

# Characteristics Of Innovation In The Services Sector In British Columbia

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### **Introduction**

There is often a perception that the goal of science and technology (S&T) policy in any economy should be the further development of the manufacturing sector. In the current economic situation there is now a glut of manufacturing capacity, and those economies which recently invested heavily in manufacturing are suffering, as has been amply demonstrated by the recent "Asian flu" among the Pacific Rim economies. Both in developed or developing economies policy-makers need to consider the application of S&T to and the role of technological innovation in the development of service-based industries. These industries have many attractions - they are often labour-intensive, environmentally sound, and usually consistent with the objectives of sustainable development.

R&D programs are usually carried out as part of a national effort to develop knowledge to produce new products or processes. In the national system of innovation (NSI) of a developed economy, universities and government laboratories produce new knowledge to feed the manufacturing sector. The productive asset is the manufacturing base. In a service economy this is not so: the assets are human assets, and the strength of the

services sector is dependent upon the ability of the national system of innovation to supply and transfer knowledge embedded in people, rather than in machinery.

Studies of innovation in Canada have been carried out at the national level, but because of the preponderance of industrial activity in Ontario and Quebec, the results understandably reflect the characteristics of these industrially based provinces. (See for example Baldwin & Da Pont, 1996; Baldwin *et al*, 1994) How does innovation work outside these areas, and more importantly, in a post-industrial future, do service-based industries innovate in areas removed from large industrial concentrations. This is the opposite of the analysis of “poles” of innovation: what happens in those vast spaces between the poles? In comparing case studies of regional systems of innovation in Canada and Europe, Acs *et.al.* have noted that there has been a lag in the recognition of the bottom-up dynamics of innovation in Canada compared to what may be observed in Europe. (Acs, de la Mothe *et al.* 1996) They found:

- The way in which relationships develop between private concerns and both the community and the public actors, and the way in which “enabling agencies” foster collaboration.
- The importance of leadership - what enables the complex inter-institutional and inter-sectoral partnerships to develop and become operational – it appears the ability of communities to shape their future depends more on social than on technological processes (Davis 1991)
- The great fragility of many local systems of innovation because they are “*weakly institutionalized*”

There have been many studies of regional industrial clusters (or “poles”) and comparisons of regional, or sub-national, innovative performance. A recent review of these concepts, in the Canadian context, has been published by de la Mothe and others in “Local and Regional Systems of Innovation”. (de la Mothe and Paquet 1998) These local systems of innovation are the building blocks of national systems. The purpose of this study is to extract what data can be had in the services sector, with a view to looking at innovation outside the manufacturing sector in a region where manufacturing is not a major element of the economy.

Outside Ontario and Quebec the role of the services sector, as a desirable outcome of development of the resources sector, becomes a major policy issue. Information on the innovative characteristics of firms in the services sector should be a major input to the policy making process. National surveys in Canada have the advantage of having diverse survey frames, and usually of numbers of responses, yet information is required at the regional level to take into account the wide differences in economic circumstances. (See (Baldwin *et al.* 1999)) Thus there is an important connection to be made between national surveys of innovation in the services sector, and regional surveys.

BC is an ideal laboratory for experiments in the measurement of innovation. The economy is simple, with one large metropolitan area, where most of the innovative firms are located, supported by a hinterland whose primary outputs are in the natural resources sector. BC is a relatively separate economic and geographic region so that external influences in the acquisition and adoption of technology should be noticeable.

Thus (in theory) economic measurements in BC should be relatively well-behaved and predictable.

## Survey Methodology

A short questionnaire for use with BC enterprises was developed by the authors for use in a survey of Lower Mainland area in March, 1997. The overall results have been reported by Holbrook and Hughes. (Holbrook and Hughes 1998) The questionnaire was not intended to cover all aspects of technological innovation identified in the OECD "Oslo Manual" (OECD 1997) but it had to conform to the main points in the OECD standard. To ensure a reasonable response rate, the questionnaire was short (no more than one page, printed on both sides) so that it would be user friendly, take little managerial time to complete, be comprehensible to a small technology-based entrepreneur based in BC, and be faxable to expedite its return. The questionnaire for this survey is included as Appendix A.

A second survey covering the Okanagan region of BC, a non-metropolitan area dependent mainly on agriculture and resource extraction, was conducted in July, 1997. For the Okanagan phase of the project, the questionnaire was modified from the version used for the Lower Mainland. Some of the modifications were the result of conclusions drawn from the analysis of the Lower Mainland responses; others were added to provide additional information on knowledge management and highly qualified personnel. The results of the Okanagan survey have been reported by Holbrook, Hughes, and Finch. (Holbrook, Hughes et al. 1999) The modified questionnaire for this section of the survey is included as Appendix B, with a detailed discussion of the changes from the Lower Mainland to the Okanagan survey included as Appendix C.

### **Sample & Response Rates**

The samples in both surveys were drawn from two industrial sectoral groups, "high technology" and "policy sectors". For the Lower Mainland survey, the sample was drawn from a commercial database, *Contacts Target Marketing*. (CTM) This database uses the US Department of Commerce Standard Industrial Classification scheme SIC87. Firms were selected in eight industrial sectors divided into the two groups: high tech<sup>1</sup> (manufactured products, computer services, and technical services) and policy sectors (food products, forest products, electrical products, construction, and transportation) High tech manufacturing firms were selected by cross-reference with the *British Columbia Manufacturers Directory* (BCMD).

For the analysis for this report, it was necessary to reclassify the firms in the Lower Mainland sample to the Canadian SIC80 scheme. Manufacturers were already classified using both schemes by way of the BCMD. The SIC87 scheme is somewhat richer than the SIC80 scheme for classifying technical services – a concordance was constructed that reclassified firms from the a number of SIC87 classifications to two SIC80 For the purposes of this analysis, computer-related services (SIC87 7370 to 7379) were

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<sup>1</sup> The BC Stats definition of "High Technology" was used throughout this research. See (BC Stats, 1997).

reclassified to SIC80 7721, and technical services (SIC87 8910 to 8915) were reclassified to SIC80 775.

The Okanagan portion of the sample was drawn from the BCMD, and from a list prepared by the Science Council of British Columbia in the fall of 1996. It consists of a census of high tech firms known to be operating at the time in the Okanagan, as well as a sample of "policy sector" firms from the agrifood, forest products, construction, and transportation sectors. Service sector firms fell into the SIC80 industry classifications 7721, and 775.

To be included in the sample, a firm had to employ at least five people, and have been in operation for at least five years. This criteria was applied based on the assumption that smaller, newer firms are still in the process of stabilizing, and are likely to be quite transient. It is commonly thought that much innovation occurs in this entrepreneurial environment, the so-called "bleeding edge."<sup>2</sup> This survey was primarily interested in the characteristics of *successful* innovators. We assumed an average five year product cycle, and that firms that had been in business for less than five years had not yet survived one product cycle. Given that the majority of new ventures fail within the first five years, firms that survived the first five years are more likely to be the successful innovators. We also drew on personal experiences gained working in the British Columbia high tech services sector; firms of less than five employees do not usually have the resources to both develop *and* exploit their own knowledge. If they are developing knowledge, it is usually under contract to another firm, and if they are exploiting or distributing innovative products or services, it is likely these have been created by somebody else.

### Response Rates

**Table 1: Response Rates by Region and Industry Group**

SIC		Lower Mainland	Okanagan	Total
7721	Sample	46	12	58
	Response	13	7	20
	Rate	28%	58%	34%
775	Sample	58	22	80
	Response	23	15	38
	Rate	40%	68%	48%
Total	Sample	104	34	138
	Response	36	22	58
	Rate	35%	65%	42%

All firms in this survey were pre-qualified by telephone before being sent a questionnaire. Pre-qualification consisted of determining if the firm was still in business, the correct mailing address and/or fax number, and the name of the Chief Financial Officer, to whom the survey would be sent. (See Holbrook and Hughes, 1997) A total of 138 surveys were sent, by return mail or by fax, to qualified service sector firms. Fifty-eight responses were received from service sector firms. Table 1 shows the response rates for the services

sectors.

<sup>2</sup> This is similar to the practice reported by Baldwin and Gellatly, who in a study of "new" entrants, focussed exclusively on firms that had been in operation between 11 and 14 years – "that [had] emerged from childhood and survived into their early teen years..." (Baldwin and Gellatly, 1998, p. 17)

### **Firm Size**

Of the 58 service sector firms responding to the survey, the majority (n = 50, 86%) employed between 5 and 25 people. Only one responding firm had more than 50 employees.

By way of comparison, in the Statistics Canada report on innovation in the services sector (Baldwin *et al*, 1999), four divisions for firm size based on employment were used: small (1 to 19 employees), medium (20 to 99 employees), large (100 to 499 employees) and very large (500 or more employees). Using roughly the same divisions, most of the firms responding to the CPROST survey are classified as *small*, with an insignificant number of firms classified as *medium*. Therefore, it was determined that no significant results could be obtained performing analyses stratified by size of firm, and equally, virtually all firms could be assumed to be establishments

### **Bias**

Contacts Target Marketing (1996) identifies 924 British Columbia firms that meet the selection criteria (ie. At least 5 employees, at least 5 years of operation, SIC87 737x or 891x). Table 2 shows the regional distribution of these firms. As can be seen, by far the majority (78%) of these firms are located in the Lower Mainland.

There are two sources of bias in the sample used for this survey. First,, the survey covered only two regions in the province. Although the proportion of firms in the sample inside and outside the Lower Mainland is consistent with what we know of the province, we are unable to say whether firms in the Okanagan are representative of other non-metropolitan regions of the province. Second, the higher response rate in the Okanagan biases the results towards that region.

## **Survey Results**

### **Innovativeness**

A majority of the services firms in the sample believed that they were innovative. Nine in ten (88%, n = 49) of service firms reported having introduced a new product or process in the past five years. However, earlier research indicated that simply introducing a new product was necessary but not sufficient as an indication of innovation – to be innovative a product must also be unique in its market. (Holbrook and Hughes 1998)

*Table 2: Representativeness of Sample and Response*

Region	Universe		Sample			Response			
	# of Firms	% of Universe	# of Firms	% Of Universe in Region	% of Total Sample	# of Firms	% of Sample in Region	% of Universe in Region	% of Total Response
Lower Mainland	723	78.3%	104	14%	75%	36	35%	5%	62%
Vancouver Island	94	10.2%							
Okanagan/Central Interior	59	6.3%	34[1]	57%	25%	22[1]	65%	38%	38%

Northern British Columbia	44	4.8%							
Columbia/Kootney	4	0.4%							
<b>British Columbia Total</b>	<b>924</b>	<b>100.0%</b>	<b>138</b>	<b>15%</b>	<b>100%</b>	<b>56</b>	<b>42%</b>	<b>5%</b>	<b>100%</b>

**Note:** Some firms in the sample are not included in the CTM universe

Applying this measure, the “New&Unique filter,” 60% (n = 30) of firms introducing a new product claimed that their product was unique. Therefore, 52% of the service firms responding to the survey were considered to be innovative. (Table 3) This proportion is consistent with that for all firms responding to the survey.

By industry group, firms providing computer-related services are much more innovative than technical service providers. Three in four (75%) of computer-related service firms reported new and unique products and/or processes, compared with only two in five (39%) technical service firms.

**Table 3: Innovation by Industry Group**

Response:	Don't know	No	Yes
New product in past five years ?	N=1	N=6	N=49
	2%	11%	88%
Unique in market?	N=3	N=17	N=30
	6%	34%	60%
Innovative - New&Unique		N=28	N=30
		48%	52%
by industry group	772	N=5	N=15
		25%	75%
	775	N=23	N=15
		61%	39%

In general, service firms reported the introduction of new products/processes as beneficial. Respondents reported positive effects on profitability (74%), cash flow (57%), market share (63%), competitiveness (85%), productivity (63%) and quality of service (67%). Perhaps surprisingly, most service firms (73%) reported the introduction of new products/services as having no effect on labour relations, with most of the remainder (23% of the total) reporting the effects of

innovation on labour relations as positive. (Table 4)

**Table 4: Effects of Innovation**

Effect of innovation on:		Service Sector Firms			All Sectors		
		negative	no effect	positive	negative	no effect	positive
profitability	all services	11%	15%	74%			
	computer			100%	5%	13%	83%
	technical	18%	25%	57%			
cash flow	all services	17%	26%	54%			
	computer	11%	6%	83%	11%	23%	66%
	technical	21%	38%	41%			
market share	all services		37%	63%			
	computer		17%	83%	1%	24%	75%
	technical		50%	50%			
competitiveness	all services		15%	85%			
	computer			100%	1%	14%	85%
	technical		23%	77%			
productivity	all services	8%	29%	63%			
	computer	6%	28%	66%	8%	43%	49%
	technical	10%	30%	60%			

quality of service	all services	6%	27%	76%	2%	43%	54%
	computer	11%	28%	61%			
	technical	3%	27%	70%			
labour relations	all services	4%	72%	23%	4%	79%	17%
	computer	6%	78%	16%			
	technical	3%	69%	28%			

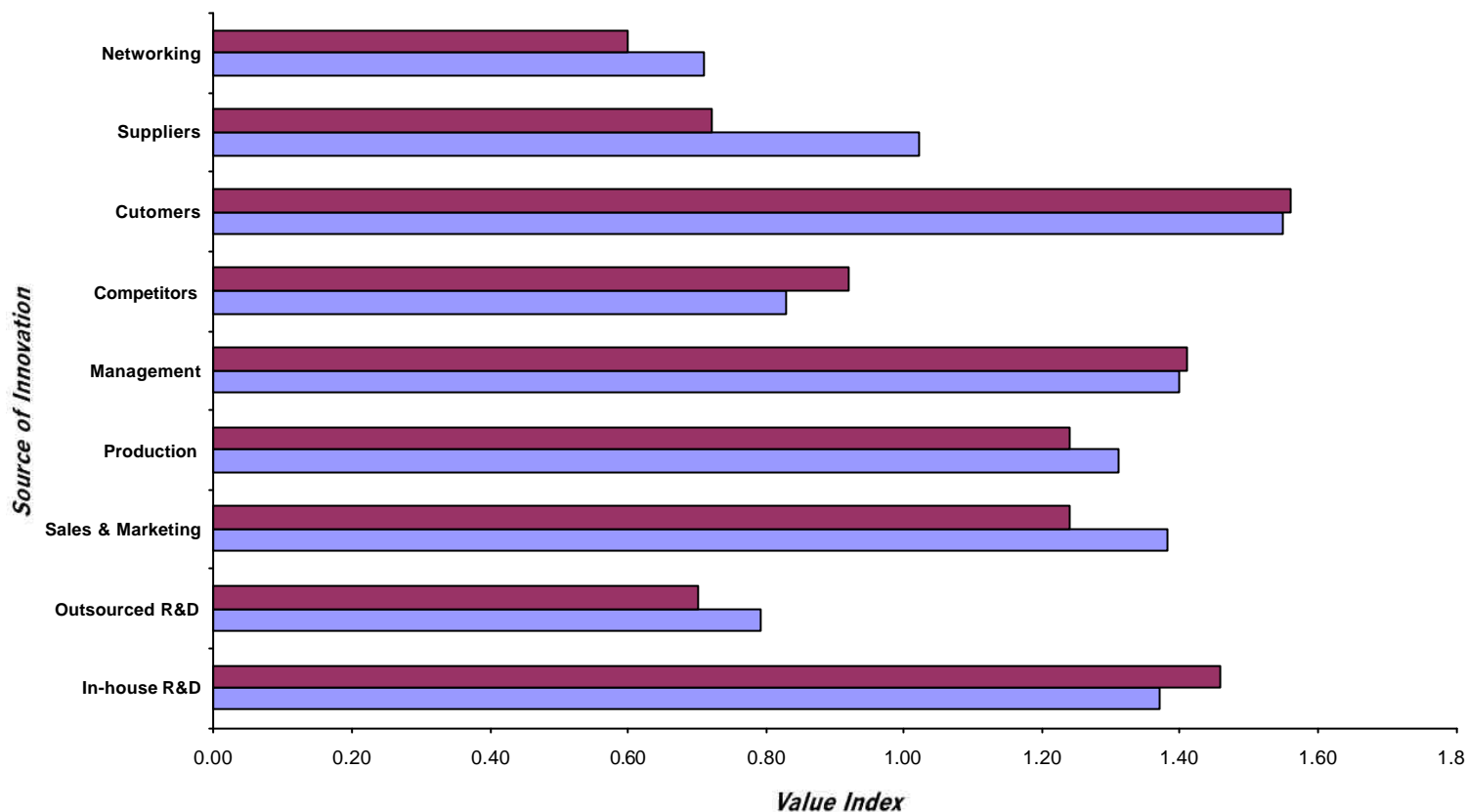
Firms providing computer-related services reported were much more positive in their view of the effects of innovation than technical service providers. With the exception of labour relations noted above, a large majority of computer-related service providers reported positive effects. On the other hand, technical service providers were less enthusiastic. One in five reported negative effects on profitability (18%) and cash flow (21%). Less than half (41%) reported positive effects on cash flow. Although most (77%) reported a positive effect on competitiveness, only half (50%) reported a corresponding positive effect on market share.

### **Sources Of Innovation**

For this section of the survey, firms were asked to rate various sources of innovation as not valuable (0), valuable (1), or critical (2). This allowed the construction of a “value index” of sources of innovation based on the mean of responses to each question. Using this value index, service firms ranked customers (1.51), in-house R&D (1.46), management (1.41), sales and marketing (1.24), and production (1.24), as valuable to their innovation processes. (Figure 1, Table 5) Suppliers, (0.72), out-sourced R&D (0.70), and professional networking (0.60) are all seen as less important sources of innovation.

Computer-related service providers view their competitors as a source of innovation much more than do technical service providers, as well as other industrial sectors (value index = 1.34 for computer-related services, 0.73 for technical services, 0.83 for non-service sectors.)

**Figure 1: Value Index for Sources of Innovation**



**Factors Affecting Innovation**

In this section of the survey, respondents were asked to identify various “factors” affecting innovation at their firm as “helping,” “hindering,” or having “no effect.” Results of this section are shown in Table 6.

**Table 5: Sources of Innovation**

Source of innovation:	All Sectors	Services Sector				
		All Services	Computer Services	Technical Services	Innovative	Not Innovative
In-house R&D	1.37	1.46	1.80	1.28	1.83	1.04
Outsourced R&D	0.79	0.70	0.55	0.79	0.64	0.76
Sales & Marketing	1.38	1.24	1.50	1.09	1.52	0.92
Production	1.31	1.24	1.32	1.20	1.25	1.23
Management	1.40	1.41	1.60	1.29	1.59	1.20
Competitors	0.83	0.92	1.25	0.73	1.03	0.79
Cutomers	1.55	1.56	1.80	1.34	1.72	1.27
Suppliers	1.02	0.72	0.69	0.79	0.82	0.60
Networking	0.71	0.60	0.60	0.60	0.86	0.32

**Table 6: Factors Affecting Innovation**

Factor:		Services			Non-services		
		Hinder	No effect	Help	Hinder	No effect	Help
Corporate Culture	all services	14%	19%	67%	7%	33%	59%
	computer	10%	10%	80%			
	technical	16%	24%	59%			
Management Attitude	all services	12%	5%	83%	2%	8%	90%
	computer	10%	5%	85%			
	technical	13%	5%	82%			
Risk/reward of innovation	all services	9%	37%	54%	2%	33%	65%
	computer	10%	35%	55%			
	technical	8%	38%	54%			
Costs of innovation	all services	43%	21%	36%	24%	24%	52%
	computer	45%	20%	35%			
	technical	42%	21%	37%			
Customers	all services	2%	14%	83%	2%	13%	85%
	computer		10%	90%			
	technical	5%	16%	79%			
Competition	all services	5%	21%	74%	8%	30%	62%
	computer		25%	75%			
	technical	8%	18%	74%			
Availability of raw materials	all services		87%	13%	8%	48%	45%
	computer		89%	11%			
	technical		86%	14%			
Government policies & programs	all services	27%	48%	25%	36%	49%	14%
	computer	15%	60%	25%			
	technical	33%	42%	25%			
Availability of personnel	all services	33%	22%	45%	19%	43%	38%
	computer	30%	15%	55%			
	technical	34%	26%	39%			
Availability of financing	all services	33%	32%	35%	23%	32%	46%
	computer	30%	25%	45%			
	technical	35%	35%	30%			
Environmental concerns	all services		86%	14%	11%	68%	20%
	computer		100%				
	technical		78%	22%			

For service firms, customers (83%), competition (74%), and the risk/reward of innovation (54%) were seen as the main external factors “helping” innovation. Availability of raw materials, and environmental concerns, have (quite understandably) no effect on innovation in service firms.

In comparison to non-service firms, some interesting differences become apparent. Most noticeably, service firms appear to be more concerned about the costs of innovation (36% “helps”, 43% “hinders”) than non-service firms (52% “helps”, 24% “hinders”).

Service firms are also more concerned about the availability of financing and personnel than firms in other sectors.

Service firms are less concerned about the risk/reward of innovation than non-service firms. This may be related to the fact that service firms are more likely to view competition as a positive factor affecting innovation. Finally, service firms are slightly less negative in their view of the effects government policies and programs than are non-service firms.

In this section of the survey, there were no significant differences in responses from computer-related services and technical services.

### **Other Results**

*Investment in capital equipment:* Purchases of capital equipment were reported by 98% (all but one) of service firms responding to the survey. Of these, 84% confirmed that this equipment contained significant technological advances. This is somewhat higher than for all respondents, where 91% reported new capital equipment, with 75% of this equipment containing significant technological advances.

*Resources for product/process development:* Three in four (74%) service firms reported that they had applied some kind of resources to the development of new products/processes. This compares to 71% for all respondents. Of innovative service firms, 93% reported applying resources for development, compared to only 54% of non-innovative service firms.

*Use of government incentive programs:* One half (50%) of service firms reported having used government incentive programs such as the SR&ED or IRAP programs (these two were specifically listed in the survey), compared to 39% for the all respondents. Three in four (73%) of innovative firms made use of government incentives, while the same proportion (75%) of non-innovating firms did not.

In previous analyses of this data, a comparison was made between the use of government programs and the view of government as a factor affecting innovation. In this analysis, 79% of service firms responding that government “helps” innovation reported having made use of an incentive program. Conversely, however, only 39% of those who had made use of a program viewed government as “helping” innovation.

*Human Resources:* Service firms reported that training existing personnel was the preferred method for obtaining needed skills - 88% of firms responded this way. This result was consistent for innovative and non-innovative firms. However, while 79% of service firms reported that they would hire a new employee to obtain needed skills, 89% of innovative firms responded that they would hire for skills, compared to 69% of non-innovative firms.

A majority (83%) of service firms reported formal or informal training programs, with an identical distribution for innovative and non-innovative firms. This compared with 80% of all firms reporting training programs.

Service firms are more likely to employ post-secondary graduates. Three in five (60%) service firms, compared (34%) to a third for all respondents, reported that 60% or more

of their employees had post-secondary education. This figure increases to 70% for innovative service firms.

*Exports:* Service firms by nature tend to be regional in focus. A third of service firms (34%) reported 60% or more of total sales outside BC, which is comparable to the overall response. Only 13% of service firms report more than 60% of total sales outside Canada, compared to 20% of all respondents. However, fully half (50%) of innovative service firms report more than 60% of their sales outside of BC, and 16% report more than 80% of their sales outside Canada.

## Key Findings

The results of this survey can be used to give some indication of the strength (or weakness) of the linkages in the BC system of innovation. Firms in the service sectors are slightly more likely to introduce new products than firms in other sectors: 88% of service sector respondents reported having introduced a new product or process in the last five years, compared to 83% of firms in other sectors. However, service sector firms are no more innovative than firms in other sectors. By the New&Unique filter, 52% of service sector firms are innovative, exactly the same proportion as for all respondents to this survey.

For respondents to this survey, it appears that service sector firms see competition as more important to their business environment than do other sectors. Several observations support this conclusion:

1. Service sector firms were less positive than other respondents about the benefits of innovation, with two exceptions: competitiveness, and quality of service. (see Table 3) Service sector firms appeared more inclined to let their financial position (profitability and cash flow) suffer in order to stay ahead of competitors. Correspondingly, service sector firms did not report negative impacts of innovation on market share.
2. Innovative service sector firms rely more on competitors as a source of innovation than do other respondents. They also place much higher value on customers, and slightly higher value on professional networks, as sources of innovation than do firms in other sectors.
3. Service sector firms are significantly more likely to regard competition as a factor "helping" innovation than do firms in other sectors. At the same time, they are more likely to regard development costs as a factor hindering innovation. Outside of this increased concern for and awareness of competition, the service firms in BC that responded to our survey are not significantly different from firms in other sectors.

## Tourism

Tourism and tourist-related activities are an important element of the service economy. As well there being many conventional tourist-based activities based on the BC natural environment, many of the advanced agri-foods businesses include tourist activities in

their business activities. The researchers were asked by regional economic development authorities to apply their survey to the tourist sector, and determine to what extent to the tourism sector was an innovative sector. Initial results suggest that tourism enterprises can be, and are, innovative, just as the other firms in non high-tech sectors. However much further work remains to be done to connect tourism services responses to responses from other services industries.

## Conclusions

Some messages for policy makers interested in the development of service industries in the emerging knowledge-based economy can be derived from the data. Small service industries appear to behave similarly to their counterparts in the manufacturing sector. More importantly, like the manufacturing sector, they regard human factors, as they affect innovation, to be more significant than other factors.

What is not clear from the survey is whether the sample drawn here is representative of BC as a whole. While the originators of the data bases from which the sample was drawn would say yes, these data bases cannot be linked back to the Business Register that Statistics Canada uses for its survey frame preparation. In particular the issue of assignment of Standard Industrial Codes is important. By its very nature, this can vary from system to system, so that the only way in which a researcher can be assured of drawing a sample that has SICs consistent with those used by Statistics Canada in its work is to use Statistics Canada's own Business Register as a starting point.

To answer the question as to whether the results for British Columbia from the Statistics Canada Survey of Innovation in Service Industries (and in particular that component which looked at business services) is truly representative of BC, would require a new survey, one that is based on the Business Register and one that oversamples in the non-metropolitan areas. The Statistics Canada survey had 385 samples drawn from BC, but since they were randomly drawn it is likely that 90% or more were from the Vancouver-Victoria area. Because of the importance of understanding the role of service industries in developing the knowledge-based economy in non-metropolitan areas, a specific study should be carried out in the near future. BC is an ideal place to do this since the metropolitan and non-metropolitan areas are so clearly defined.

Another area requiring improvement is knowledge on the levels transfers from studies to employment. Given the high cost of post-secondary education, more knowledge is needed as to about how the resulting talents are used, and how, over time, technical knowledge is either augmented or depreciated. Studies of the stocks and flows of human capital lead directly to the study of the actors and networks that make up an NSI. This is a field which is only just beginning to be being examined, but which is probably important in smaller economies than in larger ones, where the sheer number of networks and individual actors, results in individual actor-networks having less individual influence on the system.

With the current emphasis on job creation as a policy goal in itself, the analysis of non high-tech sectors becomes more important. Natural resource based industries and consumer service based industries can all be innovative within their markets. In BC these services industries tend to cluster, by sector, so that it is important to be able to situate them in any policy framework devoted to enhancing the innovativeness of firms

as a whole. The link between the tourism sector and other (innovative) sectors such as agrifoods, is also important, at least in the BC context.

While the limited data from the survey can only provide a glimpse of the policy issues emerging from the analysis of regional results within BC, the effects of geographical separation do appear to influence the responses. More detailed analysis of the data might suggest specific policy initiatives and improvements; more survey work would provide more precise results. The simple fact that government programs appear to be more negatively regarded in the hinterland suggests an immediate need to improve existing program delivery and a need to develop new programs specifically designed to benefit firms that do not have adequate access to the complete knowledge economy infrastructure available in metropolitan areas.

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