

## **A. Research Objectives**

Innovation is increasingly recognized as the key to successful competition in the global knowledge-based economy; but even the most specialized forms of knowledge are becoming short-lived, due to the accelerating pace of change. The capacity to learn and adapt to rapidly changing conditions determines the innovative performance of firms, regions and countries. The capacity for sustained innovation, in turn, is rooted in a complex set of relationships between internal firm dynamics and the broader setting within which they operate. Often these capabilities are sustained through regional communities of firms and supporting networks of institutions that share a common knowledge base and benefit from their shared access to a unique set of skills and resources (Lundvall and Borras 1997, Wolfe 1997).

An appreciation of these relationships underlies the innovation systems approach, which emphasizes the dynamic and cumulative nature of the innovative process. Although the study of innovation systems originated at the national level (Lundvall 1992, Nelson 1993), it is now part of a broader approach that focuses on different scales of analysis, but shares a common understanding of the systemic nature of the innovation process (Edquist 1997). Scholars use this framework to analyse the network of relationships among firms and the broader institutional setting in which they are embedded. This involves tracing the flows of knowledge among institutions, both public and private, that comprise the innovation system. The regional level is critical to this analysis because the factors of space and proximity contribute to the generation and sharing of tacit knowledge and the capacity for learning that are crucial for innovation (Maskell 1999). Definitions of a 'regional innovation system' emphasize how the institutional and cultural environment of a region interacts with the activities of private firms to influence the innovation process. The identification of the region as a locus of innovation and the role of proximity in the learning process also reflect the attention placed on the emergence of dynamic clusters in key locales around the globe. Clusters are viewed here as geographic concentrations of interconnected companies and institutions in a particular field (Porter 1998).

The goal of the proposed major collaborative research initiative is to analyse how the formation and growth of clusters contribute to economic growth and development within a number of regions across Canada by applying the insights derived from these two perspectives. The co-applicants (and their collaborators) propose to build upon their experience as part of an established, multi-disciplinary research network, the Innovation Systems Research Network (ISRN). Over the past three years ISRN has become a closely integrated national network of scholars, domestic partners at all three levels of government, in the private and not-for-profit sector, and international collaborators. The proposed initiative builds upon its unique research capabilities and partnerships, which themselves constitute valuable relational assets, to create a coherent agenda that will enhance Canada's innovative capacity for the 21<sup>st</sup> century. The objective of the research program is to investigate how local networks of firms in a selected number of clusters, and the supporting infrastructure of institutions and organizations that comprise the regional innovation system, interact to foster economic development.

## **B. Context**

### *Multidisciplinary perspectives:*

The analysis of cluster development within regional systems of innovation involves a diverse set of approaches. Members of the ISRN reflect this diversity, drawing on a wide range of academic disciplines to facilitate our understanding of the role that cluster formation and innovation systems play in the process of economic development. The disciplinary approaches involved include political science and public administration, economic geography, regional development

and planning, management studies, communication studies, engineering, chemistry, evolutionary and institutional economics, educational policy and industrial relations. The members of the proposed research initiative have worked together to integrate the conceptual frameworks and theoretical insights afforded by these various disciplines into a synthetic approach that is reflected in the growing number of publications produced recently (de la Mothe and Paquet 1998, Clark, Feldman and Gertler 2000, Holbrook and Wolfe 2000, de la Mothe and Niosi 2000). The experience gained through the ISRN confirms that the diversity of perspectives offered by this multi-disciplinary approach affords us a better set of tools for analysing and understanding the role of innovation systems in promoting economic development. In many respects, the interdisciplinary and networked relationships developed through the ISRN replicates the very kind of relationships we are studying.

*Relevant scholarly literature:*

Recent contributions to the scholarly literature link the global and the regional dimensions of the economy. The current period is characterized by a *paradoxical consequence of globalization* in which the ever greater integration of national and regional economies into the global one accentuates, rather than minimizes, the significance of the local context for innovative activities (Acs et al. 1996). This literature underlines the continuing influence of the spatial dimension on the conduct of research and the innovative activities of even the largest firms. While the process of globalization poses new challenges for regions and localities, it simultaneously creates new opportunities that arise from their unique capacity to serve as centers of learning and innovation. These qualities confer crucial advantages on those localities which achieve the right conditions for competition in the emerging global economy. Multinational firms, despite their global reach, are learning to exploit the richness and benefits of those geographically concentrated, innovative, interaction-rich learning regions. Large firms with the potential to engage in production in a wide range of different locales are drawn to those places providing the best prospects for learning and innovation (Florida 2000). As Morgan recently put it, “we are now beginning to appreciate that globalization and localization, far from being mutually exclusive processes, are actually much more interwoven than is generally acknowledged” (1997, 495).

This perspective views innovation as more than a linear process in which *radical* new products and processes are generated by R&D institutions in isolation from the market. It is non-linear, iterative, and interactive — in other words, a *social process* that often involves continuous, day-to-day improvements in existing products and processes, and is shaped in a path-dependent fashion by past insights, decisions, responses to events, and technological choices. The innovation systems approach underlines that this process is grounded in a complex web of institutional practices and organizational relationships that condition and shape the path along which innovation occurs (Equist and Johnson 1997). Given the social nature of learning and innovation, it comes as no surprise to find that these processes work best when the partners involved are located close enough to allow frequent interaction and the easy, effective exchange of information. Paradoxically then, the production paradigm of the new economy, with its emphasis on knowledge and creativity, remains highly dependent on localized, regionally-based, sources of knowledge and learning. This insight is grounded in the body of literature which attests that innovation is fundamentally a *geographical* process and that innovative capabilities are sustained through regional communities that share a common knowledge base: facilitated, though not necessarily contained, by spatial clustering of the involved parties (Saxenian 1994; Amin and Thrift 1995; Storper 1997).

The regional level is critical because the factors of space and proximity facilitate the kind of tacit

knowledge and the capacity for learning conducive to effective innovation (Maskell and Malmberg 1999). Spatial proximity facilitates frequent, close and (most commonly) face-to-face interaction. Such interaction, both planned and formal and unplanned and informal, enables learning-through-interaction. Second, firms clustered in the same region often share a *common regional culture* which can facilitate the process of social learning. Research indicates that such firms build up a common language or code of communication through repeated interaction over time. Because much of the most important knowledge transmitted between parties in the innovation process is *tacit* rather than codified, this characteristic confers a crucial advantage on firms which participate in such networks of exchange (Gertler 1997). From this perspective, the increasing importance of factors such as access to a highly skilled pool of local labour, specialized R&D facilities, unique support services for industry, the establishment of trust relations among networks of suppliers and buyers and the interactive learning effects that emerge in a regional or local setting all contribute to strengthening the importance of agglomeration effects and ‘untraded interdependencies’ among firms that arise from the co-location of critical inputs to the innovation process, (Dosi 1988, Storper 1997).

This interaction-facilitating common language or code of communication is further supported by the creation of *regional institutions* produce and reinforce a set of rules and conventions governing local firms’ behaviour and inter-firm interaction. The constellation of such institutions at the regional level, as well as the set of more formal organizations, that contribute to the innovation process is identified as the *regional innovation system* (Braczyk, et al. 1998). This set of institutions, both public and private, produces pervasive and systemic effects that encourage firms within the region to adopt common norms, expectations, values, attitudes and practices — in short, a common culture of innovation that is reinforced by the process of social learning. Definitions of a regional innovation system vary, but present purposes, it is defined as “the set of economic, political and institutional relationships occurring in a given geographical area which generates a collective learning process leading to the rapid diffusion of knowledge and best practice” (Nauwelaers and Reid 1995).

A critical component of the regional innovation system is the infrastructure of R&D institutions located within it, as well as the internal and external networks of relationships within and between public agencies and private actors. A number of recent schematics set out the parameters of a regional innovation system. One depicts the innovation system of a region in terms of both the demand and the supply side for innovation. On the supply side are located the institutional sources of knowledge creation and knowledge transfer in the regional economy. Closely linked to these are the institutions responsible for training and the preparation of highly qualified labour power. The demand side of the system subsumes the productive sector — firms which develop and apply the scientific and technological output of the supply side in the creation and marketing of innovative products and processes. Bridging the gap between the two are a wide range of innovation support organizations, that play a role in the acquisition and diffusion of technological ideas and know how throughout the innovation system. These may include technology centres, technology brokers, business innovation centres, organizations in the higher education sector which facilitate the interface with the private sector and mechanisms of financing innovation, such as venture capital firms (Nauwelaers and Reid 1995).

Less obvious, but equally important, are the background institutions defining the underlying incentive structures that guide firms’ decision-making: capital market institutions that shape time horizons and expectations concerning paybacks from investment; labour market and industrial relations institutions that affect rates of labour force turnover (and hence, possibilities for

workers to engage in learning-by-doing), the strength of incentives for private firms to provide training (and hence, the likelihood that firms will engage in opportunistic labour practices, such as poaching of skilled labour, with the potential to undermine inter-firm trust and co-operation), the degree of participation of shopfloor workers in firms' decision-making, and other conditions that create or limit the possibilities for intra- and inter-firm learning (Gertler 1997).

This emphasis on the region as a locus of innovation and the value of geographic proximity for the learning process is also reflected in the second approach that informs our research initiative: the analysis of dynamic, regional clusters. Michael Porter defines a cluster as "a geographically proximate group of interconnected companies and associated institutions in a particular field, linked by commonalities and complementarities" (1998, 199). They include concentrations of interconnected firms, service providers, suppliers of specialized inputs to the production process, customers, manufacturers of related products and finally governmental and other institutions, such as national laboratories, universities, vocational training institutions, trade associations and collaborative research institutes. The existence of clusters, or more precisely, the tendency of firms engaged in related fields of economic activity to cluster across a range of industrial sectors, suggests that some of the key factors that determine competitive advantage lie outside the boundaries of individual firms. Clusters consist of both high-tech concentrations of firms, frequently centred around research intensive universities, as is clearly the case in Silicon Valley, as well as those based in more traditional industries, such as the ones studied by Maskell and his colleagues in Denmark (Maskell and et al. 1998).

Porter suggests that clusters can be identified through a four stage process that begins with the identification of a large firm, or concentration of large firms located in the region and then searches for the forward and backward linkages to other firms that feed its activities. The second step locates horizontal industries or firms that produce complementary products or services, that make use of similar specialized inputs or technologies or share common supply side linkages. The third step involves locating the key institutions that provide this network of firms with specialized skills, technology, information, capital or infrastructure. The final step involves analysing the role played by government and other economic development agencies in stimulating or supporting the activities of the cluster.

Best known for his work on competitive advantage, Porter also provides a compelling explanation of the ways in which the existence of clusters affects firm-based competition and stimulates economic growth. Location of a firm within a cluster contributes to enhanced productivity by providing it with superior or lower cost access to specialized inputs, including components, machinery, business services and personnel as opposed to the alternative, which may involve vertical integration or obtaining the needed inputs from more remote locations. Sourcing the required inputs from within the cluster reduces the transaction costs in a variety of ways. It reduces the need to maintain costly inventory and the consequent delays that can arise with shipments from distant locations. It also facilitates communication with the key suppliers in the sense that repeated interactions with the supply firms in the value chain creates the kind of trust conditions and the potential for conducting repeated transactions on the basis of tacit, as well as more codified, forms of knowledge. Finally, local sourcing, especially for advanced and specialized inputs that often involve embedded technology or service content and may depend on the understanding of a common industrial culture (as in the case of machine tools) eases the costs associated with installing, debugging, training and troubleshooting the costly new equipment (Porter 1998, 214; Gertler 1995).

Clusters also offer distinct advantages to firms in terms of the availability of specialized and experienced personnel. The cluster itself often acts as a magnet in attracting skilled labour to its location. Conversely the location of specialized training and educational institutions with the cluster can provide a ready supply of new labour to the firms in the cluster. This element of a cluster's characteristics is readily revealed in the numerous accounts of the speed with which laid-off personnel are snapped up by others firms in the cluster, or the need for firms located outside the cluster to establish a part of their research activities within the cluster's territory in order to attract the specialized skills that they require.

The mutually beneficial activities of the firms in a cluster generate a number of cluster assets that can be viewed as quasi-public goods. The general level of knowledge and information built up in the cluster can act as such a good, if the level of trust is sufficient to generate an easy and mutual exchange of both tacit and codified knowledge. Similarly, the mobility of personnel between firms in a cluster can constitute a similar source of knowledge flows. Even more important, the strength of the cluster can provide an important stimulus to public investment in specialized infrastructure, such as communication networks, joint training and research institutions, specialized testing facilities and the expansion of public laboratories or post-secondary educational institutions. As the depth and value of such investments increase, so do the extent of the economic benefits flowing to firms located in the cluster. Thus the strength of the cluster and its supporting infrastructure of quasi-public goods and public institutions create a mutually reinforcing set of conditions that support is further growth and expansion (Porter 1998, 218-19). While Porter does not explicitly refer to these as 'untraded interdependencies', the economic effects are similar to those discussed in literature on innovation systems discussed above.

Clusters also have an impact on the capacity of the member firms to innovate, thus enhancing their potential for productivity growth. Membership within the cluster affords firms a clearer view of current and prospective technology trends, allowing them to identify new market opportunities for product or process enhancements through better information about buyer needs. On the supply side of the equation, cluster participation provides the firm with early information about new technology trends, component and machinery capabilities, allowing them to perceive opportunities for improving or enhancing their own products or firm capabilities. Even more important than these valuable sources of information, membership in the cluster lets firms act quickly by providing them with the ready source of supply they need to bring the new product or service to market. The presence of multiple rivals in the cluster competing to take advantage of similar market opportunities and supply capabilities pushes firms to excel at the innovative process. These internal competitive pressures are strongly reinforced by the potential for cooperation. Competition and cooperation are both present within the cluster because they work on different dimensions and between different economic actors (Porter 1998, 220-23; Best 1990).

Porter's analysis of these aspects of co-location in the cluster echoes similar points made by researchers at the Berkeley Roundtable on the International Economy in their discussion of the supply architecture of regional innovation systems. The capabilities of a specific firm or industry are conditioned by the network of suppliers and related firms to which it is linked — what can or cannot be made by the firms in question is often a function of their ability to obtain the critical inputs required for the product. The range of technological capabilities within a cluster or regional economy is strongly influenced by this set of linkages. These linkages include both the demand drivers and the supply base. The demand drivers are pressures from leading edge and innovative users in the marketplace that stimulate firms to innovate. The supply base is the local capability to supply the component, machinery, materials and control technologies that producers

need to support new product and process development — it includes parts, components, subsystems, materials and equipment technologies. The architecture of supply defines the structure of the markets and other organized interactions through which underlying technologies reach the producers. The supply base and architecture of supply proscribe the possibilities available to firms as they make choices about the paths to follow in developing new technologies (Borrus 1993, 47). The two elements combined — demand drivers and the supply base — influence the pattern of innovation firms are likely to pursue, which projects are likely to succeed and the overall probability of success. Together, they define a set of constraints and opportunities in charting technological trajectories. These factors collectively determine the technological specializations of individual countries and regions (Zysman 1996, 167-68).

Another benefit of clusters acts by stimulating the formation of new firms, further contributing to innovation and expanding the size and significance of the cluster itself. The role played by larger, anchor firms within the cluster can facilitate the process of new firm formation. Large companies often generate new ideas and research findings that they are constrained to commercialize or bring to market. New firm spin-offs provide a ready mechanism for these ideas to be developed. Similarly, the presence of specialized and knowledgeable service providers, as is the case with the venture capitalists and legal firms in Silicon Valley, ensures that these spin-off firms have access to the requisite skills and expertise needed to assist their rapid start-up (Porter 1998, 225).

Porter, along with many scholars who study the nature of innovation systems, suggests that an important element providing the glue which holds clusters together is ‘social capital’. Social capital refers to various features of the social organization of a region, such as the presence of shared norms and values that facilitate coordination and cooperation among individuals, firms and sectors for their mutual advantage. The use of the term capital indicates that it involves an asset, while the term social connotes that the particular asset is attained through involvement with a community. The existence of social capital depends upon the ability of people to associate with each other and the extent to which their shared norms and values allow them to subordinate their individual interests to the larger interests of the community. It secures the conditions that enhance the benefits derived from more tangible investments in physical and human capital. Without its supportive functioning, high levels of these more tangible forms of investment may fail to produce the benefits that should potentially flow from them (Putnam 1993, 167-76; Maskell forthcoming).

The concepts of social capital and trust suggest why certain kinds of economic activity tend to cluster despite the opposing trend towards dispersal brought on by the spread of globalization. Peter Maskell argues that it helps explain why some regions continue to be ‘sticky’ in attracting strong concentrations of firms in related activities. The process of globalization tends to transform what were previously localized inputs into *ubiquities* that can be readily accessed by more or less all firms at a variety of locations around the globe. Firms faced with this shift in their competitive environment search for alternative inputs on which to base their competitive advantage. Such inputs must have a high potential value and be difficult to imitate or replicate (Maskell 1999). Social capital represents one such input: it becomes progressively more valuable as the process of globalization continues; it is not equally available in all communities; it cannot be purchased or transferred; and it is difficult to imitate or replicate. Trust, as a component of social capital, helps overcome market failures or reduce the level of market costs for firms in densely related networks, by supporting stable and reciprocal exchange relationships among them. Partners involved in these relationships establish a willingness to exchange information on something more stable and enduring than a ‘barter’ basis. Both sides benefit from lower costs

and improved quality in the knowledge thus attained. As these relations grow and develop, a larger component of the knowledge shared and transmitted becomes 'tacit', rather than explicit with a corresponding increase in the level of understanding gained through the exchange. Ultimately, the relationships can be extended to include other partners of the respective firms, further enhancing the extent and the value of the network of firms that comprise the cluster (Maskell forthcoming; Lorenz 1993).

To those more familiar with the economic environment and business culture of North America, this concept of social capital seems somewhat remote. While continuing to employ the term, it is also recognized that the European conceptions of 'trust' or 'social capital' may not be manifested in exactly the same way in North American contexts. Cohen and Fields argue that social capital exists in successful North American regional economies, such as Silicon Valley, but its nature differs from that found in the European contexts described by Robert Putnam. The social capital in Silicon Valley is grounded in collaborative partnerships that emerge out of the pursuit of economic and institutional objectives related to innovation and competitiveness. It grows out of the collaborative networks of interacting firms, driven essentially by their mutual self-interest in maintaining their innovative edge. Trust exists in Silicon Valley, but it is a trust based on assumptions about the reliability and reputation of key actors — a performance-based trust, grounded in the expectation of how prospective partners will perform in a network relationship (Cohen and Fields 1999; Leadbeater 2000, 139-48).

The networks of social capital in present in Silicon Valley, and other dynamic and innovative regional clusters, are grounded in the productive interactions between a concrete set of social institutions and economic actors. The principle elements comprising these networks include: the core research universities that encourage close relations with outside firms that can adopt or commercialize the outputs of their research programs; key government agencies and organizations, especially in the formative period, that seeded much of the critical research underlying core innovations, or served as the demanding first user for its outputs, an aggregation of venture capital firms that serve both as an essential source of start-up capital, but also as a repository of technical and managerial expertise to assist high-tech companies; legal firms with specialized knowledge and experience in key services invaluable to the high-tech firms; business networks that reinforce the patterns of interaction among the firms; a labour market that doesn't penalize, even values, a high degree of mobility, thus helping to circulate ideas among the network of firms and ensure that hard-won experience, whether it results in success or failure, is quickly redeployed in the service of other firms; and finally, an industrial structure rooted in the specific characteristics of the technologies that it is producing (Cohen and Fields 1999). A recent piece of original research conducted by members of the ISRN confirms the underlying role played by social capital for the innovation process in a Canadian locale. The study identified five different forms of social capital and found that different elements of social capital influence both the decision to innovate and the degree of radicalness in the new product or process brought to market (Landry et al. 2000).

Recent research and policy related work has contributed further to our understanding of the factors that promote cluster development in local and regional settings. The OECD has established a focus group to examine the role that clusters play in boosting innovation within its broader project on innovation systems. The participants in the focus group, representing many of the member countries of the OECD, have been researching the nature and extent of a wide range of clusters within their individual countries and the role that clusters play in stimulating innovation and economic growth. Its findings suggest that the innovation processes relies upon cooperation to enhance competition and to link different actors in innovative clusters. These

innovative clusters form around sources of knowledge, based on a sophisticated infrastructure in which knowledge is developed, shared and exchanged. These clusters are highly concentrated and demonstrate strong linkages between entrepreneurs, investors and researchers. They exist within localised geographical areas and interact within larger innovation systems at the regional, national and international level. As the trend towards globalization accelerates, clusters are becoming key factors in a country's capacity to attract the international investment that generates new technological expertise, to interest investors in innovation (venture capital, etc.) and to benefit from the international mobility of skilled personnel (Roelandt and den Hertog 1999).

Similar work undertaken in Canada for the National Research Council also situates the process of industrial clustering within the systems of innovation approach (Nordicity Group 1996). Based on this analysis, the Planning and Assessment Branch of NRC has identified a set of factors that contribute to cluster development, including: the presence of local champions with greater vision than single firm success; the existence of a strong S&T knowledge infrastructure — which includes research universities, government laboratories, cooperative research centres; source of motivated learners and technology, knowledge and skills; the presence of at least one exporting firm, with some global reach; involvement by local networking facilitators who promote the growth of relationships within the cluster; involved, knowledgeable local sources of innovation financing; sustained, aligned development strategies by local institutions and governments; and a supportive business climate, and policy conditions favourable for innovators. Further analysis done by ICF Kaiser International for the Economic Development Administration of the US Department of Commerce has recently been replicated in studies of clusters in Toronto and the Ottawa/Carleton area. They identify a similar set of factors that contribute to regionally-based cluster development. Clusters benefit from access to specialized economic inputs referred to as 'economic infrastructure'. The seven major categories of economic infrastructure include: adaptable skills, accessible technology, adequate financing, suitable physical infrastructure, advanced communications facilities, an acceptable regulatory and business climate and an attractive quality of life (IdeA and ICF Kaiser 1997, 3-4).

Porter too identifies a variety of factors that contribute significantly to the birth and growth of clusters. The factors in question bear a certain resemblance to those presented in the analyses by Nordicity and ICF Kaiser cited above. A central element that he sees leading to the early formation of a cluster of companies is the presence of a strong pool of critical factors, such as a set of specialized skills, a strong research base, or a particularly good infrastructure. The presence of a number of the more successful clusters has been directly attributed to the role played by leading research institutions, such as Stanford in Silicon Valley and MIT in Route 128. Clusters may also emerge out of the central role played by a core or leading firm. The location of a dynamic lead firm with strong linkages to the global economy, such as Hewlett Packard in Silicon Valley or Nortel Networks in Kanata, can serve both as a demonstration effect for other firms in the cluster, as well as a continuous source of spin-offs, feeding the process of new firm formation (Porter 1998, 240).

This academic research, largely carried out in the US has not been fully replicated in Canada. In recent years, a number of studies have examined cluster-based development in specific regions of the country — such as Western Canada. This study was sponsored by the federal government, along with the governments of the four western provinces, who engaged KPMG, DRI/McGraw-Hill and Tim Padmore of Impax Policy Services International to examine the state of three emerging technology clusters in western Canada: biotechnology, information technology and advanced materials and manufacturing (KPMG et al. 1996). The first part of the study analysed



the economy of Western Canadian and then identified the largest 'driving' industrial clusters in the region. The second part of the study looked in more depth at three key technology industry groups mentioned above. The analysis covered these groups at the global/Western Canadian/provincial levels, and identified key market trends and success factors. The third part of the study consisted of a set of workshops that helped validate the study's analysis and formulate strategies and initiatives to strengthen the technology industry groups. More recently, studies of the leading clusters in Toronto and the Ottawa/Carleton area have been undertaken for the provincial Office of Urban Economic Development and the respective municipal economic development departments. The Toronto study, to which Meric Gertler of ISRN contributed, identified the key industrial clusters driving Toronto's growth and assessed their relative economic performance in relation to similar clusters across key metropolitan regions in the US. The study also identified key strategic challenges revealed by the analysis of the city's industrial clusters and proposed strategies to help respond to these challenges (ICF Consulting 2000). The Ottawa study is still underway.

We also have the benefit of the work undertaken by Richard Smith and others at Simon Fraser University in developing a methodology for describing interfirm relationships and their role in the births and deaths of enterprises (Smith, 2000). The initial objectives of the research program, to design and revise a research methodology, build and test a data collection system, and build a database of firms, were completed by December 1998 in collaboration with an industrial partner, PriceWaterhouseCoopers, and published as the *BC Techmap*. PriceWaterhouseCoopers have subsequently applied this initial research methodology to develop comparable 'Techmaps' for other urban areas in Canada. Building on this initial success, the researchers intend to develop a more sophisticated multi-dimensional system to map inter-firm relationships. Taking the BC high-tech community as the subject, they intend to examine the actors and networks that make up the community through the human, technological and financial linkages among firms, both past and present, resulting in a better understanding of the complex networks of relationships within the community.

#### *Relation to Ongoing Research*

The proposed collaborative research project grows directly out of the work undertaken by the principal investigator, his co-investigator for the past six years, and many of the other members of the Innovation Systems Research Network. During a three year secondment to the Government of Ontario from 1990 to 1993, David Wolfe became concerned with the factors that contribute to growth and innovation at the provincial and regional level in Canada, the factors that contribute to the relative dynamism of different regions in the country, and the increasing importance of regional innovation systems and cluster-based development in contributing to that dynamism. In a subsequent SSHRC strategic grant (awarded in 1995), he partnered with Meric Gertler to investigate a number of the issues concerning the growing importance of regional locales for both the innovation process and economic development more broadly, the nature and contribution of the regional innovation system to those processes and the significance of networking of collaborative research activities (Wolfe and Gertler 1998; Gertler, Wolfe and Garkut 1998; Gertler, Wolfe and Garkut 2000). In a current SSHRC research project, begun in 1999, he is investigating the nature of knowledge flows between university researchers and their industrial partners, the factors that contribute to the effective uptake of that knowledge and its successful commercialization and the effectiveness of various public policy initiatives in supporting that process, issues which feed directly into the research agenda of the proposed collaborative research initiative as well.

This research on the regional innovation system in Ontario was paralleled by the work of other members of the ISRN on similar issues in their respective regions of the country: Holbrook and others in BC, de la Mothe at the University of Ottawa, Landry in Quebec and Schaefer in Atlantic Canada. Research undertaken by network members has analysed the relationships among a series of regionally-based actors: firms, financial institutions, research bodies, universities, professional organizations, government agencies, not-for-profit associations, etc. The results lay the basis for our initial insights into the processes that contribute to cluster development: the nature of inter-firm relationships; the role human capital, or the supply and use of highly skilled personnel; a region's institutional capital, or the infrastructure comprised of public bodies and economic development agencies; the use of technology; and, a region's social capital, those cultural and social bonds that facilitate the collaborations, formal and informal, necessary for the exchange of codified and tacit knowledge underpinning the innovation process.

The growing convergence of our research agendas and methods led to increasing contact and involvement among the future members of the ISRN at a variety of academic conferences and research forums. This periodic contact became more formalized after the seminar on local and regional innovation systems organized by John de la Mothe in Ottawa in March, 1997, with the support of Statistics Canada, that led to the first collaborative output by network members (de la Mothe and Paquet 1998); and subsequently through a series of meetings leading to the establishment of the ISRN in 1998. The proposed collaborative research initiative expands on our past experiences of investigating local and regional innovation systems in the respective parts of the country by addressing questions of similarities and differences in innovation systems across the country. It goes well beyond the level of analysis we have been able to achieve to date in moving from studies limited to particular regions or localities to one that is more broadly comparative of a range of regions across the country. It does this by proposing to investigate the process of cluster development in a wide range of locales, in both knowledge-intensive sectors, as well as more traditional ones and in both large metropolitan settings that enjoy the benefits of location close to research-intensive universities, as well as in rural settings.

### *Theoretical Framework*

The theoretical framework for the project draws explicitly on the relevant bodies of scholarly literature discussed above. From the broader literature on innovation systems in general, and regional innovation systems in particular, it adopts a focus on the *interactive, social and learning* nature of the innovation process, as well as the notion that geography is important and the institutional infrastructure of a regional or local economy is essential for creating the 'untraded interdependencies' that shape and constrain the innovative capabilities and competitive dynamics of firms located in that region or locality. From the literature on clusters (and the related research on architectures of supply), we adopt the notion that the complexity of innovation in the growing knowledge-based economy is creating an increasing degree of both specialization and interdependence among firms. This interdependence channels the innovation process towards greater cooperation among firms located up and down the supply chain within geographically-based clusters. A proper understanding of the strengths and weaknesses of the innovation potential within regional and local economies requires a more detailed analysis and understanding of the nature of the linkages among firms within these clusters and how the emerging division of labour among them both influences (and constrains) their innovation and growth potential. Both bodies of literature share the critical insight that the institutional aspects and formal organizations of the innovation system, as well as the presence or absence of social capital, play a critical role in influencing the climate for innovation and economic growth in cluster-based regional and local economies. This literature identifies a number of key factors

whose presence or absence are essential for the growth and expansion of dynamic clusters. This framework forms the theoretical basis for the research methodology outlined in the next section.

### *Originality and Anticipated Contribution to Knowledge*

While the theoretical framework reviewed above — national and regional innovation systems, and the cluster approach — emphasize the historical (and path-dependent) evolution of innovative regionally-organized production systems, there is a decided tendency in the applied work on clusters in the policy sphere to adopt a more static framework oriented around the compilation of lists of factors contributing to the development of innovative local economies. While the methodologies employed in this applied work have been effective in identifying the existence and major elements of local clusters in a variety of regions, they have been less effective in capturing the *dynamics* of their formation and historical evolution to the present day. For both innovation theory and public policy, it is vitally important to address this relatively neglected aspect of existing research.

The literature on clusters and regional innovation systems also suffers from a tendency to focus on the most celebrated case studies and engaging in *ex post facto* reasoning to ‘explain’ their success. What is frequently missing from this kind of analysis is a systematic comparison between more successful and less successful regions. Furthermore, with the notable exception of some of the earliest work on design-intensive artisanal production in regions like the Third Italy, this research has tended to focus on newer, more technology-intensive sectors such as microelectronics, computing, telecommunications equipment and, more recently, biotechnology and multimedia. The majority of cluster studies have focused on large metropolitan areas and emphasized knowledge-based clusters, to the neglect of those in non-metropolitan regions. As Scott (1998), Maskell et al. (1999) and others have argued, innovation processes are also key to the rejuvenation and growth of ‘traditional’ economic activities in sectors such as resource-based products and cultural industries. In such cases, innovation systems — both national and regional — may play a central role in stimulating and supporting the renewal process. These sectors, once rejuvenated, constitute a major component of the engine of growth for large metropolitan regions as well as non-metropolitan regions with smaller urban centres.

The research conducted on the nature of clusters in Canada to date has also tended to be somewhat piecemeal. The studies discussed above have examined individual clusters in different metropolitan areas or regions of the country. They provide us with data that identify the extent of individual clusters and, in some instances, benchmark those clusters against similar ones in both Canada and the US.. They have not provided us with detailed insight into the internal dynamics and functioning of the respective clusters, nor have they examined in adequate detail the relationship between cluster dynamics and the role of the supporting infrastructure of economic and social institutions. While the Techmap methodology described above represents an important advance, in that it conveys the historical sequence in which one firm has spun off from another within a regional cluster, its usefulness is limited by two considerations. First, it does not map the relationships between firms and institutions in the same region. Second, it only hints at the dynamics of cluster formation. In other words, it represents an heuristic device and a starting point for more detailed case study analysis. No studies have attempted the systematic analysis and comparison of similar clusters in different regions across the country, as well as the detailed comparison of metropolitan and rural clusters that the proposed research initiative will undertake.

Furthermore, the proposed collaborative research initiative will combine both a strong analytical with a more policy oriented component. In our analysis of specific clusters, we intend to study

some of the questions that concern policy-makers at the regional and local level — how to generate and promote the growth of cluster-based development within the context of their own local economies. To answer this question, we need to explore issues of both history and the degree of path dependency in the evolution of regional innovation systems over time. We will investigate the role that various factors have played in contributing to their innovative capacity, in the current setting. The policy oriented component of our research initiative will examine the following issues:

- ▶ identify a set of ‘best practices’ that work elsewhere to assist local and regional development agencies to identify policy instruments and design programs that promote cluster formation and monitor their progress;
- ▶ develop guidelines to design and animate interactive learning and governance in the various parts of local innovation systems, as well as provide narratives and exemplars about trends in firm location decisions.
- ▶ provide universities and public research laboratories with better insights into their roles in cluster formation and how they can participate more effectively.

While policy-makers seem increasingly interested in answers to these questions, the research community, both in Canada and abroad, has just begun to explore some of the underlying dynamics which can provide the answers to these questions. The proposed collaborative research initiative will help fill a major gap in terms of providing better information and insight to policy makers in this regard.

### **C. Methodology**

Canada, with its great diversity of regional economic structures and histories, would seem to offer an ideal opportunity for subjecting the process and dynamics of cluster development to a more rigorous and varied examination. While major metropolitan regions such as Toronto, Montreal, Vancouver, Ottawa–Hull, and Calgary, as well as smaller urban agglomerations such as Kitchener–Waterloo–Cambridge, have successfully developed major clusters of innovative firms in high-tech industries, the economies of smaller centres and regions in less central parts of the country remain strongly tied to resource-based products. Nevertheless, there is at least preliminary evidence to suggest the presence of local dynamics which are generating the innovation-led upgrading of firms in such regions (de la Mothe and Paquet 1998; Holbrook and Wolfe 2000).

For these reasons, the proposed study will focus on nine sectors, most of which feature significant clusters in two or more cities or regions of Canada. This results in a total of twenty-seven regional clusters:

#### *Proposed Regional Case Study Clusters*

biomedical: Ottawa, Toronto, Montreal, Vancouver, Calgary

multimedia: Toronto, Montreal, Vancouver

culture industries: Toronto, Montreal, Vancouver

photonics and wireless: Ottawa, Waterloo, Calgary, Quebec

telecom equipment and services: Ottawa, Atlantic (Halifax, Saint John, Moncton)

wood products: BC (Kelowna), Quebec (Portneuf), Atlantic Canada

food and beverage: Toronto, BC (Okanagan), Quebec (Chaudière-Appalaches), Atlantic Canada

automotive and steel: Southern Ontario

metal products: Quebec (Beauce, Mauricie)

This list, developed in consultation with network members and partners from across the country, has been designed to reflect the diversity in composition of Canada's various regional economies. Moreover, for many regions of Canada the ability to renew and reinvigorate mature economic activities is central to the ability of localities to secure sustainable prosperity. This selection of clusters will enable us to examine the use of knowledge, social learning processes and supportive institutions to drive innovation in both new, knowledge-based industries (e.g. biomedical, photonics/wireless) as well as older, 'traditional' (wood products, food/beverage) sectors. While many of the sectors are present primarily in large urban-metropolitan regions, several are predominantly non-metropolitan in orientation. This too captures the geographical diversity of the Canadian economy. Finally, the sectors selected also include both new early-stage clusters (e.g. photonics/wireless, multimedia) and those that have had more time to develop (telecom equipment, automotive/steel, culture). The diversity reflected in the above list will provide ample opportunity to derive highly useful comparative insights.

#### *Methods of investigation:*

While the diversity of clusters to be studied represents a major strength of our design, it can also pose a real challenge because of the need to gain in-depth knowledge and understanding of the evolutionary dynamics of each cluster's emergence and development. For this reason, the regional structure already well developed within the ISRN represents a crucial asset that will enable us to achieve our research objectives. The detailed case study analysis of each cluster described below will be directed by locally-based team members forming regional groups, each of whom will draw upon their already established knowledge base, local partners and contacts with firms and institutions in the cluster. It is important to note that network members have already undertaken empirical research involving each of the industries and clusters selected for this study, thereby reducing the start-up problems associated with the proposed cluster studies.

Our work will rely on two principal methods of investigation: statistical analysis of survey results and interview-based case study.

#### Survey Analysis:

The first phase of analysis will conduct a systematic overview of the nine sectors present in our clusters by making use of a recently completed survey of innovative activity conducted by Statistics Canada. This analysis will permit us to establish some baseline data on innovation-generating and supporting activities and practices at both the national and regional level across Canada. It will be based on results from Statistics Canada's most recent (1999)

#### *Survey of Innovation.*

The survey covers a sample of 6,000 firms in 31 manufacturing industries and 800 firms in 5 natural resource industries, representing a response rate of over 90 per cent of firms sampled. Surveys were completed by CEOs at the enterprise level, representing small, medium and large firms. The content of the survey covers a diverse range of innovation-related activity, including the incidence or frequency of innovation, research and development activity and protection of intellectual property, the objectives of/barriers to/impact of innovation, internal and external sources of innovative ideas, inter-firm co-operation and collaboration with other firms or organizations in the innovation process, the product commercialization process, and the use of government programs to support innovation. International comparisons to counterpart firms within OECD countries are also made possible by the use of a standard survey format for key

questions.

This survey, first conducted in 1993, was redesigned with input from members of ISRN through a one-day workshop held during the first national meeting of ISRN in Toronto, May 1999, at which officials from Statistics Canada solicited suggestions and feedback on how to improve the design of the initial survey — particularly its coverage of the geographical dimensions of interaction, learning and sources of innovative ideas. Moreover, the continuing participation of several ISRN members on Advisory Committee to the Science, Innovation and Electronic Information Division of Statistics Canada (Dalpé, Landry, Schuetze and Wolfe currently, and Holbrook formerly) has provided ongoing opportunities for input in the development of this important database.

As these data have only very recently become available, they have undergone virtually no prior analysis. The Director of the Science, Innovation and Electronic Information Division of Statistics Canada (an ISRN partner) has committed to providing facilitated access to the Innovation Survey database for participants in this collaborative research initiative to conduct this analysis (see letter of support, Fred Gault). The analysis will be co-ordinated by Réjean Landry (Laval) and Adam Holbrook (Simon Fraser), although other co-applicants with expertise in specific sectors will undertake their own analyses to complement their in-depth cluster studies. The statistical work will be carried out at Statistics Canada's regional offices and their soon-to-be-established university data centres.

The data from the survey will be analysed to provide a systematic, consistent overview of innovation-generating behaviour in the key sectors selected above. Special emphasis will be placed on the relative importance of internal and external sources of innovative ideas, co-operative/collaborative inter-firm interaction, relationships to innovation-supporting institutions and the use of government programs. Despite the relatively large sample size, we do not expect to be able to conduct this analysis at the level of every one of the individual sectoral and regional clusters identified above, due to potential problems of small cell counts when disaggregating by location and industry. Hence, the insights arising from this analysis will form a useful backdrop and complement to more detail research carried out through a case study approach.

#### Interview-Based Case Studies:

Case studies will be carried out by the different regional group teams, using a common, jointly developed, semi-structured interview guide to enable systematic comparison across regions and sectors. The objective here is to conduct in-depth, detailed analysis of the dynamics of each cluster's emergence and historical evolution. As the analysis of cluster formation, structure and dynamics is still in its early stages, there is as yet no single, universally accepted methodological approach. However, previous experience of the applicant, co-applicants and collaborators strongly suggests that the semi-structured interview method is best suited to the task of capturing regionally-based innovation dynamics and the roles and relationships of the major actors involved. Furthermore previous studies, such as the classic analysis of Silicon Valley and Route 128 by Saxenian (1994) confirm that the interview is the best method for this kind of research.

The processes and relationships to be explored through these case studies have been organized into a provisional framework developed by ISRN members. Among the elements of the framework identified as potentially relevant from the preceding literature review are:

- ▶ the nature of inter-firm relationships within each regional cluster — the nature and role of buyer-supplier network relations in contributing to the innovative capabilities of regional clusters;
- ▶ the importance of pools of highly skilled labour for regional systems of innovation and barriers that may limit their availability;
- ▶ links between firms and local sources of business advice, mentors and patient capital or angel investors;
- ▶ the role of local and regional intermediaries and civic entrepreneurs in stimulating, developing and sustaining local and regional clusters;
- ▶ the supporting role of regional institutions and formal organizations, such as research universities and public laboratories, as well as local and regional governments in the system of innovation and their contribution to the process of cluster development.

The interviews will be conducted with a broad range of stakeholders and actors, including senior representatives of the following:

- a. 'Lead' firms
- b. Smaller and mid-sized firms, including suppliers
- c. Industry associations, chambers of commerce
- d. Labour organizations
- e. Government agencies (federal, provincial, local)
- f. Technology transfer organizations
- g. Universities: offices of technology transfer; relevant departments and faculties
- h. Colleges and other training institutions
- i. Financial sector (venture capitalists, banks, other)
- j. Local political leaders and 'civic entrepreneurs'

#### *Preliminary Research Plan and Schedule of Work:*

For conceptual purposes, we have broken the work plan for the project into three distinct phases outlined below. However, the allocation of the funds requested, both from SSHRC and other partners, means that some of the field research will overlap all three phases.

#### Phase I: Years 1 and 2

In phase I, the researchers will undertake a systematic compilation of the current state of cluster analysis in the regions, based on both the prior work of the research team, the relevant academic literature, as well as work done by organizations with whom we have partnered, including the ICF Kaiser, PriceWaterhouseCoopers, and local and provincial economic development agencies. We will use the framework outlined above to refine the existing state of knowledge in each of the regions, to identify critical gaps in our current knowledge, and to confirm our initial selection of clusters for subsequent detailed analysis. Based on this work, we will begin to conduct case study interviews for the initial set of clusters. Statistical analysis of the *Innovation Survey* to provide an overview of innovation dynamics will also be initiated during this period.

#### Phase II: Years 3 through 5

In phase II we will continue the detailed case studies of selected clusters in each of our regional settings, analysing the contribution of the individual factors outlined above to the process of cluster development in individual cases. In Phase II and III of the project the initial analyses of the Statistics Canada database will be used to test the validity of the research hypotheses and provide a quantitative basis for the work on sources of innovation and barriers to innovation within specific clusters.

#### Phase III: Year 5

The final phase of the project will involve a systematic comparison and analysis of the state of cluster development across the individual regions. Based on this analysis we will identify the presence of both inhibiting and facilitating factors, elaborating the implications for policy development at the local, provincial and federal levels. This will be supplemented by the participation of our international collaborators in regional and national meetings, enabling us to extend the scope of our comparison to leading clusters in the United States, Europe and Asia.

#### **D. Communication of Results**

The goal of the research program is to improve our understanding of the key determinants of successful regional systems of innovation and cluster development, to evaluate a range of policy instruments to support these determinants and, by sharing our insights with our partners at the local and regional levels, to contribute to more effective public policies for innovation and competitiveness across the country. The research results of ISRN members are presented in a wide array of academic fora, including many sponsored by the OECD, European Union, Policy Research Secretariat at the federal level and more local settings. In conjunction with the School of Policy Studies at Queen's, we have launched the first of an annual series of publications, featuring the research output of ISRN members, distributed by McGill-Queen's University Press (Holbrook and Wolfe 2000). In addition, research output by several ISRN members and some of their international collaborators appears in two academic series edited by John de la Mothe, one from Kluwer Academic Publishers and the other from Pinter Publishers. Two of the networks, one in Quebec and the other in Ontario the latter with the active involvement of two provincial government ministries), have begun the distribution of electronic newsletters containing information on current events and research output related to their research agenda.

The active involvement of our regional and national partners in the network's research program provides an additional outlet for disseminating our research results and ensures its policy relevance and impact. Regional and national partners who will participate in our research advisory committee will benefit from the results of our research output and help to ensure the relevance of our research activities to their own policy goals and initiatives. Several letters of support from provincial departments and agencies, as well as from regional development agencies at the federal level, attest to the anticipated benefits of their continuing involvement. And as part of a national research program, partners will be able to compare similar initiatives from other regions across the country.

The research network's unique integration of regional studies into a national framework also contributes to the development of federal innovation policies. The proposed project extends our collaboration with the Science, Innovation and Electronic Information Division of Statistics Canada to improve the collection of data for the study of innovation and to coordinate national with regional data collection efforts. The letter of support from the head of the SIEI Division indicates the complementary role that the research network plays to the statistical agency's own work on innovation. The expanding role of the National Research Council in promoting the



growth of regionally-based clusters, initially in Atlantic Canada and potentially in other parts of the country, also links closely to the research agenda outlined here. Several members of the research network assist the National Research Council in analysing the role of national laboratories, as part of the research infrastructure, in contributing to the development of regional clusters.

### **E. Description of Team**

The ISRN's network structure is particularly well suited to the study of regional innovation and cluster development in the diverse local and regional settings of Canada. The research team is composed of five sub-networks based in the Maritimes, Québec, Ontario (two networks) and western Canada. The co-applicants of the proposed research initiative from Atlantic Canada include Norbert Schaefer, Udo Staber and Charles Davis. Members from the network in Quebec are Réjean Landry, Jorge Niosi, Robert Dalpé and Dianne-Gabrielle Tremblay. Members from the network in Ottawa-Carleton are John de la Mothe, Jérôme Doutriaux, Keith Newton and Bruce Doern. Members of the network in southern and eastern Ontario include David Wolfe, Meric Gertler, John Britton, John Holmes and Lynn Mytelka, while the participating members of the Western Canada network include Adam Holbrook, Richard Smith, Hans Schuetze, Tim Padmore and Cooper Langford. In addition, several other participants in the network will participate actively in the research program as collaborators.

The regional node structure allows the constituent research groups to focus on the study of their respective regions. Each node has developed strong research partnerships with appropriate local and regional actors. The proposed research initiative builds on this solid base by establishing a truly collaborative research agenda that applies a common research methodology (outlined above) to study a comparable set of clusters across the country. The research results of this effort will allow us to formulate a truly comparable set of findings concerning cluster development on a national basis. In many respects, the high degree of success achieved through our decentralized and regionally-based organizational structure, with its strong links to a network of partners at the local level, mimics the business relationships that we are investigating.

### **F. Training (Role of Graduate Students in the Research Initiative)**

Each of the researchers participating in this proposal is currently engaged in an active individual research program that attracts high-quality graduate students. Network researchers draw their graduate students from a broad range of disciplinary and interdisciplinary areas and the graduate students, as well as a number of post-doctoral students have been involved in virtually all phases of the research enterprise. Each of the active members of the proposed research initiative has an average of two to three students engaged in current research; we anticipate the total number involved with this project would be 50 to 60 students. Graduate students, and undergraduates, will be involved in most aspects of the research initiative, including data collection, design and conduct of interviews with cluster participants, collation of interview results and data analysis. The research initiative will provide them with a broad scope of research and training opportunities. Graduate students will continue their role in maintaining network research listservers and helping to disseminate research results through electronic newsletters.

Under the proposed project support for students will be increased and regularized, allowing the network to expand the number of training opportunities for graduates and compete effectively with comparable programs in Europe and the US to attract the best candidates. The research initiative will continue to encourage and support the active participation of graduate students in

all aspects of its networking activities. Graduate students attend and participate in both the regional subnetwork workshops and the annual network conferences. Some sub-networks have initiated graduate student workshops and seminars. Special sessions at network meetings will provide opportunities for graduate students to explore common research interests, to feature their work to partners (and possible future employers) and to build their interdisciplinary skills. The demand for network-trained graduates is growing rapidly; at least 10 students involved in the network have been hired since 1996 by government agencies to work on science and technology policy initiatives. In addition, network-trained graduates have been hired to work by private consulting firms and placed in academic teaching positions.

## **G. Collaboration**

As the preceding pages indicate, the Innovation Systems Research Network has become a truly collaborative effort over the past two years, both in terms of the research activities of our academic members, our involvement with a broad network of international collaborators, and the range of relationships with our expanding network of partners in the public and private sectors. This dual nature of our network is reflected in the framing of this research project. The project is broadly informed by a detailed set of theoretical analyses and empirical studies of regional innovation systems and cluster development in Canada and abroad refined through network workshops and conferences. At the same time, the research agenda outlined above has been formulated as a result of our ongoing interaction with, and response to, the policy concerns of our many partners at the federal, provincial and local levels across the regions of the country. Both the research agenda and the research methodology to implement it have been formulated through a strongly interactive and collaborative process that has emerged out of our network activities of the past two years. The comparative and integrated design of the cluster analysis in this project is also based on our collaborative approach. Finally, the even distribution of our research activities across the five key regions involved, as well as the broad-based letters of support provided by the network's partners confirm its collaborative basis.

## **H. Management**

The research project will be governed by a management committee consisting of David Wolfe and Meric Gertler of PROGRIS at the University of Toronto, and the heads of the other four subnetworks, Adam Holbrook, John de la Mothe, Rejean Landry and Norbert Schaefer. The management committee will have overall responsibility for the management, direction and financial accountability of the collaborative research initiative. A Research Advisory Committee (RAC) will be established to advise the management committee on the content and direction of the research program. A majority of members on the RAC will be university-based researchers, drawn principally from among our international collaborators, with additional members drawn from our partner organizations, including some active in the development of regional science and technology programs. Members of the management committee will participate in meetings of the RAC and be responsible for integrating the advice provided with the ongoing direction of the research activities. Both bodies will also monitor the dissemination of our research results, evaluate the effectiveness of the network's knowledge exchange, and provide advice on measures to further improve the dissemination of our research results.

The Program on Globalization and Regional Innovation Systems, based in the new Munk Centre for International Studies at the University of Toronto, will assume the central management function for the collaborative research initiative. The applicant, David Wolfe, along with

graduate research assistants and other support staff for the collaborative research initiative will be located in the Munk Centre for International Studies. PROGRIS already fulfills this role for the ISRN with the administrative support structure provided by the Centre for International Studies at the University of Toronto. In this capacity, it has been responsible for organizing the annual meeting, coordinating the annual publication with the School of Policy Studies at Queen's, maintaining the national web site, generating and maintaining a current bibliography of ISRN publications and initiating a working paper series in electronic format. The official opening of the new Munk Centre on August 28, 2000 affords the network access to the latest in conference facilities, including international videoconferencing capabilities, plus an experienced and competent administrative support structure to manage it.

## **I. Networking and Partnerships**

The five subnetworks that comprise the research network work with a wide array of private firms, industry associations, community-based, not-for-profit organizations, local and regional economic development agencies, federal, provincial and municipal governments, and public research organizations. In addition to the partners in provincial government ministries and science and technology agencies, other examples of the range of existing partners include the National Research Council and its local IRAP representatives, the Atlantic Canada Opportunities Agency, le Groupe pour l'avancement technologique et industriel de la région de Québec-Chaudière-Appalaches (GATIQCA), Montréal Technovision, Sofinov, CIBC, Group d'action technologique de l'Estrie (GATE), OCRI, SMART Toronto, the Science Council of BC, Western Economic Diversification, BC Advanced Systems Institute, and the Calgary Research and Development Authority. Network members also have an extensive network of contacts with international researchers in this field. (Fuller documentation is outlined in ISRN 1999).

Network researchers work collaboratively with these partners to design and carry out policy-relevant research on regional innovation systems and cluster development. The active involvement of partners in the research activity leads to a sense of ownership among all parties of the new knowledge gained. Existing regional partners will be integrated into the proposed collaborative research program. Collaboration on research is a primary means of networking for researchers and partners of the network. As noted above, the network holds an annual conference that brings together its university-based researchers, graduate assistants and partners in the public and private sector. Participation in these meetings has become a valuable means for key policy makers to remain abreast of the latest research findings both in Canada and abroad. Furthermore, the meetings have become important opportunities for some of our partners to meet and interact not only with the academic researchers in the network, but also with their colleagues in comparable ministries and agencies from other regions, as is attested in some of the letters of support. The ensuing knowledge exchange is becoming an important mechanism for sharing policy insights among these actors. The regional subnetworks also host regular workshops and seminars to focus on specific topics with particular relevance to their regions. The format for these regional meetings varies to allow each region to maximize the opportunities for partnerships in their area. Both national and regional meetings feature the work of the network members and explore its policy applications with partners and introduce potential new partners to the network.

The proposed collaborative research project will continue to develop the ISRN web site as a networking tool and information resource for our partners (cf. <http://www.utoronto.ca/isrn>). The common bibliography, hosted on the web site, contributes to the building of a common analytical framework. As noted above, the electronic newsletters produced by two of the subnetworks have

become an important tool for disseminating research findings and informing our network partners of current research results and policy reports produced by the expanding body of international researchers working in this area, including many of our international collaborators. The easy replication and dissemination of the electronic newsletter has generated a growing number of new partners for the research network, further reproducing some of the ‘network externalities’ that we are engaged in studying. The network has also commenced discussions with the Knowledge Media Design Institute at the University of Toronto to take advantage of new collaborative media-based technologies being developed in conjunction with the Bell Canada University Labs. It is hoped that the research project may constitute one of the first ‘departments’ in a new ‘virtual institute’ that will deploy online interactive technologies to facilitate our research collaboration and the dissemination of our results. The proposed collaborative research initiative is committed to using the latest in information and communication technologies to further our own research efforts and expand the basis of our network partnerships.