. A. Brugger, *Challenges for the New Millenium in Latin America: Sustainable Development, Competitiveness and Second Generation Reforms*, 2000. The authors make a convincing case for getting the four determinants of the Diamond -- factor conditions, demand conditions, firm strategy and related and supporting industries, working together as a system. They provide the example of Peruvian tourism. In an area with tremendous natural resources such as Machu Picchu, they argue that without a strategy to attract more sophisticated and demanding tourists, they can only attract larger numbers of the average tourists that they have attracted all along. Without proper infrastructure in place, they risk the linear growth at a point where they begin to destroy the pristine environment they are selling.

⁴⁴ L. E. Harrison and S. P. Huntington, *Culture Matters: How Values Shape Human Progress*, Basic Books, 2000. The authors state that the role of cultural values and attitudes as obstacles to or facilitators of progress has been largely ignored by government and aid agencies and suggest that these cultural values and attitudes should be integrated into policy development and planning. They argue that the practical reason why some countries are better off than others lies in cultural values. They make an interesting observation between Ghana and South Korea to show how cultural values can make a difference in economic progress. The two countries had comparable levels of per capita GNP, similar divisions of their economy, and comparable economic aid, yet after thirty years South Korea has become an industrial giant and no changes occurred in Ghana.

⁴⁵ Hubert Schmitz, "Global Competition and Local Cooperation: Success and Failure in the Sinoz Valley, Brazil," *World Development*, Vol. 27, No. 9, 1999.

This case study of Sinos Valley, Brazil, a leather footwear cluster., makes a valid point that innovation needs to be fostered across the whole value chain. The article shows that a substantial increase in bilateral vertical co-operation contributed to a major rise in product quality, speed of responses and flexibility. However, in spite of these advances the cluster has not been able to raise exports and profits have fallen. The reason for this downturn is due to the fact that upgrading was largely limited to the sphere of production. Upgrading in other areas such as marketing, design and image failed.

⁴⁶ While it is true that firms and industries compete in the global market, governments can provide a basis to facilitate competition. There are a number of examples from around the world where government policies and programs have transformed their country's/region's competitiveness. Governments can provide funding for cluster studies to identify which industry is competitive, is the industry sustainable in the long-term and what are its growth prospects. For example, the Social Sciences and Humanities Research Council of Canada provided funding of \$2.5 million to examine the impact and importance of cluster-driven innovation in Canada. Research will focus on more than 20 clusters in five regions in newly emerging knowledge-intensive areas as well as in more traditional sectors.

and opportunities, propose legislative and policy changes, and collaborate with research and educational institutions to translate research and development and technological advances into commercial applications. Development agencies and other policy think-tanks can play a pivotal role by providing research, training and funding to promote the development of natural resource sectors. Multinationals can play a very important role in promoting sustainable economic development practices, investing in domestic environments, i.e., support to local suppliers, workforce development, capacity building, etc.⁴⁷

5. Concluding Remarks

Can natural resource based clusters meet the requirements of the new economy? The answer is *yes*. This view is supported by the theoretical model of competitiveness, the role of clusters in promoting innovation and productivity, and empirical evidence of successful natural resource based clusters. Porter's work, which included case studies of regions/nations, offers verification of the competitiveness model and the role of clusters driving growth and innovation. There are many examples of successful resource based clusters and new ones continue to emerge. Clusters founded on non-renewable resources, i.e., mines, demonstrate that business activities developed around these resources can continue to provide a competitive advantage to areas even after the depletion of the raw materials. Clusters that grew around renewable resources (i.e., forestry, water) provide limitless opportunities for new businesses on a sustainable basis. The drop in communication, transportation and learning costs allow easier and less costly access to an ever increasing variety of new services at home and abroad. The geographically remote regions can compete in the open market. Specific products related to natural resources, i.e., forestry, mining, processing technology, production software can provide an income stream in these regions in a sustainable manner.

There is a definite need for a renewed plan of action to deal in a forthright manner with the ecological, economic, social and cultural aspects of resource usage and conservation at all levels of government and at all fronts. At the new millennium, the over-arching importance of matching economic pursuits with human values and relations, along with nature's ability to sustain human activity must be acknowledged.

Economic progress is fundamental to human progress. Economic growth, indispensable to the other forms of human progress (e.g., health, education, infrastructure), depends on productive economic activity. Natural resource based clusters promote economic progress for all as "the whole is greater than the sum of the parts." The higher spin-off benefits often include social equity, social justice and democracy.

⁴⁷ Rosebeth Moss Kanter, "Thriving Locally in the Global Economy," *Corporate Strategies*, September-October, 1995. The author provides examples of how multinationals such as Michelin Groupe and BMW have turned Greenville and Spartanburg into international centres, stimulated learning to heighten awareness of world standards and connected local companies to global networks. Greenville and Spartanburg now are the sites of the highest per capita diversified foreign investment in the US. Rugman and D'Cruz. Case studies of Canada's successful multinationals like Alcan, Noranda and Nova, etc. illustrate the methods by which value-added has been introduced by these resource based companies.

Research shows that there is a strong correlation between rising incomes and desirable personal characteristics.⁴⁸ Furthermore, research shows that two-thirds of the causality runs from rising prosperity to rising personal and civic satisfaction. ". . . clusters . . . enhance productivity and a rising standard of living wherever they exist." The benefits of economic growth in clusters could be shared among the entire population.

It is imperative that governments and private sector leaders as well as non-profit development agencies work together to create the needed change that will result in natural resources being used in a manner that supports the distribution of wealth close to the resource areas, promotes positive values (social equity, social justice and democracy), and recognizes and builds upon the best in each culture and history.

⁴⁸ Desirable personal characteristics are defined as productive attitudes toward authority, disposition to participate in community or national affairs, tolerance of others, self-esteem and a sense of personal competence.

ACKNOWLEDGEMENTS

I would like to express my sincere thanks to Cameron Clark, Deputy Minister, Jim McClure, Assistant Deputy Minister, and Dr. John Gammon, Assistant Deputy Minister, of the Ministry of Northern Development and Mines, for their continuous support, encouragement and guidance on the clustering project.

I would also like to convey my heartfelt appreciation to the following individuals who enlightened me with their insights and experience with cluster based economic development strategies: Joe Babiec, ontheFRONTIER (Monitor Company), US; Ifor Ffowcs-Williams, Cluster Navigators Ltd., New Zealand; Josie Rowtz, Blueprint Strategy and Policy Ltd., South Africa; Kate Kuper, World Bank, US; Rudolph Buitelaar, United Nations Economic Commission for Latin America and the Caribbean, Chile; and, Michelle Lennihan, US Council on Competitiveness, US.

REFERENCES

- Association of Metropolitan Planning Organizations, *Industrial Clusters: Emphasizing a Region's Strengths*.
- Bergman, E. M., and E. J. Feser, *Industrial and Regional Clusters: Concepts and Comparative Applications*, West Virginia University, 1999.
- Culverwell, Malaika, "The Mining Cluster is Antofagasta - Integrating Small and Medium Suppliers into the Production Chain," Ph.D. Thesis, 2000.
- Economic Development Administration, United States Department of Commerce, *Cluster-Based Economic Development: A Key to Regional Competitiveness*. Washington, D.C., 1997.
- Fairbanks, M., and S. Lindsay, *Plowing the Sea: Nurturing the Hidden Sources of Growth in the Developing World*, Boston: Harvard Business School Press, 1997.
- Forest Industries in Sweden, *The Swedish Forest Industry Cluster - What is it?*, Press Briefing, Nov. 22, 1999.
- Gutierrez, R., C. Martinez, A. Sfeir-Younis, M. Fairbanks, S. Lindsay, P. Holden, and E. D. Brugger, *Challenges for the New Millenium in Latin America: Sustainable Development, Competitiveness and Second Generation Reforms*, 2000.
- Harrison, L. E., and S. P. Huntington, *Culture Matters: How Values Shape Human Progress*, Basic Books, 2000.
- "Industry's Clusters Get Their Act Together", www.btimes.co.za, 2000.
- Innovation Systems, Research Network, "Clusters Initiative," www.utoronto.ca, 2001.
- International Development Research Centre, *A Natural-Resource Cluster Development Strategy: The Case of Mining*, A Project Proposal, Ottawa, 1998.
- Kanter, Rosabeth Moss, "Thriving Locally in the Global Economy," *Corporate Strategies*, September-October, 1995.

Martin, Roger L., "A Remedy for Canada's Competitiveness Problem," *Toronto Globe and Mail*, December 20, 1999.

-----, and Michael E. Porter, "Canadian Competitiveness: A Decade After the Crossroads," C. D. Howe Institute Working Paper, 2001.

-----, and Michael E. Porter, "Weak Newsprint Makers a Metaphor for Canada," specialedition.net, *National Post*, May 2, 2001.

MMSD Briefing Paper, *Mining, Minerals and Sustainable Development*, 2000.

Moazzami, B. *Trends and Analysis of Primary Industries in Northern Ontario*. Lakehead University, 2001.

Monitor Country Competitiveness, *An Organizing Model for Building Prosperity Through Competitiveness*, 2000.

Natural Resources Canada, "Canada's Minerals and Metals Industry: An Economic Overview," September, 2001.

-----, "The State of Canada's Forests, The People's Forests 1997-1998."

Organization for Economic Co-operation and Development, *Boosting Innovation: The Cluster Approach*, 199__.

-----, *The New Economy: Beyond the Hype - Final Report on the OECD Growth Project*, 2001.

-----, *Enhancing the Competitiveness of SMEs in the Global Economy: Strategies and Policies*. Conference for Ministers responsible for SMEs and Industry Ministers, Bologna, Italy, June 14-15, 2000.

"An Organizing Model for Building Prosperity Through Competitiveness," Monitor Country Competitiveness, Cambridge, Massachusetts, n.d.

Porter, Michael E., *The Competitive Advantage of Nations*, New York: The Free Press, 1990.

-----, *Canada at the Crossroads - The Reality of a New Competitive Environment*, Boston: The Monitor Company, 1991.

-----, Address to Wellington Town Hall, New Zealand, 1998.

-----, "Clusters and the New Economics of Competition," *Harvard Business Review*, November-December 1998.

-----, "Michael Porter on How to Marry Strategy & Operational Effectiveness", www.best-in-class.com, 2000.

Ramus, J., *A Development Strategy Founded on Natural Resource-Based Production Clusters*, CEPAL: Economic Commission for Latin America and the Caribbean, 1998.

Reimer, B., and P. Apedaile, *The New Rural Economy in Canada*, prepared for the Canadian Employment Research Forum, Sudbury, Sept. 8-9, 2000.

Ritter, Archibald R. M., *Mineral Sector Development and the Community: Some Canadian Experiences*, Carleton University, 2000.

Rugman, Alan M., and Joseph R. D'Cruz, "The 'Double Diamond' Model of International Competitiveness: The Canadian Experience", *Management International Review*, Special Issue, 1993/2.

San Diego Association of Governments, "Understanding Cluster Analysis", 1999.

Schmitz, Hubert, "Global Competition and Local Cooperation: Success and Failure in the Sinos Valley, Brazil," *World Development*, Vol. 27, No. 9, 1999.

Scottish Enterprise, *International Forestry Cluster Benchmarking Summary Report*, 2000.

Scottish Forest Industry Cluster. *Roots for Growth - A Strategic Framework for Action for the Scottish Forest Industries*. 2000.

Skogsindustrierrana, "The Swedish Forest Industry Cluster - What Is It?," Press Briefing, 1999.

"Strategy Returns to Its Roots: An Interview with Michael Porter," *New Zealand Strategic Management*, Spring 1997.