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Canada's Technology Triangle:
Designing a Role for Regional
Government in Emerging
Advanced Technology Based Economy

by

Peter Norman Levesque

A thesis submitted to the
School of Graduate Studies and Research
in partial fulfillment of the
requirements for a
Master's Degree in Sociology.

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Abstract

This thesis examines the activities of the central actors in an emerging advanced technology based economy. The interaction and synergy between university based researchers and advanced technology entrepreneurs has opened significant opportunities for economic renewal and development in Western economies. An understanding of the sociological dynamic between these key players is necessary to the process of harnessing this economic potential. The comparison of this dynamic with the activities of organizations such as Canada's Technology Triangle, will perhaps provide insight into more effective methods of encouraging similar development in other communities.

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I. Introduction

The Canadian Technology Triangle is an organization formed out of the recognition that the industrial base which supported Ontario municipalities at an internationally high standard for decades is being replaced by a more subtle information based and technologically advanced post-industrial structure. This new structure, may or may not be able to provide the same level of indivisible benefits which the citizens of Ontario have grown accustomed to.

The following study attempts to demonstrate some of the social factors which drive the emerging economic system: information intensive "high" technology. The point of departure of the study is that the technoscientific activities are social in origin and are the result of particular types of interactions among several key groups of individuals.

The demonstration is limited to the region defined by the triangle formed by the cities of Guelph, Cambridge, Kitchener, and Waterloo and to a set time frame of approximately eighteen months.

II. Social Factors in the Development of Advanced Technology Research Relationships

A. Economic Diversification and Governments

Global shifts in the location of traditional manufacturing from western industrialized countries to other regions, predominately to the pacific rim and other newly industrialized countries (Mexico, Brazil) has resulted in concentrated efforts by Western governments to restructure segments of their economy around the development of what is referred to as "high technology" (Naisbitt, et al. 1990). These efforts have led to the development of strategies aimed at enhancing present capabilities in advanced manufacturing industries and filling economic voids caused by the downturn in traditional industries. These strategies include the creation of zones dedicated to promoting and supporting the fusion of high-technology industry, concentrated university research, and a community of people involved in the research, development, manufacturing, and service of high-technology industry and its products. Successful examples from the United States include the well known and documented "Silicon Valley" in California and Route 128 in Massachusetts (Rogers, 1985). The outstanding example in Britain is Cambridge (Quince, 1985). French efforts include the regions surrounding Paris, Toulouse, and Nice (Lesourne, et al. 1989).

These efforts among others have not gone unnoticed in Canada and attempts have been made to emulate them. These attempts have been supported and encouraged by various federal, provincial, and municipal/regional programs.

i) Federal Initiatives

The recent initiatives by the Canadian Federal Government have concentrated on their INNOVATION Strategy paper. Released in 1988, the aim of the strategy paper can be summed up by Prime Minister Brian Mulroney's address on Research and Development at the University of Waterloo, March 4, 1987:

"The Western World is moving toward knowledge-based economies and Canada must move with it. We want to be known not only as a resource-rich nation, not only as a trading nation, but as a nation known for brain power, our ideas, and our intellectual and educational achievements. The issue is no less fundamental than how Canada will earn a living in the 1990's and beyond."

The goal of the INNOVATION program is to act on five fronts within the existing Canadian industrial infrastructure, and to influence the direction of future growth and development. These fronts include encouraging industrial innovation and technology transfer, enhanced development of strategic technologies, effective management of federal resources, development of policy on science, technology and human resources, and the promotion of a science oriented culture (Minister of State for Science and Technology, 1988).

Aside from the strategy development, direct intervention in the development of research and development at the federal government level has been in areas of funding for projects, tax credits for companies, and tax incentives for investors.

ii) Ontario Provincial Initiatives

In Ontario, the provincial thrust has come via the Premier's Council (PC), which came to be on April 22, 1986. The PC was established to assist in the developing of long term strategies for improving the provincial economy (Premier's Council 1, 1988). Mr. David Peterson, the former Ontario Premier, and original Chair of the Council's 34 member board, was key in bringing together leaders of the business, labour and academic communities, as well as a number of government ministers to round out the PC's leadership.

The Premier's Council meets regularly to discuss ways of improving the development and use of new technology, strengthening the existing industrial infrastructure in the province and encouraging entrepreneurship. The Council developed a number of programs which operate under the 1 billion dollar Technology Fund (Premier's Council, 1990). These programs are listed and described in some detail below. This is of some importance because they are referred to quite often by the interview subjects.

1) Centres of Excellence

In June 1987, the Premier's Council designated seven Centres of Excellence at Ontario Universities. The Centres undertake long-term scientific and technological research and promote the transfer of technology from the academic world to industry. The Centres are co-operative ventures between the universities and industries working in fields considered critical to Ontario's economic strength.

The Ministry of Industry, Trade and Technology has primary responsibility for the program, in collaboration with the Ministry of Colleges and Universities (Premier's Council 2, 1988). A subcommittee of the Premier's Council meets on a quarterly basis to monitor the development and effectiveness of the Centres:

- a) The Centre for Advanced Laser and Lightwave Research, University of Toronto;
- b) The Centre in Space and Terrestrial Science, York University, Toronto;
- c) Manufacturing Research Corporation of Ontario, Oakville;
- d) Waterloo Centre for Groundwater Research, University of Waterloo;
- e) Information Technology Research Centre, Brampton;
- f) Ontario Centre for Materials Research, Kingston;
- g) Telecommunications Research Institute of Ontario, Oakville.

2) The Industry Research Program

The goal of the Industry Research Program is to stimulate industry-based research collaboration between private companies and other partners in areas that will improve the competitiveness of Ontarian businesses.

Projects must be based on sound scientific principles and display a degree of scientific risk, as well as economic and social benefits. Projects must have more than one partner, must contribute to training and development, and must demonstrate a potential for the production of tradable goods and services.

All projects are reviewed by an assessment panel chaired by a member of the Premier's Council. Eligible applicant's and collaborators are:

- a) Canadian companies or subsidiaries of foreign-owned firms which operate in Ontario;
- b) Crown corporations and research organizations which receive more than 50% of their operating funds from private sources;
- c) Ontario post-secondary institutions and ministries of the Ontario government.

3) The University Research Incentive Fund

The University Research Incentive Fund (URIF) is designed to encourage universities and the private sector to collaborate in joint research ventures.

Administered by the Ministry of Colleges and Universities, the Fund matches private-sector investment in short-term university contract research. Funds flow to the universities and may be applied directly to the project or used to expand its scope.

All Ontario universities and Ryerson Polytechnical Institute are eligible academic institutions. Private-sector partners can be Canadian corporations or foreign-owned subsidiaries operating in Ontario, industry-sponsored research organizations and Crown corporations receiving less than 50% of their revenues from the government. URIF projects must last no longer than 3 years and require a formal research contract between a private sector and an academic partner.

4) Centres of Entrepreneurship

The Premier's Council has designated six Centres of Entrepreneurship to be established in Ontario colleges and universities. The program is administered by the Ministry of Colleges and Universities. The Centres mandate include developing programs and courses in innovation and enterprise.

Designated Centres are:

- a) York University - Toronto;
- b) Ryerson Polytechnical Institute - Toronto;
- c) Queen's University - Kingston, in conjunction with St. Lawrence College - Cornwall;
- d) Lakehead University and Confederation College - Thunder Bay;
- e) Canadore College and Nipissing College - North Bay;
- f) Centennial College - Scarborough.

5) Technology Adjustment and Research Program (TARP)

This program was developed by the Premier's Council in recognition of the need to study and anticipate the effects of technological change to facilitate the process of adjustment that industries and their workers must undergo. TARP encourages cooperation among the labour and industry study partners.

6) Other Programs

Three technology initiatives have been introduced based on recommendations contained in the Council's Report, Competing in the New Global Economy, 1988.

a) The Research and Development Super Allowance: provides an extra 25% tax deduction for large firms and 35% for small businesses for R&D expenditures.

b) The Technology Personnel Program: assists smaller manufacturing firms to hire new engineering and technical staff and thus improve their advanced technological capability. The program is funded by the Technology Fund, of which \$4 million goes to the Ministry of Skills Development, for the Technicians and Technologists Skills Updating Program.

c) The Supplier Development Program: which was established to award research contracts to companies with the potential to become competitive suppliers of technology goods and services.

iii) Regional Government Initiatives

At a regional level several areas in Canada have developed industrial zones which correspond to the fusion described above. These include Ottawa-Carleton, otherwise known as "Silicon Valley North" in Eastern Ontario (DeGenova, 1984), the corridor between Montreal and Bromont in Quebec (Conklin, 1988), and the Kitchener-Waterloo, Cambridge and Guelph triangle in Southern Ontario, known as Canada's Technology Triangle (Fournier, 1991). It is the latter which is the area of focus for this study.

The study of regional efforts to reconstruct their industrial or perhaps their post-industrial focus is part of a growing recognition that local actors have regained prominence in their own communities and are translating this perception into control of the activities which are planned and performed in their local environment.

"Local political space and local political actors have come back to power. Rather than being marginal to economic, social and political development as they have been seen to be during the twentieth century, they are now being reconsidered as central to this development." (Andrew, Houle, Theriault, undated)

If the idea that "former models of social action and social regulation are no longer operable and that society is now being influenced by new logic which are as yet undefined, (Andrew, Houle, Theriault, undated) is accepted or at least recognized as plausible, then it is easy to see why the search for new logic among emerging and increasingly influential actors at the local level would be the source of exciting and dynamic speculation and investigation.

The focus of almost all of the programs emerging from the federal and provincial governments is one of decentralization and a recognition that new relationships must be encouraged. However there is a genuine fear by these "senior" levels of administration of losing control of the activities performed at a local level, and hence a loss of influence in deciding where the outcome(s) of the activities may be applied. This fear has been recognized by local actors who translate it into a lack of leadership and vision on behalf of the federal and provincial governments and a justification for increasing the influence emanating from and the resources available to regional leadership in economic policy. Again from Andrew et. al., drawing from the works of Storper and Scott, in "strict economic terms, the disintegration of the fordist model leads to a process of economic reconstruction that breaks with the classical model of hierarchical and bureaucratic communication at the same time as it develops a tendency to agglomerate locationally."

An example taken from interviews with a business broker in the Triangle region shows how traditional industries are reformulating themselves, not only in technological terms, but perhaps on social terms as well. A former metal wire manufacturer based in Guelph faced with stiff competition from the Orient, entered into a research and development process with the Queen's University Advanced Materials Group. The result was a plastic wire used in aerospace applications. A subsequent result to the new product was the manner in which the company now had to be run. Short runs for particular applications

meant that the work force now had to be more adaptable, both technologically and in terms of the time allotted for various tasks. Management has to be able to talk directly to those involved in the manufacturing process instead of flowing through levels of management, and the floor person has to accept the responsibility of relaying feedback directly to the management (interview notes, Guelph)

This example is perhaps part of a trend developing in the Triangle region or it may simply be an isolated example brought to the forefront by the directors of the CTT to strengthen their own arguments. Either way, changes are occurring in the region outlined by the cities of Guelph, Cambridge, Kitchener and Waterloo.

The identification of some of the actors involved in these changes and the processes they are involved in, is part of a larger investigation underfoot across Canadian communities, all in an effort to gain an edge against the unpredictability of the effects global economic shifts are having on municipal structures and their constituents.

B. Canada's Technology Triangle

Geographically, Canada's Technology Triangle is the area located approximately 100 kilometres west of Toronto on the Trans Canada Highway #401 (see map below). The population is a combined total of 500,000 people. The creation of "Canada's Technology Triangle" is a result of the co-operation of the business offices of the cities of:

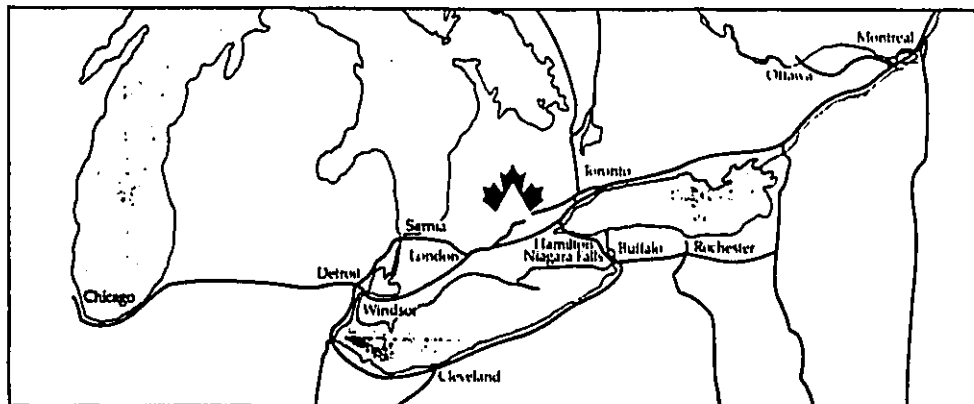
Kitchener,
(W.E.Thomson, Commissioner, Business Development),

Waterloo,
(G.B.Turcotte, Commissioner, Business Development),

Guelph,
(D.B. Murray, Industrial Commissioner),

and Cambridge,
(D.G. Eastwood, General Manager, Business Development
Department).

Figure 1. Map of the Canada's Technology Triangle Area.



The primary characteristic of Canada's Technology Triangle is not that of a geographically defined region, but rather a marketing organization initiated by the business officers of the municipalities listed above (interview notes, City of Guelph). Thus to avoid confusion in discussions of both the region and the organization, we refer to the region as "Canada's Technology Triangle" or more simply "the Triangle." We refer to the organization as CTT (Fournier, 1991).

The base from which the CTT was created is the belief that "co-operation and technology are the foundation for our combined economic growth" (Economic Profile, CTT Promotional Pamphlet, cover). The creation of the CTT is an explicit attempt to promote synergy between university research and advanced technology industries, in an effort to support the changing economy of the region; "The Triangle Cities have gone out of their way to provide service to present and new businesses to help secure their future and growth. The three universities offer research, business, and world renowned computer related expertise - all ready to serve private sector initiatives" (Economic Profile, CTT Promotional Pamphlet, 1). The CTT's revised (as of January 11th, 1991) Mission statement echoes this;

"The purpose (of Canada's Technology Triangle) is to sustain and enhance balanced economic development by encouraging the formation and adoption of new technology and promoting environmentally compatible development that in total preserves the competitive advantage of the area resulting in a strengthened economy."

A theme which emerges from a review of the CTT's promotional documentation is; as the industrial and manufacturing base of the region "evolves", new opportunities for supporting the present municipal structure and standard of living of the region are to be found in exploiting the present educational infrastructure by encouraging the creation of new companies from the results of high-technology research, and to encourage other companies to set-up in the region in order to take advantage of this research and development motherlode. The explicit objectives of the CTT are twofold, (i) to enhance existing economic development programs and (ii) to exploit the technology potential of the area. The strategies developed by the CTT to bring about these objectives are summarized in Table 1.

At first glance, the hopefulness of the CTT mission seems based on uncertain possibilities and undetermined benefits. Perhaps this is due to one or several factors; the uncharted territory in the Canadian context into which this organization has ventured; unanswered questions regarding the outcome of their international marketing efforts; or the relative ignorance by the local business community about the activities of the CTT.

TABLE 1. OBJECTIVES AND STRATEGIES OF THE CANADIAN TECHNOLOGY TRIANGLE

(i) ENHANCE EXISTING ECONOMIC DEVELOPMENT PROGRAMS:

- a) Undertake an annual review of the strengths, weaknesses and opportunities of Canada's Technology Triangle as a technology growth pole.
- b) Integrate science and technology considerations more explicitly through Official Plan statements recognizing the critical role of innovation and technology-based development.
- c) Promote CTT as a location for new research and technology intensive industrial activity.
- d) Develop and facilitate technology transfer, joint ventures and strategic business alliances when appropriate between CTT area companies and other Canadian and foreign firms.
- e) Maintain an integrated database compatible with local municipal systems to respond to development enquiries in the CTT area.
- f) Establish liaison with other selected technology regions.
- g) Continue a co-ordinated marketing plan that augments local marketing efforts involving advertising, direct mail, trade shows, and investment seminars.
- h) Promote the interests of member municipalities in matters of Senior Government technology policy through the CTT.
- i) Utilize CTT to co-ordinate involvement in the initiatives of National and Provincial organizations engaged in technology development, innovation and entrepreneurship.

(ii) EXPLOIT THE TECHNOLOGY POTENTIAL OF THE AREA:

- a) Support and co-operate where appropriate with community industrial training committees, organized labour, and other groups involved with skills development and employee upgrading initiatives.
- b) Advocate the creation of technology transfer networks between academic and research establishments and industry within the CTT.
- c) Encourage the development of additional technical support services in functional areas of importance to local industry.
- d) Pursue the development of new financing vehicles to assist local companies with strategic alliances and international technology transfer opportunities.
- e) Encourage the formation of blue-chip industry/academic panel within the CTT to provide periodic input and guidance for the technology triangle initiative.
- f) Encourage studies and research on technology innovation and entrepreneurship with the CTT by local university faculty and graduate students.

Source: Canada's Technology Triangle Mission Statement, January 11, 1991.

The directions taken by the CTT, reflected in the strategies for accomplishing their stated objectives, raises several questions. Are the hopes of the CTT warranted? Is this type of activity redefining the role of municipal governments? Have they considered whether it is the role of the municipal government to be encouraging this type of high cost, high risk research in a governmental structure whose traditional function is direct service to its specific population? Do they understand the costs involved in research and development (R&D)? What are they expecting from the development of synergy between the various elements described? Have they understood the difference between divisible and indivisible benefits? Have they addressed the question of whose research is being performed in the various university departments?

C. The Context and Scope of Study

There are many possible outcomes which may result from the direction adopted by the CTT's administrators. This study however, is concerned principally with three things.

- (1) With Canada's Technology Triangle being defined as a marketing organization for a specific region, who are the actors involved in the scenario staged by this organization?
- (2) How do these actors, once identified, interpret the roles handed to them by the directors of the CTT?
- (3) Do these interpretations mesh with the vision of the directors of the CTT, and either way, what are some of the potential outcomes of the encouraging university/industry collaborative research from a municipal or regional perspective?

D. Theoretical Choice

Deciding how to research the above questions is not straightforward. Not only is the direction of enquiry guided by the choice of foundation, but this choice reveals much about the sort of arguments to be made during the course of presentation. Reviewing literature which can be connected to this study is not a simple matter of describing what has been written by whom, but is explicitly an exercise in building alliances with others in order to make the statements presented here stronger. "As in Machiavelli's The Prince, the progressive building up of an empire is a series of decisions about alliances: With whom can I collaborate? Whom should I write off? How

can I make this one faithful? Is this other one reliable? Is this one a credible spokesperson? (Latour, 125:1989)."

The choice of supportive literature must accomplish several things. It must define the scope into which the study falls, hence make explicit what are the limitations placed on both conclusions from within and criticisms from without. It must weaken the arguments of those who would oppose the conclusions of the researcher. It must seek credibility beyond the methodological rigourousness of the research itself, and firmly ground the research in the works of recognized spokespersons. Finally, it must demonstrate that further work in the chosen area of enquiry is necessary to better understand our society.

During an interview with a member of the Technology Transfer and Licensing Office at the University of Waterloo, discussion touched on how the University of Waterloo had achieved its reputation as "the business university." Part of the explanation was a reflection of the fact that two-thirds of the University's activities, namely engineering, computer science and mathematics, were directly connected to some possible form of technological transfer to industry, either in the form of licenses or of patents. It was also indicated that this reputation was directly attributable to the marketing efforts of the University President. President Doug Wright had sought to establish greater relevancy between the activities performed in the university and the needs of industry/business outside the university (interview notes, University of Waterloo). This is to say that from within the university community, a respected senior member

of that community, has actively sought to develop stronger links between science, technology, and society. It is this identification of people who do not subdivide studies of 'science, technology and society' into discreet components by discipline or by object which shall enhance the impact of technoscience studies, of which to an extent, this study may be included.

The division of studies of 'science, technology and society' has led to a situation where "(e)conomists of innovation ignore sociologists of technology; cognitive scientists never use social studies of science; ethnoscience is far remote from pedagogy; historians of science pay little attention to literary studies or to rhetoric; sociologists of science often see no relation between their academic work and the in vivo experiences performed by concerned scientists or citizens; journalists rarely quote scholarly work on social studies of science; and so on" (Latour, 16:1989). This diffusion of interests and perspectives has not led to the development of a specialization of concentrated studies leading to a better understanding of the interrelationships of the multifarious actors in technoscience. Rather what has emerged are several streams of literature, each venturing in their own direction, and each obscuring further comprehension of society, science in action, and ready-made science.

These streams can be classified into two large groupings: those which attempt to objectify science and the activities of scientists in society, and those which subjectify the scientific method and the results produced from the various applications of this methodology. There is a further

stream which links the social and technical processes into a perspective closely reflecting the reality of technoscience.

The classification of literature into groupings may appear a simple matter, however the reality is never so neat. Authors involved either in the process of the objectification or the subjectification of science, its role in society, its methodology, and so on, try through various rhetorical tools, to resist classification and insist that their presentations reflect reality. The resistance in the objectification stream is present in the use of at least three methods. The first of these is a process whereby science is the product of great men or women, who create facts and diffuse these facts into their respective communities so that they may be used by others. Examples of such people are found in the writings around various scientific heroes.

Another method in this process of objectification is to call on Nature, that all things exist in a natural state and that they are waiting to be discovered.

The third method of objectification of this process is closely linked to the first two. This method is based on the ethical presupposition that science is neither good nor evil, but that it is the uses of technology derived from the science which leads to either beneficial or abhorrent conclusions.

The second stream of literature referred to is that characterized by an

attempt to subjectify science, scientific enquiry, and the applications of scientific procedure.

Both streams outlined above are relevant to the scenario studied here, however neither is adequate, since the process of relationships under examination has more to do with the social creation of activities than with determining whether science and associated activities are objective or subjective.

Ideas and the connections made among these ideas are influenced indirectly by hundreds of sources during the course of an investigation. For this reason it is difficult to list all of the works which play a part in the final version of a research effort. It is possible to present the major influences and to draw links between the central ideas presented and the new information and context being discussed. These major influences are presented below.

III. Theoretical Perspective

A. Latour's Technoscience

The study fits well into the model of previous studies related to the effects of science and technology (Kuhn, 1970; Mulkay, 1979; Knorr-Cetina, 1981; 1983; Barnes and Edge, 1982; Latour, 1987). The trend which has emerged is that research in the physical sciences is fundamentally an interpretative, interactive enterprise on the part of the those performing

the research. This interaction leads to the development of extensive professional and social networks on regional as well as national and international levels. By mapping out the interrelationships of the region's business officers, the university researchers and administrators, and the industrial researchers and executives, it is possible to determine what are the strongest and the weakest associations in the system, and from these associations extrapolate who is benefitting most from the collaborative efforts. It may also be possible to determine what may "come back" into the communities where these activities occur.

The study of these networks is a study of associations, the CTT being a network which is in the process of evolving, thus it is in the process of becoming, and its fate lies in the hands of the actors who are weaving its web. The CTT is also a tool, a marketing tool which is being designed to encourage a group of activities, namely the development of synergy between universities in the region and industry, specifically industry designated as "high-technology".

The reality of the CTT is the reality of those involved in the development of certain knowledge and applications of that knowledge, and actors not directly involved in that process do not necessarily form an active part of the evolving reality of the CTT. They are affected by the larger context into which the CTT is a part; the development of science and technology, the cultural belief in the potential benefits of technological innovation, the notions of progress and remaining competitive in a "changing global economy; or what may be summed up as "technoscience" (Latour, 1987). The

development of important institutions of physical science research and development are the result of the social and political networks described above and not simply the result of certain "imperitifs techno-industriels et économiques". Indeed, a particular culture is emerging from the social process studied. This social process, the networks which are evolving from it, and the development of stronger or weaker associations between the actors on the CTT stage must be followed with the explicit consideration that these activities are part of the larger multinational activity which falls under the definition of "technoscience". Latour uses the word technoscience "to describe all the elements tied to the scientific contents no matter how dirty, unexpected or foreign they seem" (Latour, 174:1987). He reserves the expression of 'science and technology' in quotation marks, "to designate what is kept of technoscience once all trials of responsibility have been settled" (Latour, 175:1987).

Associated to the word coined by Latour, are rules of method and a set of principles to be used when following scientists and engineers through their networks (society). By 'rules of method', Latour means "what a priori decisions should be made in order to consider all the empirical facts provided by the specialised disciplines as being part of the domain of 'science, technology and society'" (Latour, 17:1987). These are discussed later in Chapter Four and in relationship with the information gathered through the survey tool. The 'principles' listed below are Latour's personal summary of "the empirical facts at hand after a decade of work" (Latour, 17:1987). These principles are presented as a departure point upon

which this study takes off, and as such are subject to debate, modification, rejection, or other negotiations.

First Principle: The fate of facts and machines is in later user's hands; their qualities are thus a consequence, not a cause, of a collective action.

Canada's Technology Triangle is both a region and an organization. Both of these elements are linked to Latour's first principle, they are both facts and their qualities (or characteristics) are consequent of the collective action of those involved. It is however, through the study of the CTT as an organization that we can identify which interrelationships and associations are stronger or weaker. This ultimately links the region, and those less obviously involved in the CTT to the larger context of technoscientific activity. It is at the level of the individual actors within the organization that the various interpretations of the actors become more or less directly related to the fate of Canada's Technology Triangle as an area of university/industry synergy. This study may perhaps identify the CTT as an ineffective marketing tool and a burden on the activities of both the universities and industry in the region. It may also identify the activities of the CTT as crucial to the prosperity of the region. Either of these circumstances may become fact. This however is a consequence of the interrelationships of the actors involved, and the relative importance of these interrelationships are based on the interpretations of the actors and on their subsequent interactions.

Second Principle: Scientists and engineers speak in the name of new allies that they have shaped and enrolled; representatives among other representatives, they add these unexpected resources to tip the balance of force in their favour.

The strategies for achieving the objectives of the CTT enlist the participation of many groups: CTT area companies, Canadian and foreign firms, local municipal systems, other technology regions, advertising, direct mail, trade shows, investment seminars, national and provincial organizations engaged in technology development, innovation and entrepreneurship, community industrial training committees, organized labour, technology transfer networks, financing vehicles, industry/academic panels, and university faculty and graduate students, and others. The relationship of these actors to the development of science and technology is not obvious, but the coordinators of the CTT see them as both relevant and important to the technoscience which they are encouraging. By mapping out stronger or weaker associations between these actors (through their own interpretations), we can begin to understand the process of developing less-than-obvious allies in the process of research and development. The CTT may also in this instance become an artefact, since it was started by non-scientists/engineers. This may perhaps lead to its demise, since the persons to which its activities are directed may or may not perceive the CTT as a necessary ally.

Third Principle: We are never confronted with science, technology and society, but with a gamut of weaker and stronger associations; thus understanding what facts and machines are is the same task as understanding who people are.

The arrangement of weaker and stronger associations between the various actors in science and technology, relates directly to the fact that the actors are people with their own interpretations, explanations and aspirations, of and about the society around them. It is not feasible for a sociologist to enter the laboratories of "x" number of disciplines and to follow their activities at a technical level. Nor is it for that matter feasible for the chemist to understand completely what is happening on the workbench of his computer science colleague. We are all laymen outside of our own field(s) of specialization. What makes the study of science and technology facts feasible, is their association to technoscience, which is in all aspects a social process. Making this leap is tied to what Robert Prus (1990) describes as the interpretative challenge. At the heart of the interpretative challenge are four premises. The first is the "recognition that reality is known through human experience and that there are many varieties of reality as might be experienced by people." (Prus, 1990:356)

The second premise relates to the recognition that people are "objects unto themselves" (Mead, 1934); hence the interpretivist practice of asking about "the meanings people attribute to objects or the ways in which people make sense of situations and develop lines of action." (Prus, 1990:356) From

this follows the third premise, the notion of negotiated intersubjectivity; "that people engage in meaningful interchange with one another" (Prus, 1990:356), a concept that reflects the mutuality of human lived experience.

The fourth assumption is procedural. Interpretavists acknowledge the emergent, ongoing, formulative, or dialectic nature of human life. (Prus, 1990:356)

The recognition of the human capacity for many realities, the acceptance of reflectivity, the inclusion of human agency or enterprise in "influence related activities", contextualized into the dialectic of life in society is an exceptionally rich perspective from which to study the subject matter presented here.

Fourth Principle: The more science and technology have an esoteric content the further they extend outside; thus, 'science and technology' is only a subset of technoscience.

Canada's Technology Triangle is perhaps an example of this extension beyond the confines of areas traditionally perceived as relating to the research and development process. As listed above (Table 1) the organizational framework of the CTT is trying to draw together many groups. This identifies the CTT as a catalyst for the development relationships which may be beneficial to the researcher at the workbench, but because of the esoteric nature of that researcher's work, may not occur unless there was such a catalyst.

Fifth Principle: Irrationality is always an accusation made by someone building a network over someone else who stands in the way; thus, there is no Great Divide between minds, but only shorter and longer networks; harder facts are not the rule but the exception, since they are needed only in a very few cases to displace others on a large scale out of their usual ways.

Irrationality, irrelevance, lack of substance, and other terms are used in the context of actors interpretations of stronger and weaker associations of surrounding elements to their activities. This reflects the position of someone within a network, where their particular activity is set in the framework of technoscience. The questionnaire, which is discussed further in Chapter Four, includes questions which relate directly to the research activity of the respondent. It also includes questions which relate to the social and political opinions about certain questions. It will be interesting to see what the reactions of some subjects is to questions which draw them away from their technical expertise and into the world of less determined subject matter. The degree of explanation needed to situate a particular question into the context of the respondent's personal interest, or the accusations of irrelevance, will be indicative of the perceived strength of the association between the question and the interests of the respondent.

Sixth Principle: History of technoscience is in a large part the history of the resources scattered along networks to accelerate the mobility, faithfulness, combination and cohesion of traces that make action at a distance possible.

The history of the CTT is a history aptly described by the sixth principle. It has involved much struggle to interest people in the range of activities the organization encourages and supports. The formalization of the loose relationships of the business officers listed above into the CTT, started in a hotel room during the 1987 Ontario Industrial Development Council conference (Fournier, 119:1991). These four people went to their respective councils to gain support, this support was granted. "Initial support was forthcoming from a variety of sources, including the president of the University of Guelph and the Ontario Ministry of Industry Trade and Technology (Fournier, 120:1991). This network of support and involvement in the CTT is expanding at present. It is the mapping out of this network which shall enable a determination of which are the strongest and the weakest associations in the CTT.

B. Franklin's Divisible and Indivisible Benefits

The research question which emerges from this lattice of possible directions speaks to the hopeful theme of Canada's Technology Triangle Economic Profile and to the links being created by municipal government bodies and the world of scientific and technological research, development, and manufacturing. Municipal governments are usually regarded "as one of the great entrenchments of democracy" (Dawson, et al. 1971), it is also the level of government which most affects the day-to-day lives of its citizens. "Normally one considers it the obligation of governments, whose institutions are funded through a taxation system, to attend to those aspects of society that provide indivisible benefits (underlining is mine) - justice and peace, as well as clean air, sanitation, drinkable water, safe roads, equal access to education; public institutions, from courts and schools to regulatory and enforcement systems, developed to do these tasks" (Franklin, 1990:70).

It has been suggested that technology is changing this notion of the responsibility of municipal governments to provide indivisible benefits to its citizens. "The public infrastructures that made the development and spread of technology possible have become more and more frequently roads to divisible benefits" (Franklin, 1990:70). The creation of "high-technology" industrial zones, such as Canada's Technology Triangle purports to be, produces significant benefits. The appropriate question to be asked is not what benefits are produced, but for whom are these benefits being produced.

The potential benefits related to concentrated research and development are often divisible and thus cannot be directly translated into support for the infrastructure of the community. Municipal governments have the responsibility of providing indivisible benefits, those benefits which serve the entire community, such as listed in the quote from Franklin. The research and development process in new and advancing technology found in the collaborative efforts of university researchers and industry is a high cost, high risk enterprise, whose end product often belongs to the funder of the research. These funders are often not members of the municipal community and thus are not obliged to provide a share of the divisible benefits resulting from research to the community. Therefore the efforts put into the development and maintenance of "Canada's Technology Triangle", may not result in substantial benefits for the cities which comprise it.

The goal of this study is to understand the interrelationship of the various actors in the process of collaboration from the perspective of the actors. These interrelationships are to be mapped out by determining what are the strongest and the weakest associations within the framework created by the proclaimed objectives of Canada's Technology Triangle organization within the region described as the Canadian Technology Triangle. The relative strengths of these associations are to be determined using a series of indicators found in the survey tool discussed in Chapter Four on methodology.

IV. Research Methodology

A. Association with the "Dynamique socio-politique des nouvelles strategies de developpement" project

The time period into which this project falls is framed by one particular factor. This factor is the calender outlined for the Social Sciences and Humanities Research Council (SSHRC) funded project entitled; "Dynamique socio-politique des nouvelles strategies de developpement", under the direction of J. Yvon Theriault (Ph.D.), in association with Caroline Andrew (Ph.D), Francois Houle (Ph.D.), and Graziela Ducatenzeiler (Ph.D.). It was agreed, within the context of my participation as a research assistant, that information gathered in the interviews for the Canadian Technology Triangle (CTT) area of the study could also be used in the context of this thesis project, as long as the interpretation of the results of the interviews was original. The starting date for these interviews was Winter 1990. The final interviews for this research area were finished June 1991.

The information brought to the thesis project is limited by the time between the interview dates and the subsequent compilation period, January 1990 until June 1991. It is also limited by the fact that it is the study of a single area within the context of a much larger international process. This limitation is necessary, not only for reasons of the limited resources available, for it may allow greater insight into a particular case, the methodology of which may be reproduced either within the same region or elsewhere.

B. Sampling Method

The interview sample is designed to elicit representative first-hand information from key actors involved in the process of the collaboration described in the introduction. The purpose of the interviews is to obtain information about whom is most active in university/high-technology industry collaboration, what resources are used in this process, what types of interactions develop, and what are the results of these interactions - the structures, the programmes, and the products which evolve from collaboration, as well as less tangible results, such as the creation of networks, changes in attitudes, effects on the community, etc.

The sampling method chosen had to be capable of producing context specific results in which the interview responses are placed in a social structure. This is possible with the use of the "snowball" sampling method. A core of people considered influential to the process being studied are identified, and to this core are added people who are associated with them in the context of the subject matter, and so on (Gauthier, 1986:187).

Initially sixty interviews were to be conducted in the CTT area. In actuality, fifty-five were conducted. These are divided among representatives of the various sectors studied; university researchers, university administrators, staff from the research offices of the universities, industry executives, industry researchers, municipal government officers, various association officers, and other persons deemed

essential to the research. The breakdown by affiliation is presented in Table 2.

The selection of the sample core was done by identifying a number of key actors by way of a review of printed information relevant to the CTT, followed by asking those identified to list other principal agents in the process under study. As the sample grew in size during the course of the research, it was possible to establish how representative the sample was of the study region, and to make adjustments by determining what sectors needed more responses. These adjustments, could be considered non-strict quota sampling since certain criteria are explicitly being filled. As the interviews progressed, the sample was indeed used to verify that there was at least some representation of each of the sectors identified. Some sectors, either a high technology research discipline or an administrative body, were not represented in the sample. This occurred because of either of two factors, that there was no activity in that research discipline occurring in the region under study, or that no collaboration had happened and thus the subsequent structures had not developed or were not instituted.

Table 2: Listing of Respondents and Institutional Affiliation

**Respondent Categories - Interviews
Canada's Technology Triangle**

	Respondent Name		UW	UG	WLU	BUS	ASSO	Other
1	Annan,	Peter				*		
2	Barker,	Jim	*					
3	Beauchamp,	Shelly					*	
4	Belshaw,	Doug				*		
5	Beveridge,	Terry		*				
6	Beversdorf,	Walter		*				
7	Bray,	Tim				*		
8	Brookes,	Ralf				*		
9	Burnside,	Edward		*				
10	Chamberlain,	Savas	*					
11	Cox,	Brian						*
12	Cross,	Ted					*	
13	Dixon,	Ted				*		
14	Eastwood,	Donald					*	
15	Elmastry,	Mohame	*					
16	Fournier,	Bruce			*			
17	Furlong	Aldan				*		
18	Geddes,	Keith	*					
19	Gillham,	Bob	*					
20	Greenhouse,	John	*					
21	Headlam,	Art					*	
22	Hecht,	Alf			*			
23	Holub,	Bruce		*				
24	Lam,	Joe		*				
25	LeMaguer,	Marc		*				
26	MacPherson,	Barry					*	
27	Mackay,	Jock	*					
28	Magazine,	Mike	*					

Table 2: Listing of Respondents and Institutional Affiliation, Continued.

**Respondent Categories - Interviews
Canada's Technology Triangle**

	Respondent Name		UW	UG	WLU	BUS	ASSO	Other
29	Malne,	Frank				*		
30	Mairs,	Jim					*	
31	Marsh,	Wayne		*				
32	Mayfield,	Colin	*					
33	McFadden,	Peter					*	
34	Monroe,	Hugh					*	
35	Moo-Young,	Murray	*					
36	Murray,	Bruce					*	
37	Nazar,	Ross		*				
38	Noori,	Hamid			*			
39	Ostrovski,	Chris					*	
40	Pollack,	John				*		
41	Smith,	Charles		*				
42	Smyth,	David	*					
43	Stevens,	Roselynn		*				
44	Stubbings,	Robert				*		
45	Thompson,	Bill					*	
46	Tomba,	Frank	*					
47	Trevors,	Jack		*				
48	Ward,	Owen	*					
49	Whitfield,	Chris		*				
50	Wildamann,	Allan		*				
51	Wilkie,	Bruce		*				
52	Wong,	Andrew	*					
53	Wood,	Janet		*				
54	Wu,	Jeff	*					
55	Zepf,	Larry				*		
			15	15	3	10	11	1

C. Survey Tool

i) The Questionnaire

The interviews were conducted using two similar questionnaires (see Appendix 1 for an example of the Universities and Research Centres Questionnaire, and Appendix 2 for an example of the High Technology Enterprise Questionnaire) combining open and semi-directed questions. The questionnaire developed for "Dynamique socio-politique des nouvelles strategies de developpement" was formulated to allow study of the following research areas; analysis of the politics of technology (Graziela Ducatenzeiler), the dynamics of fusion efforts between universities and industry (François Houle), the study of cultural dynamics (J.Yvon Thériault), and analysis of work-related and residential structures (Caroline Andrew).

Extensive hands-on involvement in the development and testing of the questionnaire, the creation of the sample, the set-up of appointments, and delivery of a significant portion of the interviews (both in the CTT and in the Ottawa-Carleton area), as well as the fact that the thesis subject is closely related to the aforementioned research project, it was accepted that a large portion of the questionnaire was very relevant to the thesis being proposed.

Analysis of the results involved both qualitative interpretations of results to establish trends and quantitative coding of certain results to produce numerical representations of the frequency of particular indicators. The

questionnaire was designed to allow the interview process to flow rather easily. The final version was accepted only after testing of the interview tool was performed on potential interview candidates whose relationship with the principals of the project would allow for open criticism and suggestion.

A selection of questions were adopted to suit the purposes of the thesis project defined here. Because the goal and the theoretical perspectives of this thesis and the associated research project differed on several fronts, it was important that one not collide with the other. Interviews were performed by all members of the research group, which on the questionnaire form called itself the "High Technology Research Group: University/Business Synergy", allowing for input by all members of the group. The interviews were recorded on audio cassette to allow for correcting and discussions were held regarding the possible interpretations of the trends emerging from the interview process. From this process the following questions were adopted as appropriate in outlining the following areas of interest for this study.

A) Institutional affiliation and discipline/specialty: Information for this was garnered from the cover page of the questionnaire. In preparation for the interview, as much as possible of this page was completed and then was verified against the response of the interviewee.

B) Demographic profile of respondents: A brief demographic profile was assembled from the information provided by questions 64, 45, 65 and 46. It was assumed that the sex of the person could be determined by the interviewer and did not have to be formally asked.

C) Placement of activities in a historical, current (at time of interview), and geographical context: In order to create an operational context into which to place the analysis of the responses, the activities to the respondents were framed by a series of questions which gave the interviewer a layman's understanding of when the respondent began his or her's collaborative activities, what was the context in which they were currently operating, and what was the geographical range of this activities in the strict sense. This basic framework was constructed by questions 6,8, 9b, 9a, 11, 12a, 10, 30, and 31 (a note to the reader, the questions are listed in order of presentation).

D) Profile of the research environment: Going beyond the operational context, the following set of questions were aimed at trying to gain a perceptual context of the actual environment in which the respondents were operating. Concentration is placed on relevance of their activities, suitability of the research environment, constraints imposed upon their activities, perceptions of peers, and the possible direction of collaborative research relationships. There is a slight modification to this set of questions in relation to the procedure followed in the other sets. Researchers are asked questions 13a, 13b, 12b, 13c, 19, 14, 15, and 17. Administrators are asked questions 1, 2, and 3 instead of question 13c. This modification allows for comparison of the perspectives of the two groups within the collaborative research structure.

E) Impact of collaboration on research and development: The determination of the impact of collaboration on the R&D activities of the respondents is done using a multi-partite question (Q16) asked in reference to eleven components of the research and development process. Although this question looks at the short-term impacts as perceived by the respondents themselves, and not the long range impacts on society as a whole, the responses allow for some understanding of the relative impact of such collaboration on the dynamic of the university and enterprise R&D matrix as it currently operates.

F) Perception of what it takes for a region to develop a "high technology research portfolio": This set of questions determines, in a general manner the perceptions of the respondents to what combination of factors would lead to a region developing into a high technology research area. The framework for this is assembled by asking questions 40, 42,43, and 44b.

G) Perception of the Triangle geographical region by those living and working in it: The following questions attempt to determine the vision of the respondents own region as a centre of high technology research and development: Questions 34, 35, 36, 37, 38 and 39.

H) Perception of the CTT as accomplishing its goals: The final set of questions (Questions 20, 21, 26a, 26b,27, 28, and 29) used in this study try to uncover the vision the researchers have of the role played by the CTT as a mediating organization between the university and the business communities in the Guelph, Cambridge, Kitchener and Waterloo region.

ii) Validity of Responses

There are always a number of factors which affect the validity of responses obtained during the course of combined open and closed questionnaire based information gathering such as was the case for this project.

During the design of the questionnaire and during the testing process, the issue of whether it would be possible to properly capture many of the qualitative responses to open questions arose. This was addressed by several mechanisms. The most obvious of which was the recording of the entire interview on audio cassette to allow for an unbiased copy of the interview in case there was some dispute regarding the response to a question. Although the very use of a recording device could lead to some bias on behalf of the respondent, in most instances it proved to be a useful tool in settling disputes about the information recorded on the questionnaire sheet. It should be noted however, that because of the introduction of the tape recorder into the interview process, one of the possibly major respondents working for an international computer and system design company refused categorically to allow the interview and escorted the interviewer out of the building after consulting with the company's lawyers.

Most of the problem surrounding the validity or the quality of responses has to do with the tendency to judge qualitative research by quantitative standards (McCracken, 49:1989).

"It is important to keep the distinction between qualitative and quantitative research visible and clear. In the first, categories take shape in the course of research, whereas in the second, they are fixed from the beginning. In the first,

the analyst uses his or her methods to capture complexity and to search out patterns of interrelationship between many categories. In the second, the analyst looks instead, for a very precise relationship between a limited set of categories" (McCracken, 49:1989).

The combination of open (qualitative) and closed (quantitative) questions in the survey tool reflects the sometimes precise, sometimes obscure purpose of each of the questions. It is also a reflection that the tool was designed for the purpose of addressing the research interests of the principals of the project listed above, which included not only the desire to obtain particular information on a subject matter, but also to capture information which might lead to the identification of a trend.

It was attempted throughout most of the interview process to allow the respondent freedom to detail their experiences within a range that would be useful for the purpose of the study being performed. This means that within the context of this paper the answer of a respondent stating how his work fits into the high technology sector it was adequate to say, for instance, systems design. If that same respondent began to describe the intricacies of what the design of the system was, the information provided would be extraneous, since within this context it could not be used, let alone understood.

Regarding the bias of the interviewer against the respondent or of the respondent to the interviewer, it is recognized that length of the interview raises several issues affecting validity. The first of these is simple: Who does the respondent think the investigator is? As social actors, respondents use every available cue to categorize the investigator and the

project (McCracken, 25:1989). Institutional affiliation, the project description, the appearance and mode of dress, and patterns of speech are all judged by the respondent (Strauss and Schatzman, 1955). Obviously this exercise can dramatically influence whether and how the respondent reacts to the questions put before them (Briggs, 1986).

One of the strategies used to alleviate this possible problem was a balance between formality and informality in dress and demeanour. Inadvertantly, for it was not until after the interviews were conducted, did I realize that in preparation for conducting the interview, the questions of how would I appear, how should I introduce myself, how do I "sell" this interview, were asked in prelude to the interview itself. This approach is supported by McCracken, (26:1989):

"...strike a balance between formality and informality for each media in question. A certain formality in dress, demeanour, and speech is useful because it helps the respondent cast the investigator in the role of "scientist,"..."

The second question, in the same vein, is who does the interviewer think the respondent is? The possibility of pre-judging the respondent is as dangerous to the validity of the responses as the previous scenario. Although this problem is not quite as acute early in the interview process, as the number of interviews performed on the sample increased the tendency to expect certain responses because of emerging trends also increased. This potential problem was also recognized and addressed by the interview "cleaning process" which is described later.

iii) Limitations

The study and the information contained therein is limited on several fronts. Some of these are described above in the research methodology section. Included is time frame in which the interviews took place, the geographic area under study, and the limited size of the sample. As such, the conclusions of the study are limited to the period between Winter 1990 and June 1991, to the geographic area described as the Canadian Technology Triangle, and is representative of the university, business and associated organization respondents who participated in the interview process.

The study is also limited by the investigative and interpretative abilities of the writer of this report, and by the resources which were placed at his disposition in the analysis and preparation of the same.

Although the study is limited by the factors noted above, this does not signify that the results are limited to those factors. As discussed in the initial section, the process being studied is in evidence in several communities across Canada. Similar circumstances are causing like wise results in many Western industrial countries, hence the methodology and the findings outlined in this report may or may not be of some significance to other researchers. The conclusions are limited by the material that went into their production but not by any subsequent interpretation.

D. Collation of Interview Results

i) Cleaning

The length of the interview, the divergent nature of the questions proposed by the survey tool, and the use of several interviewers, necessitated that each questionnaire be thoroughly completed in a language and style that could be understood and interpreted by all concerned.

The first step in this process was to simply fill in any blank or incomplete sentences immediately after the interview was completed, while the information was fresh in the mind of the interviewer. This also provided a good opportunity to jot down general notes related to the interview. This process was followed by a more thorough "scrubbing" of the interview by listening to the audio tape of the interview, and comparing the written material with the electronic recording. This process also brought out any audible biases on behalf of either the interviewer or the respondent.

In several instances, with particular attention to the interviews held with municipal officials, the interview strayed significantly from the course outlined in the survey instrument. Some of the ideas or comments expressed by the respondent were not clear, so it was necessary to telephone the respondent back, and to request further details or an explanation of what was meant by her or his comments. This however, happened in only three instances.

ii) Coding

Once the questionnaires were submitted to the above process, the "raw" information was processed into a format from which generalizations, trends and comparisons could be extracted.

Each of the answers to the open-ended questions were transferred verbatim onto coding sheets comprised of blank sheets with the question written at the top of the page. This filled several two and one-half inch ring binders. Each question response set was examined to see how the responses could be collapsed into more general categories and these category sets then served as the basis from which the original responses were coded into a comparative format. This format allowed for the analysis of large amounts of information in an accessible manner. Obviously the subtlety of many of the individual answers are lost during the coding process, however, the details of responses remain available if subsequent analysis is required. The coding of close-ended questions is simply a matter of transferring the response onto a tally sheet.

The information, transformed into the format described above, was then entered into two matrices. The first of these was onto a spreadsheet program on the project leader's macintosh computer system. This matrix allowed for standard manipulation of the data, the creation of frequency, correlations between data sets, and the creation of tables and charts such as those found in this report.

The second was entered into SPSSX program found on the University of Ottawa's mainframe system. This matrix, in consideration of the more powerful computational abilities of the network, was used primarily to determine the significance of comparing certain data sets with others. The SPSSX printouts provided among other things: Counts, Row Percentage, Column Percentage, Total Percentage, Residuals, Chi-Square values and their significance on the following scales, Pearson, Likelihood Ratio, and the Mantel-Haenszel scale. The density of the information provided by this matrix did not suit the direction or the goals of this paper and were considered largely extraneous except for the Pearson skewness ratio which relates to the distribution of the information throughout the sample.

V. The Survey Results

A. Distribution of the Sample Population

i) Institutional Affiliation

The categories used in defining institutional affiliation were created after the respondents were interviewed, thus allowing each respondent to identify them self according to their perceived role in the activities of the CTT. The responses were then grouped by using an outstanding similarity which would link each responses. Most of these categories are obvious. They consist of: University of Waterloo, University of Guelph, Wilfred Laurier University, Business, Associated Organizations, and Other.

The three university categories refer to respondents which are either active in teaching, research, or in the direct management of a research project or group. Respondents whose primary role is the promotion or development of collaborative research projects, such as that of a university research officer, etc, are grouped into the category of Associated Organization.

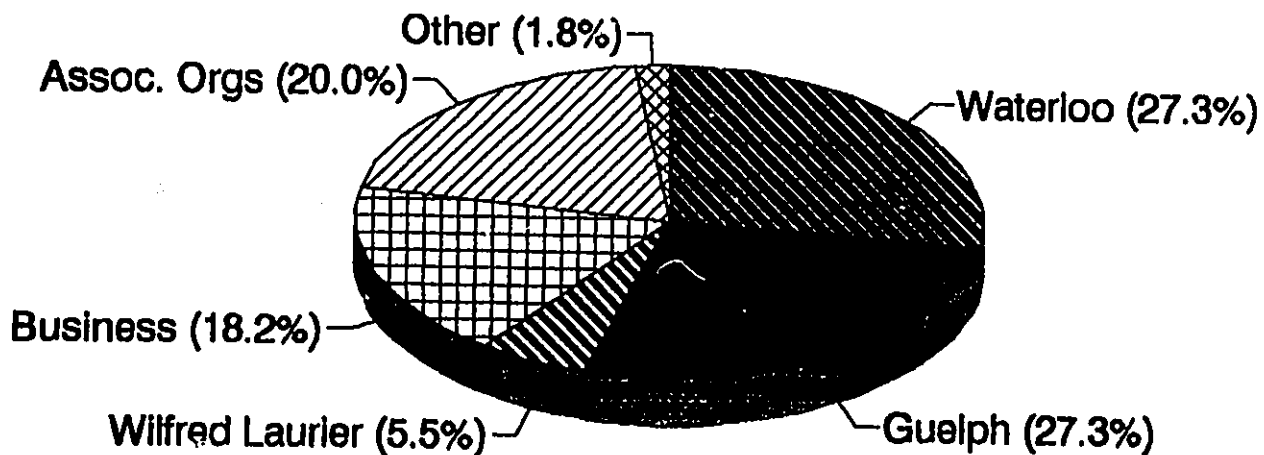
The Business category consists of representatives of companies actively involved in university/industry collaboration. Table 2 shows the distribution of the respondents by affiliation. Figure 2 presents this distribution more graphically.

Although many of the respondents are active participants in several aspects of the collaborative efforts under study, there was one organization which clearly did not fit into the discreet categories listed above. This organization, clearly operated in both the university and business

communities and was not easily separated from either and was placed into the separate category, Other.

Respondents from the Universities of Guelph and Waterloo represent over half of the sample (54.5%), with 15 interviews conducted at each institution. Considering the manner in which the sample was developed, the comparatively large size of each institution and the active support given to collaborative research by the institutions respective administrations, this result is not surprising. The relatively small sample from Wilfred Laurier University is composed strictly of representatives of the Business and Administration faculties, since the university does not have a stand alone science department to speak of.

Figure 2: Pie Chart of Institutional Affiliation of Respondents.



ii) Discipline or Specialty

Each respondent, whether from the university community or from the business community, could because of the specialized and technologically advanced nature of their research or production, be classified in a separate category by themselves. This would not lend however, to a general understanding of the thrust of the activities performed by the interview subjects.

A broad generalization of categories is presented in the two pie charts below (Figures 3 and 4). The distinction between one discipline or specialty and another is often difficult to make when the research or production activities involve cross discipline cooperation. It is recognized that several of the respondents activities could easily fit into several classifications. The choice to place a respondent into one or the other grouping was made through a determination of what the dominant activities of each subject was.

Figure 3: Wide Categorization of the Discipline of University Respondents.

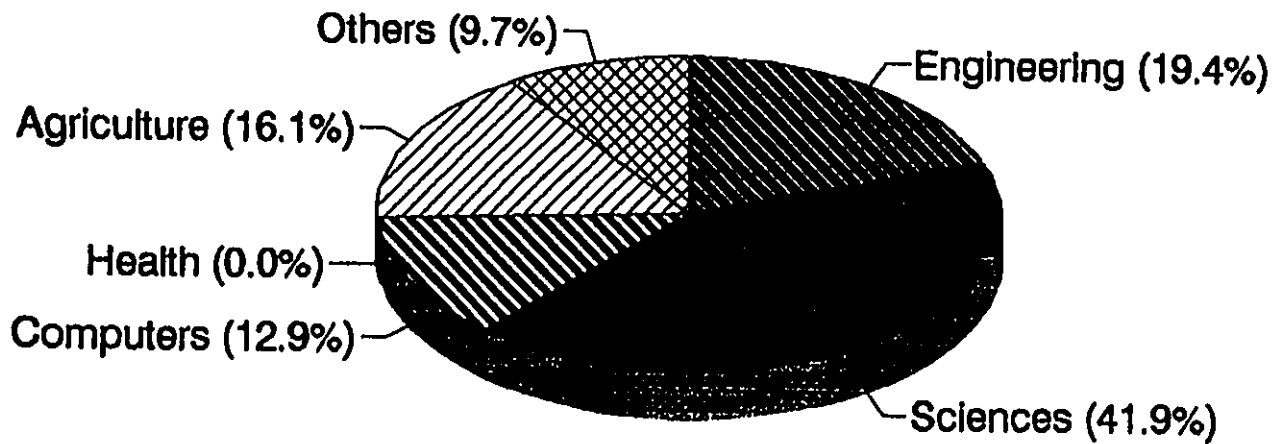
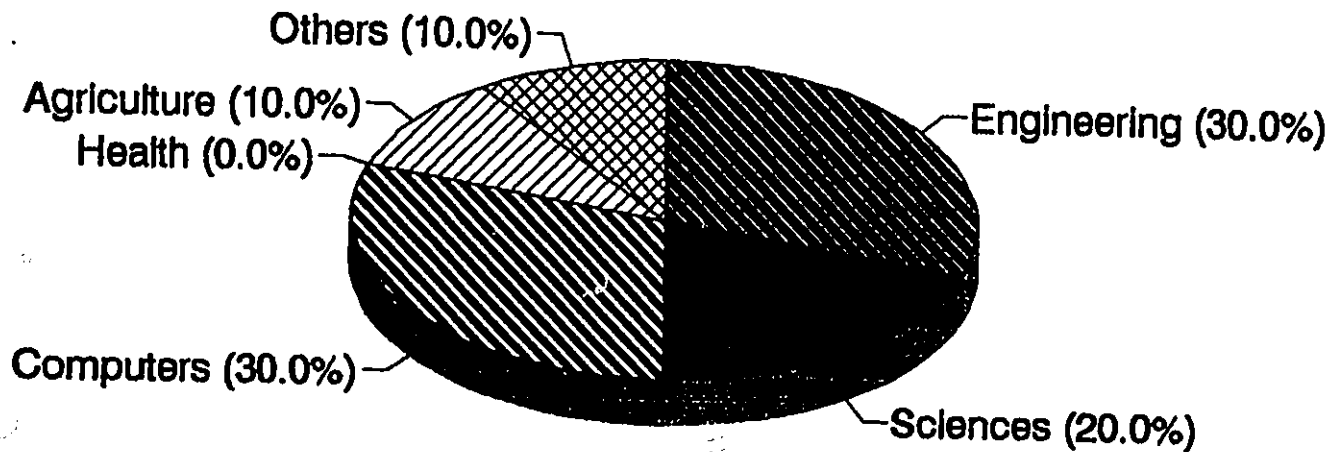


Figure 4: Wide Categorization of the Discipline of Business Respondents.



B. Demographic Profile

The brief demographic profile presented here provides some insight into the general characteristics of the two main groups studied. Based on the factors presented in Tables 3-6, the two response groups (University and Business) do not differ significantly.

There is more diversity in the University group with regards to place of origin, with slightly more than 32% of the sample coming from outside the three principal places of origin, namely Ontario, the Rest of Canada (excluding Quebec), and Great Britain. It is interesting to note that none of the respondents were from Canada's second most populated province, Quebec.

Table 3: Birthplace of Respondents by Count and Percentage.

Question 64: Where were you born?

Bar:	Birthplace:	University		Business	
		Count:	Percent:	Count:	Percent:
1	Quebec	0	0	0	0
2	Ontario	6	21.429	4	40
3	Rest of Canada	7	25	3	30
4	Great Britain	6	21.429	3	30
5	Western Europe	2	7.143	0	0
6	Eastern Europe	1	3.571	0	0
7	Asia	4	14.286	0	0
8	Indian sub-continent	0	0	0	0
9	United States	2	7.143	0	0
10	Others	0	0	0	0

The gender make-up of the two response groups is dominated by males. Only two of the respondents in the University group, and none in the Business group were female. The only other female interviewed in the Triangle was at

the Women's Innovation Project, which is classified as an associated organization.

The marital status of the two groups was surprisingly uniform. Nine out of ten of the respondents in each group was married or had a partner. It is interesting to note that one of the two people in the University sample who was single was a woman. There is perhaps something which requires further study, i.e. professional women, careers, and marriage.

From the uniformity of the civil status of the respondents follows a similar uniformity in their family structure. Table 6 shows that eight out of ten respondents in each group had children. It was not asked of the respondents whether these children were from their present marriage or whether any of the respondents had gone through a divorce.

Table 4: Marital Status of Respondents

Question 45: Are you married or have a partner?

Bar:	Response:	University		Business	
		Count:	Percent:	Count:	Percent:
1	Yes	30	93.75	9	90.0
2	No	2	6.25	1	10.0
3	No Response	0	0	0	0

The ages of the respondents were grouped around those born between 1936-45 and those born between 1946-55. There was 12.5% of the university respondents who were born before 1935. This spread is not surprising in the university community, considering the availability of tenure, etc. It is also not surprising that over fifty percent of the respondents were in the 1946-55 group. This fits in well with the generalized image of the

professional/businessman at the peak of their careers. It must also be noted that the sample grew by asking key players whom they considered other key players in the collaborative research activity of the region. It seems appropriate that there would be fewer "young" researchers or executives, unless exceptional, since they would, it is assumed be in the process of building their careers and their reputations.

Table 5: Age of Respondents

Question 65: In what year were you born?

Bar:	Response:	University		Business	
		Count:	Percent:	Count:	Percent:
1	Born after 1956	1	3.125	0	0
2	Born Between 1946-55	16	50	6	60
3	Born Between 1936-45	11	34.375	4	40
4	Born Before 1935	4	12.5	0	0

Table 6: Dependents of Respondents

Question 46: Do you have children?

Bar:	Response:	University		Business	
		Count:	Percent:	Count:	Percent:
1	Yes	25	78.125	8	80.0
2	No	7	21.875	2	20.0
3	No Response	0	0	0	0

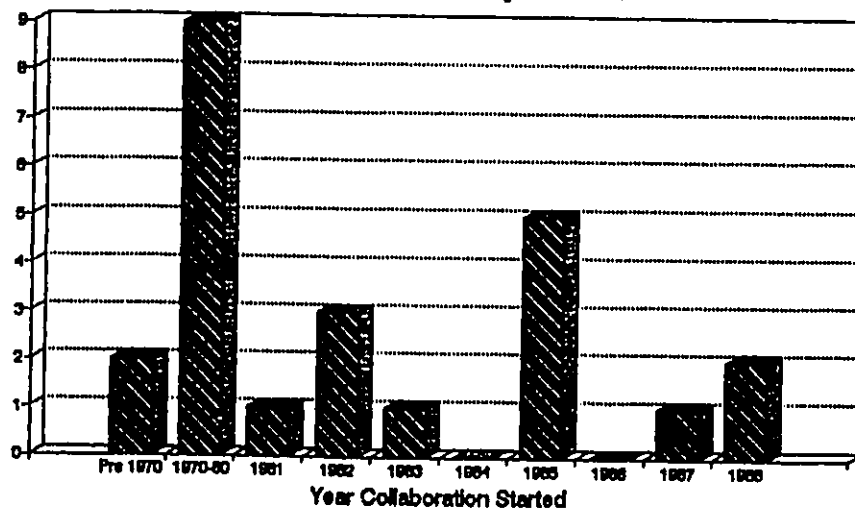
The image of the players involved in the "high-tech game" being highly educated and generally well paid proved true once again in this circumstance.

C. Placement of Activities in a Historical, Current (at time of interview), and Geographical Context.

There seems to be no set pattern as to when or why a university researcher enters into collaborative research with the business community. Figure 5 shows a large number of the respondents having started between the period 1970-80. The interview notes of several of these respondents indicate that because of the applied nature of their research, that it was a natural fit to continue developing a network of technical contacts which started when they were graduate students or early in their university careers. The peaks in 1982 and 1985 could be linked to downturns in the Canadian economy, hence the possibility that the increase in collaborative activity is due to researchers searching for new monies, or that companies are looking for cheaper sources of R&D than providing for it in-house. Either of these possibilities would require further investigation to be supported.

Figure 5: Beginning of Collaboration with the Business Community by University Respondents.

Question 6: When did your first collaboration with the high technology business community start?



The business responses to this question were inadequate in number to be of any significance. Respondents indicated difficulty in providing a definite answer because their personal experience often did not reflect the experience of the company.

The scope of relationships between the university, the company, and a third party differs depending on whether you are talking to a university respondent or a business respondent. The trend which emerges from Table 7 is that the business community is more willing have a third party involved in a collaborative research project and are also more willing to search in more places to find this third party. The university community seems more reluctant to go outside its own walls for a third party, and when it does, based on the sample of respondents interviewed, they will search exclusively at another university. Perhaps the wider spectrum demonstrated by the business community is caused by the limited resources they are faced with. Perhaps the broader range of people available directly within the university, i.e. intra and interdepartmentally, the university respondents are not reluctant to search elsewhere, they simply don't need to.

Neither proposition can be answered definitely within the context of the responses received, however Table 8a and 8b lend ground to the hypothesis that the source of outside help has much to do with the internal resources available in the university or the business. In both cases discussed with the interviewees, the business community indicated that well over half of their collaborative research started from personal contacts, whereas the

university community depends more heavily on institutional contacts and academic reputations before starting collaborative research efforts.

Table 7: Other Participants in Collaborative Research Projects.

Universities - Question 8: Other than your laboratory and the companies, are there researchers in other institutions which participate in the various projects?

Businesses - Question 8: Other than your company and the university/research centre, are there researchers in other institutions which participate in the various projects?

Bar:	Response:	University		Business	
		Count:	Percent:	Count:	Percent:
1	Yes	14	46.667	6	60.0
2	No	16	53.333	4	40.0
3	Don't Know	0	0	0	0

Whom, Could you describe what their role is?

Bar:	Response:	University		Business	
		Count:	Percent:	Count:	Percent:
1	Enterprise	0	0	3	50.0
2	University	13	100	1	16.667
3	Organization	0	0	2	33.333

The type of research being performed by either group differs significantly. In both cases discussed, universities are largely involved in biotechnological research, and business community is more interested in systems design and electronics. The almost total lack of companies involved in collaborative research in biotechnology in the Triangle (see Table 9) leads one to assume that the research is being performed with a partner outside the geographic range of the CTT. This is supported by the range of activity shown in Figure 9 which is outside the Triangle region.

The business community seems to stay closer to home in their search for research partners, as indicated in Figure 10. The type of research entered into seems balanced between basic and applied, with an almost even split between partners in sciences and those in engineering, Table 11.

Table 8a: Manner in which Collaborative Research Started (first of two cases discussed).

Question 9b: How did these relationships (collaborative research) start?

Bar:	Method:	University		Business	
		Count:	Percent:	Count:	Percent:
1	Personal Contacts	9	30	6	60
2	Coop Students/Ex-Students	0	0	0	0
3	Institutional Contacts	11	36.667	1	10
4	Academic Reputation	6	20	2	20
5	Consulting	4	13.333	1	10

Table 8b: Manner in which Collaborative Research Started (second of two cases discussed).

Question 9b: How did these relationships (collaborative research) start?

Bar:	Method:	University		Business	
		Count:	Percent:	Count:	Percent:
1	Personal Contacts	11	40.741	5	55.555
2	Coop Students/Ex-Students	1	3.704	1	11.111
3	Institutional Contacts	7	25.926	2	22.222
4	Academic Reputation	6	22.222	0	0
5	Consulting	2	7.407	1	11.111

Table 9a: Relationship of Collaborative Research to the High Technology Sector (first of two cases taken).

Question 9a: With relation to the research undertaken in your collaborative projects, how is each project related to the high technology sector?

Bar:	Sector:	University		Business	
		Count:	Percent:	Count:	Percent:
1	Biotechnology	13	48.148	1	10
2	Pharmacology	2	7.407	0	0
3	New Materials	0	0	2	20
4	Systems Design	3	11.111	4	40
5	Electronics	3	11.111	1	10
6	Telecommunications	1	3.704	0	0
7	Physics	1	3.704	1	10
8	Transportation	0	0	0	0
9	Administration	1	3.704	0	0
10	Others	3	11.111	1	10

Table 9b: Relationship of Collaborative Research to the High Technology Sector (second of two cases taken).

Question 9a: With relation to the research undertaken in your collaborative projects, how is each project related to the high technology sector?

Bar:	Sector:	University		Business	
		Count:	Percent:	Count:	Percent:
1	Biotechnology	10	41.667	0	0
2	Pharmacology	1	4.167	0	0
3	New Materials	0	0	1	10
4	Systems Design	3	12.5	5	50
5	Electronics	1	4.167	2	20
6	Telecommunications	1	4.167	0	0
7	Physics	2	8.333	2	20
8	Transportation	0	0	0	0
9	Administration	1	4.167	0	0
10	Others	5	20.833	0	0

Table 10: Industrial Sector of Companies Collaborated With by the University Respondents.

Question 11: In what industrial sector(s) are the companies you cooperate with?

Bar:	Sector:	Count:	Percentage:
1	Biotechnology	15	53.571
2	Pharmacology	1	3.571
3	New Materials	0	0
4	Systems Design	3	10.714
5	Electronics	3	10.714
6	Telecommunications	2	7.143
7	Physics	3	10.714
8	Transportation	0	0
9	Administration of Technology	0	0
10	Others	1	3.571

Table 11: University Department of Researchers Collaborated With by the Business Respondents.

Question 11: In which department(s) are the university researchers with which you cooperate?

Bar:	Sector:	Count:	Percentage:
1	Engineering	4	40
2	Sciences	5	50
3	Computer Science	1	10
4	Health Sciences	0	0
5	Agriculture	0	0
6	Others	0	0

The range of activities performed within each of the disciplines was tested against nine categories of research case types developed prior to the interview. These are found in Table 12.

The results show that all partners seem to active on several fronts within each partnership. The four levels of research contracts are very active fields for both parties. Neither set of respondents showed much enthusiasm

for using each other's equipment. As expected the university respondents produce more seminars and transfer more technology outside of their own laboratories than do the companies. This confirms the expectation that the companies would be more secretive about the results of their collaborative efforts, and that they are seeking the expertise and knowledge available within the university community.

Table 12: List of Case Types for Figures 6-9

Bar	Case Type
1	Research Contract - basic research
2	Research Contract - applied research
3	Research Contract - joint research
4	Research Contract - expert advice
5	Quality Control, Product or Process Testing
6	Use of Laboratory Equipment
7	Use of Company's Equipment
8	Transfer of Knowledge - technological process
9	Transfer of Knowledge - seminars.

Figure 6: Current State of Collaborative Research. Comparison of University and Business Respondents who have NO Activities in Nine Research Case Types Verified. List of Case Types Found in Table 12.

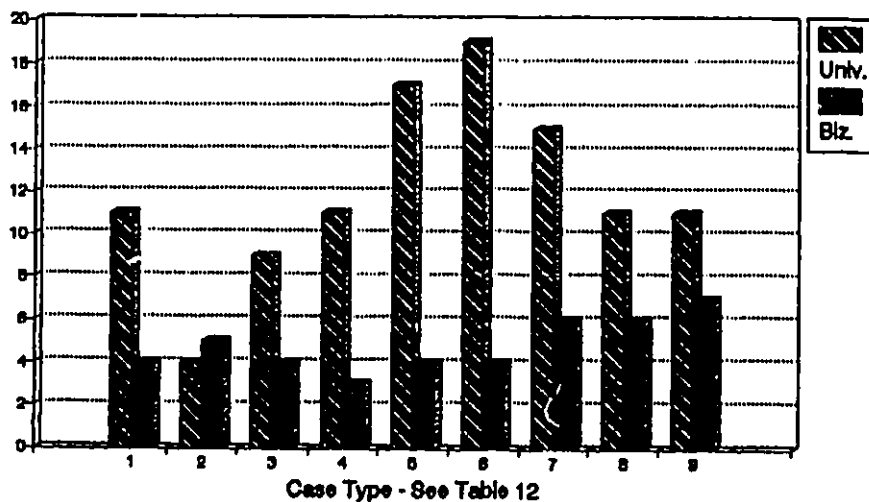


Figure 7: Current State of Collaborative Research. Comparison of University and Business Respondents who have ONE Activities in Nine Research Case Types Verified. List of Case Types Found in Table 12.

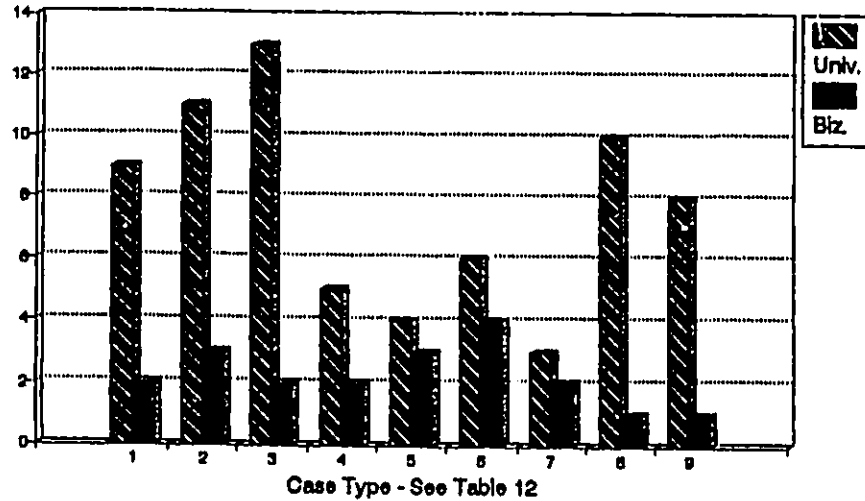


Figure 8: Current State of Collaborative Research. Comparison of University and Business Respondents who have TWO Activities in Nine Research Case Types Verified. List of Case Types Found in Table 12.

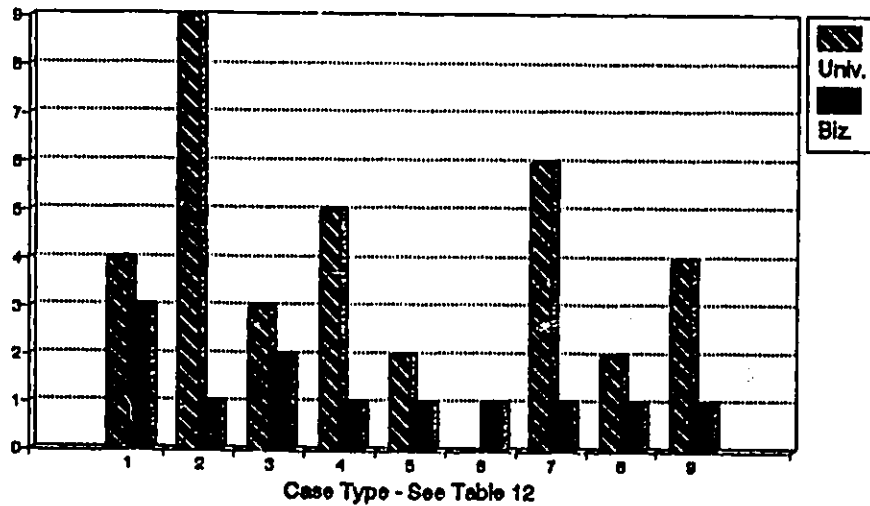


Figure 9: Current State of Collaborative Research. Comparison of University and Business Respondents who have THREE Activities in Nine Research Case Types Verified. List of Case Types Found in Table 12.

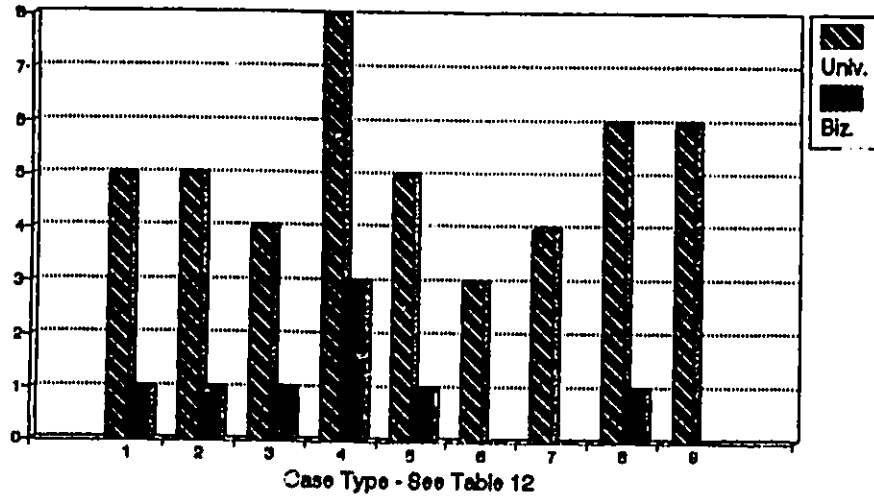


Figure 10: Geographic Range of Companies Identified by University Respondents for Three Project Cases.

Question 10: Where are the companies with which you cooperate located?

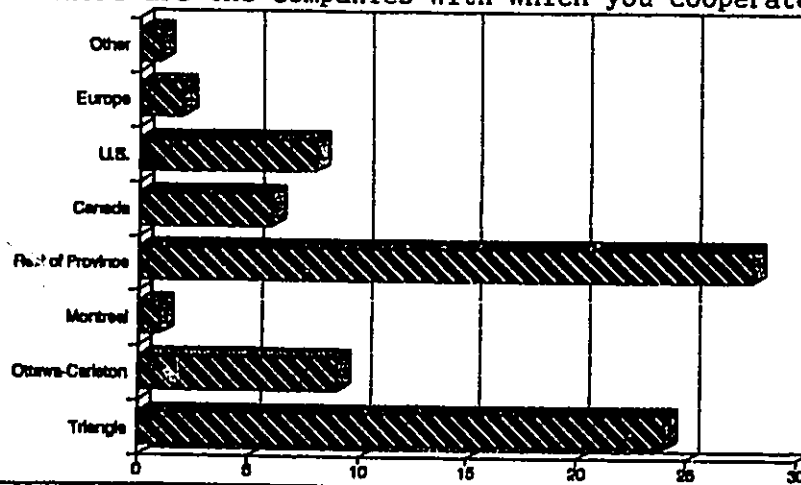
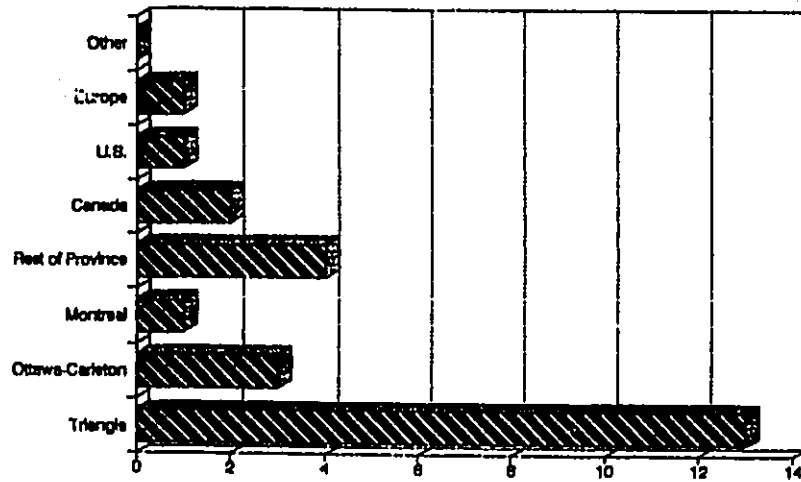


Figure 11: Geographic Range of Universities/Research Centres Identified by Business Respondents for Three Project Cases.

Question: Where are the Universities/Research Centres with which cooperate located?



D. Profile of the Research Environment:

i) Motivations

The demographic profile of the two respondent groups showed little variance along general lines. The context and range of their research activities however show a significant difference in the range and purpose of their R&D activities. The same can also be said about the personal motivations of the actors for getting involved in a collaborative process. The question of relevance, as shown in table 13, is a significant factor in motivating the university researcher.

Table 13: Measurement of the Importance University Respondents Place on the Question of Relevance as a Motivation for Participating in Collaborative Research with the Business Community.

Question 13a: Some people say that collaboration with the private sector has been mainly motivated because researchers wanted to be more relevant? Is this an important consideration for you?

<u>Bar:</u>	<u>Importance:</u>	<u>Count:</u>	<u>Percentage:</u>
1	Very Important	22	68.75
2	Moderately Important	6	18.75
3	Not Important	4	12.5
4	Don't Know	0	0

The business respondent is much less interested in the question of relevance as a motivating factor. Forty percent indicated that it was not important. As one respondent put it, "If it wasn't relevant to begin with I sure as hell wouldn't be involved, now would I (interview notes, Waterloo).

There is again divergence between the two groups on the question of funding or tax incentives as a motivation for getting involved in collaborative research efforts.

Table 14: Measurement of the Importance Business Respondents Place on the Question of Relevance as a Motivation for Participating in Collaborative Research with the University Community.

Question 13a: Some people say that collaboration with the university has been mainly motivated because the development of the high tech sector is impossible without direct links to basic research. Is this an important consideration for you?

Bar:	Importance:	Count:	Percentage:
1	Very Important	3	30
2	Moderately Important	3	30
3	Not Important	4	40
4	Don't Know	0	0

Table 15: Measurement of the Importance University Respondents Place on the Question of Funding as a Motivation for Participating in Collaborative Research with the Business Community.

Question 13b: Other people say that the principal motivation for collaboration with the private sector is to make up for government under funding of research? How important is this to you?

Bar:	Importance:	Count:	Percentage:
1	Very Important	12	37.5
2	Moderately Important	10	31.25
3	Not Important	10	31.25
4	Don't Know	0	0

Although not as important a factor for the university sample as the relevance question, table 15 shows that over 68% consider it at least moderately important. This is in contrast to the 60% of the business sample who consider not an important factor (see table 16).

The trend points towards a stricter purpose for the activities of the business respondents than for those from the universities. Although, it is

not substantiated by this study, the combined problems of a need for more relevance and the need for funding points to a potential if not already existing crisis in the university system.

Table 16: Measurement of the Importance Business Respondents Place on the Question of Tax Incentives as a Motivation for Participating in Collaborative Research with the University Community.

Question 13b: Other people say that the principal motivation for collaboration with universities is because government gives generous financial incentives? How important is this to you?

Bar:	Importance:	Count:	Percentage:
1	Very Important	1	10
2	Moderately Important	3	30
3	Not Important	6	60
4	Don't Know	0	0

Table 17: Range of the Personal Motivations of University Respondents for Entering into Collaborative Research with the Business Community.

Question 12b: What has been your main motivation in collaborating with high tech industries?"

Bar:	Motivation:	Count:	Percentage:
1	Money/Funding	4	12.5
2	Common Interest	4	12.5
3	Cutting Edge	14	43.75
4	Technology Transfer	3	9.375
5	Societal Good	1	3.125
6	Student Placement	1	3.125
7	Formal Obligation	5	15.625
8	Expertise	0	0
9	Access to Equipment	0	0

Amidst the different motivations for entering into collaborative ventures, there is a common thread which stands out when the results in tables 17 and 18 are presented. Both groups have a desire to be on the cutting edge and to avail themselves of the leading technologies and knowledge in their respective fields.

Table 18: Range of the Personal Motivations of Business Respondents for Entering into Collaborative Research with Universities.

Question 12b: What has been your main motivation in collaborating with universities/research centres?"

Bar:	Motivation:	Count:	Percentage:
1	Money/Funding	1	10
2	Common Interest	2	20
3	Cutting Edge	3	30
4	Technology Transfer	0	0
5	Societal Good	1	10
6	Student Placement	0	0
7	Formal Obligation	0	0
8	Expertise	3	30
9	Access to Equipment	0	0

ii) Procedural Limitations

The perception of the researcher in both the university and the business environments is that they are more or less free to do what they think is appropriate in setting up . In the university sample, 90% responded this way, and a full 100% of the researchers in the business sample stated that they were free to do as they saw fit.

An interesting anomaly to this perception is that when the same question was directed at administrators in each of the sample sets, the majority stated that there were specific procedures which had to be followed in order to set up collaborative research relations. This is then followed up by an overwhelming majority of the administrative respondents agreeing that informal structures and personal contact was the best way to actually establish new relationships.

iii) The Suitability of the Work Environment

Concerning the suitability of the university environment to encouraging and developing collaborative research relationships, there is more support for the university by those who are actually part of the institution. Only ten percent of the business sample thought of the university as very well suited for the development of relationships, while forty percent expressed that it was not well suited to the purpose. Table 18 suggests that there is a problem with poor communication and structural incompatibility between the two environments that leads to some friction.

Table 19: Suitability of the University Research Environment for Collaborative Research Projects.

Question 19: In your opinion, is the university research environment very well, well, or not well suited for the development of collaborative projects with industry?"

Bar:	Suitability:	University		Business	
		Count:	Percent:	Count:	Percent:
1	Very Well	11	34.375	1	10
2	Well	16	50	5	50
3	Not Well	5	15.625	4	40

"Why?"

Bar:	Reason:	University		Business	
		Count:	Percent:	Count:	Percent:
1	Complementarity	3	11.111	0	0
2	Structure/Pressure	12	44.444	2	20
3	Material/Human Resources	2	7.407	0	0
4	Better Suited	3	11.111	1	10
5	Poor Communication	2	7.407	3	30
6	Structurally Incompatible	1	3.704	2	20
7	Depends on Personalities	1	3.704	2	20
8	Others	3	11.111	0	0

With that in mind however, there is universal consent with regards to the desirability of the growth of cooperative relationships between universities and private enterprise, as table 20 attests to.

Table 20: Desirability of the Growth of Cooperative Research Relationships.

Question 17a: Does the growth of cooperative relationships between university research and industry seem desirable?

Bar:	Response:	University		Business	
		Count:	Percent:	Count:	Percent:
1	Yes	32	100	10	100
2	No	0	0	0	0
3	Don't Know	0	0	0	0

The consent is not so unanimous with regards to the inevitability of the such relationships growing, Table 21

Table 21: Inevitability of the Growth of Cooperative Research Relationships.

Question 17b: Does the growth of cooperative relationships between university research and industry seem inevitable?

Bar:	Response:	University		Business	
		Count:	Percent:	Count:	Percent:
1	Yes	22	75.862	6	60
2	No	7	24.138	4	40
3	Don't Know	0	0	0	0

E. Impact of Collaboration on Research and Development:

Table 22: Percentages of Responses by both University and Business Interviewees Concerning the Degree of Particular Types of Impact Experienced as a Result of Collaboration (to be used in association with Figures 11-15 below).

Bar:	Impact:	University			Business		
		None:	Some:	Much:	None:	Some:	Much:
1	Funding for Research	9.375	28.125	62.5	55.555	22.222	22.222
2	New Equipment	28.125	40.625	31.25	55.555	22.222	22.222
3	Increase in Personnel	25.0	43.75	31.25	44.444	55.556	0
4	Income/Prestige	40.625	50	9.375	22.222	55.556	22.222
5	Hiring of Students	9.675	62.5	28.125	33.333	55.556	11.111
7	New Research Directions	12.5	40.625	46.875	22.222	66.667	11.111
8	Access to New Knowledge	65.625	31.25	3.125	0	66.667	33.333
9	Patents and Licenses	12.5	43.75	43.75	44.444	22.222	33.333

Table 23: Responses by University and Business Interviewees Concerning Whether or not Particular Types of Impact Resulted From Collaborative Research (to be used in association with Figures 11-14 below).

Bar:	Impact:	University		Business	
		Yes:	No:	Yes:	No:
6	Training of Graduate Stu.	63.871	16.129	60	40
10	Spin-Off Companies	70.968	29.032	90	10
11	Product Dev & Marketing	60	40	80	20

The impact felt by both sectors involved in the collaborative research and development has been dramatic and in most instances rewarding. Tables 21 and 22, and Figures 11-14 demonstrate that both parties seem to be getting what they set out to acquire.

The two issues of funding and relevance for the universities are addressed quite significantly. Over 62% of the university respondents indicated that there was much impact on funding for research, and almost half of the

respondents indicated that they uncovered new directions for research, thus addressing the relevancy question.

The business sample, although not as dramatic, show significant impact on most fronts, including access to new knowledge, new research directions and increased income and/or prestige for the research and development process.

Figure 12: Bar Graph Outlining MUCH IMPACT Response to Factors Listed in Table 21.

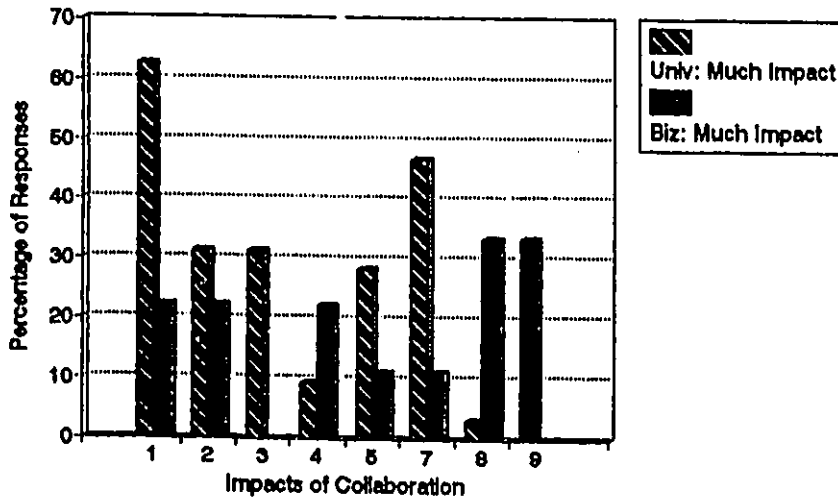


Figure 13: Bar Graph Outlining SOME IMPACT Response to Factors Listed in Table 21.

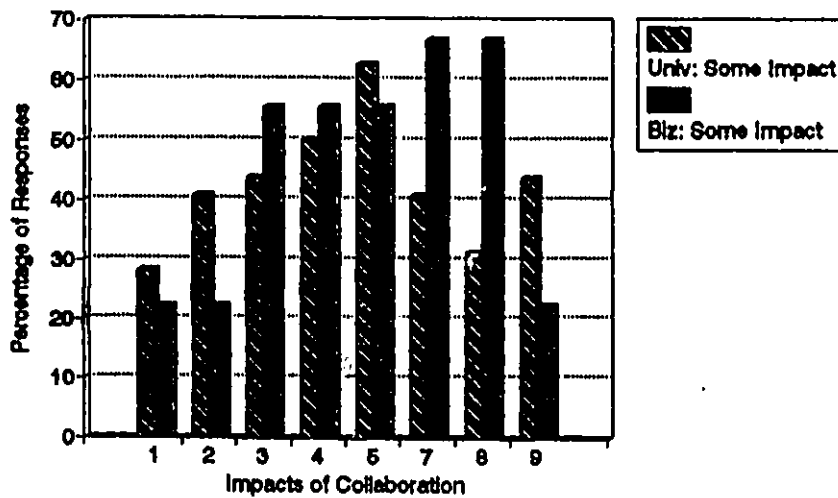


Figure 14: Bar Graph Outlining NO IMPACT Response to Factors Listed in Table 21.

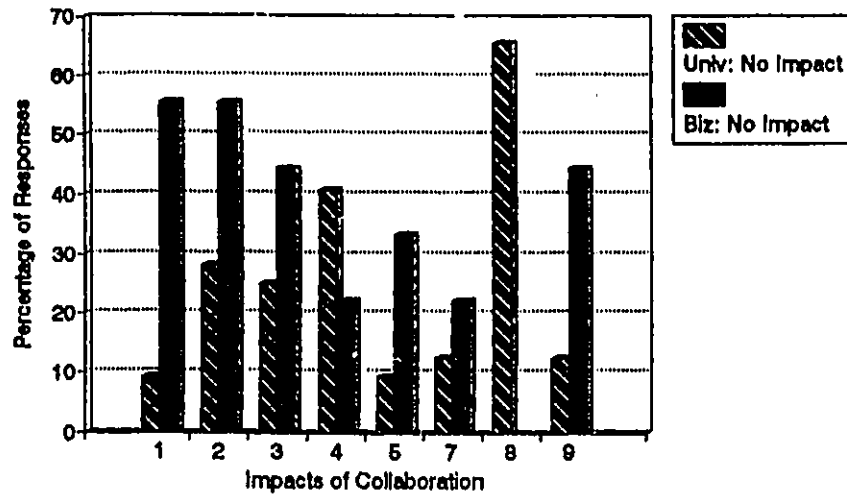
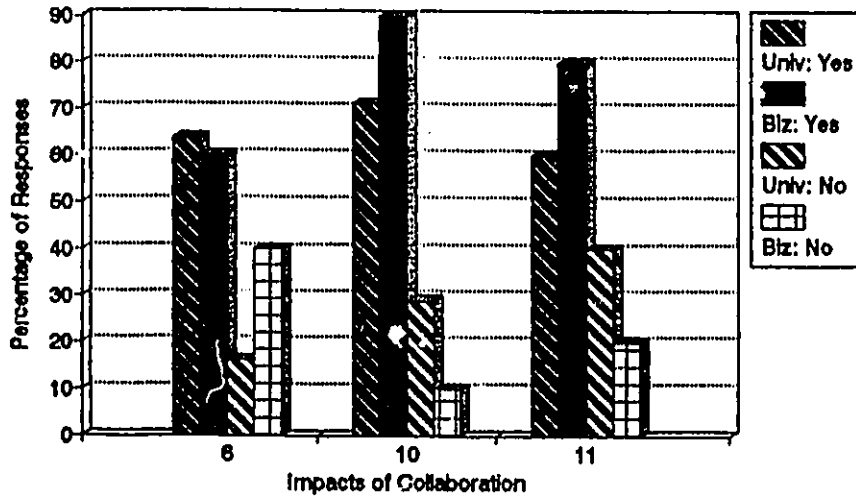


Figure 15: Bar Graph Outlining Positive or Negative Response to Factors Listed in Table 22.

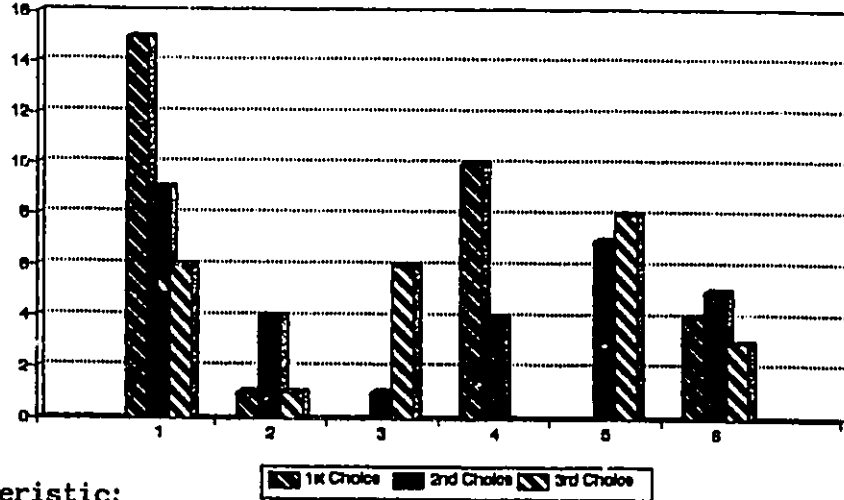


6. Perception of What is Needed for a Region to Develop as a High Technology Research Area:

A theme is gaining strength through the analysis of the results thus far: it is the people and their expertise which make the difference between successful and unsuccessful cooperation. The building of alliances and of supportive structures which allow the development of collaborative relationships. This is supported by the information provided by table 16 & 17. The key, as perceived by the sample interviewed, to developing a high technology research area is 1) a university and trained labour (expertise), 2) a concentration of high tech companies, and 3) a good business climate.

Figure 16: Characteristics Necessary in a Region to Allow for High Technology Development. University Respondents. Three Answers per Respondent.

Question 40: "In your opinion, what are the necessary characteristics a region must have to allow for the development of high technology?"

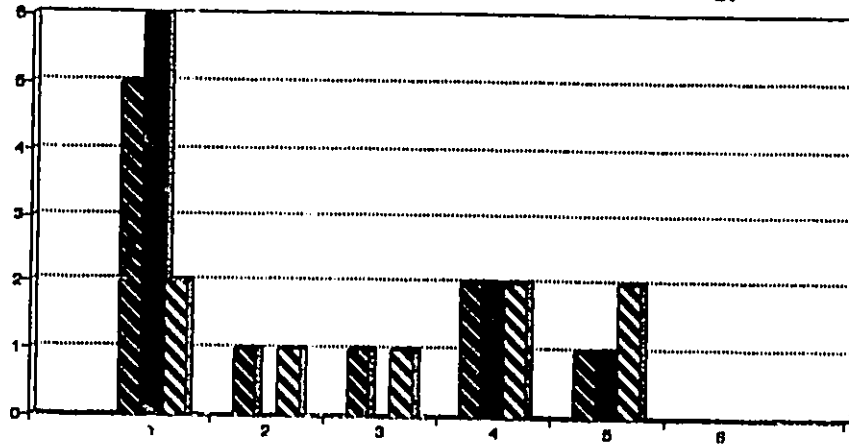


Legend: Bar: Characteristic:

- 1 University/Trained Labour
- 2 Environment/Quality of Life
- 3 Infrastructure
- 4 Concentration of High Tech
- 5 Venture Capital/Business Climate
- 6 Others

Figure 17: Characteristics Necessary in a Region to Allow for High Technology Development. Business Respondents. Three Answers per Respondent.

Question 40: "In your opinion, what are the necessary characteristics a region must have to allow for the development of high technology?"



Legend: Bar: Characteristic: 1st Choice 2nd Choice 3rd Choice

1 University/Trained Labour
 2 Environment/Quality of Life
 3 Infrastructure
 4 Concentration of High Tech
 5 Venture Capital/Business Climate
 6 Others

The confidence that success is a matter of having the right people, with the right combination of infrastructure and climate, is such that the large majority of respondents felt that without these factors, social and economic differences between the have and have-not regions will be reinforced (table 25 & 26) rather than be eliminated by technology transfers.

Table 24: Importance of a Concentration of High Tech Companies in the Development of a Region.

Question 42: Is it important that high tech companies be located in an area where there is a concentration of similar companies?

Bar:	Response:	University		Business	
		Count:	Percent:	Count:	Percent:
1	Yes	23	82.143	4	40
2	No	5	17.857	6	60
3	Don't Know	0	0	0	0

Table 25: Regional Economic Differences linked to Advanced Technology Development

Question 43: Some people argue that the development of the high technology sector will eliminate economic differences between regions. Others hold that it will reinforce these differences. What is your opinion on the subject?

Bar:	Response:	University		Business	
		Count:	Percent:	Count:	Percent:
1	Eliminate	6	23.077	1	14.286
2	Reinforce	20	76.923	6	85.714
3	Don't Know	0	0	0	0

Table 26: Regional Social Differences linked to Advanced Technology Development

Question 43: Some people argue that the development of the high technology sector will eliminate economic differences between regions. Others hold that it will reinforce these differences. What is your opinion on the subject?

Bar:	Response:	University		Business	
		Count:	Percent:	Count:	Percent:
1	Eliminate	4	16.667	1	14.286
2	Reinforce	20	83.333	6	85.714
3	Don't Know	0	0	0	0

G. Perception of the Triangle Geographical Region by Those Living and Working in it:

The sample interviewed were generally favorable in estimating the level of success attained by their region in terms of the level of high technology development. A very significant portion of both the university and the business interviewees felt that the Triangle was either "the best region in Canada" or was "among the leaders" depending on the sector (table 27). Most of the respondents either strongly or somewhat agreed with the expression of the Triangle as "a dynamic centre of high technology development (table 28).

Table 27: Comparison, by Respondents, of the CTT to Other Regions in Level of High Technology Development

Question 34: With regard to the level of high technology development, in your opinion, how does your region compare with others?

Bar:	Response:	University		Business	
		Count:	Percent:	Count:	Percent:
1	Among the World's Best	6	20.69	1	10
2	Best in Canada	5	17.241	3	30
3	Best in Canada but Poor Worldwide	1	3.448	1	10
4	Among the Leaders/Depends on Sector	15	51.724	4	40
5	Getting Better	0	0	0	0
6	Poor	2	6.897	1	10

Table 28: Perception of Respondents to the Question of the Dynamism of CTT as a Centre of High Technology Development.

Question 35: Would you completely disagree, somewhat disagree, have no opinion, somewhat agree. or completely agree with the statement that this region is a dynamic centre of high technology development?

Bar:	Response:	University		Business	
		Count:	Percent:	Count:	Percent:
1	Completely Disagree	0	0	0	0
2	Somewhat Disagree	3	9.375	0	0
3	No Opinion	3	9.375	0	0
4	Somewhat Agree	10	31.25	5	50
5	Completely Agree	16	50	5	50

Table 29: Definition of Regional Boundaries

Question 36: When you describe this region, how do you define its boundaries?

Bar:	Boundaries:	University		Business	
		Count:	Percent:	Count:	Percent:
1	Triangle Proper	9	29.032	5	55.556
2	Triangle + (Toronto, Windsor)	14	45.161	4	44.444
3	Ontario	5	16.129	0	0
4	Ontario + Quebec	2	6.452	0	0
5	Canada	1	3.226	0	0

The definition of regional boundaries is more precise among the business sample interviewed. This is perhaps due to the stronger ties to the infrastructure they are building within the community. This is not to say that the university community does not have strong ties to the region. Although more university respondents indicated a much wider scope to the region, they profess to have similar attachment to the region, and demonstrate almost identical willingness to leave if offered an important position elsewhere. The ease at which most of the respondents would leave their present location to pursue other opportunities if offered relates back to the stronger need to be on the cutting edge of technology.

Table 30: Regional Attachment

Question 37: Are you attached to this region?

Bar:	Attachment:	University		Business	
		Count:	Percent:	Count:	Percent:
1	Very Attached	10	31.25	5	50
2	Attached	9	20.125	2	20
3	Medium	6	18.75	2	20
4	Not Very Attached	5	15.625	0	0
5	Not at all Attached	2	6.25	1	10

Table 31: Offer of Position and Willingness to Move - Country

Question 38: If you were offered an important position elsewhere, would you leave the country?

Bar:	Response:	University		Business	
		Count:	Percent:	Count:	Percent:
1	Yes	12	40	5	55.556
2	No	18	60	4	44.444
3	Don't Know	0	0	0	0

Table 32: Offer of Position and Willingness to Move - Province

Question 38: If you were offered an important position elsewhere, would you leave the province?

Bar:	Response:	University		Business	
		Count:	Percent:	Count:	Percent:
1	Yes	22	70.968	7	77.778
2	No	9	29.032	2	22.222
3	Don't Know	0	0	0	0

Table 33: Offer of Position and Willingness to Move - Region

Question 38: If you were offered an important position elsewhere, would you leave the region?

Bar:	Response:	University		Business	
		Count:	Percent:	Count:	Percent:
1	Yes	24	77.419	7	77.778
2	No	7	22.581	2	22.222
3	Don't Know	0	0	0	0

The strongest link between the two sample groups, regarding the attraction to the Triangle region in particular is the environment and the quality of life. The university sample regards the attraction to the university as the strongest, and the business group has a series of other reasons, most of them individually based. There is also a moderate attraction to the concentration of high-tech companies, but this by no means the force that draws and keeps them in the Triangle area.

Figure 18: CTT's Main Attractions - University Respondents

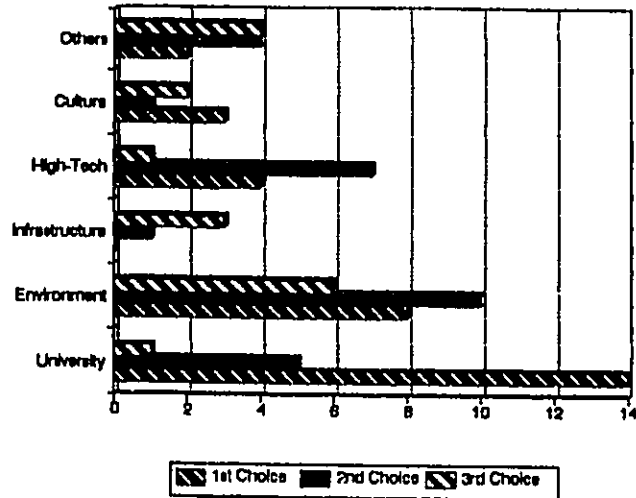
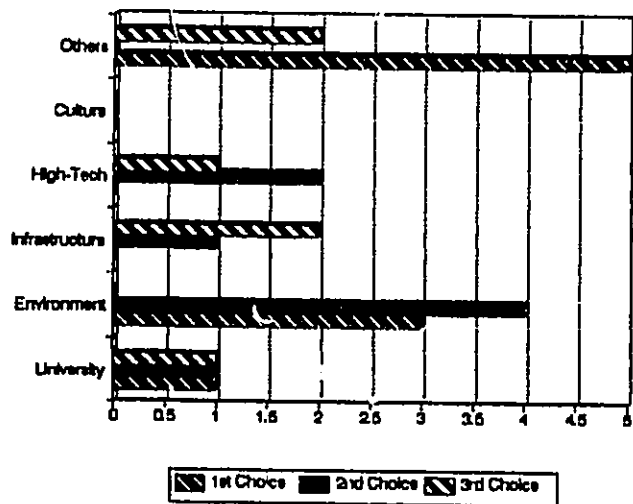


Figure 19: CTT's Main Attractions - Business Respondents



H. Perception of the CTT as Accomplishing its Goals:

It is no surprise based on the preceding trends that universities are interested in getting more money for their research, and the companies want access to the expertise and knowledge found within the universities.

Table 34: Identification of Useful Support for Collaborative Activities

Bar:	Support:	University		Business	
		Count:	Percent:	Count:	Percent:
1	Money	17	56.667	1	10
2	Administrative Support	2	6.667	2	20
3	Equipment	5	16.667	1	10
4	Expertise	0	0	3	30
5	New Problems to Solve	2	6.667	0	0
6	Freedom of Action	0	0	3	30
7	Networking	3	10	0	0
8	Others	1	3.333	0	0

When asked which programs are most effective, the largest percentage of university respondents acknowledge the federal granting agencies, and the businesses respondents warm up to the programs which will put them in touch with the knowledge base they need.

Table 35: Programs, Incentives, or Organizations Identified as Most Effective in Promoting and Developing Collaborative Projects?

Bar:	Response:	University		Business	
		Count:	Percent:	Count:	Percent:
1	Provincial Programs	4	13.333	3	30
2	NSERC/MRC	9	30	1	10
3	Other Federal Programs	0	0	3	30
4	Coop Programs	1	3.333	0	0
5	University Programs	3	10	1	10
6	Regional Programs/Orgs.	0	0	0	0
7	Industry/Funding	3	10	0	0
8	Researcher Specific	2	6.667	1	10
9	Non-Specific Governmental	4	13.333	0	0
10	None	3	10	0	0
11	Others	3	10	1	10

Hardly a mention was made, by any of the respondents of the Canadian Technology Triangle Organization, or the real or potential contribution they could make to the collaborative research activities in the region. None of the respondents in either group identified the CTT as effective in promoting and developing collaborative projects. When asked directly by the interviewer almost all subjects acknowledged the CTT's existence, but many were unaware of precisely what its mandate was or how it could help their particular case. When asked to rate regional structures against a series of criteria, the majority of the respondents felt that they had inadequate knowledge in order to evaluate them fairly.

Table 36: Does the local or regional government play an important role in the organization or structure of mediation, with relation to the determination of activities, funding, or other activities?

Bar:	Response:	University		Business	
		Count:	Percent:	Count:	Percent:
1	Yes	3	30	4	57.143
2	No	7	70	3	42.857
3	Don't Know	0	0	0	0

The verdict was split as to whether the local or regional government played an important role in mediating of activities. The business community seemed to have a better grasp of what the CTT was trying to accomplish, but the majority of university respondents who knew anything about the organization did not think that it played a major role in influencing their activities.

V. Conclusions

The Canadian Technology Triangle organization is in a process of evolution. It combines new innovations and old ideas about the role of municipal government, regional development and the interrelationship of the public and the private sectors of its economy. At present it represents what seems to be a variation of the standard economic development office found in cities across Canada and the United States. It also demonstrates the potential to become an influential player in the development of synergistic research and development relationships between universities and advanced technology enterprises in the region it serves.

The administration of the CTT has recognized that the key to economic survival is the promotion and development of the Triangle region "as a location for new research and technology intensive industrial activity (CTT's Mission Statement, 1991)." The results of the study indicate however that their activities are producing scattered results.

The business officers interviewed (as listed on page 12) recognize that the role of a municipal government is indeed to provide indivisible benefits to its citizens: justice and peace...clean air, sanitation, drinkable water, safe roads, equal access to education; public institutions. They also realize that these benefits are provided for by the collection of taxes. What they are painfully aware of however, is the shrinking tax base which follows the global economic shifts described in the introduction to this study. It is a result of this awareness that they undertook the effort to

organize the CTT and promote the Triangle region as a centre of advanced technology development.

The officers of the CTT agree that the promotion of high cost, high risk research does not necessarily result in direct payback to their respective communities. Their attitude is best summed up by the phrase "nothing ventured, nothing gained." The activities of the CTT may result in very little benefit to their respective communities, but it may also result in very large and prolonged benefits. It is this factor which drives the CTT. This attitude reflects Latour's first principle, "the fate of facts and machines is in later user's hands; their qualities are thus a consequence, not a cause of collective action."

The wisdom of the business officers of the four cities of Guelph, Cambridge, Kitchener and Waterloo is the recognition that in joining forces to create a broader "regional" identity they will be able to pool their resources, avoid duplication of activities, and possibly profit from activities which have a much wider scope than their municipal boundaries.

The development of regional allies has happened between key figures at an organizational level rather than between the individuals themselves. Hence when the results of the study demonstrated that the Canadian Technology Triangle organization has a very low profile with either the university researchers or the business community there are at least two possible conclusions which can be derived. The first of these is that the effectiveness of the CTT is questionable. The second, is that there is more

than one agenda and more than one stratum of activity.

The effectiveness of the CTT is questionable if one looks at the perception of the interview subjects regarding the goal accomplishments of the CTT. As presented, none of the respondents in either group identified the CTT as effective in promoting and developing collaborative projects. Although most of the interview subjects acknowledged the CTT's existence, very few were aware of what its mandate or accomplishments were. There was a split however, as to whether local or regional government played an important role in the mediating of activities. It is this split which perhaps shows where the strengths of the CTT are to be found.

The identification of the actors involved in advanced technology research and development demonstrated that "high technology" or information and technology intensive industries are as "people" focused as they are "technology" focused. The second principle of Bruce Latour's "technoscience" stresses that "scientists and engineers speak in the name of new allies that they have shaped and enrolled...". The enrolment of allies; the type of allies, the recognition of potential allies, and consequently the rejection of enemies or obstacles, is related directly to the scope of activities of the respondent. Hence when we look at which programs, incentives, or organizations are most effective in promoting and developing collaborative research projects, we see that those identified as most effective are those which help the respondents acquire what they want or need to continue their chosen activities. Respondent trends indicate that the universities are interested in getting more money for their

research, and the companies want access to the expertise and knowledge found within the universities. It is no surprise then, that the organizations which are identified as most effective are those which provide the above.

The split mentioned above regarding the role of local government in mediating advanced technology activities follows very closely the idea that allies are needed to achieve the results desired. The university researcher, in most cases, was oblivious to the activities of the CTT as an organization. At a professional level this makes sense. The CTT has very little to do, directly, with the activities he/she performs in the laboratory or the classroom. The CTT however has more to do with the support provided to the universities as institutions in the regional economy, and this is reflected by the greater recognition of the organization by the administrative representatives of the universities. The CTT also focuses on enhancing a positive climate for advanced technology enterprises in the municipal councils. Thus there is more recognition of the CTT at the level of the business owner or administrator than there is at the research level, although there is more recognition at the research level if the activity is within a smaller, less stratified enterprise.

As stated, the business officers who founded the CTT, recognize the role of municipal government in providing indivisible benefits to the community they represent. This recognition is apparently contradicted if the reader assumes that the encouragement of research and development activities by the CTT produces only divisible benefits that are the property of researchers and companies that are easily displaced.

Divisible benefits, in the form of information and technologies which may be transformed into profits for owners and shareholders, are indeed produced by the actors in the region. The potential mobility of the individuals involved in the production of such benefits is also reason to ponder whether the activities of the CTT is the best use of the limited resources available to the communities which form the Triangle. The sample response also indicates that there is only moderate loyalty to the region. The university respondents indicated that although they were for the most part "attached" to the region, there was a defined willingness to leave the region if they were offered an important position elsewhere, hence the mobility factor.

The "mobility problem" seems to have been addressed by the CTT in examination of with whom their strongest alliances have been made. The researchers, the front line actors in the development of advanced technology have limited knowledge of the promotional and marketing activities of the CTT. The business officers, the front line actors in the promotion of the organization also have limited knowledge of the technical activities of the universities and enterprises. Where the two forces meet is where the activities become solidified in institutional structures; the universities, the business associations, the spin-off companies, and the services to support these structures.

The universities found in abundance in the Triangle area, are poles which attract interested individuals. The interaction of these individuals produce ideas and concepts which are in turn exported to other centres via

the university researcher and their graduate students, and/or are exploited by entrepreneurs which convert them in to the spin-off companies which dot the region.

It is the attraction of the individual researchers, business managers, technicians, students to these institutions which is important for the region. If there is a growth in the activity in the university, there is a corresponding growth in the community surrounding the university. The CTT's activities are aimed at the promotion of the region as a dynamic centre of advanced technology development. In this function they have been successful. A large proportion of the respondents in both sector identified the Triangle region as "the best" or "among the leaders".

The Canadian Technology Triangle is a marketing vehicle using traditional techniques of regional promotion to showcase new and emerging technologies found in the institutional structures of their communities. There is little direct participation by the CTT in the technologies being produced, and similarly little promotion of the region by the producers of the technology. There is an understanding between the two groups however, that by creating an alliance which highlights these activities there will be mutually beneficial results: an increased tax base for the municipalities provided by new businesses replacing outmoded forms of production and a potential growth in population resulting from the wider recognition by outsiders of the dynamic activity in the region, and a higher profile for the activities for the researchers and producers of advanced technologies which may result in additional support and funding for the universities, and greater access

to expertise and new markets for the companies located in region.

The role for regional government in emerging technology based economy, as represented by the CTT is in the fostering of alliances between the key players in the institutional structures which formalize the activities, and in the creation and maintenance of physical and economic environments which act as conduits for attracting and keeping the critical mass of individuals needed to allow for dynamic international exchange of ideas and technologies.

There is room within this study for further analysis of the immediate sample as well as comparisons to be made between disciplines active in the region and between regions. The results of this study are based on the Triangle as a geographic framework of activities, but the activities themselves are not limited to the region. They are part of research efforts ongoing in communities around the globe. As part of these efforts, the understanding of the results presented here may provide insight into potential economic and developmental opportunities to be found in other communities in Canada and elsewhere.

Appendix 1: Universities and Research Centres Questionnaire

The Socio-Political Dynamics of
New Strategies of Development

UNIVERSITIES AND RESEARCH CENTRES QUESTIONNAIRE
RESEARCHER/EXECUTIVE

I Name: _____
Title: _____
Position: _____

Dept./Lab. Faculty University

II Name of the University, Faculty, Department, Research Center or
Laboratory: _____

III Location: _____
Date: _____/_____/_____
Time of interview: _____
Telephone number:_(_____)_____

IV Notes : _____

Interviewer : _____

- N.B.: •Questions preceded by EX (executive) are addressed only to
the executive and the administration.

•Questions preceded by RE (researcher) are addressed only
to the researchers.

•All other questions are addressed to all respondents.

HIGH TECHNOLOGY RESEARCH GROUP:
UNIVERSITY/BUSINESS SYNERGY
DEPARTMENT OF SOCIOLOGY
UNIVERSITY OF OTTAWA
OTTAWA, ONTARIO
K1N 6N5

EX 1) Does your university (faculty, department or research laboratory) have general policies or programs that relate to collaboration between university research and high technology firms?
 yes no dk/nr

If yes, what are they? _____

EX 2) Is the best way to initiate collaborative projects between university research and private companies...

*by formal agreements

*by informal means (ie: research offices, professor/graduate contact, transfer agencies)?

*other (specify) _____

EX 3) Who was the person or structures who were the most active in facilitating the development of collaborations?

EX 4) During the last five (5) years, what are or have been, the major collaborative projects between your institution and companies in the high-tech sector?

TITLE	COMPANY	AGENTS		COST \$
		Institute	Company	
A				
B				
C				

EX 5) Have there been important collaborative projects which were abandoned? yes no dk/nr

To what do you attribute this? _____

RE 6) When did your first collaborations with the high technology business community start? _____

RE 7) Over the last 5 years, which companies have you collaborated with?

A) _____
 B) _____
 C) _____
 D) _____
 E) _____
 F) _____
 others _____

RE 8) Other than your laboratory and the companies, are there researchers in other institutions which participate in the various projects? yes no dk/nr

Whom, Could you describe what their role is? _____

RE 9a) With relation to the research undertaken in your collaborative projects, how is each project related to the high-technology sector?

A) _____
 B) _____
 C) _____
 others _____

RE 9b) How did these relationships start?

A) _____
 B) _____
 C) _____
 others _____

RE 10) Where are the companies with which you cooperate located?

A) _____
 B) _____
 C) _____

RE 11) In what industrial sector(s) are the companies you cooperate with?

RE 12a) What is your present state of collaboration with these enterprises?

	A	B	C
*research contract			
◊ basic research related to the area of specialty of the company or of its products	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
◊ applied research with specific objectives	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
◊ joint research with scientists/researchers from the company	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
◊ expert advice: practical problem solving	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
*quality control, product or process testing	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
*use of laboratory equipment by business	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
*use of company's equipment	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
*transfer of knowledge			
◊ transfer of a technological process	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
◊ seminars	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
*others _____			

12b) What has been your main motivation in collaborating with high tech industries? _____

13a) Some people say that collaboration with the private sector has been mainly motivated because researchers wanted to be more relevant? Is this an important consideration for you?

very important	moderately important	not important	dk/nr
1	2	3	0

13b) Other people say that the principal motivation for collaboration with the private sector is to make up for government underfunding of research? How important is this to you?

very important	moderately important	not important	dk/nr
1	2	3	0

RE 13c) In order to begin the process of collaboration with business, were there specific procedures that had to be followed,
or were you free to do as you saw fit?

Explain _____

RE 13d) Who was at the source of these collaborations with business?

• University or research center yes no dk/nr
 a member of the central administration
 (name) _____
 a laboratory or department head
 (name) _____
 a laboratory or department researcher
 (name) _____
 • Business yes no dk/nr
 a director or member of the executive
 (name) _____
 a researcher at a company
 (name) _____
 • A facilitating or mediating agency yes no dk/nr
 (name) _____
 • Representative at the municipal, regional, provincial or
 federal
 level yes no dk/nr
 (name) _____
 • Other yes no dk/nr
 (name) _____

14) Would you say that collaboration with companies is always, sometimes, or seldom seen to be of value and encouraged by:

	always	sometimes	seldom
(1) your department or laboratory	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
(2) your faculty	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
(3) your university?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

15) Are the researchers in your department or laboratory always, sometimes, or seldom interested in cooperative ventures with business?

always sometimes seldom

Why? _____

16) What was the impact for your laboratory or department, faculty or university of the collaborative efforts with business? Was there no impact, some impact or much impact, with regards to the following?

	No impact	Some impact	Much impact
— funding for research	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
— new equipment	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
— increase in personnel	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
— another source of personal income	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
— hiring of students by companies	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
— new directions for research	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
— decrease in basic research	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
— access to new knowledge	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
— patents and licenses	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
— other _____			

17) Does the growth of cooperative relationships between university research and industry seem:

	yes	no	dk/nr
-desirable	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
-inevitable	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

18) Has collaboration with industry already taken the form of temporary assignments of personnel?

yes no dk/nr

if no or dk/nr go to B

A —if **yes**: have researchers from your department or laboratory been assigned to the companies? yes no dk/nr

◊ if **yes**: have they returned or do they have the intention of returning to the department or laboratory?
yes no dk/nr

◊ did these assignments help to emphasize the importance of collaboration? yes no dk/nr

◊ what were the effects of these assignments on your department or laboratory? _____

B —were researchers from a firm attached to your department or laboratory? yes no dk/nr

◊ if **yes** did they stay or do they have the intention of staying in your department or laboratory?
yes no dk/nr

◊ did these assignments contribute to the perceived importance of collaboration? yes no dk/nr

19) In your opinion, is the university research environment very well, well, or not well suited for the development of collaborative projects with industry?

very well well not well

Why? _____

20) In your collaborations with industry, what support is the most useful? _____

21) Which programs, incentives, or organizations seem to be the most effective in promoting and developing collaborative projects? _____

22) Do you think it is part of the role of a university researcher to provide up-to-date information and training to private enterprise personnel? yes no dk/nr

Why? _____

23) Are collaborative projects playing an increasingly important role in the training of your graduate students?

yes no dk/nr

24) Have researchers in your department or laboratory created companies related to their fields of research?
 yes no dk/nr

25) Have researchers in your department or laboratory successfully marketed certain products or processes/technologies?
 yes no dk/nr

26a) Within this region, are there structuring groups, committees, agencies, or other mediating organizations which bring together the various actors in the high-technology sector?
 yes no dk/nr

26b) What are the principal organizations? _____

If no or dk/nr, go to question 30.

27) Do these organizations include people, groups or institutions from outside this region?
 yes no dk/nr

Who/what are they? _____

28) In your opinion, do the principal mediating organizations or structures seem:

-- completely disagree,	- somewhat disagree,	0 no opinion,				
+ somewhat agree,	++ completely agree					
			-	0	+	++
-to be sufficiently developed	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
-to understand your needs and possibilities	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
-to provide quality service	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
-to have adequate funding	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
-to be well managed	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
-to have university support	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
-to have industry support	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

29) Does the local or regional government play an important role in the organization or structure of mediation, with relation to:

	yes	no	dk/nr
-the determination of activities	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
-funding	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
-other	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

RE 30) Do you have joint research projects with other university departments, laboratories or public or publically-funded research centers? yes no dk/nr

What are they? _____

RE 31) Do you maintain research contact with researchers outside of your region? yes no dk/nr

If yes in which regions, cities or universities are your primary contacts located? _____

32) Could you name five (5) researchers, from universities, research centers and companies in the region, whom you would consider among the most active in university/ high tech. enterprises collaboration?

1. _____
2. _____
3. _____
4. _____
5. _____

RE 33) Could you briefly describe your research team (colleagues, technicians, students)? _____

In addition to looking at collaborations between university research and private enterprise, this research is also interested in examining the socio-political effects of the development of new technologies. The following questions are aimed at understanding your personal attitudes and opinions on various political and social questions.

34) With regard to the level of high technology development, in your opinion, how does your region compare with others? _____

35) Would you completely disagree, somewhat disagree, have no opinion, somewhat agree, or completely agree with the statement that this region is a dynamic center of high technology development?

- ⁻ ⁻ ⁰ ⁺ ⁺⁺

44 b) Were the following considerations, very, somewhat, or not all important in your decision of where to live?

	Very	Somewhat	Not at All
•proximity to work	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
•proximity to downtown	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
•reputation of the neighbourhood	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
•pleasant surroundings (environment)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
•language	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
•personal attachment to a particular area	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
•quality of public services (public transit, parks, etc.)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
•schools	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
•others _____			

45) Are you married or have a partner? yes no

46) Do you have children? yes no dk/nr

47) Do you think that the following factors will stimulate, slow down, or have no effect on the development of the high technology sector?

i) Ecology Movement	<input type="checkbox"/>	stimulate <input type="checkbox"/>	slowdown <input type="checkbox"/>	indifferent <input type="checkbox"/>	dk/nr <input type="checkbox"/>
ii) Unions	<input type="checkbox"/>	stimulate <input type="checkbox"/>	slowdown <input type="checkbox"/>	indifferent <input type="checkbox"/>	dk/nr <input type="checkbox"/>
iii) Nationalism	<input type="checkbox"/>	stimulate <input type="checkbox"/>	slowdown <input type="checkbox"/>	indifferent <input type="checkbox"/>	dk/nr <input type="checkbox"/>
iv) Feminism	<input type="checkbox"/>	stimulate <input type="checkbox"/>	slowdown <input type="checkbox"/>	indifferent <input type="checkbox"/>	dk/nr <input type="checkbox"/>

48) It is still quite rare to find women in engineering, research, or executive positions of high-tech companies. What do think of this?

49) The persons with which you socialize are primarily:

•people who work for the same university or research center;	yes <input type="checkbox"/>	no <input type="checkbox"/>	dk/nr <input type="checkbox"/>
•people who work in high-tech, but not necessarily for the same university or research center;	yes <input type="checkbox"/>	no <input type="checkbox"/>	dk/nr <input type="checkbox"/>
•people who work in the same field as your partner;	yes <input type="checkbox"/>	no <input type="checkbox"/>	dk/nr <input type="checkbox"/>
•long-time friends and family;	yes <input type="checkbox"/>	no <input type="checkbox"/>	dk/nr <input type="checkbox"/>
•people from many different professional backgrounds;	yes <input type="checkbox"/>	no <input type="checkbox"/>	dk/nr <input type="checkbox"/>
•other _____			

50) Do you place great importance on leisure and recreational activities?

very important	moderately important	not very important	dk/nr
1	2	3	0

51) What is (was) your partner's job or profession? _____

52) Do you consider yourself as very, somewhat, or not at all favourable to the following issues:

	very	some	not at all	indifferent
A) Rights to Abortion	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
B) Ecology	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
C) Sexual Equality	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
D) Anti-nuclear movement	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
E) Human rights	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
F) War on Drugs	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

53) From among the following problems, which do you consider the two most important and the two least important?

	most	least
A) World Hunger	<input type="checkbox"/>	<input type="checkbox"/>
B) Urban Violence	<input type="checkbox"/>	<input type="checkbox"/>
C) Third World Debt	<input type="checkbox"/>	<input type="checkbox"/>
D) Illiteracy	<input type="checkbox"/>	<input type="checkbox"/>
E) Canadian National Debt	<input type="checkbox"/>	<input type="checkbox"/>
F) Pollution	<input type="checkbox"/>	<input type="checkbox"/>
G) Racial Integration	<input type="checkbox"/>	<input type="checkbox"/>
H) Education of our Youth	<input type="checkbox"/>	<input type="checkbox"/>

54) From the following, which do you personally consider, the two most important elements and the two least important elements.

	Most	Least
1. income and social benefits	<input type="checkbox"/>	<input type="checkbox"/>
2. experience	<input type="checkbox"/>	<input type="checkbox"/>
3. work environment	<input type="checkbox"/>	<input type="checkbox"/>
4. time spent with family	<input type="checkbox"/>	<input type="checkbox"/>
5. advanced training opportunities	<input type="checkbox"/>	<input type="checkbox"/>
6. level of responsibility	<input type="checkbox"/>	<input type="checkbox"/>
7. spirituality	<input type="checkbox"/>	<input type="checkbox"/>
8. leisure time	<input type="checkbox"/>	<input type="checkbox"/>
9. promotion opportunities	<input type="checkbox"/>	<input type="checkbox"/>
10. interest in work	<input type="checkbox"/>	<input type="checkbox"/>
11. time spent with friends	<input type="checkbox"/>	<input type="checkbox"/>
12. long-term career goals	<input type="checkbox"/>	<input type="checkbox"/>
13. job security	<input type="checkbox"/>	<input type="checkbox"/>

55) Do you consider people (technicians, administrators, engineers) who work in the high technology sector to be different politically? Are they:

- *more progressive than the general population
- *more conservative than the general population
- *similar to the general population

56) Would you say that the present degree of government intervention in the process of economic development is:

not sufficient	sufficient	more than sufficient	too much	dk
1	2	3	4	0

57a) Would you say that the present degree of government intervention in the development of high technology is...

not sufficient	sufficient	more than sufficient	too much	dk
1	2	3	4	0

Why? _____

57h) In your opinion, in which high-technology sector(s) do you think Canada has the greatest chance of being internationally competitive? _____

58) Do you mostly agree or mostly disagree with the following statements:

	agree	disagree	dk/nr
i) Generally, I am in favour of State or public intervention in economic development.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
ii) One of the major problems with the development of high technology in our area is the lack of innovative ideas and entrepreneurial spirit.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
iii) The Government should impose measures to protect us from a flood of foreign high-tech equipment and technology.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
iv) The high technology industry needs an agreement with their labour force which gives management the <i>flexibility</i> necessary for the development of the high technology sector.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
v) In order to encourage a sense of identity with the company and to ensure a <i>continuity</i> in their work, high technology firms should provide job security to their professional employees (researchers, engineers).	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
vi) The primary responsibility for the promotion of development in high technology rests with local government and not with the other levels of government.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

59) In your opinion, which of the following groups provides the most leadership in trying to solve the main problems faced by our society today?(1 provides most , 2 provides least)

POLITICIANS	<input type="checkbox"/>
INTELLECTUALS	<input type="checkbox"/>
ENGINEERS AND TECHNICIANS	<input type="checkbox"/>
BUSINESS PEOPLE AND ENTREPRENEURS	<input type="checkbox"/>
UNION LEADERS	<input type="checkbox"/>
RESEARCHERS	<input type="checkbox"/>

60) Would you agree that success in the world of high technology depends more on individuality and on entrepreneurial spirit within the company, than on the administrative structure of the company?

individual
organization

Explain. _____

61) Social programmes in Canada are more important and offer greater coverage than those found in the United States. Do you believe that harmonization of our social policies with those of the United States would encourage more risk-taking (entrepreneurship) as well as a more competitive environment for Canadian enterprises?

-- completely disagree, - somewhat disagree, 0 no opinion,
+ somewhat agree, ++ completely agree

61h) Is this a policy we should follow?

Explain. _____

62) A management model, often identified with the Japanese, is where employees and the executive share a deep loyalty to the enterprise. Another model, more often identified as American, is one based on innovation and entrepreneurship. Between these two models, which one do you believe to be more suited to promoting the development of high technology in Canada?

Japanese model American model dk/nr.
 Explain. _____

63) Indicate the highest level of education completed by the following persons:

•your mother _____
 •your father _____
 •your partner _____

64) Where were you born? _____
 Where was your partner born? _____

65) In what year were you born; 19____
 and your partner? 19____

66) What is your present salary before taxes?

- 1. less than \$40,000
- 2. \$40,000 to \$59,999
- 3. \$60,000 to \$79,999
- 4. \$80,000 to \$99,999
- 5. \$100,000 or more.

67) What is your educational history since terminating secondary school?

Name of University	Place	Field	Diploma	Year
1. _____	_____	_____	_____	_____
2. _____	_____	_____	_____	_____
3. _____	_____	_____	_____	_____
4. _____	_____	_____	_____	_____
5. _____	_____	_____	_____	_____

68) What were the three positions you held preceding this one?

Position	Company	Location	Date
1. _____	_____	_____	_____
2. _____	_____	_____	_____
3. _____	_____	_____	_____

Appendix 2: High Technology Enterprise Questionnaire

The Socio-Political Dynamics of
New Strategies of Development

HIGH TECHNOLOGY ENTERPRISE QUESTIONNAIRE
RESEARCHER/EXECUTIVE

I Name: _____
Title: _____
Position: _____

II Name of the Enterprise: _____

III Location: _____
Date: _____/_____/_____
Time of interview: _____
Telephone number: (_____) _____

IV Notes : _____

Interviewer : _____

- N.B.: •Questions preceded by EX (executive) are addressed only to the executive and the administration.
- Questions preceded by RE (researcher) are addressed only to the researchers.
- All other questions are addressed to all respondents.

HIGH TECHNOLOGY RESEARCH GROUP.
UNIVERSITY/BUSINESS SYNERGY
DEPARTMENT OF SOCIOLOGY
UNIVERSITY OF OTTAWA
OTTAWA, ONTARIO
K1N 6N5

EX 1) Does your company have general policies or programs that relate to collaboration between university research and high technology firms? yes no dk/nr

If yes, what are they? _____

EX 2) Is the best way to initiate collaborative projects between university research and private companies...
 *by formal agreements
 *by informal means (ie: research offices, professor/graduate contact, transfer agencies)?
 *other (specify) _____

EX 3) Who was the person or structures who were the most active in facilitating the development of collaborations?

EX 4) During the last five (5) years, what are or have been, the major collaborative projects between your company and universities/research centers?

TITLE	INSTITUTE	AGENTS		COST \$
		Institute	Company	
A				
B				
C				

- EX 5) Have there been important collaborative projects which were abandoned? yes no dk/nr

To what do you attribute this? _____

- 6) When did your first collaborations with the universities/research centers community start? _____

- 7) Over the last 5 years, which universities/research centers have you collaborated with?

A) _____

B) _____

C) _____

D) _____

E) _____

F) _____

others _____

- 8) Other than your company and the university/research center, are there researchers in other institutions which participate in the various projects? yes no dk/nr

Whom, Could you describe what their role is? _____

- 9a) With relation to the research undertaken in your collaborative projects, how is each project related to the high-technology sector?

A) _____

B) _____

C) _____

others _____

- 9b) How did these relationships start?

A) _____

B) _____

C) _____

others _____

- 10) Where are the universities/research centers with which you cooperate located?

A) _____

B) _____

C) _____

- 11) In which department(s) are the university researchers with which you cooperate?

12a) What is your present state of collaboration with these universities/research centers?

	A	B	C
•research contract			
◊ basic research related to the area of specialty of your company or your products	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
◊ applied research with specific objectives	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
◊ joint research with scientists/researchers from the universities/research centers	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
◊ expert advice: practical problem solving	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
•quality control, product or process testing	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
•use of laboratory equipment	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
•use of company's equipment	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
•transfer of knowledge			
◊ transfer of a technological process	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
◊ seminars	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
•others _____			

12b) What has been your main motivation in collaborating with universities/research centers? _____

13a) Some people say that collaboration with the university has been mainly motivated because the development of the high tech. sector is impossible without direct links to basic research. Is this an important consideration for you?

very important	moderately important	not important	dk/nr
1	2	3	0

13b) Others say that the principal motivation for collaboration with universities is because government gives generous financial incentives? How important is this to you?

very important	moderately important	not important	dk/nr
1	2	3	0

RE 13c) In order to begin the process of collaboration with universities/research centers, were there specific procedures that had to be followed,
or were you free to do as you saw fit?

Explain _____

- 18) Has collaboration with universities/research centers already taken the form of temporary assignments of personnel?
 yes no dk/nr

If no or dk/nr go to B

- A —If **yes**: have researchers from the universities/research centers been assigned to your company? yes no dk/nr
 ◊ if **yes**: have they returned or do they have the intention of returning to their department or laboratory?
 yes no dk/nr
 ◊ did these assignments help to emphasize the importance of collaboration?
 yes no dk/nr
 ◊ what were the effects of these assignments on your company?
-

- B —were researchers from your firm attached to a department or laboratory? yes no dk/nr
 ◊ if **yes** did they stay or do they have the intention of staying in the department or laboratory?
 yes no dk/nr
 ◊ did these assignments contribute to the perceived importance of collaboration?
 yes no dk/nr

- 19) In your opinion, is the university research environment very well, well, or not well suited for the development of collaborative projects with industry?
 very well well not well

Why? _____

- 20) In your collaborations with universities/research centers, what support is the most useful? _____
-

- 21) Which programs, incentives, or organizations seem to be the most effective in promoting and developing collaborative projects? _____
-

- 22) Do you think it is part of the role of a university researcher to provide up-to-date information and training to private enterprise personnel? yes no dk/nr

Why? _____

- 23) Is the training of graduate students playing an increasingly important role in collaborative projects?
 yes no dk/nr

24) Do you know of researchers from the universities/research centers who have created companies related to their fields of research? yes no dk/nr

25) Do you know of researchers from the universities/research centers who have successfully marketed certain products or processes/ technologies? yes no dk/nr

26a) Within this region, are there structuring groups, committees, agencies, or other mediating organizations which bring together the various actors in the high-technology sector? yes no dk/nr

26b) What are the principal organizations? _____

If no or dk/nr, go to question 30.

27) Do these organizations include people, groups or institutions from outside this region? yes no dk/nr

Who/what are they? _____

28) In your opinion, do the principal mediating organizations or structures seem:

-- completely disagree.	- somewhat disagree,	0 no opinion,		
	+ somewhat agree,	++ completely agree		
			+	++
—to be sufficiently developed	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
—to understand your needs and possibilities	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
—to provide quality service	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
—to have adequate funding	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
—to be well managed	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
—to have university support	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
—to have industry support	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

29) Does the local or regional government play an important role in the organization or structure of mediation, with relation to:

	yes	no	dk/nr
-the determination of activities	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
-funding	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
-other	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

30) Do you have joint research projects with more than one public or publically-funded university/research center?
yes no dk/nr

What are they? _____

RE 31) Do you maintain research contact with researchers outside of your region? yes no dk/nr

If yes in which regions, cities or universities are your primary contacts located? _____

32) Could you name five (5) researchers, from universities, research centers and companies in the region, whom you would consider among the most active in university/ high tech. enterprises collaboration?

- 1. _____
- 2. _____
- 3. _____
- 4. _____
- 5. _____

33) Could you briefly describe your research team that is involved in university collaboration? _____

In addition to looking at collaborations between university research and private enterprise, this research is also interested in examining the socio-political effects of the development of new technologies. The following questions are aimed at understanding your personal attitudes and opinions on various political and social questions.

34) With regard to the level of high technology development, in your opinion, how does your region compare with others? _____

35) Would you completely disagree, somewhat disagree, have no opinion, somewhat agree, or completely agree with the statement that this region is a dynamic center of high technology development?

-
-
- 0
- +
- ++

44 b) Were the following considerations, very, somewhat, or not all important in your decision of where to live?

	Very	Somewhat	Not at All
•proximity to work	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
•proximity to downtown	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
•reputation of the neighbourhood	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
•pleasant surroundings (environment)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
•language	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
•personal attachment to a particular area	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
•quality of public services (public transit, parks, etc.)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
•schools	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
•others _____			

45) Are you married or have a partner? yes no

46) Do you have children? yes no dk/nr

47) Do you think that the following factors will stimulate, slow down, or have no effect on the development of the high technology sector?

i) Ecology Movement	<input type="checkbox"/>	stimulate <input type="checkbox"/>	slowdown <input type="checkbox"/>	indifferent <input type="checkbox"/>	dk/nr <input type="checkbox"/>
ii) Unions	<input type="checkbox"/>	stimulate <input type="checkbox"/>	slowdown <input type="checkbox"/>	indifferent <input type="checkbox"/>	dk/nr <input type="checkbox"/>
iii) Nationalism	<input type="checkbox"/>	stimulate <input type="checkbox"/>	slowdown <input type="checkbox"/>	indifferent <input type="checkbox"/>	dk/nr <input type="checkbox"/>
iv) Feminism	<input type="checkbox"/>	stimulate <input type="checkbox"/>	slowdown <input type="checkbox"/>	indifferent <input type="checkbox"/>	dk/nr <input type="checkbox"/>

48) It is still quite rare to find women in engineering, research, or executive positions of high-tech companies. What do think of this? _____

49) The persons with which you socialize are primarily:

•people who work for the same company	yes <input type="checkbox"/>	no <input type="checkbox"/>	dk/nr <input type="checkbox"/>
•people who work in high-tech, but not necessarily for the same company;	yes <input type="checkbox"/>	no <input type="checkbox"/>	dk/nr <input type="checkbox"/>
•people who work in the same field as your partner;	yes <input type="checkbox"/>	no <input type="checkbox"/>	dk/nr <input type="checkbox"/>
•long-time friends and family;	yes <input type="checkbox"/>	no <input type="checkbox"/>	dk/nr <input type="checkbox"/>
•people from many different professional backgrounds;	yes <input type="checkbox"/>	no <input type="checkbox"/>	dk/nr <input type="checkbox"/>
•other _____			

50) Do you place great importance on leisure and recreational activities?

very important	moderately important	not very important	dk/nr
1	2	3	0

51) What is (was) your partner's job or profession? _____

52) Do you consider yourself as very, somewhat, or not at all favourable to the following issues:

	very	some	not at all	indifferent
A) Rights to Abortion	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
B) Ecology	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
C) Sexual Equality	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
D) Anti-nuclear movement	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
E) Human rights	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
F) War on Drugs	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

53) From among the following problems, which do you consider the two most important and the two least important?

	most	least
A) World Hunger	<input type="checkbox"/>	<input type="checkbox"/>
B) Urban Violence	<input type="checkbox"/>	<input type="checkbox"/>
C) Third World Debt	<input type="checkbox"/>	<input type="checkbox"/>
D) Illiteracy	<input type="checkbox"/>	<input type="checkbox"/>
E) Canadian National Debt	<input type="checkbox"/>	<input type="checkbox"/>
F) Pollution	<input type="checkbox"/>	<input type="checkbox"/>
G) Racial Integration	<input type="checkbox"/>	<input type="checkbox"/>
H) Education of our Youth	<input type="checkbox"/>	<input type="checkbox"/>

54) From the following, which do you personally consider, the two most important elements and the two least important elements.

	Most	Least
1. income and social benefits	<input type="checkbox"/>	<input type="checkbox"/>
2. experience	<input type="checkbox"/>	<input type="checkbox"/>
3. work environment	<input type="checkbox"/>	<input type="checkbox"/>
4. time spent with family	<input type="checkbox"/>	<input type="checkbox"/>
5. advanced training opportunities	<input type="checkbox"/>	<input type="checkbox"/>
6. level of responsibility	<input type="checkbox"/>	<input type="checkbox"/>
7. spirituality	<input type="checkbox"/>	<input type="checkbox"/>
8. leisure time	<input type="checkbox"/>	<input type="checkbox"/>
9. promotion opportunities	<input type="checkbox"/>	<input type="checkbox"/>
10. interest in work	<input type="checkbox"/>	<input type="checkbox"/>
11. time spent with friends	<input type="checkbox"/>	<input type="checkbox"/>
12. long-term career goals	<input type="checkbox"/>	<input type="checkbox"/>
13. job security	<input type="checkbox"/>	<input type="checkbox"/>

55) Do you consider people (technicians, administrators, engineers) who work in the high technology sector to be different politically? Are they:

- *more progressive than the general population
- *more conservative than the general population
- *similar to the general population

56) Would you say that the present degree of government intervention in the process of economic development is:

not sufficient	sufficient	more than sufficient	too much	dk
1	2	3	4	0

57a) Would you say that the present degree of government intervention in the development of high technology is...

not sufficient	sufficient	more than sufficient	too much	dk
1	2	3	4	0

Why? _____

57b) In your opinion, in which high-technology sector do you think Canada has the greatest chance of being internationally competitive? _____

62) A management model, often identified with the Japanese, is where employees and the executive share a deep loyalty to the enterprise. Another model, more often identified as American, is one based on innovation and entrepreneurship. Between these two models, which one do you believe to be more suited to promoting the development of high technology in Canada?

Japanese model American model dk/nr.

Explain. _____

63) Indicate the highest level of education completed by the following persons:

•your mother _____
 •your father _____
 •your partner _____

64) Where were you born? _____
 Where was your partner born? _____

65) In what year were you born; ·19____
 and your partner? 19____

66) What is your present salary before taxes?

- 1. less than \$40,000
- 2. \$40,000 to \$59,999
- 3. \$60,000 to \$79,999
- 4. \$80,000 to \$99,999
- 5. \$100,000 or more.

67) What is your educational history since terminating secondary school?

Name of University	Place	Field	Diploma	Year
1. _____	_____	_____	_____	_____
2. _____	_____	_____	_____	_____
3. _____	_____	_____	_____	_____
4. _____	_____	_____	_____	_____
5. _____	_____	_____	_____	_____

68) What were the three positions you held preceding this one?

Position	Company	Location	Date
1. _____	_____	_____	_____
2. _____	_____	_____	_____
3. _____	_____	_____	_____

N.B. Would it be possible to obtain a copy of your latest annual report, as well as the figures relating to the portion of the budget allocated to R&D.

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