CPROST // SIMON FRASER UNIVERSITY

Centre for Policy Research on Science and Technology

REPORT

CPROST–9908

# Innovation in Enterprises in a Non-Metropolitan Area

## Quantitative and Qualitative Perspectives


Adam Holbrook
Tim Padmore
Lindsay Hughes
Judith Finch



CENTRE FOR POLICY RESEARCH
ON SCIENCE AND TECHNOLOGY
100–515 West Hastings Street
Vancouver, BC, Canada V6B 5K3
Telephone 604/291.5114
Fax 604/291.5165
E-mail cprost-staff@sfu.ca
Web http://www.cprost.sfu.ca/cprost/

Draft

# Innovation in Enterprises in a non-Metropolitan Area: Quantitative and Qualitative Perspectives

Adam Holbrook, Simon Fraser University
Tim Padmore, University of British Columbia
Lindsay Hughes, Simon Fraser University
Judith Finch, Medical Research Council of British Columbia

**Centre for Policy Research on Science and Technology,**
**Simon Fraser University, Vancouver, BC**

Report # CPROST - 9908

*as presented to*
*Inaugural Meeting of the Innovation Systems Research Network*
*Toronto, Ontario*
*May 17, 1999*

**Abstract**

*The researchers have done several studies in the Okanagan Valley of British Columbia. This paper is a synthesis of this experience trying to answer three questions: What are the innovation issues most important to key industrial sectors? From the perspective of these sectors, what are the most important elements of innovation system and how do they perform? What is the overall competitive situation of each sector, and what role does the regional innovation system play in that situation?*

## Introduction

The importance of innovation to industrial success is generally accepted. In seeking to understand the dynamics of innovation, researchers have expanded their focus from individuals to firms and to the milieus that they operate in. The studies have great policy importance, a fact that was recognized early by national governments interested in sharpening policy tools for economic development. That interest, and the relative availability at the national level of helpful statistical data, led to an early focus on *national* systems of innovation. This paper is in the context of more recent work on *regional* systems of innovation (de la Mothe, 1997) which recognizes that, while national policies are important, most of the interactions of importance to most firms take place over relatively modest distances. The scope and reach of these interactions varies a great deal from region to region and industry to industry, but it is fair to say that the characteristic distances are "regional" rather than "national".

Regions can be hard to pin down. We have tried to choose a study region that is relatively well defined geographically and economically, without worrying too much about political

divisions. In fact, there is no single governing body for the Okanagan (it covers part or all of three Regional Districts and quite a few more municipality and city governments) but many formal and informal business networks span the valley as we have defined it.

We have done a number of qualitative and quantitative studies in the region. (Holbrook, Hughes et al., 1997; Impax, 1997; Impax, 1997; Impax, 1997; Holbrook, 1998.) These include descriptive economic profiles, quantitative economic modelling, and innovation studies. The methodologies include stakeholder and firm interviews, surveys and research and analysis of published statistics.[1]

The purpose of this paper is to use this experience to address three questions:

1. *What are the innovation issues most important to key industrial sectors?*

Following the interests of local stakeholders, we have looked at four classical industry groupings or clusters: construction industries, forestry and wood manufacturing, agriculture and food processing, and tourism. We have also looked at categories of firms that can be viewed as high or advanced technology; these do not form a single cluster of interacting firms, but do have many characteristics in common.

There are different definitions of innovation. The OECD's Oslo manual (OECD, 1996) provides a precise definition of Technological Product and Process innovation that is useful for standardizing surveys. Our own innovation surveys (Holbrook, Hughes et al., 1997; Holbrook, 1998) do not confine the question explicitly to technology innovation. In other work, we have argued that other innovative behaviour including marketing innovation, financing innovation and management innovation, is very important to competitiveness.(Padmore, Schuetze et al., 1998) In this, we largely follow Schumpeter, the pioneer conceptualizer of industrial innovation (Schumpeter, 1934).

In our qualitative discussions around innovation, we did not try to constrain the definition at all, preferring to learn from our respondents what *they* considered to be innovations and to explore how those innovations occurred and their importance to their firm or their industry sector.

2. *From the perspective of these sectors, what are the most important elements of innovation system and how do they perform?*

The short innovation survey that we developed devotes most of its length to questions on the sources and drivers of innovation. The data suggest that there are some striking

[1] The interview program included about a dozen interviews per sector, most in person, the rest by phone. Interviews with firms were guided by the GEM framework (Padmore and Gibson, 1998). The economic model was a custom input-output model created for the Central Okanagan Regional District by Hervey Gibson of Cogent Strategies International in Scotland (Impax, 1997). The innovation surveys are described in (Holbrook, Hughes et al., 1997). A further survey, not conducted by ourselves, looked more deeply at firms' location decisions and is described in (Impax, 1997). In addition, we studied standard statistical sources such as industry directories like the BC Manufacturers Directory, the Regional Index and BC Stats Community Profiles.

differences among sectors, and this is confirmed in the qualitative studies. There are also distinct regional differences, especially when it comes to the use of and attitudes toward government programs.

*3. What is the overall competitive situation of each sector, and what role does the regional innovation system play in that situation?*

Innovation is only part of the picture. As part of our work in the Okanagan, we have done overall assessments of cluster competitiveness using the GEM framework that has been discussed elsewhere. (Padmore and Gibson, 1998) Each of the GEM determinants potentially affects innovation capacity and innovation behaviour. However, there are other matters unrelated to innovation that may limit or stimulate a sector, for example availability of financing or a key material input. Therefore it is useful to embed the discussion of innovation in the broader competitive picture, which is the framework for actual business decisions on innovation. (In the interest of brevity, this paper addresses question 3 in detail only for the construction sector.)

**The setting**

The most important fact about the Okanagan is its location and climate. The region is in the province of British Columbia in Canada. It straddles Okanagan Lake, which lies in a valley stretching approximately 150 kilometres north from the United States border.[2] The climate is equable, with annual rainfall of 280 millimetres midway up the valley, less in the north and more in south, but everywhere agreeably light. The region has five months of 20 degree or warmer days and winters that are crisp but not harsh, with about a metre of snow on average in the central valley. Extremes of temperature are moderated by the lake, which supports a wide variety of recreational and a modest amount of commercial and industrial activity. The adjacent high country offers an extended season of winter recreation. There is good agricultural land on the benches around the lake.

The geography of the region has attracted settlers for more than a century. With the construction of a modern highway system in the 1950s and 1960s, the region became a prime destination for tourists as well as for people seeking permanent homes and a better or cheaper life than they could have in the metropolitan region to the west (the Lower Mainland, centred on the city of Vancouver). Population growth has been rapid; in 1996 the census population of Kelowna was 136,541, a 22 per cent increase from 1991 and now more than half the total population of the valley. Compared to the rest of the province, the Okanagan has more elderly people and fewer young adults. The population picture is consistent with a view of the region as a mecca for retirement and a popular place to raise young families.

The region includes several Indian Reserves. These First Nations communities generally have economic development strategies and one, the Westbank First Nation, is an important focus of commercial and residential development near Kelowna.

[2] Where census data are cited, the reference area is the Census Metropolitan Areas of Vernon, Kelowna and Penticton.

Kelowna is the commercial heart of the region, the centre for business services and manufacturing. The city of Vernon in the north and Penticton in the south are secondary centres. The communities are closely interrelated, with many people living in one community, working in another and sometimes shopping in a third.[3]

**General economy**

The valley economy is quite diversified and has enjoyed growth in most sectors, especially services. Only one company in five has more than 10 employees, and less than one in 10 has 20 or more. There are many home-based "micro-businesses." [4] Less than half the labour force is employed full-time throughout the year. The region attracts both skilled and unskilled labour and very few companies report difficulty recruiting. The high incidence of part-time work, self-employment and small firms all contribute to reported incomes that come in below the provincial norm, but close to the average for Canada.[5]

British Columbia is often viewed as two worlds: the urban and industrially diversified south west corner (the Lower Mainland and the city of Victoria on Vancouver Island) and the rest of the province -- characterized by small communities, narrow industrial base, and dependence on resource industries and tourism. The outlines of the economic structure of the Okanagan, however, are closer to those of Vancouver than to most of the Okanagan's sister regions. The Okanagan has more manufacturing, business services and wholesale trade than the sister regions. However, there are important differences. Okanagan firms are smaller and more specialized. In particular, high technology industries are less numerous and much less diverse than in the Lower Mainland.

**Construction cluster**

As a detailed example of an innovation/competitiveness profile, we present findings for the Construction cluster.[6] This is not a sector generally seen as very glamorous or

[3] This qualitative impression of the valley as an integrated economic unit is supported by data, e.g. census demographic analysis, and by evidence from firms on supplier and customer relationships.

[4] Local development authorities estimate that as many as one quarter of homes have a home-based business.

[5] Information in this paragraph is from Central Okanagan Community Profile, 1995, Kelowna Canada Employment Centre.

[6] For purposes of statistical analysis and economic modeling, we selected the following Standard Industrial Classifications as an approximation to the cluster.

Quarries and sand pits
Services incidental to mineral extraction
Textile products
Fabricated metal products
Non-metallic mineral products
Building, developing and general contracting
Industrial and heavy (engineering) construction
Trade contracting
Services incidental to construction
Wholesale household goods

innovative. However, the evidence suggests that innovation is important to the competitiveness of the cluster, that managers are very conscious of innovation issues, and that there are system issues that both encourage and inhibit innovation. The sector is also interesting because of the importance of non-technological innovation.

The Construction cluster has been driven by population growth. The prime need is for new structures for people to live in, for businesses to operate in, and for government services and infrastructure. Up to now, replacement, renovation and redevelopment have been secondary.

Transportation developments triggered the first waves of growth, beginning with railroad links to the rest of Canada in the 1890s, critical to the agricultural industry. Highway construction in the 1950s and 1960s opened up the area to tourism from the Lower Mainland, the province of Alberta other parts of Canada. At the same time, changes in forest tenure in British Columbia greatly expanded the forest industry. Highway modernization in the 1980s reduced the travel time from the Lower Mainland to less than four hours, triggering another wave of development.

Tourism patterns amplified the waves. Many people became acquainted with the attractions of the region as tourists and later returned to settle, at first largely as retirees, and now increasingly as well-off baby-boomers. The last wave was further amplified by soaring housing prices in the Lower Mainland, which created a strong incentive for people to relocate to the Okanagan.

By far the largest component of the Construction cluster is trade contracting, followed by industrial and heavy contracting, building development and general contracting. These functional categories overlap the various *types* of construction: commercial, industrial, government and residential. Recently, residential construction comprised about two-thirds, commercial construction about one-fifth, government construction about one tenth, and industrial construction a few per cent of the total. As a proportion of the total, residential construction has been trending *down* while commercial construction has been trending *up.*

Compared to Canadian norms, all the major construction sectors in the Okanagan stand out by their relative size, evidence of a strong and balanced cluster.

Following is a competitive analysis of the construction sector cluster following the categories of the GEM framework.[7] Results from the innovation surveys[8] are woven

---

Wholesale metals, hardware, plumbing, etc.
Wholesale machinery, equipment and supplies
Retail household furniture, appliances, furnishing
Real estate operators
Insurance and real estate agents

[7] The GEM organizes competitive determinants under three headings (Groundings, Enterprises, Markets) and divides each of these two into categories: Groundings = resources, or infrastructure; Enterprises = related and supplier firms, or firms structure and strategy, Markets = local markets, or access to external markets. These determinants can be scored and the scores combined -- taking into account the

into this discussion. The qualitative data are not only useful to interpret the statistical evidence. They can also confirm or oppose quantitative data with marginal statistical significance. Because of the modest number of firms surveyed in the Okanagan and in the Lower Mainland (which serves as a reference region), many observed differences have low statistical significance. The qualitative data are therefore very important, even though it is hard to quantify the degree to which they strengthen conclusions.

*Resources*

The basic resource for construction industries is land. In the Okanagan, the resource issue is more particular. It is not so much the land but the quality of life on the land that creates much of the value. Increasingly, economic opportunities of all kinds -- which drive demand for construction services -- are also linked less to conventional resources (land, water, minerals, trees) and more to quality of life. A readier supply of the services and amenities of modern life has improved the Okanagan quality of life. However, the visual landscape has deteriorated in some high growth areas, and the valley is now facing urban ills like traffic congestion and rising housing costs.

Despite heavy development in the last decade, there is still a reasonable supply of residential building lots. There is some pressure on industrial land. Water supply in this semi-arid region is currently a constraint, but conservation measures such as metered fees for water use have not been thoroughly exploited.

Construction companies are among the very few to report any human resource shortages. Employers blame this on high labour mobility, especially in the summer: workers quit to enjoy the sun, expecting to be rehired quickly when their vacation is over. Firms prefer experienced workers, but many do not have current construction knowledge and may be unwilling or unable (due to limited literacy) to go back to school. Younger workers may be "paper-qualified" but not do well on the actual job site.

The innovation-survey questions on barriers and incentives tend to confirm that availability of personnel is not much of an issue one way or the other for this sector in the Okanagan. Financing and environmental issues also appear neutral to innovation. Availability of raw materials scored moderately higher as a positive influence, and this was reflected in some of the interviews, where respondents pointed to the presence of forest and quarry resources as favouring the industry. The construction sector was more likely to acquire new skills by hiring a new employee than other "low technology" sectors; however we think this reflects a general industry pattern related to high labour

---

complimentary and substitutional relationships -- into an overall rating that correlates reasonably well with cluster success. [Padmore, 1998 #375]

[8] The innovation survey was developed by Holbrook (Holbrook, 1998). In the Okanagan, 105 firms in four categories provided useful responses, but there were only 14 in the construction cluster (plus 37 food and agriculture, 25 forestry and wood products, and 29 high technology). An almost identical survey was conducted in the Lower Mainland. The survey is a short (two-page) version of innovation surveys widely deployed in OECD, modified through a series of focus groups to suit British Columbia needs. Most answers are recorded as simple yes/no/don't know responses. Only firms with more than five employees were surveyed.

mobility, as the same result was seen in the Lower Mainland. The sector also had a relatively high proportion of employees with post-secondary training; this certainly reflects the ubiquity of trades training in this industry.

A special problem is faced by First Nations groups. While real estate development is a strategic priority, band members are said to lack key skills ("too many lawyers and not enough entrepreneurs and business people").

Competition is fierce in the valley, and margins narrow. So technology is important for maintaining profitability. Most technology comes out of the regional industry and comes in the form of incremental innovation, for example how to deal with new building standards, how to handle new materials, or how to build novel structures.

Much innovation occurs on the work site. While engineers are credited as important innovators, the industry relies routinely on skilled workers and their managers ("the contractor in his office trying to figure out how to implement the engineer's or the architect's idea").

*Infrastructure*

Currently, there are some substantial strains in the regulatory framework as the incorporated and unincorporated areas of the Central Okanagan move to stronger planning frameworks and more recovery of costs. Eventually, these changes may be beneficial to the industry, but currently they are seen as a constraint.

Because of the important link between the Construction cluster and tourism industries, and because of the importance to both of quality of life issues, the flow of costs and benefits from regulation is complex. Benefits, costs and revenues from the same project flow at different times, perhaps separated by many years. The streams of value diffuse out to multiple parties, especially values created by public works like parks, walkways and underground wiring (none of which are covered by development charges).

Many interviewees called for innovation in the regulatory process to more fairly reflect the Okanagan patterns. One developer described his work as "the successful application of imagination" and made sure we understood that some of the innovation is finding creative ways to work with, or around, regulatory system.

In the innovation survey, government policies and programs were frequently cited as a barrier to innovation. *This very important finding was common to all sectors and is discussed more fully in the next section.*

One interviewee said innovative use of technology can be used to solve planning problems, for example the use of electronic surveillance to meet security concerns.

There are some problems of jurisdiction. For example, the Ministry of Transportation and Highways has a major influence on development along the major north-south

highway, but its primary objectives are safety and traffic flow -- not effective social organization or esthetic values -- which translates into requirements for lots of parking, requirements that are most easily met by large shopping malls.

Planning is mostly at a municipal level, and there is limited co-ordination with First Nations development. Further, there is uncertainty arising from native land claims and self government negotiations. First Nations typically have a unique strategic framework: social development through exploitation of their land base.

When the status of growth centres changes (incorporation, amalgamation) building standards may be upgraded, creating new demand but also forcing industry to absorb higher costs.

The highway infrastructure is adequate to support continued growth. There is a need for improved communications infrastructure, including fibre optic links, to support the high-value construction (replacement and upgrading) envisaged for the future.

The industry itself is reasonably well organized with a number of trade associations for contractors, builders and developers, with good local representation on the provincial and national scene.

Research infrastructure is located outside the valley and is seen to be focussed on *materials*, while firms feel they need more help with construction *methods*.

Education infrastructure is well developed in the valley, including a degree-granting university-college, but some of the training was criticized, e.g. trades training is "too narrow" in some cases. Industry skills expectations are increasing. One innovative employer sits on the apprenticeship advisory board at the college -- not only to influence the direction of training, but also to get leads on the best students.

While informal know-how sharing is sometimes important, professional networks were not mentioned in interviews as a source of innovation. This negative finding was reinforced by the survey question on professional networks as an innovation source: professional networks were one of the least important sources.

Manipulation of the Employment Insurance system was blamed for some of the labour shortages.

*Supplier and related firms*

There is good availability of local suppliers for specialized goods and services. This is important, because it can be costly to equip and train workers to perform functions in-house, e.g. welding and machining. Manufactured products are often imported. Sometimes specifications call for imported components or furnishings that could have been bought from local suppliers. This bias was blamed in part on sourcing of architectural services in the Lower Mainland.

The innovation survey found suppliers to be one of the *most* important sources of innovation (although out-sourcing of research and development was very low). However, a question on strategic alliances elicited a weak response. Linkages among firms are characterized by informality, flexibility, and frequency.

One successful firm works extensively with project engineers and architects to invent new approaches or modify plans to manage costs or improve quality.

Competitiveness is also affected by *related* firms (firms that have indirect impacts on cluster firms).

Tourism attractions (especially golf courses) provide centres of demand for residential and commercial construction services. Construction services benefit from the availability of commodity and value-added wood products.

The existence of a major truck manufacturing plant has stimulated a considerable capacity in metal fabrication. These fabricators do half or more of their business with other industrial and commercial clients, but the truck plant is a stable, core customer.

The provincial telecom company has a significant influence on high quality development through constraints imposed by the telco's internal timetable for upgrading and new infrastructure, e.g. fibre optics and underground cable.

*Firms' structure and strategy*

The industry includes many SMEs, which generates some inherent instability. However, this is also true for comparison clusters in other regions. The most important advantage enjoyed by the Okanagan cluster is the highly competitive business atmosphere in the valley, said to be a consequence of the high quality of life, which attracts founders and small, mobile firms.

**Firm Size in the Construction Sector, Kelowna, 1994[9]**

| **Number of employees** | **0 to 5** | **6 to 20** | **21 to 50** | **51 to 100** | **Over 100** | **Total** | **Increase from 1988** |
|---|---|---|---|---|---|---|---|
| **Number of firms** | 1134 | 224 | 37 | 5 | 0 | 1,400 | 155% |

The excess capacity not only engenders competitiveness, it also shaves profit margins. Margins have fallen drastically since the early 1990s, from 20 to 40 per cent to 5 to 10 per cent. This is sometimes referred to as the "sunshine tax." Thin margins can lead to difficulties in financing large projects.

[9] Kelowna Canada Employment Centre, Labor Market Information Unit

Strong competition has two effects unusual for this industry, especially for a non-urban region. First, there is competition on service as well as price. For example, producers of commodities like ready-mix concrete compete vigorously on timely service. Profits are found in service niches, such as a shop that runs two shifts and has a developed a reputation for quick, round-the-clock service on small jobs (while charging high margins). Second, the region exports construction services. This is unusual for the construction industry because of the high cost of transporting equipment and maintaining personnel outside the home region. In the innovation surveys, Okanagan firms reported twice the level of extra-regional exports as did those in the Lower Mainland.

There appears to be significant innovation in construction methods, particularly in the non-residential sectors. Competitors are willing to share know-how developed on a previous project.

Customers and the sales force scored high as sources of innovation in the survey. This contrasted with the Lower Mainland survey, where construction stood out for its low use of this related pair of sources. Perhaps surprisingly, firms reported that in-house R and D is also important to innovation. The rating was rather higher than for construction firms in the Lower Mainland, but we have no qualitative information bearing on the difference, which could be due to chance. Competitors were not a significant source of innovation.

As for barriers and incentives to innovation, the most important incentives were management, customers and competitors. All three scored higher than for the reference group in the Lower Mainland. This pattern is consistent with the oversupply and competitive pressures reported in interviews.

There is considerable diversity in the organization of firms, for example different combinations of development, building, and engineering activities. Alliances are very fluid and there is no evident trend to consolidation.

Quiet restructuring and innovation is reported in a variety of areas: trades training, pricing, bonus arrangements and commissions for estimators, and bidding strategies. Management innovation is vital: "there are a lot of innovative products around but they are very costly, the real innovation is how you manage your business."

Developers are concentrated in Kelowna, while constructors and trades are distributed along the valley

*Local markets*

The market is becoming increasingly quality conscious, partly due to higher building standards, and partly to a shift in migration patterns. Where newcomers once were mainly retirees with relatively low incomes, now there are many more professionals and pre-retirees with more money to spend and higher expectations.

Volume, however, is slowing as population growth "slows" to a still-vigorous three per cent a year.[10] The shift from volume to quality has stimulated innovation in methods and increased reliance on technology infrastructure.

In the past, public sector projects have been an important source of counter-cyclical demand. Because valley firms are small, they are vulnerable on large projects. If a large outside competitor lands a large valley project (hospital, highway), the impact may be severe. Local employment effects may be small, because the large firms will hire locally, but local firms will lose not only profits but also experienced manpower and innovation know-how.

The innovation survey confirmed the importance of the local market . Consistent use is made by firms of customers and the sales force as sources of innovation.

*Access to external markets*

The competitive pressures in the valley have created opportunities for aggressive low-cost producers to compete outside the valley and many contractors are reported to do 30 to 40 per cent of their business outside. In the innovation survey, firms reported 20 to 30 per cent extra-regional exports, which is consistent with the subjective estimates, and about twice as high as the proportion of exports reported by the Lower Mainland construction cluster.

However, the Okanagan is not a real estate development centre in the sense that Vancouver or Toronto are, as it lacks not only skills but connections that would give it access to large projects outside the region or outside the province.

Export content is tilted to higher levels of expertise, e.g. design and supervision, since the exporting contractor will normally hire some trade skills from the client region. The Okanagan has no particular advantage in accessing export markets, other than its history and reputation for delivering competitive product (which is highly dependent on continuing innovation).

One firm said *marketing* innovation in the development sector is focussed on redefinition of the product to suit the new demographics, that is, designing "adult communities" rather than "retirement communities."

**Sector and regional comparisons**

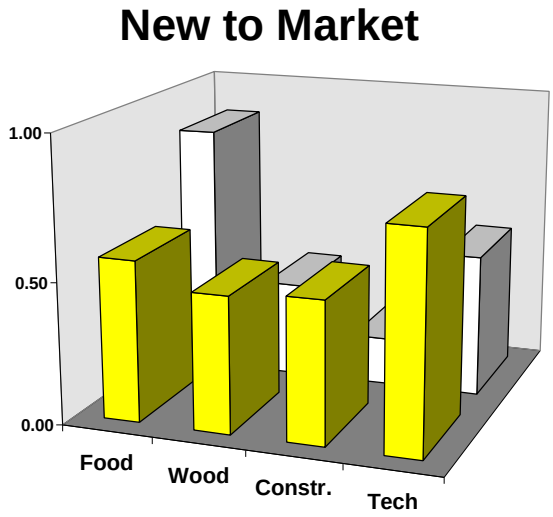
We have a great deal of data on other clusters in the Okanagan, particularly forestry and wood products, agriculture and food, and advanced technology industries. For purposes of this paper, it is not necessary to go into these data in detail. However, there are some

[10] Projections by the provincial statistical agency put growth at 3 per cent a year in the early 2000s, falling to 2 per cent by end of the decade. However, one industry observer said three per cent is optimistic, because part of earlier growth merely reflected recovery from a local recession, and another part was fuelled by a gap in house prices compared to the Lower Mainland. The gap is now much narrower.

interesting comparisons among sectors and with the reference region (Lower Mainland) that further illustrate the usefulness of co-ordinating qualitative and quantitative data in answering the three questions posed by this paper.

*Incidence and flows of innovation*

The following chart gives the proportion of firms reporting innovations, introduced in the last three years, and new to the industry. The coloured bars are for the Okanagan, while the white bars are for the Lower Mainland. The chart shows results for the stronger definition of innovation ("new to your industry") used in the survey. When firms were simply asked if they had introduced a new product or process, regardless of newness to the market, the response rates were high (80 to 90 per cent) in all sectors except for the Lower Mainland construction cluster.




It is interesting that the Okanagan is stronger in three of the four groupings, and that it is weaker than the Lower Mainland in its traditional industrial base, namely food and agriculture.

The qualitative studies provide an explanation for this apparent oddity. While there has been considerable innovation in the Okanagan in agriculture, a lot of the innovation (higher value varieties, more efficient land use) has been forced by the North American Free Trade Agreement, which opened the region to competition from low-cost tree-fruit producers and high-value wine makers. In many cases, the products were not new to the market, and in fact the Okanagan was being forced to catch up to more competitive regions.

In the Lower Mainland, the competitive picture is quite different. What has driven the agriculture and food cluster there is a combination of market opportunity (large and sophisticated domestic market, access to external markets) and resources (a climatic niche favourable to greenhouse growing and a productive fishery). These have more than offset a resource weakness, namely expensive land. (The disadvantage of costly land is

shared to some extent by the Okanagan.) Therefore, both history and geography confer advantages on the Lower Mainland, and favour a culture of innovation.

Overall, firms report lower exports from the Okanagan region than from the Lower Mainland. That is, markets appear to be more local. On the other hand, new-to-market innovation is higher. This seems to suggest that Okanagan firms are transferring technology *into* the region, an impression reinforced by the importance of suppliers as innovation sources (see next section).

Examined at a sectoral level, however, the picture is more complex and interesting. The high technology industries follow the suggested pattern exactly (more innovation, fewer exports) and the qualitative evidence supports the picture of technology imports: while some firms do highly original work, most rely to some extent on imported technology.

However, the Construction cluster, as noted in the previous section, is a *strong* exporter; it also innovates agressively if incrementally; however, it probably does import technology because many suppliers of advanced materials and furnishings are located in the Lower Mainland.

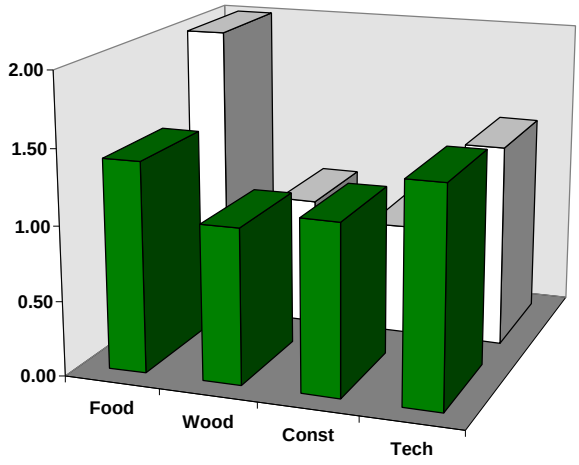
The Food cluster does not fit the pattern either, but for a different reason. The Okanagan industry exports less but also (and unlike the other Okanagan sectors) innovates *less*. Nevertheless, it is after all a technology importer! The qualitative story makes all this clear. The industry in the Okanagan is very different structurally than the Lower Mainland and its biggest need in the past decade has been to bring in technology to catch up with world competitors.

As for the Wood cluster, the Okanagan version looks rather similar to that of the Lower Mainland with respect to the two variables under discussion (innovation and exports). This is not surprising, as the much of the cluster is organized on a provincial scale.

*Sources of innovation*

Firms rated the importance of sources of innovation on a three-point scale: not valuable, valuable and crucial. Responses were aggregated using scores of 0, 1 and 2 respectively.

## In-house R and D as a Source of Innovation




The pattern for in-house research and development is very similar in the two regions, with expected strength for high technology firms. The agriculture and food clusters appear to be quite reliant on R and D, especially the Lower Mainland firms, which is consistent with the development historyof the two industries.

Firms appeared to favour in-house R and D over out-sourced R and D everywhere except in the forestry and wood products industries. We know as well that the forestry industry has a well-developed infrastructure for collective industry research, centred in the Lower Mainland.

Sales, customers and management are consistently rated as valuable or crucial sources. The only remarkable comparison is the one between the Okanagan and the reference region for the construction cluster, noted earlier. The Lower Mainland construction industry attaches smaller values to these three sources.

No remarkable regional differences were noted for production as an innovation source.

The high technology industries frequently said competitors are a valuable source of information. Okanagan food and agriculture firms looked to competitors somewhat more often than the Lower Mainland cluster. This statistically doubtful observation is, however, consistent with the structural differences in the industry. The Okanagan is remains commodity based, while the intensive agriculture in the reference region relies more on proprietary information. (Previous work in the Lower Mainland (Schuetze, Gibson et al., 1995) showed that co-operation among British Columbia competitors is more common when the product is a near-commodity than when it is specialized or customized.)

Customers and suppliers tend to get high ratings across the board, so it is hard to draw confident conclusions. It does appear that both the wood products and construction clusters in the Okanagan draw considerable strength from these sources, relative to the reference region; this is consistent with the interviews. It is possible that the Okanagan context -- where communities are relatively small and share a common identity -- encourages this innovation channel.

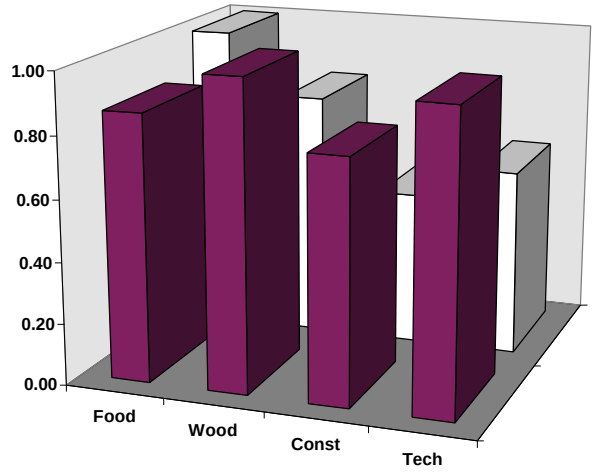
*Factors influencing innovation*

A further question asked about factors that might help or hinder innovation. Responses were aggregated scoring -1 for hinder, +1 for help and 0 for no effect.

Corporate culture was a modestly positive influence generally, and rather stronger for Okanagan advanced technology companies. There was some evidence from the interviews that the Okanagan life style was a strong shared value among employees and management, which may help explain this result.

Management is also rated as a positive influence (although one has to take into account that most of the respondents would have been senior managers). On the basis of correlation tests, the generally stronger results in the Okanagan do *not* appear to be associated with the fact that Okanagan firms are generally smaller than those in the Lower Mainland.[11]

**Influence of Management on Innovation**




The risk/reward balance was seen as highly positive by the research-intensive Lower Mainland agriculture and food cluster, but only moderately positive in the other samples.

Cost reduction was a moderately important incentive for the Okanagan forest industry, but not for other sectors. In recent years, falling lumber prices and increased harvest

[11] Some responses *were* correlated with firm size. The strongest correlation was with R and D effort, with a correlation of about 0.3.

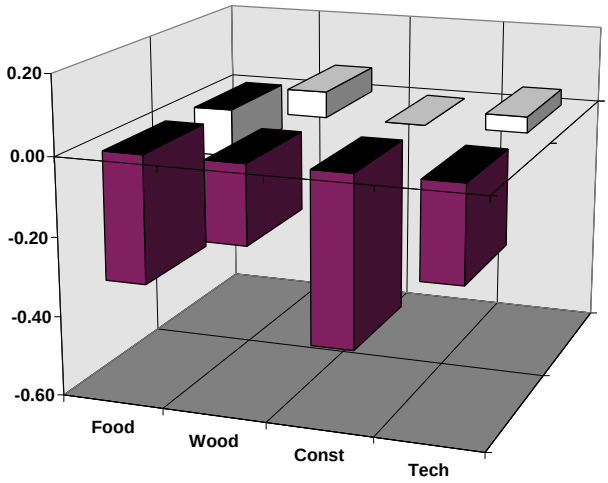
costs have put pressure on the primary forest sector, which is more important in the Okanagan than in the reference region.

Customers have a consistently positive impact on innovation, and likewise competitors, with the single exception of the Lower Mainland agriculture and food industry, where competitors were held to have a negative impact on average (consistent with the weak role of competitors as s*ources* noted in the previous section).

The most dramatic contrast in the entire profiling exercise is around the impact of government policies and programs, where the Okanagan is uniformly and substantially *negative* compared to an almost neutral stance in the Lower Mainland. It is very common to find that rural regions value government programs less than urban ones, and also that they use government programs less -- factors working to reduce uptake include less access to programs, limited marketing effort, weak network links to public sector agencies, and inappropriate design.

The provincial government is well aware of the lower uptake of programs generally outside the Lower Mainland and has made efforts to correct this through marketing efforts and improving access, e.g. through co-locating National Research Council advisors and provincial science council representatives. The Okanagan has witnessed many such measures. Another survey question dealing with program use shows only a small difference in program uptake between the Okanagan and the reference region, and most of this seems to be accounted for by the agriculture and food cluster. (The structurally different Lower Mainland food cluster is research-intensive and makes more use of government programs than *any* other sector measured, including the advanced technologies.)

**Influence of Government Programs and Policies on Innovation**




If uptake and access are not the issue, what is? It is clear from the Okanagan interviews that there are additional factors at work in the valley. Interviewees refer frequently and without prompting to politics: the valley is traditionally conservative and is represented in

the legislature by MLAs who have been in the Opposition for two terms. There is also a strong perception of inappropriate program design for at least three of the clusters (food, wood, and construction).

Also striking is the regional difference on the issue of personnel. Okanagan firms consistently report higher positive impact from the "availability of personnel" issue. This is clearly related to the almost universal opinion that firms can always find talented people to work in the Okanagan, in almost any specialty, for wages that Okanagan firms can afford. This, in turn, is due to the sterling "lifestyle" reputation of the region. The difference is apparent in all four sectors. Interestingly, it is twice as large for the agriculture and food clusters. This may reflect a lower requirement for very specialized knowledge in the commodity-oriented Okanagan industry, but further research would be needed to confirm this explanation.

Environmental issues are not seen as very important to innovation in either region, even though three of the four industry groupings have relatively high environmental impacts.

*Other innovation questions*

The innovation surveys touched on several other areas, including capital investment, use of government programs, current innovation effort, and human resource policies.

Except in the construction industry, most firms have updated or replaced capital equipment in the last five years. The new equipment was more likely to incorporate significant technological advances in the high technology and the agriculture and food groupings.

About as many firms had used government programs as had not. Forestry and wood products firms and construction firms were least likely to use government programs.

*Current* innovation effort was low in the construction and wood industries in the Okanagan, despite the importance of past innovations. These two, however, are the most cyclical industries, and the survey was conducted just before the start of a provincial recession.

Many companies have formal or informal programs for employee training and education; there were no marked differences among sectors or between the Okanagan and the reference region. Similarly, companies showed a similar willingness to train a current employee to meet a new skill need, and a lesser reliance on hiring new employees to meet the same needs. The construction industry, with its fluid labour markets, hires as often as it trains; others tend to train existing employees; the exception is the Lower Mainland food industry with its apparently urgent need for knowledge and innovation, which routinely uses the hiring route.

**Innovation indexes**

It is clear from the detailed discussion of the Construction cluster in the Okanagan valley that innovation-related issues are important to all aspects of competitiveness. Just as the GEM framework was developed to help predict the competitiveness of regional clusters, it would be useful and interesting to be able to predict innovation outcomes based on key behaviours and key elements of the business environment (or innovation system).

One approach is to build synthetic measures based on quantitative measures and relate these to innovation and competitiveness outcomes. Holbrook and Hughes (Holbrook, 1998) have described one such indicator, constructed by combining responses to five questions under the heading Management of Innovation in the Okanagan survey.

The GEM framework suggests a slightly more comprehensive approach. Because the determinants of innovation are also determinants of competitiveness, each of them finds a home in the six-category competitiveness framework. As a first step to building what we might call an Innovation Quotient (IQ) we have taken the innovation survey questions and organized them under the six GEM headings, e.g. out-sourcing of R and D is an issue under the heading of Suppliers and Related Firms. Responses were coded as 0, 1 for yes/no questions and +1/-1 for help/hinders questions, and then summed for each of the six determinant categories with equal weights. The determinants were combined according to the GEM methodology, which takes in account the substitution and complementarity relationships among the determinants.

The resulting scores characterize the innovation strengths of the firms in each region. The process is very imperfect, because the innovation questionnaires provide quite a bit of information on some determinants, e.g. Firm structure and Strategy, and very little on others, e.g. the strength of Local Markets.

Preliminary regression tests support the proposition that a high IQ predicts innovation new to the market.

In particular, we suggest that a comparison of the average IQ of the same cluster in different regions gives some idea of relative innovation strength. Following is a table of *ratios* (Okanagan value divided by Lower Mainland value) for the average cluster IQ and the two measures of innovation incidence (*Inew* denotes innovation in product or process, *Imkt* an innovation that is new to the industry). Although there are only four clusters, the correlation between relative IQ and relative incidence is very high, and regression tests are highly significant. However, the sample size is small enough and the data incomplete enough that the proposition remains far from confirmed.

**Correlation between relative "IQ" and relative innovation incidence**

| *Sector* | Tech | Food | Wood | Const. | Correlation |
|---|---|---|---|---|---|
| ***Region ratio for*** | | | | | |
| IQ | **1.19** | **0.89** | **1.19** | **1.41** | *1.00* |
| Inew | **1.08** | **0.95** | **1.20** | **1.57** | *0.91* |
| Imkt | **1.54** | **0.65** | **1.44** | **3.00** | *0.95* |

It is important to emphasize that while the Innovation Quotients indicate capacity to innovate, they do not completely determine competitiveness.[12] In fact, for two of the industry clusters, the competitiveness GEMs are quite different from the Innovation Quotients, because the industries face critical external issues. In the case of the forestry and wood industry, there is a long-term shortfall in fibre (logs, chips, etc), which is the critical resource for the industry, and for the agriculture and food cluster, exposure to an international competitive environment has created pressures that have shaken the industry.

**Policy implications and conclusions**

The very detailed information that was gathered in these studies can help policy makers to formulate more precise tactics to address specific weaknesses in the regional system of innovation, or to build on its strengths.

For example, in the construction sector, the differing development objectives of one of the First Nations communities and the neighbouring communities need to be dealt with more directly. Also, there is room for co-operative innovation not only in development planning but also in human resource development. The cluster is bursting with ideas (e.g. crediting bicycle parking spaces towards requirements for vehicle parking) to solve development problems. However, networking that might allow these ideas to be worked out is lacking: networks are strong within sub-sectors (e.g. contractors) but weak among sub-sectors (e.g. linking contractors with architects and planners). Formal mechanisms can build on path-breaking examples of successful collaboration among architects, engineers and builders. The history of strong supplier relationships, confirmed both by qualitative and quantitative data, is a platform for such partnerships. Finally, large public sector contracts are important to maintaining expertise in the area, and they could be structured so high quality local firms are not disadvantaged against larger outside firms.

A more general observation is how many of the pluses of the region (access to external labour markets, concentration of entrepreneurial talent, strong competition) depend on

[12] By competitiveness, we mean the combination of profit share and profitability. Analysis of innovation our survey data indicates that in the context of innovation impacts, firms make a similar equation between competitiveness and these two business outcomes.

perceived quality of life. That quality-of-life underlies a region's economic success is a common proposition in other regions, but it is unusual to find consistent data backing the assertion. Okanagan policy-makers have a stronger-than-usual argument for investing in improvement of scenic and social values.

As for infrastructure, one interesting finding was the importance of air transportation, both to innovation and market access, in a number of sectors. On the plus side is the recent entry of a discount carrier flying to Alberta and the Lower Mainland. As a result, fares are lower on all carriers, significantly reducing the cost of know-how and market linkages with the other regions. On the negative side, the Kelowna airport needs expansion and redevelopment to accommodate more aircraft, more reliably. Because the airport is owned by the city, it presents an opportunity for local action.

A lesson of the research is that it is not only the so-called high technology industries that are innovative, but also the traditional mainstay industries of the region. The Construction cluster, for example, accounts for 30 per cent of Gross Domestic Product in the Central Okanagan, according to our econometric model. We have found that innovation is a major reason for its competitive success and in particular for the cluster's ability to earn export revenue.

Our work highlights the importance of measurement as a basis for policy. More quantitative measurements, repeated over time, would enable governments to better understand the impacts of policy as well. Regular innovation surveying could form a basis for setting target outcomes in key sectors, both in terms of the desired behaviour (innovation) and its impacts (market share, profitability and social benefits). Innovation surveys designed for this purpose could put more emphasis on infrastructure issues and try to quantify some of the innovation impacts.

A straightforward first step could be for Statistics Canada to over-sample in selected regions when the agency conducts national innovation surveys. The regions could be selected in co-operation with interested researchers who would agree to conduct (or who have already conducted) case studies and other qualitative research in the area. Because regional researchers generally have good ties with regional agencies and with community leaders, Statistics Canada could expect local political support for burdening businesses with extra sampling. The combination of better statistics and in-depth understanding of the region would be a powerful tool for understanding innovation in non-urban regions. Such understanding is a national political priority (Canada, 1997).

**Acknowledgments**

This work was supported by grants and contracts from the Social Sciences and Humanities Research Council, Statistics Canada, the Regional District of Central Okanagan, the Information, Science and Technology Agency of British Columbia, and the Science Council of British Columbia. Important in-kind support, including many introductions to the local community and formal endorsement of the innovation survey, was provided by the Okanagan regional Science Council and the Central Okanagan Economic Development Commission.

# Bibliography

Canada, Government of., 1997, Speech from the Throne. (Parliament of Canada, Ottawa)

de la Mothe, J., ed. , 1997, Local and Regional Systems of Innovation. (Kluwer, Amsterdam).

Holbrook, J. A. D., and Hughes, L. P., 1998, Measurement of Regional Systems of Innovation: Innovation in Enterprises in British Columbia, in J. de la Mothe (eds), Local and Regional Systems of Innovation. (Kluwer, Amsterdam) pp. .

Holbrook, J. A. D., L. P. Hughes, et al., 1997, Characteristics of Innovation in a Non-Metropolitan Area: The Okanagan Valley of British Columbia. (CPROST, Simon Fraser University, Vancouver **,** .

Impax, 1997, Construction, Tourism and Agriculture Industries in the Regional District of Central Okanagan. (Economic Development Commission, Regional District of Central Okanagan, Kelowna, British Columbia, Canada **,** 86.

Impax, 1997, Forest Products Industries in the Regional District of Central Okanagan. (Economic Development Commission, Regional District of Central Okanagan, Kelowna, British Columbia, Canada **,** 60.

Impax, 1997, High Technology Industries in the Central Okanagan. (Economic Development Commission, Regional District of Central Okanagan, Kelowna, British Columbia, Canada **,** 43.

OECD, 1996, Oslo Manual. (Organization for Economic Co-operation and Development, Paris).

Padmore, T. and H. Gibson, 1998, Modeling Systems of Innovation II: A Framework for Industrial Cluster Analysis in Regions, Research Policy 22, 625-632.

Padmore, T., H. Schuetze, et al., 1998, Modeling Systems of Innovation I: An Enterprise-Centred View, Research Policy 22, 605-624.

Schuetze, H., H. Gibson, et al.,1995, The Role and Impact of Science and Technology Policies in Innnovation and Regional Economic Development in Bristish Columbia. International Workshop on the Role and Impact of Science and Technology in Innovation and Regional Economic Development: Models, Approaches, Policies and their Effectiveness, University of British Columbia, Vancouver, Canada.

Schumpeter, J., 1934, The Theory of Economic Development. (Harvard University Press, Cambridge, MA).