EXAMINING GENDER BIAS IN STUDIES OF INNOVATION

by

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ABSTRACT

Is there an inherent bias in the types of questions asked in interview guides used in innovation studies? This question is important given the role of innovation studies in economic policy recommendations. Using the Innovation Systems Research Network and its interview guide as a case study, this research project examines how accurately and completely such studies present gender differences in the innovation process. Based on data derived from focus groups and interviews, the research question became "Do innovation-type surveys serve to exclude certain forms of innovative practices by using a limited target population?" The answer: Yes.

Two focus groups – involving fourteen women from Vancouver, British Columbia's biotech and multimedia sectors – and eight one-on-one interviews with people from high tech industries formed the basis of this research. The resulting data suggests women in knowledge-based sectors encounter challenges similar to those faced in the older, manufacturing-based economy, and that tools currently used for measuring innovation do not fully capture their experiences or their contributions.

Several key themes emerged, common to the entire range of demographic and employment backgrounds represented in the research groups:

- The inadequacy of the OSLO Manual's definition of innovation, which forms the basis of innovation survey tools, particularly in the exclusion of support services and cultural/social dynamics.
- The OSLO Manual's 'success' bias. By ignoring 'failed' innovations, survey tools miss some of the processes and learning that contribute to future successful innovations.
- The lack of questions about human resources and cultural capital components that nurture innovation processes.
- A lack of consideration of how corporate structure affects employee participation in innovation processes and if gender factors into perceptions of hierarchy.
- The importance of teamwork and interdisciplinary collaboration to innovation processes.

- The adoption of professional 'manipulation' tactics by women as a way of facilitating their work in corporate environments.

The research findings, combined with a thorough survey of existing literature and research on gender, work and innovation, led to a number of conclusions and recommendations focussing largely on broadening the scope of questions in survey tools and on improving the sampling methods of innovation studies.

"When both men and women acquiesce to the masculinist substructure or organization, that system is allowed to reproduce itself without regard for its dysfunctional consequences for women, men, and organizations. The lens of gender allows us to shift our attention away from the traits of the individual making decisions in organizations and toward the characteristics of the masculine–encoded structures and processes within which men and women are required to operate. These structures and processes are gendered in ways that elevate typically male experiences to the level of unquestioned norm while dismissing that which appears feminine as irrational, illogical, unsubstantiated, or irrelevant; that is, "normal" managers are masculine." (Maier, 1999, p. 90)

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TABLE OF CONTENTS

LIST OF TABLES AND FIGURES

LIST OF ACRONYMS AND ABBREVIATIONS

ASTTBC	Applied Science Technologists and Technicians of British Columbia
CPROST	Centre for Policy Research on Science and Technology
GBA	Gender-Based Analysis
ISRN	Innovation Systems Research Network
NCE	Networks of Centres of Excellence
NIS	National Innovation System
OECD	Organisation for Economic Co-operation and Development
RIS	Regional Innovation System
SCWIST	Society of Canadian Women in Science and Technology
WAGIS	Women's Advisory Group on Innovation Studies

FOREWORD

This study was made possible through a research grant from Status of Women Canada and was conducted for the Centre for Policy Research on Science and Technology (CPROST) between March 2002 and July 2003.

The "Examining Gender Bias in Studies of Innovation" project was initiated by Innovation Systems Research Network (ISRN) researcher Nicola Crowden. After conducting several interviews with men as part of study of Vancouver's biotech cluster, Crowden began wondering if men and women would answer the ISRN questionnaire differently. This initial curiosity was bolstered by the knowledge that the questionnaire was developed exclusively, albeit unintentionally, by five men. Background research revealed a study of the gender-inclusiveness of the ISRN questionnaire did not exist. This gap in research, combined with the knowledge that future economic policy would possibly be based on the opinions and insights of men alone, led Crowden to propose this research project to Status of Women Canada.

In order to ensure this project was carried out to its most effective capacity, Status of Women Canada suggested the creation of an advisory group. In March 2002, Crowden and Adam Holbrook created the Women's Advisory Group on Innovation Studies (WAGIS) with the intention of advocating gender equality in research methods. The groups and individuals of WAGIS deserve Crowden's thanks and gratitude – without their contributions this work would not have been possible.

Several individuals and organizations contributed to this project in an advisory capacity: Helen Loshny from Society for Canadian Women in Science and Technology, Fabiola Bazo from Industry Canada, Mebrat Beyene from Status of Women Canada, Adam Holbrook from CPROST, and Catherine Murray from Simon Fraser University.

CHAPTER 1: INTRODUCTION

THE IMPORTANCE OF STUDYING INNOVATION

The maintenance of Canada's high standard of living depends in large part on the country's ability to transform its resource-based, traditional economy into one driven by knowledge and based on technology. Success in this context increasingly depends on applying the results of innovations, which are new or significantly improved services, products, production techniques, or management methods. Recent studies of the innovation process point toward the interdependence of economic, political, social and cultural factors in determining the relative degree of success enjoyed by individual nations and regions in the new economy.

The notion of studying innovation as an economic indicator within industrial sectors became mainstream philosophy when the Organisation for Economic Co-operation and Development (OECD) supported the movement in the mid-1960s. The decision by the OECD to study innovation resulted in the creation of the OSLO Manual, which was essentially a 'how to' guide for countries studying innovation within their relevant industries. Since technological innovation was considered a viable indicator for predicting future business and economic directions, the OSLO Manual attempted to create a methodological guide for measuring the trends and patterns of innovation 'waves.' Measuring these trends would essentially aid governments in supporting the development of future technological innovations, which, in turn, would create economic activity and keep the capitalist 'wheels in motion.'

The OECD has had a global impact on economic studies measuring innovation. The world's focus, including Canada's, has turned toward studying the economic factors that influence innovation, including the geographical clustering of industries, from manufacturing to high tech. The Canadian focus is evident in Industry Canada's 'Innovation Strategy.' As part of Canada's 'Innovation Strategy,' current Industry Canada Minister Allan Rock stated:

> Canada must become more innovative if we are to continue to build on our economic and social foundations...We need to find ways to create knowledge and bring it to the market more quickly, secure a skilled work force, support our communities as magnets for investment and make our business and regulatory policies attractive while protecting our quality of life. If Canada is to be successful globally, innovation must be everybody's business. (Industry Canada, 2002)

Industry Canada's 'Innovation Strategy' uses statistical analysis to benchmark and report on the progress and development of certain industries across the nation. The industries under study cover a wide range from resource extraction-based manufacturers to those of the new knowledge-based economy, such as biotechnology and multimedia. Underpinning many of these policy statements is a national system of innovation approach. First covered by Nelson Lindquist, such an approach postulates that innovative processes rely on technology and information flowing between the people, institutions and businesses of a given nation, but researchers have found problems. From a policy perspective, such studies serve an important purpose in guiding policy development or contributing to the evaluation of specific policy initiatives designed to advance innovation.

THE ISRN PROJECT

The 'one size fits all' approach commonly adopted in national systems of innovation, such as Canada's, must be critiqued (Holbrook & Wolfe, 2000). This approach demands analysis because it does not take into account regional differences in innovation styles – such as the differences between British Columbia's natural resource sector and Ontario's manufacturing sector – and different regional elements influencing innovation. Researchers at the Centre for Policy Research on Science and Technology (CPROST) at Simon Fraser University are currently participating in the Innovations Systems Research Network (ISRN) project (principal investigator: Adam Holbrook). This project investigates how local networks of firms and supporting infrastructures of institutions, businesses, and people in communities across Canada interact to initiate economic growth. This national study, being conducted through the collaborative efforts of researchers

drawn from five regions of Canada (Appendix A), involves gathering data from the existing business clusters in each region which will later be compared to similar clusters in other regions.

The hypothesis guiding the ISRN project is that 'regional systems of innovation contribute to national systems of innovation.' In an attempt to understand the nature of the innovative process at the regional level and its interaction at the national level, the ISRN project studies how actors within systems of innovation bring about technological change. In shifting focus from national to regional innovation processes, social issues and the importance of communication and interaction emerged as important factors for study. Researchers analysing the flows of knowledge and knowledge creation now recognise the importance of different interaction styles between various actors, mutual trust, and the proximity needed to facilitate these flows (Innovation Systems Research Network, 2002).

The ISRN project uses standard survey tools, which have been developed internationally at the OECD and nationally at Statistics Canada.[1] It is important to note that despite the innovative methodology adopted by the ISRN project researchers to assess regional diversity and its impact on economic growth in relevant Canadian industries, the project has not considered the impact of gender on responses to the interview guides. In fact, the OSLO Manual and the OECD have never attempted to measure gender as a variable. Current analyses of technological innovation are based on studies assumed to be gender neutral, in that there is no overt gender-sensitive language in the research instruments. However, the scholarship on innovation and the performance of successful industrial clusters is based on studies relying heavily on information obtained predominantly from men. When innovation surveys are administered the target population is commonly corporate executive officers and senior management. Due to systemic

[1] Canadian academics deemed the research conducted by both Industry Canada and Statistics Canada's 'Survey on Innovation' as incomplete and problematic because of the location-bias in the methodological development of the 'Innovation Strategy' (Holbrook & Wolf, 2000). Focusing on Ottawa, the research is simply not in-depth enough to cover the complex issues, such as regional dynamics that promote or discourage business growth, affecting innovation levels across Canada.

and social barriers resulting in women's low level of participation in these types of jobs,[2] women's perspectives are often under-represented in such surveys. This could result in a direction of economic growth that perpetuates the exclusion of women.

The results of the research conducted by those involved in the ISRN project will influence future policy recommendations regarding economic growth and change. It is, therefore, crucial that these recommendations reflect both women's and men's views on scientific and technical work. Accounting for women's roles in Canada's innovation is key to fostering balanced policies for economic growth. It is for this reason that a study challenging the gender neutrality of innovation survey tools, such as the ISRN questionnaire, is needed.

Women's Advisory Group on Innovation Studies

The Women's Advisory Group on Innovation Studies (WAGIS) was formed in response to the need for studying innovation survey tools. WAGIS is a working group consisting of Simon Fraser University faculty, women from science and technology fields, community members involved in issues around women in science and technology, and representatives from Status of Women Canada, Industry Canada, and the Society of Canadian Women in Science and Technology (SCWIST). Members of CPROST assisted in the creation of WAGIS and also provided access to the ISRN project. As an advisory group the WAGIS committee members are not responsible for conducting research.

[2] Well-documented are the cultural influences and gender-role stereotyping in the education system. These are the dominant obstacles to young women choosing math and science studies and contribute to the barriers facing women in their pursuit of science-based professions (Frize, 1996). In addition, women are socialised from a young age to seek help rather than be self-reliant or function autonomously or competitively, as boys are (Etzkowitz et al., 1994). Women's participation in science-based professions has increased over the last 20 years, particularly in engineering. According to a study conducted by the Canadian Coalition of Women in Engineering, Science and Technology, women's involvement in engineering has increased by 80 percent. However, this study indicates women still account for only six percent of the total population of registered professional engineers (Frize, 1996).

The project "Examining Gender Bias in Studies of Innovation" was initiated by ISRN researcher Nicola Crowden with the intention of exploring gender equality in research methods. The mandate of WAGIS is to:

- carry out research on the effects of gender in interactive research environments;
- analyse existing social research instruments to determine if there are inherent gender-based biases in the methodology and structure of the tools which could lead to gender-biased results; and
- research the gender differences in the sources of and barriers to innovation in research and technological environments.

Using the ISRN project as a case study, Status of Women Canada suggested conducting a Gender-Based Analysis (GBA) on research tools used for studying innovation in the new economy. Status of Women Canada supports GBA as a guide for measuring the gender inclusiveness of cultural policies. Created in 1995, GBA is a useful methodological guide that assists in understanding the assumptions and social values that exist in the construction of knowledge about innovation. GBA was adopted as a policy requiring analysts to take "the nature of the relationships between men and women and the different social realities, life expectations and economic circumstances" into consideration (Status of Women Canada, 1998, p. 5). Since social context and economic issues cannot be separated from each other, effectively understanding the true dynamics of an economic system means all elements affecting and affected by that system, including gender, must be taken into account. It is, therefore, essential that the social conditions affecting women's position in society and the economy be considered throughout the eight steps of policy making. These steps, as suggested by the GBA guide, include: identifying the issue, defining the outcomes, defining inputs, research, developing options, recommending and seeking decisions, communication, and assessing quality. The purpose of using GBA in this ISRN project case study was to focus on the research step of policy

making by examining whether or not there is an inherent bias in the types of questions asked in interview guides used to measure innovation.[3]

GUIDING HYPOTHESIS – RESEARCH TOOLS AND GENDER

Based on the conventional division of labour between men and women in Canadian society and the socially prescribed characteristics that influence the way men and women behave in the workplace it is likely the structure of innovation processes privileges men. Is the under-representation of women in innovation processes reflected and reinforced by the methodology and instruments used in the ISRN project? Although literature discussing women's roles in science and technology acknowledges systemic barriers to their involvement in these fields, this same literature fails to consider the research tools used to represent women's perceptions and attitudes towards processes of technological innovation.

The structured nature of the professional engineering licensing process provides a wealth of data on systemic barriers to women's involvement in engineering.[4] Women comprise six percent of the total population of registered professional engineers and about 20 percent of the total bachelor-level engineering graduates. While the increase in women's participation in professional engineering is, in part, a result of policies aimed at encouraging their pursuit of science and engineering careers, there may be a ceiling effect and women's involvement in the professions is predicted to plateau at around 25 percent (Frize, 1996).

While establishing themselves in these professions many women face sexism and gender-biased work environments. Technologies are generally developed in systems based on male-

[3] The GBA proposed by Status of Women Canada is also referred to by academics as gender mainstreaming. "Gender mainstreaming involves not restricting efforts to promote equality to the implementation of specific measures to help women, but mobilising all general policies and measures specifically for the purposes of achieving equality by actively and openly taking into account at the planning stage their possible effects on the respective situation of men and women (gender perspectives). This means systematically examining measures and policies and taking into account such possible effects when defining and implementing them" (European Commission, http://europa.eu.int/comm/employment_social/equ_opp/gms_en.html#def).

[4] Engineering is not the only profession covered by this project. It was chosen as an example because professional engineers are licensed and self-regulated, and a great deal of information is available for statistical purposes.

defined work ethics and professional norms. For example, women in engineering have stated they leave the profession because the organizational structure is too rigid, there is a lack of flexible work options, and they experience harassment. When participating in the public sphere women often maintain their family responsibilities and try to balance them with the demands of work. It is argued family responsibilities prevent women from receiving job promotions (because the work hours are too demanding) and from networking with other professionals outside of the office, such as at trade shows and conventions (ibid). It is equally likely the high drop out rate of women from engineering positions results from unequal access to advancement and the difficulty of balancing work and family. Prescribed social roles affect women's involvement in innovation processes and must be taken into consideration by studies such as the ISRN project.

CHAPTER 2: LITERATURE REVIEW

This literature review will allow the reader to combine knowledge with critical thought when reviewing the research undertaken in this project. This chapter will cover national innovation systems (NIS) and regional innovation systems (RIS), fundamental economic theory, and feminist political economy.

SYSTEMS OF INNOVATION

Innovation is internationally recognised as a powerful source of competition that supports modern capitalistic economies. The term 'national systems of innovation' was first used by Christopher Freeman in 1987 (Hughs, 1999). While there is no single accepted definition of a NIS, two of the most commonly used definitions are:

- The interaction of innovative capabilities of firms with a set of institutions that determine the firm's capacity to innovate. The interrelationship of these institutions is also important, since they do not always work in the same direction and easily together, nor is the system purpose-built (Nelson and Rosenberg, 1993).
- "The elements and relationships, which interact in the production, diffusion and use of new and economically useful knowledge (...) and are either located or rooted inside the border of a nation state" (Lundvall, 1992). (Holbrook et al, 2003)

Hughs suggests that the systems of innovation approach is not a formal theory but rather a framework that allows for the application of supporting theories. Professional networks that support innovation often include research universities, industrial laboratories, infrastructure, private companies, and government agencies (Porter, 1988). Networks, or systems, of innovation, also known as clusters or agglomerations, are found at both regional and national levels.

> Holbrook and Wolfe (2000) have argued that, at least in the case of Canada, in order to understand the NIS [National Innovation Systems], one must first understand the RIS [Regional Innovation Systems]. Is the Canadian NIS the sum of a number of RIS, whether based on economic regions or provincial boundaries? In the Canadian context this summation is distorted by the wide variation in sizes of the regional systems – national level data (and the ensuing analyses) of the Canadian system of innovation are heavily biased by the

> economic activities occurring in the two major industrialized provinces, Ontario and Quebec. In most developed nations, innovation, science and technology policies are formulated by the central government, yet most innovation activities take place locally. Thus nation-wide innovation policies may not affect each region equally, and could conceivably be counterproductive in some instances. (Holbrook, 2003, p. 4)

The focus of networks at the regional level is beneficial for two reasons: recognition is given to the social processes of innovation that are influenced by geographical and cultural composition, and the study of regionally unique industries is recognised as being culturally influenced. It is essential to acknowledge and incorporate geographical diversity when determining what influences economic growth.

The system of innovation approach is shifting from a national perspective to a regional or local one. Recent literature is oriented, first, to questioning if there is really a NIS or the sum of RISs, and, secondly, how knowledge is created and how (interactive) learning, networking, and clustering occurs within a territory. When the analyses of NISs step "down" from the national level to a regional one, social issues emerge more clearly, and the importance of communication and interaction are highlighted. Researchers analysing the flows of knowledge, and how knowledge is created, have realised the importance of interaction among the different actors, and the mutual trust and geographic proximity needed to facilitate these relationships (Holbrook, 2003, p. 5).

Focusing on regional differences of innovation in a nation-based system such as Canada stems from the disciplinary perspectives of economic geography. In this regard, economic geographers enlighten conventional economic principles by integrating them with geographical themes. Regions are often defined in terms of shared normative interest (cultural areas), economic specificity (mono-production systems), and administrative homogeneity (governance areas). To these may be added other criteria, such as a non-specific size (except that of being part of a nation state), identifiable cultural or industrial mix, an ability to be distinguished from other regions in terms of these criteria, and possession of some combination of internal cohesion characteristics

(Cooke, 1998). Based on regional differences in countries with diverse political and economic structures, such as Canada, a "one size fits all regions" approach is less than adequate (Holbrook & Wolfe, 2000). It is for this reason that when determining region-specific trends and patterns that promote innovation, the cultural role of women within that region is also considered.

The acknowledgement by economic geographers that regional differences in economic practices exist is a relatively new phenomenon, and is similar to the argument that one must understand the complexity and diversity embodied in place before understanding human behaviour in that region. The acknowledgement of the heterogeneity that characterises place motivates the field of economic geography. Place refers to the localised context in which human social patterns and cultural practices occur, including the cultural perceptions that influence the analysis of place. In today's economy it is imperative that place not be separated from space – which is the global, more abstract connection that place has with macro influences. There have been two main traditions in geography within the last 50 years that have impacted the dominant perspectives used by geographers to assess and analyse the dynamics of place and space. As Susan Hanson notes (1999), the nature-society perspective and the space-society perspective have dominated the analytical frameworks adopted in geography. Contextualising the dominant themes of geography within these traditions exemplifies the post-modern philosophical awareness that is embedded within the discipline. The space-society dynamic perceives the location and connection of spatial relationships as a horizontal process whereas the nature site perspective focuses on the vertical. Merging these perspectives and incorporating various levels of analysis into their theoretical positions enlightens conventional knowledge creation by considering the impact of all social influences and power dynamics in its assessment of behaviour. This merging has also allowed for the possibility of explaining the spatial scale and allocation of economic activity (Clark, Feldman & Gertler, 2000).

The acknowledgment of heterogeneity and the regional diversity of place questioned the traditional dominant theme of the universal model that "to understand the world requires a 'single master key' rather than 'a loaded ring'" (Barnes, 1987). Thus, homo economicus found in literature on economic geography at times is an inappropriate assumption and cannot be applied to regions that embody different cultural perceptions towards women, as this understanding of women's role in a culture is critical to establish barriers to and sources of innovation. Universal models fail to recognise the particularity of the local context that the study of place represents (Barnes, 1987). As further supported by Florida (1995), economic change occurs through regional shifts and is deeply embedded in economic geography. In the new knowledge-based economy it is essential that the local context is studied to determine how knowledge is acquired, obtained, used and verified in the everyday practice of people living in a particular place (Barnes, 1997).

Background Theory – Schumpeter and Rogers

There are two dominant perspectives on how to assess the diffusion of innovations in business sectors over time. Based on Schumpeterian views, the neo-institutional economic perspective incorporates contemporary theory on the importance of innovation and its impact on economic environments. The social perspective represented by the work of Everett Rogers focuses on the importance of personal relationships in the adoption of innovations by business sectors and communities. Both of these perspectives, while inter-connected, are not explicit about the analysis of innovation in relation to gender differences.

The importance of innovation as a means of assessing future industrial trends is founded on Joseph Schumpeter's theory of economic development known as creative destruction. Schumpeter (1975) believes the fundamental impulse keeping the capitalist 'engine in motion' comes from new consumers, new methods of production, and organizations that capitalism (competition) creates. This theory revolves around the idea that technological innovation is not a

separate phenomenon, but is a crucial factor in explaining business cycles and the dynamics of economic growth generally (Freeman, 1988). To explain this theory, Schumpeter distinguishes between incremental and radical innovations.

Incremental innovations are continuous and do not disrupt the equilibrium of the economic environment of their particular time. Radical innovations, on the other hand, are discontinuous and often disrupt the economic environment when they are invented.[5] The distinction between radical and incremental innovations is important because they affect economic development in different ways. Each wave of change, now referred to as a Schumpeterian wave (Yin & Zuscovitch, 2000), begins with a radical innovation followed by incremental innovations, initiating a complex business cycle.

Competitive environments based on innovation are linked to dynamic industrial systems between sectors known as 'national systems of innovation' (Mytelka & Farinelli, 2000). Underlying the systems of innovation approach is "a characterisation of innovation as an interactive process and [a] reconceptualization of the firm as a learning organization embedded within a broader institutional context" (ibid, 2000, p. 7). The broader context includes actors such as government, academia, private sectors and the technology spilling over from other industries. Innovation within these systems affects all actors within the system.

Although Schumpeter discusses competition based on the innovation environment of a particular time, he does not mention the dynamics within firms that influence the decision-making processes related to radical and incremental innovations. According to Rogers, the social diffusion of an innovation is almost more important. Rogers defines diffusion as the process by which "(1)

[5] As stated by Freeman and Perez (1988, p. 45), incremental innovations are found "more or less continuously in any industry or service activity although at differing rates in certain industries and different countries, depending upon a combination of demand pressures, socio-cultural factors." They are also "technologically the result of any deliberate research and development activity, but as the outcome of inventions and improvements suggested by engineers and others directly engaged in the production process, or as a result of initiatives and proposals by the user." By contrast radical innovations are "discontinuous events of recent times that are usually the result of a deliberate research and development activity in enterprises and/or in university and government laboratories."

an innovation (2) is communicated through certain channels (3) over time (4) among the members of a social system" (Rogers & Scott, 1997, p. 5). Many parts of this definition involve possible gender differences, although Rogers never directly addresses these differences.

Several aspects of the innovation itself affect the adoption rate. First, an individual weighs the *relative advantages* of the innovation. The weight assigned to the relative advantages is likely affected by gender given the differing social experiences of men and women. Second, the innovation's perceived *compatibility* with existing values, past experiences, and the needs of potential adopters varies between men and women since they perceive the values and norms of their social system differently. As Maier states, "masculine and feminine ways of attending, being and relating may function as metaphors for quite different – basically gendered – ways of understanding and acting upon the world" (1999, p. 75). Third, the perceived *complexity* or the degree to which an innovation is difficult to understand and use comes into play. Fourth, the degree to which an innovation can be experimented with on a limited basis (the *trialability* of the innovation) leads to different gender-based interpretations of its benefits. Finally, the obviousness or *observability* of the innovation's results is a factor.

The communication associated with this process is problematic since the gendered nature of many workplaces excludes or under-represents women's perspectives from many of the social circles and opportunities for discussing the innovation's benefits and related business decisions. The 'old boys' network' exemplifies this type of social exclusion and prevents women from contributing to the types of innovations that are created and adopted. How an individual communicates is inevitably influenced by their gender because perceptions of 'risk' associated with expression are weighed in a social context. 'Risk' is a socially constructed category and all individuals accept varying levels of risk in their daily lives, including the risks taken when expressing an opinion in the workplace. Faulkner states "decisions about risk inevitably involve judgments about the acceptability of certain risks, and rest upon subjective and mutable value

judgements" (1998, p. 7). Communicating in a male-dominated environment may increase the perceived social risks for women, leading to a reluctance to contribute ideas and to less participation in the innovation process. As Maier states:

> In a society that differentiates sharply between males and females from birth and that accords greater status and worth to males, the dominant understanding of selfhood and society – and their consequences for one's relationship to others; for one's leadership, organisation, and power; and one's view of social relations, basis for reasoning, key influence strategies, ethical frameworks, decision guides, and so forth – tend to differ along gendered lines. (1999, p. 74)

Maier also discusses the different principles that shape male and female conceptions of the moral fairness of their decisions.

The element of the diffusion process that appears most relevant in terms of gender differences is the social system in which the innovation is adopted, including behavioural patterns and the ability of individuals to influence the attitudes of others regarding the innovation and related decisions. There are many reasons and explanations for women's exclusion from the social systems and communication structures that affect their roles in incremental and radical innovations. For instance, women's credibility is often undermined by their perceived social characteristics in the workplace. If a woman adamantly supports adopting an innovation she may be deemed 'bitchy' and treated as a threat to her colleagues. This perception was expressed in the focus groups conducted for this research project (discussed in Chapter 4). Three women described themselves as being 'bitchy' (or expressing non-ideal attributes) during a conversation about expressing ideas in the workplace. The roles of women and men in the social adoption of innovation affect the types of innovation they are involved in, be they incremental or radical.

WHY GENDER MATTERS

Neither Schumpeter nor Rogers discuss gender as a variable in their theoretical explanations of economic activity. As stated earlier, Schumpeter identifies transformative forces called 'gales of creative destruction,' which "increasingly revolutionize the economic structure from within,

incessantly destroying the old one, incessantly creating a new one" (Florida, 1996, p. 315). There is a gender-based element to this transformation. Men may be more likely to radically innovate because of their social characteristics, so business cycles initiated by radical innovations can be deemed male-based. "Technology involves organisation, procedures, symbols, new words, equations, and, most of all, a mindset" (Franklin, 1990, p. 3). We can infer from Franklin's statement that technology is not objective, but a product of socially constructed practices that are rooted in patriarchal systems.

The fundamental ideals of objectivity at the heart of many studies of technology are based in contradictory capitalistic and systematically unjust worlds. For example, positivism is based on ontological and epistemological methods that are used to form the basis of science. Positivists base their research on what they can measure and observe. The individual who initiates the research initiatives in science-based disciplines are often men. As discussed earlier, women have traditionally been excluded from these professions. As Pursell states (2001) the masculine processes of creating science and technology are socially constructed and serve to culturally marginalise individuals based on race and class. As Kirkup and Keller point out, this is problematic, because:

> Whether a particular technology is done primarily by men or women almost always depends upon where the technology fits into pre-existing cultural notions of what is appropriate to each gender. Women can be and are excluded from certain technologies for a variety of reasons and rationalizations: they are thought to 'lack' such characteristics as bodily strength or intellectual capacity; certain activities are seen as threatening a woman's 'natural' role; women have less access to education, tend to be less experienced and less assertive to gain experience and training; education and training may be unfriendly. (1992)

Schumpeter recognises economic direction is based on pre-existing knowledge, which is socially constructed by contemporary values.

Researchers adopting a social construction of knowledge perspective argue that the power structures of society reinforce the position of the already advantaged (Foucault, 1984). As stated by Atkinson-Grosjean:

> They argue scientific research can and should be driven by social and political agendas. Specifically, they contend that conventional scientific research is partial and distorted since it is exclusionary, and that the objectivity so highly valued in science is a flawed and damaging concept. Harding proposes that starting scientific research from women's lives, or from the lives of the systemically oppressed, exploited or dominated' would actually increase the objectivity of scientific results – by bringing into the picture previously unquestioned assumptions and practices inherent in the '...white, masculinist, modern, heterosexual, western dominance of science.' (1996, p. 6)

Modern technology is a product of that knowledge and can be seen as an agent of power:

> Looking at technology as practice, indeed as formalized practice, has some quite interesting consequences. One is that it links technology directly to culture, because culture, after all, is a set of accepted practices and values. Well laid down and agreed upon practices also defines the practitioners as a group of people who have something in common because of the way they are doing things... The historical process of defining a group by their agreed practice and by their tools is a powerful one. It not only reinforces geographic or ethnic distributions, it also affects the gendering of their work. When certain technologies or tools are predominantly used by men, then maleness becomes part of the definition of those technologies. It is for these deep-rooted reasons it is so difficult for women to enter what are now called 'non-traditional' jobs. (Franklin, 1990, p. 6)

Socially constructed knowledge privileges the 'natural' plight of men and serves as a disadvantage to women.[6] If men continue to dominate radical technological innovations then the structure of society that directly or indirectly privileges men and excludes women will continue. This is not surprising since many theorists argue the social construction of expertise and the importance of innovation are entirely masculanized and dominate the majority of economic, social and scientific disciplines. As McDowell writes:

> Long termed the dismal science by its detractors, economics is arguably the most masculine of the social sciences, distinguished by an insistence on scientific rationality and objectivity in certain guises or its grand claims to truth in order. It has stoutly resisted, at least until the recent past, all challenges to positivistic and empiricist claims even though the work of the more abstruse modellers is based on versions of the world that by their abstraction and elegance are ideal illustrations of the discursive construction of reality. (2000, p. 499)

[6] This is supported by McDowell, who writes (2000, p. 499): "Although, as social scientists in several disciplines have demonstrated, the cultural attributes, activities, skills, and behaviours that are perceived to be feminine vary over time and space, typically they are defined in relation to and as inferior to those attributes, activities, skills and behaviors that are coded as masculine."

Faulkner notes (1998) that perceived expertise and accredited knowledge result from an individual's professional status based on years of specialized training, which leads to respect for the individual's judgement and authority. Gender inevitably influences the perception of an individual's expertise. For example, training and professional skills shape an individual's level of expertise, but regulation into certain practices excludes women (McNeil, 1998). Since "knowledge and expertise are at the heart of innovation studies" (Faulkner, 1998, p. 19), gender matters in analyses of innovation clusters in the new knowledge-based economy. Janet Atkinson Grosjean (2001) notes that in the case of Canada's Networks of Centres of Excellence (NCE), women were largely excluded from the process of policy innovation that led to the creation of the NCE she studied. The policy innovation behind the NCE was bringing together ideological concerns for commercial relevance and research excellence with the concept of distributed research networks, yet women were excluded from this policy development. The exclusion of women and limiting the selection of scientists to the 'few elite' restricted the variety of expertise that "feeds more risky innovation-led research" (Atkinson-Grosjean, 2001, p. 127). The male-biased nature of the NCE and the exclusion of diverse expertise resulted in the reinforcement of masculanized science. Atkinson-Grosjean notes that of the 21 total researchers that headed the NCE she studied, only five were women, which is unrepresentative of the 50 percent of doctorates in biology awarded to women.[7]

An abundance of literature exists on the possible effects of ignoring the different roles adopted by men and women in the innovation process of technology-based firms (Wajcam, 1998, 1991; Lie, 1995; Pursell, 2001; Mack, 2001). In Monique Frize's article "Managing Diversity"

[7] Later analysis of the Canadian Research Chair (CRC) program shows under-representation of women (www.chairs.gc.ca). A group of eight Canadian women professors in spring 2003 launched a human rights complaint with the Canadian Human Rights Commission over discrimination within the CRC program. The allegation is Industry Canada contravened the Canadian government's commitments to non-discrimination made in the Canadian Human Rights Act, as well as its 1995 commitment to gender-based analysis, in setting up the CRC program. According to recent statistics, only 16 percent of the 926 Chairs awarded between December 2000 and June 2003 went to women (SCWIST, 2003). Furthermore, 28 out of the 61 universities receiving CRCs to date have appointed no women (ibid.).

(1998), she details how the masculine nature of science-based professions deters women from related careers. Frize argues that because of existing social relations, the priorities of managers in the industry decisively shape technology. The low level of women's participation in scientific management positions means technology is characterised by masculinity and shaped by masculine interests.[8] Of major concern is the possibility that women are seen simply as the passive recipients of technology rather than active participants in its development. Clearly, insufficient attention is given to women's increased involvement in developing innovations; the incorporation of their perspectives might bring about a more people-centred approach to technology policy and practice (Carr, 1997).

Focusing on women's roles in Canadian innovation is crucial to fostering economic growth, as demonstrated by the work of Doreen Massey. An economic geographer, Massey observed the importance of including gender roles when analysing geographic elements that promote region-specific innovation. Using Cambridge, England, science parks as a case study, Massey analysed links between the geography of high tech firms, their structure and locational strategies, dominant cultural values about science, and how they relate to cultural employment and recruitment in terms of women. Massey connects the lack of women in Cambridge science parks to the region's dominant religion and she argues that both "monasteries and high-tech workplaces are 'masculine' spaces not in the sense that it is mainly men who work here, but in the sense that their construction of spaces embodies the elite, separated, masculine concept of reason dominant in the west" (McDowell, 2000, p. 7). Massey's interest in the histories behind the constitution of these spaces as elite, exclusive and masculine, leads to a story about locational strategies that is different from more typical economic geographers (ibid). Thus, it is essential the ISRN project consider the cultural values of place and space that inevitably influence the roles

[8] As one female graduate student said in a study conducted by Etzkowitz (1994, p. 3), "My science is different because of my socialization, not my gender."

women have in innovation in Canada's new economy. Economic surveys measuring innovation that do not consider gender as a variable are possibly hindering the direction of economic growth in Canada.

The importance of determining gender differences in terms of innovation in science and technological fields is apparent when viewing a recent initiative supported by the European Commission. In an attempt to unify gender indicators across European countries, the European Commission developed The Helsinki Group in March 2000. Currently, countries involved with the European Commission do not have consistent data collecting techniques when measuring women's involvement in science and technology. The Helsinki Group's research initiative focuses on the nomination of statistical correspondence for each participating country as a way of managing the reporting and methodological consistency of data and metadata concerning gender indicators. One of the three projects created by The Helsinki Group is the development of "Patent Indicators by Gender and of Bibliometric Indicators by Gender" (Cordis, 2003). The aim of this project is to create new gender indicators related to the inventors of technology in order to explore gender differences between countries, technological fields, and sectors over time. The Helsinki Group's involvement with gender indicators, in terms of understanding and tracking the differences between male and female inventors, exemplifies the importance of understanding in order to reinforce women's participation in shaping the future direction of science.

Gender Bias in Innovation Studies

As the current literature indicates, there are many possible sources of gender bias in studies measuring innovation, from theoretical foundations to the actual survey tools. Current studies of technological innovation rely heavily on responses from men and seem to ignore the systemic barriers to women's inclusion in the target survey populations. Innovation studies do not generally take into account or explicitly seek out the views of women about innovation processes

or their roles in innovation, and they do not consider the possibility that women's and men's contributions to innovation may differ. Even the OSLO Manual's exclusion of creative, more 'incremental' or process related innovations, such as cosmetic changes to a product, indicates a gender bias in the methodology of innovation surveys, since women are more likely to participate in supportive and creative roles.[9]

Given the importance of innovation studies to policy making, in Canada and beyond, examining the potential gender bias of tools used for studying innovation is of immense importance. Using the ISRN interview guide as a case study, this research project endeavours to answer the question: "Is there an inherent bias in the types of questions asked in interview guides used in innovation studies?" Or, as later restated, "Do innovation-type surveys serve to exclude certain forms of innovation practices by using a limited target population?"

[9] This conclusion was derived from the focus groups conducted as part of this project. Since the subjects were not drawn randomly they cannot provide statistically generalizable information.

CHAPTER 3: RESEARCH METHODS

The proposal to Status of Women Canada reviewed by WAGIS featured focus groups with professional women in science and technology to test the question: "Is there an inherent bias in the types of questions asked in interview guides used in innovation studies?" The rationale for the selection of the focus group methodology was to allow women to discuss the ISRN questionnaire in a confidential and supportive environment, which would encourage them to speak openly about their opinions and concerns without fear of social repercussions (Appendix B). As Killingsworth (2000) notes, group discussions and subsequent brainstorming should result in innovative ideas surfacing from non-traditional sources. It was determined focus groups would support more free-flowing conversation and ideas from the participants, providing observational data for an analysis of the participants' interpersonal dynamics. As Berg states, using focus groups "researchers strive to learn through discussion about conscious, semiconscious, and unconscious psychological and socio-cultural characteristics and processes among various groups" (1995, p. 68).

This study, which received approval from the Simon Fraser University Ethics Committee (Appendix C), proposed two types of focus groups. The first type would consist of women already eligible to participate in the ISRN survey[10] – women working in executive or management positions within relevant industrial sectors who have decision-making roles within their firms. This group would provide insight into the perspectives of women in similar positions regarding innovation and perceptions of the existing ISRN questionnaire. The second type would consist of 'change agents' not usually be sampled by the ISRN project – women who understand the

[10] Based on the economic and business nature of the questions used in the ISRN interview guide, the individual responding to the survey must be knowledgeable about all business aspects of the company they represent. The knowledge an individual needs in order to complete the ISRN questionnaire (and other like surveys) resulted in the customary practice of interviewing those in top level positions. It is important to note that although women will be participating in the ISRN project, the responses from women in top level positions will be under-represented when the data is collected and analyzed. In total, the final ISRN project data will include roughly 2000 interviews and it is estimated women will represent about 20 percent of that number, making the determination of whether the ISRN survey questions exhibit gender bias important.

concept of innovation but do not necessarily work in science and technology fields.

To provide this research initiative with credibility among others sensitive to gender issues, there was a heightened priority on attracting women from outside the conventional hierarchy of recognised professionals. The intention was to acknowledge the value of insights from women not at the (admittedly narrow) top level of the hierarchy. These change agents would accommodate the feminist liberal perspective that stresses the importance of addressing minority women's voices in analyses of gender inclusiveness of policy making.

SAMPLING METHOD AND PARTICIPANT RECRUITING

The target population for the focus group samples consisted of:

- professional women recognised in top level positions in science and technology fields in the Vancouver area,
- women who are change agents (as described above),
- women employed by both large and small high tech firms in Vancouver, B.C.,
- women employed in their sector for 10 years or less,
- women employed in their sector for more than 10 years.

Women from three high tech sectors situated in the lower mainland (biotech, multimedia, and wireless) were targeted. These sectors were chosen for their existing involvement in the ISRN project and for their regional accessibility.

A snowball sampling technique was adopted for recruiting focus group participants.[11] Several organizations and people involved with this project – including the National Research Council, Status of Women Canada, Industry Canada, SCWIST, and professors from Simon Fraser University – provided personalised contact information for eligible focus group participants. From these contacts, 64 personalised e-mails were sent informing potential participants of the WAGIS project and asking for their participation in a focus group. These e-mails contained

[11] Since the subjects were not drawn randomly they cannot provide statistically generalizable information.

electronic letters with a description of the project and objectives with a briefing note attached (Appendix D). If the potential participant showed interest in the project, they were sent another e-mail asking for their job title and number of years employed in their sector (since the focus groups were originally organized by these demographics), requesting their participation in a focus group, and informing them of the meeting time (7:30 a.m. during the business week). These personalised e-mails resulted in eight women recruits (8/64 for a 12.5% response rate).

A briefing note explaining the WAGIS research project and requesting participation was also distributed electronically through various list serves. The majority of organizations that distributed the briefing note (a total of three) were approached as a result of their mandates, which are oriented toward supporting women in science and technology in Vancouver. The Applied Science Technologists and Technicians of British Columbia (ASTTBC) group was chosen in an attempt to access change agents involved at the technical level.

Several other organizations[12] with mandates focused on supporting women in science and technology were approached about distributing the WAGIS briefing note through their list serves, but they did not respond. Perhaps the WAGIS mandate did not correspond with their current provision in their initiatives.

TABLE 1: List Serve Distribution and Results

Organization	Distribution Date	List Serve Distribution	Responses of Interest	Results From Follow-up
ASTTBC	May 14, 2002	193 women	6	• 3 unable to participate (geographically limited); 2 offered to assist in other ways • 1 recruited (did not show) • 2 did not respond to second follow- up e-mail
SCWIST	May 15, 2002	250 women (approx.)	4	• 1 participant recruited • 2 did not respond to follow-up • 1 did not qualify (student)
Wired Women	May 16, 2002		1	• 1 did not respond to follow-up
Women's Enterprise Society of B.C.	Posted on Web site		No responses	

[12] Organizations asked to distribute the WAGIS briefing note via their list serve that did not respond to the request were: the Vancouver branch of Women's Entrepreneurs of Canada, Digital Eve, Canadian Women in Communications, and the Women's Information Centre at the Vancouver YMCA.

There was a low response rate to the follow-up e-mail for list serve briefing notes and for initial personalised e-mails. It appears as though distributing the WAGIS briefing note electronically through list serves was ineffective. A more personal approach to recruiting focus group participants is superior.

The briefing note was also distributed at several professional networking events with limited results.

TABLE 2: Networking Event Distribution and Results

Organization	Conference Details	Conference Date	# of Women in Attendance	Responses of Interest/ Results From Follow-up
ASTTBC	Annual general meeting	May 3, 2002	0	
B.C. Technology Industries Association	'Work and life balance' theme; directed towards women only	June 15, 2002	35 – 40	• 1 participant recruited • 1 expressed interest but did not respond to follow-up e-mail
B.C. Ventures	Venture Capital forum	June 16, 2002	5	• 4 expressed interest but did not respond to follow-up e-mail • 1 participant recruited

In the end, 14 women participated in the focus groups.

CHALLENGES IN RECRUITING PARTICIPANTS

Two possible factors contributing to the low recruitment rate for the focus groups are the lack of women in high tech professions in the Vancouver area and the reluctance of women to participate in focus groups.

Women are a minority in Vancouver's high tech professions as evidenced by the lack of women at networking events. This under-representation created difficulties when attempting to recruit the 35-40 participants for the original focus group design. The requirement that participants be in senior management or decision-making roles further limited the pool of potential recruits. For instance, many women who responded to the list serve distributions and personalised e-mails did not meet the job description requirement.

The number of women who received e-mails and briefing notes more than once is also indicative of the small community of women in high tech professions. Due to the use of a snowball sampling technique, women often referred others who were among the original group used for referrals. Many of these women are members of the same networking groups, such as SCWIST, Digital Eve and Wired Women, which may explain the multiple referrals.

The focus groups also became an opportunity for many of the participants to network and 'catch up' with each other. Several women knew each other prior to the focus group discussions, which reinforces the idea that there is a small group of women in high tech professions in the Vancouver area.

Also contributing to the low recruitment rate was the reluctance of women in high tech professions to participate in research projects. Many women had already scheduled vacations, and when informed of the 7:30 a.m. start time the majority of women moaned and said they would have to think about it. Asking women to schedule extra activities in their already busy lives was presumptuous and the impact of the work-life balance on working mothers was not fully appreciated during the recruiting process (for instance, arrangements for child care were not offered as a way of facilitating women's participation).

TELEPHONE INTERVIEWS

Overall, there was a low response rate for the follow-up e-mail for list serve briefing notes and for initial personalised e-mails (Appendix E). It appears as though distributing the WAGIS briefing note electronically through list serves was ineffective. A more personal approach to recruiting focus group participants is superior.

The large number of non-responses in the focus group recruiting process led to a second phase of research probing the non-respondents' perceptions of organizational dynamics within high tech companies (Appendix F). This research, which received approval from the Simon

Fraser University Ethics Committee (Appendix G), also addresses possible criticisms about a selective sample bias. Since the focus groups contained mostly public sector employees and consultants, who have more flexibility to take time off, the second phase of research concentrated on the private sector.

The second phase of research involved the distribution of personalised letters inviting the previous non-respondents and a group of key informants[13] to participate in a 10-15 minute interview via phone or in person (Appendix H). Contact phone calls followed the letters to ensure they were received and to book interviews. Due to time restrictions, the phone calls were made within a one-week period from May 20-23, 2003. Of the 42 people on the distribution list, four were unavailable because of re-elections, six were too busy for interviews, and 23 were unreachable by telephone.

Eight people from the private sector – one consultant and seven managers from large companies – participated in interviews. Five of the interviewees were non-respondents from the first phase of research and three were key informants. Three venture capitalists were interviewed because of their importance as stakeholders in the innovation process, particularly in the area of policies and practices. Several points on the importance of financial capital to the innovation process emerged in the original focus groups (see Chapter 4). *BC Business* magazine (Willcocks, 2003) confirmed this in an article discussing the necessity of financial capital for 21st century innovations. The level of authority possessed by the venture capitalists during the focus group discussions, and the discussion of money's role in high tech innovations also pointed to the importance of financial capital. Venture capitalists receive a great deal of respect in high tech industries as they assess innovations and determine which companies receive funding. As such their participation in the second phase of research was crucial.

TABLE 3: Profile of Telephone Interviewees

Participant	Details	Sector	Type of Employer	Years of Experience
I-1	female, venture capitalist	Biotech	private	10
I-2	female, venture capitalist	Biotech	government	10
I-3	male, venture capitalist	Multimedia	private	15 (5 in venture capital)
I-4	Female	Multimedia	private	15
I-5	Female	Biotech	private	10
I-6	Female	Biotech	private	10
I-7	Female	Biotech	consultant	15
I-8	Female	Biotech	private	5

The interviews generally ran for 20 or 30 minutes and the interviewees seemed excited to participate. A standard questionnaire (Appendix I) based on themes emerging from the focus groups in the first phase of research guided the interviews, but tangents and follow-up questions were often pursued. Although the interviews were conducted by phone, tape recordings were not made. Answers were recorded by shorthand, so no direct quotes appear in this report.

Focus Group Design

The original focus group design envisioned five group discussions with between six and nine women in each group. One group discussion consisting of change agents would be conducted first in order to provide insight into what form of discussion to pursue in the other focus groups. The remaining four focus groups would consist of professional women working in science and technology who would already be eligible to participate in the ISRN project.

Two variables would affect the placement of participants in the focus groups: length of time employed in the sector and the size of the employing firm. Organizing the focus groups in this way would allow for some qualitative analysis of the attitudes and opinions of participants based on these two variables. For comparison purposes the focus groups were to be organized as follows:

1. Change agents
2. Women representing small firms, employed for 10 years or less
3. Women representing small firms, employed for more than 10 years

[13] Forty-two people received letters and phone calls in the second phase of research. This included 30 women from the list of 64 non-respondents in the first phase of research and 12 people (10 women and two men) considered 'key informants' based on their status and expertise in the areas of research. The response rate was 12.5 percent.

4. Women representing large firms, employed for 10 years or less
5. Women representing large firms, employed for more than 10 years

Three themes shaped the design of questions used to guide the focus group discussions (Appendix J). The first theme, a general contextual one, assessed how women perceive their roles in relation to innovation and how they believe they influence innovation. These questions were essential in determining whether the conventional levels of analysis adopted by the ISRN project include all elements that influence innovation, specifically gender differences. The contextual questions also served to determine women's positions within their employing firms, allowing for analysis based on their attitudes and job titles.

The second theme, based on participants' career experiences and challenges in their roles in innovation, assessed the structural inequalities that influence the positions adopted by women in the workplace and whether they perceive their access to innovation differently as a result. Again, the responses to these questions could provide insight into whether men and women answer the ISRN survey questions differently.

The third theme stemmed directly from the ISRN questionnaire. Participants were sent a copy of the ISRN interview guide and the WAGIS research briefing note, asked to read the interview guide questions and then identify questions they thought could be answered differently based on the gender of the person being interviewed. Discussion of these differences would provide insight into the gender inclusiveness of the ISRN questionnaire.

A before-and-after design guided the focus group discussion. This design involves the measurement of 'outcome' indicators (e.g. attitudes) prior to the implementation of the treatment (in this case the discussion of the ISRN questionnaire), and subsequent re-measurement after implementation. Any change in the measurement is attributed to the treatment. This design provides a significant improvement over the one-shot study because it measures change in the factor to be impacted (Weightman, Barker & Lancaster, 2001). Inverting the discussion themes

would allow for comparison of attitudes and reactions from participants with similar professional backgrounds when asked the questions in different orders. Discussion initiated with contextual themes is referred to as the 'general to specific' design. Discussion initiated with questions relating to the ISRN questionnaire is referred to as the 'specific to general' design.

Difficulty in recruiting a sufficient number of focus group participants led to the cancellation of the change agents focus group. With a total of 14 participants, two focus groups were conducted using the 'general to specific' order of questions. The focus group discussions were held at Harbour Centre in downtown Vancouver between 7:30 and 9:00 a.m. on two consecutive Wednesdays in July 2002. This time was chosen for the convenience of the participants in an attempt to conduct the discussions "without impinging on the business day, or home life, as would be the case if they were conducted in the evening" (Hughs, 1999, p. 68). Breakfast, juice, coffee and pastries were provided.

Focus Group Procedures

A researcher greeted participants as they arrived at the focus group venue. Participants were asked to sit in the location of the folder with their name printed on it. The locations were not strategically planned. The folders included:

- a $20 honorarium (to cover the cost of parking and any other inconveniences experienced as a result of attending the discussion),
- a letter of consent approved by the Simon Fraser University Ethics Committee, to be read and signed by the participant for the purpose of research ethics (Appendix K),
- the company questionnaire used in the ISRN project (Appendix L),
- the definition of technological innovation used in the OSLO Manual (Appendix M), and
- an agenda for the focus group discussion (Appendix J).

After being seated, participants were introduced to the lead researcher and two assisting researchers. Participants were then informed of the nature of the focus group and details

surrounding ethics and confidentiality. Following this debrief they were asked to sign the consent forms and the discussion commenced as outlined in the agenda.

TAPE RECORDING AND CONFIDENTIALITY

Audio recordings were made to ensure accuracy when reviewing focus group discussions and specific dialogue. Two research assistants from CPROST attended the focus groups to monitor the tape recorder and observe the behavioural dynamics of the participants.

The consent forms signed by the participants outlined the objectives of the research and guarantees of anonymity. To safeguard anonymity, the audio recordings were transcribed using numbered coding known only by the lead researcher. The names of the participants will never be revealed, nor will any description of their character that may identify them.

GROUNDED THEORY APPROACH FOR TRANSCRIPT ANALYSIS

The Grounded Theory Approach was adopted for coding the focus group transcripts. The Grounded Theory Approach supports the analysis of qualitative research and helps minimize interpreter bias. In order to reduce the wealth of data derived from the focus groups, the 'open coding' technique was used for coding participant responses for the GBA.

Using the open coding technique involved examining the transcripts for key themes and concepts for categorisation. These categories were divided into subcategories, called properties, which represent multiple perspectives about the categories. The focus group themes determined by the pre-arranged order of the discussion guide used for facilitating the participants' dialogue.

Following the open coding process, the 'axial coding' relationship between the categories was determined. Axial coding allows for examination of a 'central phenomenon' that is present throughout the categories. For example, in the case of the WAGIS project, an emphasis on the social relations involved in innovation was found throughout the categories. The participants initiated the focus group discussions by emphasizing the importance of interdisciplinary

approaches to innovation. This theme arose in the 'challenges to innovation' category with participants acknowledging social factors as barriers to providing input into innovation. This theme re-emerged in discussion of how the OSLO Manual and the ISRN project fail to consider human resources and processes to innovation as indicators worth measuring. Using axial coding enabled the creation of graphs organizing the thematic responses of the participants and providing visual comparisons based on their demographics (Appendix N). Due to the number of participants there were only two analytical categories with room for critical comparison: years of experience in the profession and the nature of employment (private firm, government or self-employment).

Adopting the Grounded Theory Approach for analysing the focus group material resulted in a change in hypothesis. Based on the data, the original research question – "Is there an inherent gender bias is surveys used to study innovation?" – changed to: "Do innovation type surveys serve to exclude certain forms of innovative practices by using a limited target population?"

GROUP PROFILES AND DYNAMICS

With the exception of a few unique group characteristics, the two focus groups had similar compositions in terms of the participants' demographics.

TABLE 4: Focus Group Profiles

Participant	Sector	Type of Employer	Years of Experience
Focus Group 1			
F1-A	Multimedia	consultant	3
F1-B	biotech (venture capital)	consultant	6
F1-C	biotech (lawyer)	private	18
F1-D	Biotech	consultant	3.5
F1-E	biotech (research scientist)	private sector	4
F1-F	biotech (policy analyst)	government	12
F1-G	multimedia (policy analyst)	government	11
F1-H	Biotech	government	5
Focus Group 2			
F2-A	Multimedia	consultant	14
F2-B	multimedia/finance	venture capitalist	11
F2-C	biotech (policy analyst)	government	15
F2-D	Multimedia	private sector	7
F2-E	biotech (grant facilitator)	government/university	4
F2-F	Biotech	government	5

Although the two focus groups had several demographic similarities, their interpersonal dynamics differed.

Women in the first focus group responded to almost all the questions in a very structured manner. Several of the women were acquainted prior to the group discussion and the atmosphere was relaxed. There appeared to be a supportive attitude among the group when women talked. The presence of younger consultants in this group, who have a greater tendency to facilitate discussions as it is the nature of their job, could account for the relaxed atmosphere and structured approach. One could also hypothesize that women from the biotech sector, which focuses both directly and indirectly on helping people, are less competitive. Evidence of this was found in the introductory comments of two participants who referred to their transitions from academia to industry as switching to the 'dark side.' Perceiving industry as the dark side suggests an ironic detachment from the competitive nature of those employed in corporate workplaces.

A statement by one of the participants (F1-D) about owning her own company may have also influenced the dynamics of the first focus group. This may have been an attempt by F1-D to claim status in the room as the previous introductions were from women in positions on top of the conventional hierarchies in their firms. Interestingly, soon after this participant stated she owns her own company another participant (F1-A) made the same statement out of context. This dynamic possibly reflects attempts by the women to determine their status in the room relative to the other participants' corporate status.

The interpersonal dynamics of the second focus group were noticeably different. Discussions were generally unstructured with heated debates occurring very early on and participants generally appearing less supportive of each other. This atmosphere could reflect the multimedia sector, which is very competitive due to its 'fast paced' business nature. Multimedia firms work around milestones, which the group identified as four-month product cycles, and they continuously compete with each other to ensure 'first to market' positions. There were fewer

consultants and more women employed by private companies and government agencies compared to the first focus group, which could also account for the difference in dynamics.

Interestingly, the women who appeared to be recognised as having more authority in both focus groups had been employed in the multimedia sector for more than 10 years and were involved in providing finance to 'start up' firms. It appeared as though their 'alpha' attitudes and their positions of power within the science and technology community were maintained in the focus groups. That is, the hierarchy of corporate culture remained consistent and the participants acted based on their visions of themselves and their cultural status.

CHAPTER 4: FOCUS GROUP AND TELEPHONE INTERVIEW FINDINGS

Analysis of the focus group transcripts resulted in the identification and grouping of responses around several main themes. These themes were generally supported by the one-on-one interviews that were conducted in the second phase of research.

CONTEXTUAL QUESTIONS: VIEWS OF THE INNOVATION PROCESS

The purpose of this series of questions was to get an accurate picture of how the women in the focus groups perceived innovation. These questions were essential in determining whether conventional levels of analysis adopted by the ISRN project include all the fundamental elements of innovation.

Context – Question 1: "What type of innovation are you involved with?"

Three categories of responses emerged: helping or supporting companies, designing, and studying innovation. To initiate discussion the focus group facilitator gave a brief description of innovation, which stressed the importance of brainstorming and collaboration in the creative process. Responses to this question were structured in both focus groups with each woman answering in relation to the seating order.

The language most women (nine in total) used in describing their roles in innovation was based on themes of helping companies innovate or supporting companies' innovation by providing services. The participants who responded with this language were more often consultants and government employees who provide consulting-like services to clients in their sector. In both focus groups the first women contributing to the discussion were consultants.

> "My job is to help people who are designing new industrial technologies to integrate them into consumer projects and industrial products ... I think my role is really in integrating it [innovation] into everyday things." (F1-A)

> "Our mandate is to support small to medium companies with technological innovation, so that is what we do every day." (F1-G)

> "In terms of innovation, I help other people innovate ... Innovation can be in terms of a business model or, for a big company, how they manage their operations and strategic planning." (F2-A)

These responses may have influenced the responses of other participants. For instance, one woman employed in a management-level position in the private sector (F2-D) stated early on: "My job does not entail a lot of innovation." However, she later said she directly influences innovation and supports creative thinking – "When we pitch a game contract we want to win that contract, so you have to think of creative, innovative ways to do that." She also stated, "Oh, I definitely think I'm promoting innovation, except I'm one woman." It is likely the other women, who acknowledged their roles in innovation and used the term in a broader context, influenced this woman's identification with the term. Perhaps she was initially unfamiliar with mainstream definitions of innovation due to her position within a private firm. Today the term innovation is used repeatedly by government agencies and is applied to almost every aspect of business. As such, it is essential those employed in government be aware of the terminology. Similarly, consultants are more likely to depend on financing based on supporting this new business term.

Context – Question 2: "How do you influence innovation?"

Three participants, all government employees (F1-H, F2-C, F2-F), did not participate in this discussion. Among the other participants, six categories of responses emerged, including:

- Encouraging interdisciplinary approaches, supporting collaboration, encouraging brainstorming/conceptualizing/thinking,
- Encouraging networking and broadening approaches,
- Creating hierarchical pressure,
- Creating non-hierarchical structure,
- Manipulating or soft-shelling ideas,
- Information sharing.

Ten of the 14 participants stated they influence innovation by adopting interdisciplinary approaches, supporting collaboration and brainstorming. Six of these responses were from the

first focus group and, again, may have resulted from a consultant initiating the discussion. Versatility and awareness of multiple approaches is the nature of the consulting profession in technology-based sectors. For consultants, thinking outside the box is essential.

> "I have a commitment to interdisciplinary work and that's how I try to stress innovation. I like to bring in all the people involved and try to create a common vision for what this technology has to do with both the user and the company." (F1-A)

> "Making sure people aren't discouraged in putting forward their views, so they're not afraid to do so, and just keeping the lines of communication really open." (F1-B)

> "To try and bring other experts in the field to try and broaden their [clients'] view on how they might approach a problem. Let's break out of the box and try to think of other ways we can approach this problem." (F1-G)

A heated and unstructured debate broke out in the second group on the topic of hierarchies. One participant, a grant facilitator with fewer years of experience (F2-E), began the discussion by stating: "Innovative ideas come from non-hierarchical environments. As soon as there is a hierarchy imposed it becomes structured and non-creative and non-innovative." This led to an immediate rebuttal from three participants from the multimedia sector (F2-A, F2-B, F2-D). These women, who knew each other prior to the focus group, stressed the need to promote supportive activities and an orderly approach to innovation in order to speed up the process.

> "We are looking at processes always because we promote innovation by trying to assist early-stage entrepreneurs as much as we can to get as many steps up as possible." (F2-B)

> "Half of your business can't be innovative because you have to drive, drive, drive to get your product out the door." (F2-A)

> "I think the hierarchy works ... You're constantly putting pressure on people too ... And a lot of it is done because there is these time frames and milestones." (F2-D)

These responses may reflect the nature of the multimedia industry, which is seen as male-dominated and structured around the constant improvement of technology (which is also rooted in masculine culture). As one participant put it, multimedia is "definitely a male-dominated

industry, there's no question. I've come a long way in my life along this topic. Yeah, I think if there was more women there would be a very different environment" (F2-A). The search for constant technological improvement results in a very competitive environment. It appears as though the speed of innovation in the multimedia industry requires a large focus on the processes of innovation. In this case, the need for a disciplined approach results in acceptance of hierarchical environments.

Interestingly, the less experienced woman (F2-D) who was last to respond to the 'non-hierarchical environment' statement represents a firm that often interacts with the two more experienced women (F2-A, F2-B). It appears as though the hierarchical corporate culture and the senior position of the finance woman (F2-B) were maintained during this discussion, since it tended toward consensus.[14]

The conversation about the importance of hierarchy occurred for roughly 10 minutes and the lead researcher unsuccessfully attempted to change the topic. This inability may have arisen from the researcher's student status in a situation where the group dynamics seemed to reflect the participants' positions on the corporate ladder. An inability to mediate the conversation may have also come from a lack of facilitating experience, although this problem did not arise in the first focus group. The conversation finally ended when a government employee who studies innovation policy (F2-C) initiated a discussion (out of context) about the effectiveness of putting more money into basic research and increasing research and design activities in Vancouver. Perhaps she intentionally spoke out of context to de-escalate the debate. Her statement represents the mandate of the government agency she works for, so she maintained her corporate identity.

[14] The corporate importance, and thus presumed authority, of the women in finance was evident in the interpersonal dynamics in both focus groups. Those women in a position of controlling money were perceived as possessing power. Participants from both focus groups discussed the importance of money in supporting innovative endeavours.

"I think it's really important for biotech to ask 'how much money did you raise?' because how successful you are depends on how much money you raised." (F1-C)

"There's only a handful of people in B.C. that have ever taken a biotech company public." (F1-D)

"I [a venture capitalist] push power because I tend to be the one that makes things happen." (F2-D)

In addition to the debate on hierarchies, several women from the second focus group suggested they influence innovation through indirect methods of manipulation. "Basically what I do now is plant ideas" (F2-B). Concern about corporate hierarchy was matched by a reluctance to be seen as 'too pushy.' The same four women who participated in the hierarchy debate (F2-A, F2-B, F2-C, F2-D) also participated in this discussion. "I promote innovation differently ... I have to manipulate ideas like, 'Call me crazy, but ...' I do it intentionally and craft it and it's not natural because I'm very confident" (F2-D). Perhaps this woman identified as being confident to ensure she was still recognised in the room as having a leadership role. In essence, women facilitate working with men by manipulating situations.

During this discussion the less experienced woman from the biotech industry (F2-E) stated she is referred to as too assertive when she doesn't 'soft shell' the straight truth. "I get reviewed as being too assertive ... Well, no man's ever going to get reviewed like that ... It's inappropriate to review me differently than a male in the same role who has exactly the same training as I have and acts in the same manner" (F2-E). This participant later stated she doesn't agree with 'manipulating' situations, but admitted to 'strategising' when she works with men. Of the three women in the second focus group that participated in this discussion, two identified as being referred to as 'bitches' and one as 'too aggressive.'

A more experienced woman from the first focus group (F1-F) alluded to a similar technique when working with male co-workers, suggesting use of such techniques is not necessarily based on age or sector-specific customs. This woman stated that despite her position of power within her workplace she often looks for support before releasing her innovative ideas. "I really look around for someone who will support my idea and talk to them first ... That way my tougher critics or people that you know are a little bit more difficult to convince will come in from the outside later on. You need support when you try something new."

The biotech grant facilitator who raised the point about non-hierarchical environments supporting innovation (F2-E) responded to a statement made by a woman from the multimedia sector (F2-D) that manipulation is a positive business tactic. These two participants appeared to be very competitive during this conversation. The biotech woman responded: "Doesn't that disturb you that you have to put yourself down before you explain your ideas?" (F2-E). The response to this by F2-D was "It works better" with the subtext of 'Who cares? Whatever works.' Women from the multimedia sector who were already participating in the discussion (F2-A, F2-B) supported this response. These women also persuaded F2-E that manipulating does, in fact, 'work better' even though she originally said it was unethical. She finally conceded by stating, "OK, I would agree with that completely because I do the same thing because I soft shell ideas with someone so it doesn't make them defensive" (F2-E).

Again, the corporate culture seemed to be maintained within this focus group. The more experienced women influenced the less experienced woman and those from the (older) multimedia sector influenced the woman from the (newer) biotech sector. These interactions are very symbolic of the power structures prevalent in corporate culture, which also symbolise gender hierarchies.

Lastly, four women from the second focus group agreed (F2-A, F2-B, F2-D, F2-E) that women, unlike men, are generally more prone to information sharing and talking in ways that promote creative activity. "If there were more women it would be a very different environment ... women share ideas, synthesise, and then strategize. Men don't" (F2-B). No participants refuted this view.

QUESTIONS ABOUT EXPERIENCE: CHALLENGES

The second set of questions used to facilitate the focus group discussions looked at challenges participants may encounter in their roles as innovators. This theme was used to assess the structural inequalities that influence the positions adopted by women in the workplace and their

perceptions about their access to innovation. As a result of these discussions, it is possible to conclude socio-economic factors affect the levels and types of influence women have on innovation processes. Answers to such questions could provide insight into whether men and women would answer the ISRN questionnaire differently.

Challenges – Question 1: "When have you experienced challenges in your role as an innovator in your firm?"

Several categories of responses emerged from this question. In the first focus group responses included:

- "because I'm too polite and likely to back down from male counterparts sooner",
- the actual implementation of innovation outside the conventional processes 'box',
- challenging the status quo,
- maintaining input into conversations when brainstorming due to people resisting ideas,
- building trust with people in order to influence their decision making.

In the second focus group responses included:

- male environments creating social barriers,
- being judged by different standards due to gender,
- managing the work-life balance,
- choosing not to climb the corporate ladder.

Responses from the first focus group were raised in random order. The first respondent stated:

> "This is where gender might come into play as well. With my experiences I sometimes tend to be more polite than my male counterpart, and I will back down sooner ... They [men] will only be influenced by others who are either male or might be perceived as more experienced and more influential." (F1-B)

This woman informed the focus group she has three children and is a consultant for the flexible work hours that accommodate her family responsibilities. Although she has worked in her profession for fewer than 10 years she is an older woman. Her age combined with minimal work

experience could explain why she 'backs down' sooner. Perhaps she has more difficulty questioning the conventional male-female power structure.

Differences in job titles do not seem to create differences in the workplace dynamics women encounter in corporate culture. Two consultants in the first focus group also stated they have difficulty challenging the status quo:

> "The willingness of people to implement those innovations ... They just don't want to spend the time ... And that's really frustrating because one hour of incremental improvements will result in something that isn't status quo."(F1-A)

> "I find the biggest challenge is to maintain input when they will not flex." (F1-E)

These women possess PhDs and still find gaining credibility in the workplace a challenge.

Statements from the second focus group were not prompted, but arose as part of a naturally flowing conversation. This exemplifies the known existence of challenges for women in high tech industries. The same participants who dominated the previous discussions were also very vocal during this one.

> "It's definitely a male-dominated industry [multimedia], there's no question. I've come a long way in my life along this topic. Yeah, I think if there was more women there would be a very different environment." (F2-A)

> "It's inappropriate to review me in a way that's different from the way you would review a male who is in the same job who has exactly the same training and education as I have. Sometimes I get reviews that say I'm too assertive or I could have said that in a more polite way." (F2-E)

> "The whole dynamic is set up against us playing the game as they are." (F2-B)

> "You're still seeing in some companies that there are so few women, especially in roles surrounding innovation ... It's just a male-dominated industry." (F2-D)

There was no debate in the second focus group related to the existence of male-dominated workplaces. Based on the general tone of the discussions in the second focus group it was taken for granted there was a consensus their workplaces were male-dominated.

Despite the contextual differences surrounding these conversations there were several dominant themes across both groups, including the recognition of predominantly masculine

clusters in the multimedia and biotech industries and a style of influencing innovation that is different from the one used by men. These themes were also present in the second focus group's manipulation discussion, and participants from different demographic backgrounds shared these perspectives. The acknowledgement of barriers affecting women's participation in innovation reflects a need to change rigid perceptions of innovation and support approaches that facilitate thinking outside of the 'box.'

Challenges – Question 2: "Did you have a mentor?"

The purpose of probing the availability of mentors was to provide insight into the level of support for women in corporate culture. The second focus group was not asked this question due to time constraints.

Almost all the women in the first focus group responded – something that did not occur with any of the other questions. Perhaps the high response rate resulted from the known importance of having a mentor in science and technology fields. Half of the participants in the first focus group replied they did have a mentor and half replied they did not.

Without prompting, half of the participants who stated they had a mentor said they did not have a problem having a male mentor. Some of these statements seemed inconsistent with earlier comments. For example, one woman said, "There are no women out there [as mentors] and I know it is pretty much a 99 percent chance it will be a man and I don't mind that" (F1-A). However, this woman earlier identified her gender and her inability to 'stand up' to people as a challenge. Another such example was F1-E's statement: "And gender, to me, is irrelevant. The odds are good it's going to be a male and I don't mind that." This participant later stated that as long as your science is good "it doesn't matter what you have in your underwear." Another woman asserted, "I'm not worried about the gender issue. It's not an issue for me so you may find my responses slightly unusual" (F1-G). Moments earlier she commented on recently joining a

female networking group and how unusual it is for her because she has been surrounded by men in her profession her whole life.

Not having a problem working with male mentors may not necessarily based on choice, but may be based on acceptance since in these sectors senior women are under-represented compared to younger women. Frize (1996) identifies the lack of female mentors in science and technology as a barrier to women entering related professions. In corporate culture perhaps the gender of the mentor is not an issue as the behaviours are the same (corporate and masculinized). Furthermore, the mentor's gender may have social repercussions in the workplace. If the power structure in corporate culture is based on a patriarchal hierarchy then seeking a male mentor may be more strategic for women. If men were asked the same mentor question, would they voluntarily state they do not have a male mentor but it isn't an issue for them?

DISCUSSING THE ISRN QUESTIONNAIRE

The third set of questions was intended to directly explore whether or not the ISRN interview guide is gender-inclusive based on perceptions of the language and purpose of the questions.

Questionnaire – Question 1: "What do you think about this definition?"

This question refers to the definition of innovation found in the OSLO Manual, which forms the basis of the ISRN interview guide. The definition reads:

> Technological Product and Process (TPP) innovations comprise implemented technologically new products and processes and significant technological improvements in products and processes. A TPP innovation has been implemented if it has been introduced on the market (product innovation) or used within a production process (process innovation). TPP innovations involve a series of scientific, technological, organizational, financial and commercial activities. The TPP innovation firm is one that has implemented technologically new or significantly technologically improved products or processes during the period under review. (OECD, 1996)

Due to time restrictions the second focus group was not asked for their views on this point, although one woman (F2-C) provided her views outside the context of other discussions.

Only four of the participants from the first focus group took part in the discussion of this definition (F1-A, F1-E, F1-G, F1-H). According to those who offered their insights, the definition misses fundamental elements that influence the creation of the end product and the role that services play in the development of an innovation.

Two participants said the definition does not look at processes of conducting innovation (F1-E, F1-H). Another two participants said the definition does not look at methodologies or approaches to innovation (F1-A, F2-C).

> "I don't really see this as talking about approaches or methodologies and I think that in itself creates innovation – how you approach the problem. You could be working on five or six projects and there's only one that makes it to the market, but those five other ones that helped you get it to where it's at. There's a focus on those things that have been introduced to the market, but what about those failed experiments that led to innovation?" (F1-A)

> "It doesn't look at organizational changes; it mentions it, but doesn't focus on it. It doesn't look at the process of doing innovation, just at the end product. I think the process of innovation is just as important as the result." (F1-H)

> "Instead of using the word implemented how about using the word developed? The companies developing technologies may not ever implement them themselves." (F1-E)

It is the lead researcher's impression that most of the participants lost interest in the material at this point. Interestingly, four of the women in the first focus group (F1-B, F1-C, F1-D, F1-F) did not respond to this question even though they participated in the previous discussions. Perhaps they were not familiar with the material and, as a result, did not feel comfortable talking. It is possible the OSLO Manual definition does not reflect the more dynamic social understanding of innovation held by the participants, raising the possibility that the OSLO Manual excludes certain forms of innovation.

Two of the women who provided insights on the OSLO Manual definition were non-responsive in previous discussions of other issues (F2-C, F2-F). Both of these women study innovation professionally and it is likely they already had informed opinions on the subject.

Those who held the power during this discussion were the women who possessed knowledge on the topic – power was an issue of intelligence and not an ability to influence discussion.

Questionnaire – Question 2: "Does the ISRN ask the right questions?"

Roughly half the participants in the first focus group did not contribute to discussion of this question. There were several areas of overlap between the two groups:

- *Capturing the role of consultants* – "I don't think it captures the relationship between the consultants and the people who help the companies who aren't necessarily there, but are basically a sort of expertise" (F1-G). This is particularly relevant for a gender analysis since, "it's a gender issue too because many of the consultants end up having family reasons that they can't take on a full-time job and so practice as a consultant instead" (F1-B).
- *Assessing the contribution of human resources* – "It says, 'tell us about employees who have left,' but it doesn't ask 'how do you retain them and how do you keep them around once you have them?'" (F1-A). "'How do you recruit employees?' is more important than how you lose them" (F1-D).
- *Extracting information about informal relationships* – Four of the participants (F1-C, F1-G, F2-D, F2-E) stated the ISRN questionnaire does not ask enough about relationships. "So that's one thing that square boxes and bureaucratic listings doesn't deal with, some of the things [informal relationships] that go on" (F1-G). "Do you think these questions regarding networking are extracting sufficient information to reflect the role of women and men in these clusters? Is the person responding identified by gender?" (F2-E).
- *Looking at individual contributions to innovation* – "There are not enough questions about 'how do you personally create innovation?' ... as maybe men and women would respond differently to that because they create in different ways" (F2-D). Two of the participants from the second focus group (F2-D, F2-E) said the ISRN interview guide should ask: "What do you personally do to promote innovation?"

Questionnaire – Question 3: "Do you think men and women would answer questions used in the ISRN interview differently?"[15]

The jury was hung on this question. In response, four of the participants replied yes, four replied no, and six women did not take part in the discussion. Three of the four participants from the first focus group (F1-C, F1-E, F1-F) stated women would respond differently to the questions as they are more likely to possess a different position within the firm. "I think you're going to get different answers in general because I think, in general, women play a different role in senior management and it is very unlikely to be the founder" (F1-C). Adding to this point, another woman stated: "Women may answer some of the questions differently, but because of maybe their position in the company or the way of viewing how the company operates, but in terms of the survey itself I think the questions are probably gender neutral" (F1-D).

The remaining respondent from the first focus group (F1-G) stated women would not answer the questions differently. Earlier in the session she stated she never focuses on the gender aspect of her work, but she later said women may answer the "futures" section of the ISRN questionnaire differently because they are likely more concerned about social issues in the region. This woman contradicted herself several times throughout the focus group, almost as though she did not want to be perceived as a feminist ideologically, yet she opportunistically made statements such as, "I've recently joined an all women's networking group." Could being perceived as possessing feminist-like qualities be a sign of weakness or hold elements of risk in corporate culture? If so, is this evidence that feminine qualities are excluded from this culture?

The four women from the second focus group who responded (F2-B, F2-C, F2-D, F2-E) reached a consensus that women would not answer the ISRN questionnaire differently as the questions were mostly seen to be based on facts. The consensus was reached after the less experienced multimedia employee (F2-C), who had a tendency to facilitate the discussions other

[15] Due to time constraints the questions that were supposed to be asked before this one (How would you answer the questions in the ISRN interview? Do you think the guide is applicable to you?) were discarded.

women initiated, changed her original position. Her original response was also counted in the final analysis since it more likely reflected her original thoughts.

Of the six women who did not take part in the discussion, four are consultants. Could this level of non-response reflect their exclusion from the target population of the ISRN questionnaire? As it stands, there is no version designed for those in support services. If an ISRN researcher were interviewing a consultant or lawyer, the researcher would have to customize an existing 'company' questionnaire.

Can we assume corporate responses to the ISRN questionnaire are genderless? Perhaps the corporate response is masculine in nature. The majority of women said the ISRN interview guide does not ask enough questions about relationships and human resources, but the same women said they would answer the existing questions in the same way as men. Can we assume there are, in fact, gender perspectives to innovation, but the ISRN questionnaire reinforces the conventional (biased) status quo? As already stated, the behaviour in the focus groups mirrored conventional corporate hierarchies. This behaviour is evidence that corporate culture is based on hierarchy, which may itself seem to be masculine in nature.

Questionnaire – Question 4: "Would men and women respond to question #36 differently?"

Questions #36 in the ISRN interview guide reads: "Did any of your present relationships with suppliers, customers, collaborators, research institutes develop from your participation in associations, conferences, trade fairs, etc.?" This was not part of the original research design, but was used to facilitate the responses to the previous question. This question was chosen for discussion based on the hypothesis that women are less likely to travel to trade shows due to family commitments. Women may interpret the relationships that develop from trade shows differently than men, resulting in different responses.

All six of the participants who replied to this question (F1-B, F1-D, F1-G, F1-H, F2-A, F2-D) responded 'no' based on the idea that once women are in top-level positions they "will do anything" (F1-D).

> "Once you're at the top you're on the road or else you would otherwise not get that job." (F1-B)
>
> "There are a lot of women at these conferences – there is no bias ... They have daycares at conferences so women can attend." (F1-G)

One participant from multimedia stated she has to leave conferences early because of family commitments. "Because of my family I have to be home at 8 p.m. It would be better competition if I could attend these things" (F2-B). This woman also initiated the discussion of the gender-neutral nature of the questions. Perhaps she would, in fact, respond to question #36 differently than a male colleague.

SUMMARY OF FINDINGS

Several themes emerged from the focus group data. These themes not only address the inadequacies or limitations of the ISRN interview guide, but also the systemic, gendered differences within knowledge-based workplaces that affect women's participation in innovation processes. Insofar as the ISRN interview guide does not look at areas where systemic differences exist, it exhibits a gender bias.

While these themes are strongly supported by other literature on women in business and in innovation, it is dangerous to infer too widely from such a narrow, small research study sample. To check if systemic differences exist between those who chose to participate in this study and those who did not – a factor that would invalidate these findings – WAGIS recommended a follow-up non-response study. The results from the focus groups and the telephone interviews will be discussed in the themes presented below.

Theme 1: The OSLO Manual's definition does not reflect a contemporary understanding of innovation because it exhibits a 'success' bias, it ignores the role of support services, and it does not measure the cultural and social elements involved in the innovation process.

The scope of activities measured by the OSLO Manual is based on a narrow definition of innovation, as inferred from the participants' responses. This weakness could stem from the growing complexity of economic systems. Hodgson defines economic complexity as "a growing diversity of interaction between human beings, and between people and their technology" (2000, p. 90), and points out that as economic complexity increases, more and more 'bits' of information are required to specify interactions and changes within the structured system. The bits of information needed for measuring new knowledge-based systems – details about people, institutions, policies, and so on – require a broader definition of innovation that reflects the increasing number of elements and interactions that make up the more complex economic system.

First, the focus group participants suggested there is a market or 'success' bias in the OSLO Manual's definition because it does not necessarily include those processes – such as trial and error, failed innovations and the methodologies used in their development – that create tacit knowledge and add to workplace productivity. By ignoring 'failed' innovations, the OSLO Manual definition excludes some of the factors contributing to future successful innovations.

Second, the definition ignores the important roles service industries and individuals, such as consultants, play in the development of an innovation. The OSLO Manual's focus on manufacturing and other traditionally male-dominated sectors is a structural problem. Although it refers to difficulties in sampling methods used to assess the innovative qualities of service industries (Section 4.2.3, "Sectoral Coverage"), the OSLO Manual focuses solely on the 'manufacturing, construction, utilities and marketing services,' thereby excluding the service sector where women more often find employment. For instance, structural forces evident in both the public and private sphere mean many women opt for employment in service industries, such as consultancy, which provide more flexible hours.

The OLSO Manual definition is intended as universal and should apply to all sectors, yet there was a high level of non-response from women from both biotech and multimedia during the discussions of the definition. Several variables could have brought about the level of non-response, including: the participants' inability to relate to the OSLO Manual definition because it does not reflect their dynamic social understanding of the term, an interviewer bias, a sample bias (women from the private sector were under-represented), or the structure of the discussion being 'too formal' an instrument in their relatively less formal industrial sectors.

The results from the interviews in the second phase of research confirmed the information gleaned from the original focus groups. In support of the focus group findings, several of the interviewees (I-1, I-2, I-3, I-7) discussed the importance of assessing the processes and approaches adopted when categorising the success of an innovation. For example, participant I-1 explained that when deciding to invest in a biotech company she thinks looking at how the board team processes and analyses expert data on technology is important. This particular venture capitalist also agreed on the importance of previous market launches and the firm's history of clinical trials. Although biotech companies in Vancouver are young this is a valuable insight into the problems of measuring only successful innovations because a successful product does not reflect all economically productive industries.

In addition, this interviewee acknowledged women more often find employment in consulting professions because of increased work flexibility. Participant I-4 also identified the lack of work-hour flexibility in private firms as a problem for women. Four of the participants stated women are scarce in general in high tech fields in Vancouver. This contributes to the evidence of women's higher representation in service industries.

Theme 2: Surveys measuring innovation need to examine the culture surrounding innovation and how firms nurture the innovation process. This includes assessing the firm's human resources or cultural capital.

As a result of the perceived limitations of the OSLO Manual's definition of innovation, the focus group participants concluded the ISRN questionnaire lacks questions on human resource issues, including how companies retain employees, employee demographics, and policies affecting employee recruitment. The focus groups viewed human resources as a means of enabling women to sustain employment within the industry and as a potential way of diversifying the existing perspectives that hinder their ability to contribute to innovation processes. Identification of this weakness in the ISRN questionnaire underlines the need to focus on the culture surrounding innovation and how innovation is nurtured.

Although the OSLO Manual recognises that a number of human, social, and cultural factors are crucial to effective operations of firms (Section 3.3 "Transfer Factors), there are no instructions for measuring these dynamics as indicators. As it stands the cultural and social elements of workplaces that promote innovation, such as communication and interpersonal dynamics, are ignored. In addition, the OSLO Manual does not consider the structural and social characteristics affecting gender and gender differences in involvement in innovation.

Knowledge creation and transfer are more and more important as the economy moves from a manufacturing base to a more high tech, knowledge base. As stated by Swenson:

> Some executives consider knowledge to be the single most important resource a company can have, and can represent 75% of a company's worth. In a 1995 Knowledge Imperative Symposium, Arthur Anderson & Company polled 80 executives from mostly large corporations (e.g. Amoco, Kodak, Hewlett-Packard, Pillsbury). About 80% of the managers believed that knowledge management was an important or essential part of business, but only 15% currently did it as well as they would like at the time (Highlights, 1995). (1998)

Attempts at maximizing knowledge-based innovative behaviour have resulted in changes in organizational culture. Specifically, an emphasis is placed on the activities and interpersonal dynamics of the people involved. The focus group data suggests the dynamics of organizational

structures affect and are affected by women in the workplace, reinforcing the need for innovation survey tools to examine organizational culture in a gender-inclusive way.

Organizational culture is defined as "the organization's expectations and the reward structures, which communicate to its members what an organization values. The values are communicated to its members whether explicitly or implicitly through practices, policies, and symbolic interactions" (Ford & Chan, 2002, p. 8). New theory suggests that organizational culture can significantly promote or hinder knowledge management initiatives. As stated by Burgelman et. al. (1996), organizational cohesion is essential for tapping into the energy and creativity of the whole organization. Anything restricting the flow of ideas or undermining respect towards individuals is a potential danger to innovative activities. The current economic complexity of knowledge-based sectors requires flexibility and adaptability in organizations (Hodgson, 2000), as knowledge creation is supported or hindered by the flexibility of the work environment. Thus, managers should increasingly focus on fostering the creation, sharing and integration of knowledge (Gray & Chan, 2002; Leonard-Barton, 1995).

Organizational culture is important for the success of knowledge creation and practices for managing cultural capital. Cultural capital is defined as the knowledge, skills, and abilities possessed by the firm through its individual members. Cultural capital is also the cumulative sum of human capital within the organization (Jones, 2001). In short, cultural capital is an organization's human resources, which are valued as an important aspect of business in the emerging global economy (Bloom & Associates, 2000). Cultural capital provides value to a firm's technological, financial, and organizational strategy as an individual's unique skills and creative ability aid in knowledge creation. As suggested by Hodgson (2000), work requires judgment, and all judgments unavoidably involve the deployment of both tacit and explicit knowledge and the social and cultural processes through which they are learned. The OECD (2000) notes the prospects for prosperity and well-being in the 21st century depend on leveraging

social diversity and cultural capital in order to encourage technological, economic and social dynamism. This dynamism fuels the creativity and uniqueness necessary for a knowledge-based economy and requires welcoming and facilitating diversity through flexible organizational practices. The OECD position on the need to foster social and cultural diversity is reflected in section 3.3 of the OSLO Manual – 'Transfer Factors.' The OSLO Manual recognises there are a number of human, social and cultural factors that are crucial to the effective operations of firms although there is nothing mentioned about how to capture these dynamics. As it stands, the OSLO Manual does not focus on the cultural and social elements of workplaces that promote innovation. Despite mentioning the importance of measuring communication patterns and organizational dynamics, the OSLO manual does not recognise the structural and social characteristics that affect gender and involvement in innovation and does not provide instruction on how to capture these dynamics (ibid).

Encouraging and promoting communication in an organizational culture allows for effective knowledge management (Ford & Chan, 2002). Key aspects of an organization's culture that are necessary for maximizing knowledge transfer include: trust, common cultures, common vocabularies and frames of reference, meeting times and places, broad absorptive capacity in recipients, belief that knowledge is not the prerogative of particular groups, absence of the 'not-invented-here' syndrome, and tolerance of mistakes and needing help (ibid). An organization's flexibility in adopting changes and its tolerance toward trial-and-error practices are logically linked to a more diverse and creative workplace. The absorptive capacity of a firm, which is part of its ability to adopt changes, is linked to the learning ability of its employees, which, in turn, links to a change of knowledge within the firm. Firms learn from past experiences, through trial and error, and apply learned behaviours and practices to 'successful' innovations. As such, the unique knowledge acquired through trial and error, which is supported by the diversity of perspectives within the organization, becomes a sustainable advantage (ibid).

As a firm's cultural capital increases so does its ability to absorb new forms of knowledge. As cited in Gray and Chan (2002), interpreting and classifying knowledge is a process comprised of discrimination and norms. The ability to discriminate and accept knowledge based on norms reflects the unique cultural values and perspectives of an individual, who filters the information and selectively learns. Filtering information through cultural 'lenses' affects the ability to maximize knowledge creation by a firm. Logically, the greater the diversity of norms and practices represented in a firm, the greater its absorptive power.

The interviewees from the second phase of research placed a strong emphasis on the importance of workplace culture in nurturing innovation. All three of the venture capitalists stated the ability of a company's board members to work as a team greatly affects their decision to investment in that company. One venture capitalist (I-3) said that in addition to team working ability, the flexibility of the work environment and the proximity to recreational amenities affect the decision to invest. This emphasizes the desire to support 'flat' structures and relaxed atmospheres. It is important to note this comment originated from the only male participant.

Some of the interviewees (I-7, I-5) also discussed the importance of brainstorming, acknowledging the success of flat-style organizations and the need for a comfortable environment where information can be shared freely.

Theme 3: How people perceive themselves and their place on the corporate hierarchy affects how they behave in the workplace and how they contribute to the innovation process.

The behaviour of the focus group participants reflects both their subjective and objective perceptions of corporate power relative to the other women in the room. The interactions between participants symbolise the power structures prevalent in the corporate culture of the high tech industry, which also symbolises gender differences.

Group identity can develop around a professional membership, gender, nationality or particular hierarchical status in an organization (Child & Rodrigues, 2001). Child and Rodrigues note that social identity is based on emotional and behavioural characteristics that are part of a person's biography and career. Social identity influences individual's behaviour in a group and, in turn, affects how they communicate and accept knowledge within the group. The existence of corporate hierarchies can have negative social repercussions, as competition between individuals inhibits knowledge transfer and can result in an individual feeling powerless to influence knowledge creation and transfer within that culture. According to Burgelman et. al (1996), high tech companies try to prevent hierarchical barriers by creating multidisciplinary project teams.

The ISRN questionnaire does not pick up on the ways hierarchy impedes knowledge creation and transfer because it targets top (predominantly male) employees who are less likely to notice, and are therefore less likely to report on, the negative consequences of workplace (and gender) hierarchy.

Please note that since the interviews were conducted one-on-one over the telephone, there were no opportunities to observe the interpersonal dynamics in the second phase of research.

Theme 4: Interdisciplinary tactics and teamwork promote innovation. The focus group participants' promotion of collaboration exemplifies a desire to deconstruct the rigid cultural guidelines and hierarchies that exist in corporate workplaces.

The majority of the participants perceived social processes as fundamental to the innovation process, implying team work is essential for successful knowledge development. A consensus was also reached that innovation is a collaborative process involving interdisciplinary approaches to brainstorming and conceptualizing. It could be inferred from this finding that by under-representing the perceptions of women, innovation surveys could produce results that do not fully recognise the social elements that are a fundamental part of the innovation process.

The creation of teams is one practice managers use to promote knowledge creation. Teams generate knowledge through experimentation and new product development (Gray & Chan, 2002), and as team members discuss their projects with each other they discover opportunities for cross-pollination of ideas. The collaborative nature of innovation practices needs to be reinforced through management. As Child and Rodrigues (2001, p. 10) point out, "organizational learning does not occur naturally. It requires the active management of different social identities and of the conflict these identities may entail." Maximizing innovative thinking requires the design of collaborative groups in a manner that allows individuals to feel comfortable sharing their knowledge. As Burgelman et. al suggest (1996), multidisciplinary project teams that require matrix-like organizational structures remove the barriers created by hierarchies.

As noted under Theme 2, the interviewees agreed with the focus group participants that teamwork and brainstorming are essential parts of successful knowledge development. Removing the structural barriers (such as workplace hierarchies) affecting the ability of women to communicate effectively in the workplace is crucial because it will enhance women's participation in the workplace and in the innovation process.

Theme 5: The adoption of professional 'manipulation' tactics by women to facilitate their work with men in corporate environments, in addition to a general desire to nurture collaborative practices, alludes to the existence of male-dominated ideologies in conventional corporate cultures.

Women in the focus groups discussed tactics they adopt to assist in their work with men and to maintain their input into conversations. These practices reflect the masculine nature of corporate culture and women's need to influence decisions within the 'box' (ideological, dominant culture). The majority of focus group participants discussed the importance of interdisciplinary perspectives in developing innovative ideas, which exemplifies their desire to deconstruct the rigid cultural guidelines they work within. By not probing the interpersonal and

cultural aspects of the innovation process, especially those experienced by women in the workplace, survey tools used for measuring innovation tacitly accept the male-dominated ideologies found in conventional corporate culture.

The existence of patriarchal corporate cultures also explains why few women are represented in top-level positions within organizations. As Wajcman (1998) states in her book "Managing like a Man," the material and institutional structures of patriarchy are still largely intact, despite the recent cultural shift that has increased the support of women in the workplace. According to Wajcman, management is based on male standards that position women as 'out of place' and deem them as threats when they do make it to top-level positions. The focus groups reflected this point in their discussion of social conditioning (to act in a manner that does not challenge the status quo), being judged by different standards when adopting conventionally masculine traits, and choosing not to climb the corporate ladder for personal reasons (not because of the inability to do so). Organizational dynamics in the workplace also create challenges to women's participation in innovation and reflect their subordinate roles within corporate culture. Is it possible to conclude socioeconomic influences affect the level and type of influence women have on innovation and how they perceive innovation? Furthermore, is it possible to conclude the male-dominated culture of the workplace reduces women's desire to climb the corporate ladder to the top positions, instead being satisfied in 'almost top' positions? At a minimum, the ideological exclusion of women in top-level positions results in homogeneous cultural practices.

'Social capital' best describes the flows within the masculinized nature of the workplace. Jones (2001) describes social capital as the presence of shared codes and language, and shared narratives within a network. One's perception of their role and value with the social capital of a workplace influences the type of knowledge creation they participate in. Child and Rodrigues (2001) study the importance of social identity and how it influences the conversion and creation of knowledge aimed at facilitating organizational goals (or innovation). They also note little

attention has been paid to the relevance of organizations' social dynamics in terms of different groups and their identities, which contribute to organizational performance (in this case, innovation). It is important to note that the social capital of a firm will influence its cultural capital (as discussed earlier).

Child and Rodrigues (2001) assume managerial initiatives can transcend identity boundaries with the aim of generating a collective learning process. This collective learning process could deconstruct conventional hierarchical managerial styles. For example, almost all focus group participants identified with the challenge of working in male-dominated environments. There appeared to be two perceptions of innovation discussed in the focus groups based on the different types of high tech sectors represented. The first type of innovation was associated with an undisciplined perspective, such as fostering creative energy. The second perception of innovation appeared more disciplined and based on sector-specific workplace expectations. Women in the multimedia sector recognised the need to nurture creative energy for innovative ideas, but when pressured by product-to-market time frames they advocated discipline in the form of hierarchies. Conversely, women from the biotech sector discussed innovation based on interdisciplinary approaches and creative ideas, without mention of workplace structures for disciplining these ideas. Is the stress on hierarchy in the multimedia sector, as a means of facilitating innovation at the product development level, an example of the dominant corporate culture? Do some forms of corporate culture produce innovation cycles that result in the conventional screening of ideas and products at the top level dominated by male discretion? If so, are women less likely to influence top-level decisions as a result of hierarchical structures? Can we conclude that the more hierarchical an organizational culture, the more male-biased in managerial styles and the closer the relation to marketable products? Can we also infer from the focus group discussion that the more open to interdisciplinary tactics an organization is the more innovative and open to female managers it becomes?

Social identity within a workplace can be influenced by how a person perceives him- or herself on the social ladder of the corporate culture. As Wajcman (1998) states, corporate cultures are generally masculanized. It is the subjective perception of power in masculanized cultures that inhibits women from completely participating in innovative activities. If the women in the focus groups adopt tactics to work with men, we can assume the organizational cultures are masculine in nature. Changing these existing corporate cultures is needed, although it may be difficult because changes to social policy promoting knowledge creation can be perceived as a threat to social identity and can result in resistance. The inclusion of women in high tech sectors in the past 20 years has resulted in resistance and, in turn, has caused the unnatural climate within which women work.

The resistance to knowledge creation outside conventional practices can result in an inability to maximize knowledge and thus impedes the growth in human capital value. In addition, problems arise when transferring knowledge. As Ford and Chan (2002) state, knowledge transfer is one of the most challenging processes for a knowledge-based company due to its employees' reluctance to share knowledge or accept shared knowledge. Interestingly, masculine cultures that thrive on competition impede knowledge transfer practices. Since knowledge is seen as a source of power and success, it can be more difficult to share when the members of a company are competing with each other.

In the second phase of research there were several interesting points raised by the interviewees on the differences between the workplace experiences of men and women. I-2 stated she recently discovered her male colleague, who is not as qualified as her in their job description, receives more monetary compensation. Participant I-7 stated she was essentially "bullied" into working free for a company by a male co-worker. Four of the interviewees identified with the professional female's life cycle. That is, women often leave the workforce at the age of 30 and

then return at the age of 50 at which time they move from the service sector and into entrepreneurial activities. Participant I-2 added that the onus is usually on female board members to prove themselves in order to win the acceptance of male colleagues.

TELEPHONE INTERVIEWS – OTHER CONTEXTUAL INSIGHTS

Three venture capitalists were interviewed because of their importance as stakeholders in the innovation process, particularly in the area of policies and practices. As stated earlier, venture capitalists garner a high level of respect in high tech industries as they assess innovations and determine which companies receive funding.

During the interviews the venture capitalists were specifically asked about the process of assessing whether or not to invest in a start-up firm, and if, in assessment of the management team, gender diversity is a factor. I-1 stated she does not specifically use terms of gender as success indicators because of the general lack of women within high tech industries in Vancouver, although she does look at different traits of management, such as their technological backgrounds and how they look at their business in comparison to her own impression of it. Interestingly, this woman stated she does pay close attention to how the board members of the company function as a team. This suggests there is a greater chance of firms with flatter organizational structures receiving funding. The flatter style of organizational practice can be a metaphor for gender. It is important to note that this woman recognises there is a lack of women in top-level position in Vancouver's high tech industry, making a standard policy or practice reinforcing their involvement difficult. This participant identified with traditional barriers preventing women's full participation in Vancouver's business sector, drawing on her own experiences as a mother and full-time employee.

I-3, the male venture capitalist, responded similarly, stating he does not use gender-sensitive policy or practice when assessing the social capital of firms, although he sees the need

for assessing the board members as a team and their ability to work together. This reinforces the preference for a flatter organizational style.

The third venture capitalist interviewed, I-2, stated she too had no "portfolio brush" for assessing gender in a firm. However, she hesitates investing in companies where 'old boy's networks' exist. This implies a need to move away from traditional organizational styles of management and look for more culturally diverse environments.

Interestingly, when the two female venture capitalists were asked about their perceptions of possible policy changes the government could make to affect the entrepreneurial role of women in high tech industries they both identified with grassroots approaches. These approaches include the need for the federal government to support maternity leave in order to enforce cultural diversity and helping with social support networks for working women with kids in the community.

CHAPTER 5: CONCLUSIONS AND RECOMMENDATIONS

This study began with a simple research question: "Is there an inherent bias in the types of questions asked in interview guides used in innovation studies?" The answer to this question is less simple than first thought. Several key findings and hypotheses emerged from the focus group discussions and one-on-one interviews. First, women perceive social processes as fundamental to innovation. The majority of participants agreed that innovation is a collaborative process involving interdisciplinary approaches to brainstorming and conceptualising. This implies that the knowledge development aspect of innovation requires team effort rather than individual action. As a result, surveys used for measuring innovation that exclude a broader team and especially the perceptions of women could lead to a lack of recognition of the fundamental social and cultural elements supporting innovation. In particular, surveys need to probe 'team' work more and may need to survey more than one view in a firm to effectively capture the innovation process. Furthermore, the same proportion of participants stated they either help or support innovation through consulting or support services. This implies women are more involved in facilitating processes that enhance innovative outcomes and may have peripheral contributions to innovation clusters. Again, the exclusion of support services from innovation surveys may result in an inadequate examination of the full picture of influences on innovation, making the effective promotion of innovation through policy difficult.

Second, social barriers affecting women's participation in innovation exist. Almost all the participants, in some form or another, identified with the difficulties of working in male-dominated environments and adopt manipulation tactics as a way of facilitating their work. Among the difficulties discussed were social conditioning preventing women from challenging the status quo, the adoption of conventionally masculine traits leading to women being judged by different standards, and not climbing the corporate ladder for personal reasons rather than an

inability to do so. One possible conclusion is that socio-economic factors affect the level and type of influence women have on processes of innovation.

Third, the OSLO Manual definition of innovation misses some fundamental elements that influence the creation of the end product, such as failed attempts at innovation and the methodologies used in development, and it does not reflect the important role of services, such as those provided by consultants, in developing an innovation. Participants said the ISRN interview guide needs questions about human resource issues, including how companies retain employees, policies affecting employee recruitment, and employee demographics. The ISRN interview guide also has a pro-innovation bias – it looks at successes but ignores trial and error and the frequent failures that contribute to an organization's knowledge base. In addition to the end product of innovation processes, the ISRN interview guide should look at the source of ideas for these processes. In simplest terms, the ISRN interview guide is missing several levels of analysis.

Fourth, the ISRN interview guide ignores hierarchical differences in perceptions of innovation by assuming one respondent can accurately report on what is often a team process. Participants stated the questions themselves are not gender-biased because they require factual answers, and as such a female CEO and a male CEO would likely interpret and answer the questions similarly. However, they also agreed women at different levels in a firm possess perceptions of innovation different from the CEO and top executives. Women are less likely to be employed in the 'almost top' positions due to the existing power structures in corporate culture, which are based on deeply ingrained hierarchies and patriarchal social practices. The existence of these power structures was evident in the focus group discussions, specifically the dynamics of the participants involved and the level of non-response in the groups. As such, the ISRN questionnaire's sampling technique and choice of target population exclude women in a systematic way.

GENERAL RECOMMENDATIONS

Is there an inherent gender bias in the questions used in the ISRN project? There are both yes and no answers to this question. On the one hand, the questions used in the ISRN project do not display elements of direct sexism, either in the language or possible differences in responses. On the other hand, the ISRN surveys are not sensitive to systemic bias and, therefore, exclude the perspectives of women and how they perceive factors associated with innovation.

Based on data derived from the focus groups and interviews, the original research question changed to: "Do innovation-type surveys serve to exclude certain forms of innovative practices by using a limited target population?" The answer to this question is an unequivocal yes. The following recommendations are designed to remedy this exclusion:

Recommendation 1: Sampling Methods – Target Population

As it stands, innovation studies under-represent the perspectives of women as the surveys are gender blind in terms of recruitment of the target population. Researchers should determine what type of innovators to interview in order to include women's perspectives. The type of innovation an individual participates in depends on their position within their firm, which is strongly influenced by gender. Since women are usually more involved at the supporting levels, researchers must include those people involved in the processes of innovation rather than only interviewing CEOs and top executives. Recent studies also suggest a non-hierarchical or middle management cross section of the firm is better than an executive or top down approach to selecting respondents.

Recommendation 2: Sampling Methods – Responder Demographics

Demographic data of interview participants is not currently collected. To address this problem, as much demographic and professional life cycle data as possible should be known about the selected respondents. Future socio-economic research requires data on the gender of

participants from previous innovation studies and would greatly benefit from a change in the sampling methods of innovation surveys.

Recommendation 3: Sampling Methods – Supporting Services

Social factors influence the large number of women employed in the service sector. The service sector has a major influence on economic activity and is an integral part of innovation-based economies. Including the service sector in studies measuring the integral elements of innovation is, therefore, essential.

Recommendation 4: Scope of Questions – Innovative Culture

Questions used to guide innovation surveys do not currently focus on interdisciplinary dynamics or the culture of innovation that influences collaborative processes. Assessing the human resources and social processes affecting knowledge development is needed.

In addition, surveys should look at hierarchical versus flat organizational structures and link those structures to knowledge production in order to determine best practices for maximizing knowledge production and transfer. This could be measured by assessing individuals' perceptions of their place and power within their organization and how supportive their work environments are to new ideas (or the main forms of resistance to new ideas).

Recommendation 5: Scope of Questions – Pro-Innovation Bias

There is currently a 'success' or pro-innovation bias in innovation questionnaires. An increased emphasis on studying the reasons some innovations succeed while others fail, in short the 'trial and error' and frequent failures associated with innovation, may influence the structure and promotion of innovative environments.

Understanding the social dynamics that encourage and support innovative environments is essential to promoting innovation in knowledge-based economies because it helps identify

elements that influence decision-making processes. Measuring the approaches adopted when achieving the end results of an innovative process or product is also imperative. Failed attempts at innovating are viable indicators of what elements in an innovation process can be supported by governments.

RECOMMENDATIONS TO INDUSTRY CANADA

Industry Canada is leading the country's "Innovation Strategy" and thus has the most influence over the direction of future research. For this reason it is imperative the following recommendations be followed:

- Ensure a gender, race and innovation network similar to the ISRN project be created in order to incorporate and consider all social dynamics influencing innovation in Canada.
- Liaise with the Organisation for Economic Co-operation and Development and other interested countries on their research.
- Adopt and support theories of feminist economic analysis in order to improve current mainstream methods.

RECOMMENDATIONS TO STATUS OF WOMEN CANADA

Status of Women Canada's GBA formed the basis for the investigation into the original research question: "Is there an inherent bias in the types of questions asked in interview guides used in innovation studies?" The experience using GBA has resulted in recommendations to Status of Women Canada on what should be considered for future economic analysis.

- GBA should acknowledge the new liberal feminist perspective often adopted by women in business professions who do not feel disadvantaged. This would allow for a more mainstream analysis.
- Global studies focused on innovation are relatively new and gender is not yet recognised as an indicator worthy of measurement. Status of Women Canada should play a part in Canada's leadership role by recognising gender as a necessary variable to measure in order to obtain a full understanding of the economic, social and cultural dynamism that fuels the Canadian economy.

APPENDIX A

The Innovation Systems Research Network (ISRN) Project

Researchers at the Centre for Policy Research on Science and Technology (CPROST) at Simon Fraser University are participating in a major national study on the role of local and regional industrial clusters in Canada. This is a five-year, $2.5 million study funded by the Social Sciences and Humanities Research Council that will examine the impact and importance of cluster-driven innovation in Canada. The first of its kind in Canada, this study is investigating how local networks of firms and supporting infrastructure of institutions, businesses and people in communities across Canada interact to spark economic growth.

This is a national project with a regional focus. The research is conducted through a collaborative effort of ISRN researchers drawn from five regional nodes based in Atlantic Canada, Quebec, Ontario, and western Canada. Representatives of ISRN's diverse network of scholars, government partners, private and not-for-profit sectors, and international collaborators will examine the dynamics of key clusters in both urban and non-urban centres.

Clusters	BC/Alberta	S.Ontario	Ottawa/NCR	Quebec	Atlantic
Biotech	X	X	X	X	X
Multimedia	X	X		X	
Photonics/wireless	X	X	X	X	
Wood Products	X				
Food/wine	X	X			
Info.tech			X		X
Auto/steel/aerospace		X		X	

While previous studies of innovation systems and economic development have been limited to individual regions, this project analyses how the growth of clusters contributes to economic growth and development within a number of regions across Canada. Research focus on more than 20 clusters across the five regions in newly emerging knowledge-intensive areas as well as in more traditional sectors. It focuses on large metropolitan settings located near research-intensive universities as well as in rural settings.

CPROST is the administrative centre for the western sub-network "InnoCom." The sub-network comprises researchers from Simon Fraser University, the University of British Columbia, the University of Calgary and the University of Saskatchewan. The research will looks at the regional innovation systems of British Columbia, Alberta and Saskatchewan. It focuses on issues of technological innovation through case studies and in-depth interviews. The work sets the stage for a more ambitious program in future years to develop a system of innovation "accounting" indicators analogous to financial accounting, and a set of broader measures that can be used to assess the overall strengths and weaknesses of regional industrial structures.

Background: Canada's ability to adapt its resource-based traditional economy to a more knowledge-driven, technology-based economy will play a key role in the maintenance of our high living standard. Success in the new knowledge-based economy increasingly depends on the ability to apply the results of innovation – a new, or significantly improved, service, product, production technique, or management method. Recent studies of the innovation process point toward the interdependence of economic, political, social and cultural factors in determining the relative degree of success enjoyed by individual nations and regions in the global knowledge-based economy. These studies lead toward a better understanding of the complex interdependencies between internal firm dynamics around the innovation process and the broader institutional setting within which the firms operate.

Researchers have noted strong national, regional, or local components that influence the opportunities for science-based innovation and competitiveness of firms. The interaction of these components in geographic regions is termed the system of innovation, and includes the network of institutions in the public and private sectors whose activities and interactions initiate, import, modify and diffuse new technologies. The concept of the innovation system gives special prominence to local, regional, and national social and political institutions and mechanisms that support the innovation process. It moves the theory of industrial innovation from a simple description of the entrepreneur in an isolated firm to a consideration of how all the elements of society contribute to technological change. It encourages the examination of interactions and synergies, which are not visible in an analysis of individual firms or competition among firms.

Of particular interest to, and relevance for, the work of ISRN is the regional level of the innovation system. The geography of production in the new economy is marked by a 'paradoxical consequence of globalization' – the increasing importance of locality as a site for innovation. The role of knowledge and creativity in this economy places a premium on the kind of localized or regionally based innovation that is fostered by proximity. Innovative capabilities are frequently sustained through regional communities that share a common knowledge base and interact through common institutions. The forms of collaboration and interaction that occur in these communities draw attention to the role regional institutions play in supporting innovation in a global economy. Distance is a critical variable that exerts a significant influence over the success of transferring new product innovations from the laboratory to commercial exploitation or the success of adopting and diffusing process innovations across developers and users. This focus on the importance of the region as a site for innovation has led to a new emphasis on the importance and contribution of the regional system of innovation.

Both the broader systems of innovation approach and its regional application are of specific relevance to an economy with the breadth and diversity of Canada's. Attempts to understand the nature of the innovation process and to develop policy to support it solely at the national level may founder on this problem of diversity. A regional focus overcomes this problem and provides a better way to ground our understanding of the innovation process within the diverse realities that make up the national economy.

APPENDIX B

Justification for Methodological Approach

The contents of this project were publicly presented nationally several times between January 2001 and December 2003. As a result of these presentations, the same methodological critiques emerged from conference participants. These critiques included questions surrounding the validity of research that did not conduct an all-male focus group, the lack of statistically valid quantitative research techniques, and the researcher setting out to find what she wanted to find.

The idea of conducting a focus group of only men did not go without consideration. After extensive thought, it was deemed methodologically justifiable to assume that the documents used to form the basis of current innovation surveys are based on traditional economic value systems reinforcing 'malestream' perspectives and practices. It was therefore determined that the validity of the OSLO Manual and ISRN questionnaire (which formed the basis for the focus groups) were in fact already 'tested' on a male population. The time and resources available for this project resulted in the decision to focus on women's perspectives related to these instruments.

The assumption that this research is not valid because it does not use quantitative research techniques can also be refuted. It was proposed in a recent conference (Calgary, October 2003) that in order to truly test whether men and women would answer the questionnaire differently it was necessary to conduct 1000 interviews with both men and women from a controlled population. Theoretically, this proposal is solid and justifiable. Unfortunately, the systemic barriers and differences in social roles affecting the type of employment men and women participate in results in the lack of women available to participate in such a research project. It would be extremely difficult to study women in the same position as men as they simply do not exist. The time and financial limitations guiding this project did not allow for such research.

Another possible critique was that the researcher set out to find what she wanted to find. Based on the mediator's lack of experience the focus groups were in no way controlled and manipulated. In fact, the focus groups consisted of two hours of conversation that relied on minimal mediation and free flowing, unprompted discussions by the participants. Furthermore, the themes that emerged resulted in the hypothesis changing from "Is there an inherent bias in the types of questions asked in interview guides used in innovation studies?" to "Do innovation-type surveys serve to exclude certain forms of innovative practices by using a limited target population?" The change in hypothesis resulted in the re-examination of the themes from the focus groups with one-on-one interviews. These interviews verified the themes in the focus groups.

The one-on-one interview style was adopted as the data collection technique in order to avoid the power dynamics that occurred in the focus groups. As stated in this report, some individuals' participation appeared to be inhibited as a result of their perceived social status. It was, therefore, essential that any barriers to participant discussion in the second phase of research be removed.

This research brought awareness of the fact that men and women have different roles and different perspectives regarding systems of innovation. Many elements of innovation are not capture by the mainstream style of surveys that are currently used. It is essential that more qualitative analyses be conducted in order to maximize researcher understanding of the social dynamics that occur when creating new ideas and products. This will assist in supporting future economic trends and directions.

APPENDIX C

SIMON FRASER UNIVERSITY

OFFICE OF RESEARCH ETHICS

BURNABY, BRITISH COLUMBIA
CANADA V5A 1S6
Telephone: 604-291-4370
FAX: 604-291-4860

June 13, 2002

Ms. Nicola Crowden
Graduate Student
School of Communication
Simon Fraser University

Dear Ms. Crowden:

Re: Examining Gender Bias in Studies of Innovation Policy Making
Status of Women Canada

I am pleased to inform you that the above referenced Request for Ethical Approval of Research has been approved on behalf of the Research Ethics Board. This approval is in effect for twenty-four months from the above date. Any changes in the procedures affecting interaction with human subjects should be reported to the Research Ethics Board. Significant changes will require the submission of a revised Request for Ethical Approval of Research. This approval is in effect only while you are a registered SFU student.

Best wishes for success in this research.

Sincerely,

Dr. Hal Weinberg, Director
Office of Research Ethics

c: A. Holbrook, Supervisor

/bjr

APPENDIX D

Examining Gender Bias in Studies for Innovation Policy Making

Womens' Advisory Group for Innovation Studies

(WAGIS)

The Women's Advisory Group on Innovation Studies (WAGIS) was established in 2002 with the intent of advocating gender equality in research methods. WAGIS: carries out research on the effects of gender in interactive research environments, analyses existing social research instruments to determine if there are inherent gender biases in the methodology and structure of the tools which could lead to gender-biased results; and researches the gender differences in the sources of and barriers to innovation in research and technological environments.

Gender Sensitivity of Innovation and Cluster Research Instruments: The objective of this research proposal is to investigate whether interview-based research tools used in projects researching the new economy have an underlying gender bias. This project will develop an innovative research methodology to verify the gender neutrality of surveys and questionnaires based on the OECD Oslo Manual model used in research projects on technological innovation. WAGIS will be using the Innovative Systems Research Network project (ISRN) as a case study to investigate whether the interview-based research tools being used are gender biased. This will result in a better understanding of the consequences of gender differences in approaches to technological innovation and will inform policy makers on the need to be sensitive to gender issues in formulating innovation policies. Status of Women Canada is supporting this initiative. The expected outcomes will include: the development of gender-neutral methodologies for studying innovation, a reanalysis and normalization of results from existing survey instruments, and the sensitization of policy analysts, decision makers, and researchers working in the field.

The Innovation and Clusters Project: Researchers at the Centre for Policy Research on Science and Technology (CPROST) at Simon Fraser University are participating in a major national study on the role of local and regional industrial clusters in Canada. This five-year study funded by the Social Sciences and Humanities Research Council that will examine the impact and importance of cluster-driven innovation in Canada. This study will investigate how local networks of firms and supporting infrastructure of institutions, businesses and people in communities across Canada interact to spark economic growth. This is a national project with a regional focus.

Background: Canada's ability to adapt its resource-based traditional economy to a more knowledge-driven technology-based economy will play a key role in the maintenance of our high living standard. Success in the new knowledge-based economy increasingly depends on the ability to apply the results of innovation - a new, or significantly improved, service, product, production technique, or management method. Recent studies of the innovation process point towards the interdependence of economic, political, social and cultural factors in determining the relative degree of success enjoyed by individual nations and regions in the global and knowledge-based economy. These studies point the way towards a better understanding of the complex interdependencies between internal firm dynamics around the innovation process and the broader institutional setting within which the firms operate.

Theoretical approach: Based on the conventional division of labour between men and women in Canadian society, and the adopted socially prescribed characteristics that influence the way men and women behave in the workplace, it is likely the innovative process is structured to privilege men. Is the diminution of the role of women in the process of innovation reflected and reinforced by the

methodology and instruments used in the ISRN project? Although literature discussing women's roles in science and technology has acknowledged systemic barriers to their involvement in this field, this literature has neglected to consider the research tools used to represent women's perceptions and attitudes towards processes of technological innovation.

The structured nature of the professional engineering licensing process provides a wealth of data acknowledging systemic barriers to women's involvement in engineering. Women comprise only 6% of the total population of registered professional engineers and comprise about 20% of the total bachelor level engineering graduates. While the increase of women's participation in professional engineering is, in part, a result of policies aimed at encouraging women to pursue science and engineering careers, there will be a ceiling effect and women's involvement in the professions will plateau at around 25%.

While establishing themselves in these professions many women face sexism and gender biased work environments. Technologies are generally developed in systems based on male-defined work ethics and professional norms. For example, women in engineering have stated they leave the profession because the organisational structure is too rigid, there is a lack of flexible work options, and they experience harassment. When participating in the public sphere women often continue to maintain family responsibilities and try to balance them with the demands of work. It is argued family responsibilities prevent women from receiving job promotions, as work hours are too demanding, and from networking with other professionals outside of the office, such as at trade shows and conventions. Equally it is likely the high drop out rate of women from engineering positions is a result of unequal access to advancement and the difficulty of balancing work and family. The social roles prescribed to women that effect their involvement in innovative processes must be taken into consideration by studies such as the ISRN project.

Methodology: In order to determine whether the methodological tools used in the ISRN project (particularly the interview guide and its related coding techniques) are gender indifferent, there will be an analysis of the content of the specific questions in the interview guide. This analysis will use focus group techniques to investigate gender biased assumptions on the sources of innovation, the barriers to innovation and their outcomes, and the necessary factors which influence the creation of innovative industrial clusters which could result in differences of interpretation between the men and women being interviewed.

We will be contacting people in the community to participate in focus groups, but if you would like to participate please contact us.

Contact Information: Nicola Crowden, Project Officer (wagis@sfu.ca)

APPENDIX E

Non-Response Diary

April 2002

April 15	• WAGIS meeting; methodology agreed upon.
April 16	• Began administrative tasks for first scheduled networking event for participant recruitment.

May 2002

May 3	• Attended Applied Science Trades and Technicians of B.C. (ASTTBC) Annual General Meeting. No women in attendance; unable to distribute briefing note.
May 5	• Advances Science Innovation (ASI) Exchange; distributed briefing notes.
May 8 - 14	• Away at conference in Quebec; WAGIS briefing note distributed.
May 14	• T.D. at ASTTBC distributed briefing note via e-mail to all female members in the BioSciences, BioMedical, Electronics, Chemical, and Gas and Petroleum (total = 193). ▪ BioScience: 139 members (60 women) ▪ BioMedical: 140 members (34 women) ▪ Electronics: 1550 members (74 women) ▪ Chemical: 132 members (22 women) ▪ Gas and Petroleum: 80 members (3 women)
May 15	• Left message at Wired Women for T.L. (605.8825); no response.
May 16	• E-mailed Women's Entrepreneurs of Canada (Sheila@portfolio.com) and asked if could distribute briefing note; no response. Also called Vancouver office (682.7390); no response. • E-mailed Women's Enterprise Society of BC (Karin@wes.bc.ca) WAGIS briefing note; posted on Web site; did not result in any responses.

E-mail method: Would send personal e-mail to contact person with description of project and objective. If respondent replied and showed interest another e-mail would be sent asking for information regarding job title and year in sector – as the focus group were originally created based on these demographics.

May 17	• E-mailed M.K., Sr. Advisor – Public Policy. (F contact), *(too busy)* • Response from ASTTBC e-mail – A.S., biomedical engineer tech (lives in Cranbrook). • E-mailed E.U., VP – Chromos (biotech) (F contact). Replied 'no' *(too busy).* • E-mailed M.B. (F contact) *(no response).* • E-mailed N.K., reality software (F contact); replied back, interested. On May 23, sent second e-mail; May 30, send third. Stated in original e-mail that would attend, but not outside of downtown core. Sent package to participate. Called and informed me the questionnaire she received was biotech and concerned as she is in MM. I told her June 7 just a standard questionnaire, *(too busy).* • E-mailed J.B. (F contact) *(no response).* • Sent second e-mail to M.M., e-learning strategies (F contact). Replied 'can't commit time' *(too busy).* • E-mailed K.W., CEO of two high tech Companies in software sector, Synergy Computer Software (F contact); showed interest. Sent second e-mail on May 23, again May 30. Agrees to participate July 24 or June 21. Asked for mailing address. Last minute holiday prevented her from attending. *(vacation)*

May 17 (continued)
- E-mailed J.F., BC Cancer Agency, Business Affairs Leader (F contact) *(no response).*
- Sent second e-mail to E.R., student (ASTTBC contact) *(no response).*
- Sent second e-mail to K.B., works for Telus (ASTTBC contact – CTECH). No show at Focus Group (was originally a change agent). *(no show)*
- Sent second e-mail to A.R., lab tech in oil field industry in Red Deer Alberta (ASTTBC contact). Stated is very interested and will help in another form if she can *(geographically limited).*
- Sent second e-mail to A.S., biomedical engineering tech (ASTTBC contact). Lives in Cranbrook, but will help in another way if she can *(geographically limited).*
- Sent second e-mail to S.C., QA software (ASTTBC contact). Asked if there will be an honorarium; I replied no (no further contact) *(no honorarium).*
- Sent second e-mail to L.R (ASTTBC contact) *(no response).*

May 23
- Sent second e-mail to Dr. C.S. (SCWIST contact) *(participant).*
- Sent second e-mail to Dr. A.E., Director of Biotech and Natural Product Division (SCWIST contact) *(no response).*
- Sent second e-mail to H.M., Director of diversity and recruitment at the Dean's Office of Applied Science (SCWIST contact). Resent info May 30 *(no response).*
- Sent second e-mail to M.B., Doctoral Candidate in Technology Studies in the faculty of education (SCWIST contact). E-mailed me and asked to discuss research *(didn't qualify to participate in research).*

May 30
- Called C.L., NRC rep for wireless (referred me to K.M.). E-mailed me she is busy, but will be around later in June for a phone conversation *(too busy).*
- Called A.M., NRC rep Biotech. E-mailed again June 21 *(no response).*
- K.M., ex-president of Wired Women, agreed to participate, but couldn't make July 24 focus group because going on *(vacation).*
- E-mailed S.A., Director of Systems Science (A. contact). Too busy, but referred me to D.M. (*too busy*).
- D.M. (President of SCWIST). Gave me more contacts (*participant*).
- E-mailed Digital Eve to distribute briefing note; did not respond.
- E-mailed the Institute for Women in Technology www.iwt.org; did not respond.

June 2002

June 1
- Sent first e-mail to T.G., Davis and Company, partner at law firm (M. contact). Responded to first e-mail and sent second June 2. *(participant)*
- Sent first e-mail to V.T., works at Cantox (M. contact) (*no response*).
- Sent first e-mail to S.K., BioPharma Solutions biopharmasolutions@telus.net (M. contact). Sent second e-mail June 13 *(no response).*
- E-mailed N.H., President at Ventures West (M. Contact). Responded and sent second e-mail June 3. Responded to request about why asking for years in company. Sent third e-mail June 3. Confirmed for August 7. Sent e-mail asking for mailing address *(no response after asking why want demographic info).*
- E-mailed T.M., Hill and Knowlton (M. contact). Responded and sent second e-mail June 2 *(no response).*
- E-mailed J.H. (M. contact). Responded to first e-mail; sent second on June 2 (*participant*).

June 1 (continued)

- Sent first e-mail K.L., Stemcell. Cold call based on ISRN contact *(no response).*
- Sent first e-mail to S.G., Cardiome Pharma Corp. (M. contact) *(no response).*
- Sent first e-mail to A.H., Canadian Venture Exchange. Sent second e-mail asking for work info. Sent e-mail June 16 asked to attend July 31 *(no response).*
- Sent first e-mail to M.B. (M. contact) *(no response).*
- Sent first e-mail to D.W., Phytogen Life Science (M. contact) *(no response).*
- Sent first e-mail to A.E. (M. contact). Replied and sent second e-mail June 6 asking to attend July 17 focus group *(no response).*
- Sent first e-mail to G.G., I.G. Micromed (M. contact) *(no response).*
- Sent first e-mail to C.W. (M. contact) *(no response).*
- Sent first e-mail to M.M., Healthcare Dynamics (M. contact) *(no response).*
- Sent first e-mail to L.C.; attending July 17 *(participant).*
- Sent first e-mail to B.I., BCD Venture (M. contact) *(no response).*
- Sent first e-mail to L.B., Center for Molecular Medicine and Therapeutics (M. contact) *(no response).*
- Sent first e-mail to D.K., Galt Global Recruiting (M. contact) *(no response).*
- Sent first e-mail to M.H., The iCapture Centre (M. contact) *(no response).*
- Sent first e-mail to K.S., JR Laboratories Inc (M. contact) *(no response).*
- Sent first e-mail to D.S., International Wex technologies (M. contact) *(no response).*
- Sent first e-mail to C.P., Micrologix biotech (M. contact) *(no response).*
- Sent first e-mail to C.W., Blake, Cassels and Graden LLP (M. contact) *(no response).*
- Sent first e-mail to D.A., BCTIO Ministry of Competition (M. contact) *(no response).*
- Sent first e-mail to C.R., Xillix Technologies Corp. Responded June 2 *(too busy).*
- Sent first e-mail to L.K., Ray and Verndston. Sent second e-mail explaining the dates *(no response).*
- Sent first e-mail to C.W., Parallel Vancouver (M. contact) *(no response).*
- Sent first e-mail to N. (M. contact) *(no response).*
- Sent first e-mail to D.K., Future Works. Responded and sent second e-mail June 3 (*too busy*).
- Sent first e-mail to A.N., Northy Communications and Designs (M. contact) *(no response).*
- Sent first e-mail to G.S. (M. contact) *(no response).*
- Sent first e-mail to S.T., Teeter Totter Productions. Responded and sent second e-mail June 3 *(no response).*
- Sent first e-mail to C.W., B.C Functional Food & Nutrition (M. contact) *(no response).*
- Sent first e-mail to C.B., UBC UILO officer. Responded and asked to attend July 17 on July 2 *(no response).*

June 5

- Sent first e-mail to M.S. (LC contact) *(no response).*
- Sent first e-mail to J.R. from Wired Women (K.M. contact). E-mailed me June 8 to let me know will disseminate briefing note.
- Sent first e-mail to G.S., BC Hydro Sr. Environment Coordinator (D.M. contact). Sent second e-mail *(no response).*
- Sent first e-mail to P.F., Recruiting and Human resource Manager "Main Frame

June 5 (continued)	Entertainment" (D.M. contact) *(no response).* • Sent first e-mail to S.M., BANDGAP Photonics V.P. Human Resources (D.M. contact) *(no response).* • Sent first e-mail to K.J., Micheal Smith Foundation for Health Research, Program Manager (D.M. contact). Sent second e-mail *(no response).* • Sent first e-mail to wiredwomen@info.com. E-mailed "to whom it may concern" about distributing the briefing note to Wired Women.
June 11	• Sent first e-mail to digitialeve@memberservices.com M.B for list serve info; no response.
June 13	• E-mailed BCTIA and asked if could distribute briefing note at conference.
June 15	• Sent first e-mail to C.J., dentist (C.H. contact). Sent first e-mail following up a conversation she had with C.H. Sent second e-mail June 16 *(no response).*
June 20	• M.S. e-mailed second mail from Wired Women list serve – currently on maternity leave; no response. • E-mailed cwcafc@cwc.afc.com (Status of Women contact) asking for access to list serve; no response. • E-mailed enquire@ywcavan.org (Status of Women contact) asking for access to list serve; no response.
June 21	• E-mailed R.S. and asked if he could help with contacts and if it is a good idea to approach his wife for help. • E-mailed M.S. and ask for help. Sent first e-mail *(participant).* • Called C.B., Science Council (A. contact) *(participant).* • Called V.D., Science Council (C.B. contact); agrees to attend *(participant).* • E-mailed A.H., consultant (R.S. contact) *(participant).* • E-mailed D.M. (R.S. contact) *(participant).*
	July 2002
July 2	• E-mailed C.S. from BCTIA. Called July 4 and resent e-mail asking for work *info (no response).* • E-mailed C.L. (D.K. contact) – introduced at V.C. conference *(no response).* • E-mailed M.M. (D.K. contact) – introduced at V.C. conference *(no response).*
July 3	• Responded to briefing note at BCTIA wellness event – M.G. *(participant).*

Responses as a result of conferences attended:

- There was one response from the BCTIA conference attended that resulted in the recruitment of a participant.

Responses from mass e-mail through list serve:

- Six women responded from the ASTTBC e-mail and three were unable to participate due to geographical limitations. One was registered as a participant and did not show for the focus group. Two did not respond to second e-mail.
- Four responses were a result of the SCWIST e-mail and resulted in one participant. Two potential participants did not respond and the other was a doctoral student and did not qualify.
- One e-mail was a result of the Wired Women distribution.

Personal contacts = 64
List Serve contacts = 12
Total = 76 women contacted with personalized e-mails requesting participation

In total, 76 women received personalised follow-up e-mails requesting their focus group participation (64 from personalised contacts and 12 from interest in a list serve distribution) resulting in 12 focus group recruits. Of the remaining 64 potential participants, 40 women did not respond to the initial e-mail contact, seven women did not respond to the second e-mail, and 17 women provided several reasons for not being able to attend a focus group. Reasons for not attending included:

- Too busy (eight women)
- Already planned vacations (four)
- Geographically limited (three)
- Did not respond to an e-mail informing there was no honorarium (one)
- Not eligible to participate due to being a student (one)
- Questioned why demographic information was being requested and then did not respond to subsequent e-mails (one).

The seven non-responses to the second e-mail were possibly a result of the stated time of the focus group (7:30 a.m.), the request for employment and age information, or a lack of interest in the subject matter.

APPENDIX F

"Examining Gender Bias in Studies for Innovation Policy Making: Phase Two"

Will you be asking your subjects to participate in a project involving completion of an interview questionnaire, survey or a similar instrument? Yes – No

If yes, please submit the instrument and describe below the nature of the survey and the types of information the survey is intended to access. Include information about how you will secure informed consent of your subjects.

Subjects

The research initiative "Examining Gender Bias in Studies for Innovation Policy Making: Phase Two" will draw its sample from women working in management or executive positions in the biotech and multimedia industry in Vancouver. The subject pool from which these women will be drawn from is based on the research design adopted by the first phase of this project (which received ethics approval from SFU on June 13th, 2002). The first phase of this research used the snowball sampling technique to approach 75 women to participate in a focus group. From these 75 women contacted 11 participated in one of two focus groups. These focus groups provided the information forming the foundation for phase two of this project.

Phase two of this research initiative will draw a sample of between 10-15 women from those who belonged to the 64 women who did not respond to the personalized email requesting their participation in a focus group.

The subjects for phase two will be sent a personalized letter (see attached) outlining the research initiative and inviting them to participate in a short – roughly 10-15 minute interview, either via phone or in person. The subjects will be ensured anonymity and provided with contact information where they can receive information about the project.

Informed Consent

The women will be sent a consent form with the letter requesting their participation in the interview. Upon accepting the invitation to participate, the women will be asked to complete the consent form and return it via fax or mail.

Interview Schedule

The interview schedule is comprised of questions that attempt to probe the subject's perception of organizational dynamics within the high tech companies of which they are employed. The analysis of the focus group data from the first phase of this research aided in understanding the importance of several elements of corporate culture that influence the processes leading to innovative activities. An essential area of focus in the groups was on the creation of knowledge in a firm leading to the development of innovative activities and products. The focus on the formation of knowledge as being key to innovation is reflective of the change in the economic environment from manufacturing based industries to a 'knowledge-based economy'. Facilitating innovation in the knowledge-based economy is understood to be the conversion and creation of knowledge aimed at maximizing corporate product of service outputs. The underlying theme of the importance of knowledge creation has assisted in choosing the next direction of this research, which is focused on the organizational dynamics in the firm and the impact on knowledge creation.

The increased focus on knowledge creation has sparked a change in organizational culture within the work place in an attempt to maximize knowledge based innovative behaviour. The change in organizational culture has placed an emphasis on the activities of those involved in creating knowledge. The corporate

roles of knowledge producers and facilitators and the dynamics of organizational structures affect women in the workplace, as suggested by the focus groups, and are therefore important to understand. Derived from the focus group data is the hypothesis that despite the change in organizational structure of the workplace – women continue to encounter similar challenges as when the economy was manufacturing based. That is, the two new technological based sectors, multimedia and biotechnology, are comprised of barriers to women that are related to 'old' work routines associated with old industries. Thus, this evidence supports the theory that challenges to women in the workplace are systemic in nature and reinforced by conventional workplace practices.

It is imperative for this project that conventional workplace dynamics of a corporate innovation culture is understood in order to adequately asses an affective means of conducting a Gender Based Analysis on measuring the elements effecting innovation in the workplace. The aim of this project is to determine key indicators used to measure corporate culture that will assist in measuring and promoting innovation in a manner that is supportive of women and recognises the systemic issues affecting their methods of contribution to the innovation process. In doing so, we will examine the strategies, policies, practices and decisions that result in the successful management of high tech companies – and whether successful companies are those that welcome diversity and are more open to women's perspectives.

APPENDIX G

SIMON FRASER UNIVERSITY

OFFICE OF RESEARCH ETHICS

BURNABY, BRITISH COLUMBIA
CANADA V5A 1S6
Telephone: 604-291-3447
FAX: 604-268-6785

May 7, 2003

Ms. Nicola Crowden
Graduate Student
Department of Communication
Simon Fraser University

Dear Ms. Crowden:

Re: Examining Gender Bias in Studies for Innovation Policy Making: Phase Two
Status of Women Canada

I am pleased to inform you that the above referenced Request for Ethical Approval of Research has been approved on behalf of the Research Ethics Board. The approval for this project is for the term of the period of the grant, as defined by the funding agency. If this project does not receive grant support, the term of the approval is twenty-four months from the above date.

Any changes in the procedures affecting interaction with human subjects should be reported to the Research Ethics Board. Significant changes will require the submission of a revised Request for Ethical Approval of Research. This approval is in effect only while you are a registered SFU student.

Your application has been categorized as 'minimal risk" and approved by the Director, Office of Research Ethics, on behalf of the Research Ethics Board in accordance with University policy R20.0, http://www.sfu.ca/policies/research/r20-01.htm. The Board reviews and may amend decisions or subsequent amendments made independently by the Director, Chair or Deputy Chair at its regular monthly meetings

"Minimal risk" occurs when potential subjects can reasonably be expected to regard the probability and magnitude of possible harms incurred by participating in the research to be no greater than those encountered by the subject in those aspects of his or her everyday life that relate to the research.

.../2

Page 2

Please note that it is the responsibility of the researcher, or the responsibility of the Student Supervisor if the researcher is a graduate student or undergraduate student, to maintain written or other forms of documented consent for a period of 1 year after the research has been completed.

Best wishes for success in this research.

Sincerely,

Dr. Hal Weinberg, Director
Office of Research Ethics

c: Dr. Catherine Murray, Supervisor

/jmy

APPENDIX H

Name
Company
Address
City, BC
Canada

Sunday, May 04, 2003

Dear Ms. _____,

How can we develop indicators of which will predict and promote innovation and knowledge in the new economy? This study aims to support women and identify the systemic barriers affecting women's contribution to building a culture of innovation.

You were originally contacted by email in June 2002 to participate in a focus group because of your professional status in the _____community. Your contact information was provided by _____.

We want you to participate in a brief ten-minute telephone or personal interview at your convenience during the week of May 20th – May 23rd, 2003.

The Women's' Advisory Group on Innovation Studies, referred to as WAGIS, is researching tools used in projects studying the new economy. Several hypotheses emerged as a result of the focus groups regarding the importance of understanding women's contribution in the corporate cultures influencing innovation. The questions you will be asked are based on your perceptions of "innovation", the importance of human capital and management styles of a firm, and the link between innovation and workplace dynamics that promotes women's involvement in the innovation process. We are interested in your views.

Enclosed with this letter you will find an abstract on the purpose of WAGIS'. Any time you can provide in sharing your insight into these subject areas will be valuable and appreciated.

All of the information gathered from you will be treated as confidential. Your participation in this study is strictly voluntary.

You may withdraw at any time from this study. If you have any questions please feel free to ask the interviewer, or to contact me. Should you wish to direct your concerns to someone else within the university please do not hesitate to call Nicola Crowden at 604.291.5257. I thank you in advance for your participation.

Yours sincerely,

Dr. Catherine Murray, Project Supervisor
604.291.5322

Nicola Crowden, Project Leader
604.291.5257

APPENDIX I

PHASE TWO QUESTIONS

1) How do you define "innovation"?

   - How do you feel you influence innovation?

A. What type of innovation is your firm involved with?
B. How do you define a culture of innovation?

2) What factors in your organization do you think cultivate/support innovation? (For example; hierarchical or flat organizations)
(Culture – values and practices of an organization)
   - How do you feel your work can contribute to a more innovative work environment?
   - Do you think a firm's cultural diversity policies influences how they accept and support women?

A. Do you think there are certain workplace cultures that promote innovation within your industry?
B. What is most important in supporting a culture of innovation within your industry?
C. Do you think organizations that promote teamwork are more effective in terms of innovative progress?

Scenario question:

If you were working in a Venture Capital Industry/sector/firm and were interested in participating in a start up a Biotech or Multimedia company or organization, what are key factors you would use to identify if there is *innovative capital* in management to warrant an investment?

3) What promotes your involvement in the innovation process?
   - What is your definition of a successful process of creating innovation or an innovative producing environment?
   - What should researchers be aware of in order to find a link that promotes women's involvement in the innovation process?
   - Is there a link between the richness of a firm's cultural diversity and their ability to innovate? – (or productivity)

A. Do diverse opinions benefit the process of knowledge creation within the firm?
B. What human resource policies best promote the innovation within your firm – within other firms?

APPENDIX J

Women's Advisory Group Innovation Strategy

July 17th 2002, 7:30 a.m. – 9:00 a.m.
Room 101 at Harbour Centre
515 West Hastings
Focus Group

7:20-7:35 **Welcome**

7:35-7:45 **Introductions**

7:45-7:50 **Participant Introductions**

7:50-8:10 **General Discussion**

1) What types of innovation are you involved with?

2) How do you influence innovation in your firm? What works and what doesn't?

8:10-8:35 **Challenges**

1) When have you experienced challenges in your role as an innovator in your firm?

2) Did you have a mentor? What did you think about the mentoring?

8:35- **Questionnaire Discussion**

1) What do you like or dislike about this definition?

2) Do you think the ISRN interview guide asks the right questions? What would you add to the interview guide? How would you improve the interview guide?

3) How would you answer the questions in the ISRN interview? Do you think the guide is applicable to you?

4) Do you think men would answer these questions differently?

5) Would you answer the questionnaire in a corporate voice or personal voice?

6) Are there any recommendations you can make about gender-based analysis of innovation in such surveys?

Thank you

APPENDIX K

Consent Form

Dear Participant,

Simon Fraser University's ethics policies guiding research requires you to read and sign this consent form. If you have any questions regarding this consent form, please feel free to ask for clarification.

You are attending a focus group conducted at the Centre for Policy Research on Science & Technology (CPROST) as part of the research undertaken by the Womens' Advisory Group on Innovation Studies, referred to as WAGIS.

CPROST is part of the school of Communication at SFU. The Centre is involved in research into many aspects of Innovation, from theoretical examinations of how and when it occurs, to the development of policy relating to, and supporting, technological innovation in specific economies.

Currently, WAGIS is researching whether interview-based research tools used in projects researching the new economy have an underlying gender bias. WAGIS will be using the Innovation Systems Research Network (ISRN) project as a case study. The ISRN project involves interviewing professionals at management level in the industry clusters such as wireless, biotechnology, and multimedia. The majority of the ISRN participants will be male, as women are less likely to fill these roles in Science and Technology firms. The intention behind conducting focus groups is to obtain the opinions of women who may not be represented by the interview guide used in the ISRN project. These focus groups will allow you to voice any concerns they may have with the interview guide.

Statements gathered from this focus group could be used as a quotation when analysing and reporting the results. The organisation and individual quoted will be *anonymous*.

All of the information gathered from the focus group will be treated as confidential and will be stored under lock and key. Your participation in this study is strictly voluntary and we assure you that neither your identity, nor that of your organisation, will be revealed in any presentation or publication that results from this research without your explicit permission. We will be tape recording this session, but these recordings will only be used for the purpose of transcription and analysis.

You may withdraw at any time from this study. If you have any questions please feel free to ask Nicola Crowden or Caroline Hickton. Should you wish to direct your concerns to someone else within the university please contact the Director of the School of Communication at Simon Fraser University at 604-291-3383.

Participant's Name: (please print)

_____

Signature: _____ Date: _____

APPENDIX L

ISRN CLUSTER STUDY—COMPANY GUIDE OCTOBER 17TH, 2001

Company Fact Sheet

Pleased be reassured that all information will remain confidential.

Company Name: _____

Address: _____

Contact Name/Title: _____

Phone No.: _____ Fax No. _____ E-mail: _____

Note on Terminology The term "*firm*" refers to your company as a whole while the term "*establishment*" refers to the branch or subsidiary in which you are located if distinct from the former.

1. *Firm ownership* (please check all that apply):

   ☐ Public ☐ Private ☐ Foreign ☐ Domestic

2. *Year this establishment was founded*: _____

3. *Type of business*: SIC Codes: _____

   ☐ Service Please specify: _____

   _____

   ☐ Manufacturing Please specify: _____

   _____

4. *What is the number of employees*	Permanent	Contract
At this location:	_____	_____
In this region:	_____	_____
In your firm (if different):	_____	_____

5. *How many employees of your establishment are in*:

Management:	_____	_____
Marketing/Sales:	_____	_____
Logistics and Distribution	_____	_____
Production:	_____	_____
Research & Development	_____	_____
Other (please specify)_____:	_____	_____

ISRN Cluster Study—Company Questionnaire

Part A: Company Background

The purpose of this section is to gain a sense of the background factors that underlie the presence and growth of the company in its specific cluster. Interviewers should pursue any other relevant lines of information that are introduced in the interview that expand on these points.

1. What events stimulated the founding of this company? Who were the individuals and-/or organisations inside and outside the company who player a key role in its development?

2. If your company is a subsidiary or branch of another firm, what role does it plat within the overall corporate structure?

3. Are there any other companies in this region and/or province that your company is associated with? Do you have a strategic partnership with any particular company? Were you spun-off from any other companies; or have you spun-off any companies from your firm?

4. Why is your company located in this region/locality/specific part of town?

5. What are the current advantages of this particular location for your company?

Part B: Research Strategy and Innovation

The purpose of this section is to gain some insight into the way the company positions itself to innovate within the context of its cluster. Interviewers should adapt their questions to the realities of competition and innovation within their specific clusters.

6. During the last three years, did your company offer new or improved products (goods or services) to your clients, or introduce new or significantly improved production/manufacturing processes?

7. Was this the most important innovation...

   - A world first?
   - A first in Canada?
   - A first for your firm
   - A first in the market for which you serve?

8. What is the relative importance of the following *local* sources of innovative ideas for your product, service and process development [1=not important, 5=very important]

	Not important (1)				Very important (5)
Research and development unit	1	2	3	4	5
Marketing department	1	2	3	4	5
Suppliers	1	2	3	4	5
Competitor's products	1	2	3	4	5
Fed. or Prov. Agencies/research inst.	1	2	3	4	5
VC or other financial services	1	2	3	4	5
Production engineering staff	1	2	3	4	5
Management	1	2	3	4	5
Customers	1	2	3	4	5
University researchers	1	2	3	4	5
Consultants (academic or professional)	1	2	3	4	5
Other, (please specify)	1	2	3	4	5

_____

9. What is the relative importance of the following *non-local* source(s) of innovative ideas for your product, service or process development?

	Not important				Very important
Parent or affiliated companies	1	2	3	4	5
Suppliers	1	2	3	4	5
Customers	1	2	3	4	5
Universities Researchers	1	2	3	4	5
Fed. or Prov. Agencies or research instit.	1	2	3	4	5
VCs or other financial services	1	2	3	4	5
Suppliers	1	2	3	4	5
Other public research institutes	1	2	3	4	5
Competitors products or services	1	2	3	4	5
Consultant (academic or professional)	1	2	3	4	5

Part C: Networking, Relationships, Suppliers and Customers

These questions are designed to probe the role of demand and supply factors in the formations and strength of the cluster. We are interested in the extent to which co-location may be a crucial factor in grounding the cluster.

10. Where are your key customers located—locally (within 100km), in the rest of the country, North America or the world? How important is it for you to be located close to them? Would your company consider relocating to be closer to these key customers?

11. Are your relations with local customers different from your relations with non-local customers? If yes, in what ways are they different?

12. What are the most important inputs to your company (resources, raw material, components, services)? Are your key suppliers located locally (within 100km) or non-locally? How important is it for you to be located close to them? Would your company consider relocating to be closer to these key suppliers?

13. Are your relations with local suppliers different from your relations with non-local suppliers? If yes, in what ways are they different?

14. Who are tour primary competitors and where are they located? What are their comparative sizes and market shares? Is it important for you to be located close to them as well?

15. How does your company keep track of the activities of your current and potential competitors? Or to monitor competitive products, services or process innovations?

Part D: Location/Infrastructure Factors

The purpose of this section is to test for some of the classic factors identified in the cluster and RIS literature as influencing the development of clusters. Interviewers should alter the questions to reflect the realities of their own clusters.

16. What are the most important factors in the local/regional economy that contribute to or inhibit the growth of your firm?

- Co-location with other firms in the same industry
- Supply of workers with particular skills
- Physical, Transportation or communications infrastructures
- Availability of financing
- Specialized research institutions and universities.
- Specialized training or educational institutions
- Presence or key suppliers and/or customers
- Government policies or programs
- Other

17. Of the factors mentioned above, which are the two or three most important for the growth of your firm?

18. What are your main sources of new employees in each of the following categories?

Employee Categories Position	Postsecondary Institutions (local/ non-local; please give examples)	Specialized Training Programs (local /non-local; please give examples)	Other (local/ non-local; please give examples)

Management			
Science, Technology, Engineering			
Design			
Marketing/ Sales			
Production			
Freelance/ Contract			

19. Does the labour force in your locality or region possess any distinctive or unique sets of skills, knowledge or capabilities that are an asset to your company?

20. Tell us about the employees that have left your establishment within the last three years; how many have been employed by other firms within your region/locality? If your key employees were to quit, how easily could you replace them from within your local region?

Part E: Role of Research Institutes/ Technology Transfer Centers

This part of the guide is designed to explore the importance of knowledge flows within the cluster and the role that research and technology transfer centers, including IRAP ITA's, play in grounding the cluster. Is the knowledge base so valuable that firms are willing to locate here to gain access to it?

21. How frequently do you or others in your company interact with public research institutes or technology transfer centres (local/ non-local), including federal or provincial government institutes, universities and colleges to gain access to new sources or knowledge?

22. What type of knowledge exchanges are you (or others in your company) involved with?

- Formal collaborative research projects
- Participation in research consortia
- Development or adoption of new technology
- Company personnel working with a College or University
- University faculty working in or consulting with the company
- Licensing or patenting of public research inventions
- Development of specialized training program with college or university

23. Tell us more about how these relationships developed or evolved?

24. What primary benefits do you derive from these relationships?

- leveraging R&D expenditures
- access to technical expertise
- source of new product ideas
- information about the knowledge frontier
- connection to larger research community
- market respectability
- lower overhead costs on research
- access to equipment and material
- problem solving
- improvement of in-house R&D procedures
- hiring and retention of employees

25. How many of these are locally based and what additional benefits do you derive from close proximity?

26. Would you consider relocating or establishing another facility to be located close by such a centre or institute?

Part F: Local Cluster Characteristics/ Social Capital

This section is designed to get at the underlying dynamics of the local cluster, the role of local associations, civic entrepreneurs, etc., and the significance of social capital within the cluster.

27. Do you see your company to be part of a network or related firms in your region/locality (i.e.: cluster)? What evidence is there to this?

28. Are there any specific events that played an important role in the development of your local industry cluster? If yes, explain.

29. Are there any key business, community, or government leaders who played an important role in the development of your local industry or cluster? If yes, explain.

30. Are there any unique local assets or capabilities that have contributed significantly to the development of your local industry or cluster? If yes

31. Does your company employ specialized service providers (such as law firms, accounting firms, business or technical consultants, etc.) located in this region?

32. What are the major sources of finance for your company? (angel investors, family friends, internally generated funds, funds from parents or affiliated firms, banks, VC, equity investment (IPO's) government loans or subsidiaries, others.) What percent of these sources are local (located within 100km.)?

33. How has this changed over the life of your company? Describe the challenges you're faced in obtaining the finances needed for your establishment to grow.

34. Does your company (or key individuals in it) belong to any formal or informal associations at the local and regional level? If yes, which are the most valuable and

why? If no, why not? Are there any significant networking events that your attend regularly?

35. Did any associations play an important role in the development of your local industry or cluster? If ye, explain.

36. Did any of your present relationships with suppliers, customers, collaborators, research institutes develop from your participation in associations, conferences, trade fairs, etc?

37. Are there any government programs that contributed significantly to the development of your local industry? If yes, explain.

Part G: Future

38. What are the key trends (challenges or opportunities) that will most influence the growth of your business in the next five years?

39. What are the most important challenges or obstacles facing your local industry?

40. What factors, external supports or policies would be most helpful in growing your local industry? Or your company?

APPENDIX M

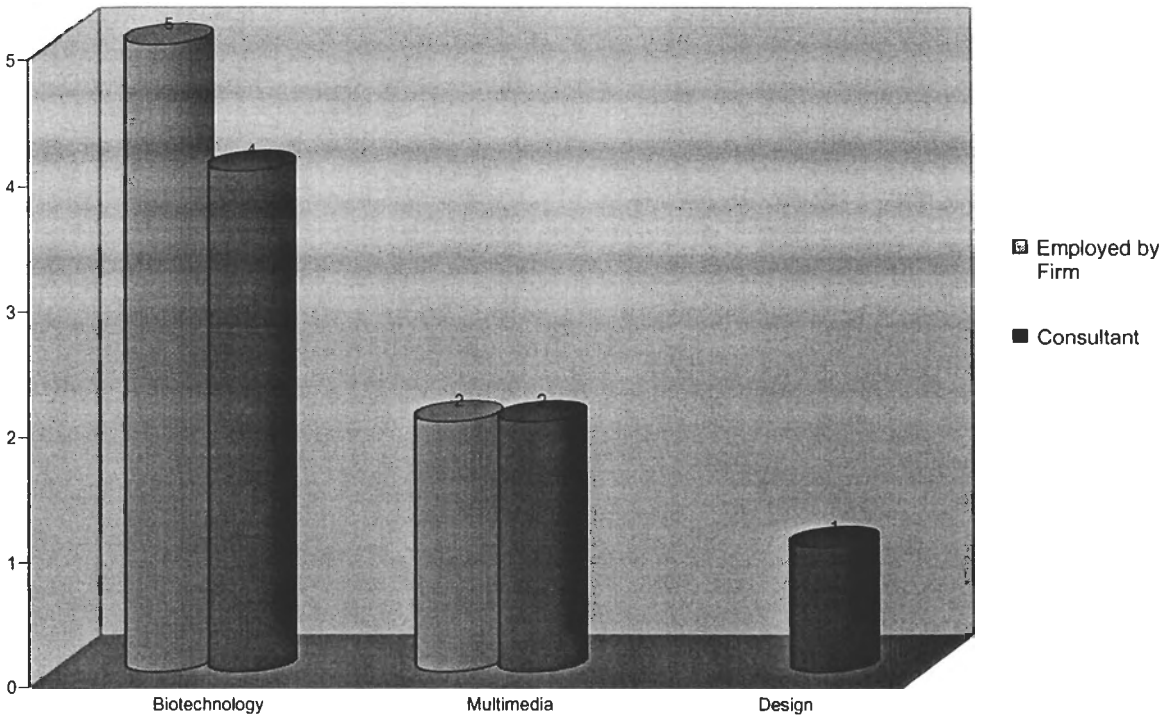
Definition of Technological Innovation:

Technological Product and Process (TPP) innovations comprise implemented technologically new products and processes and significant technological improvements in products and processes. A TPP innovation has been implemented if it has been introduced on the market (product innovation) or used within a production process (process innovation). TPP innovations involve a series of scientific, technological, organizational, financial and commercial activities. The TPP innovation firm is one that has implemented technologically new or significantly technologically improved products or processes during the period under review.

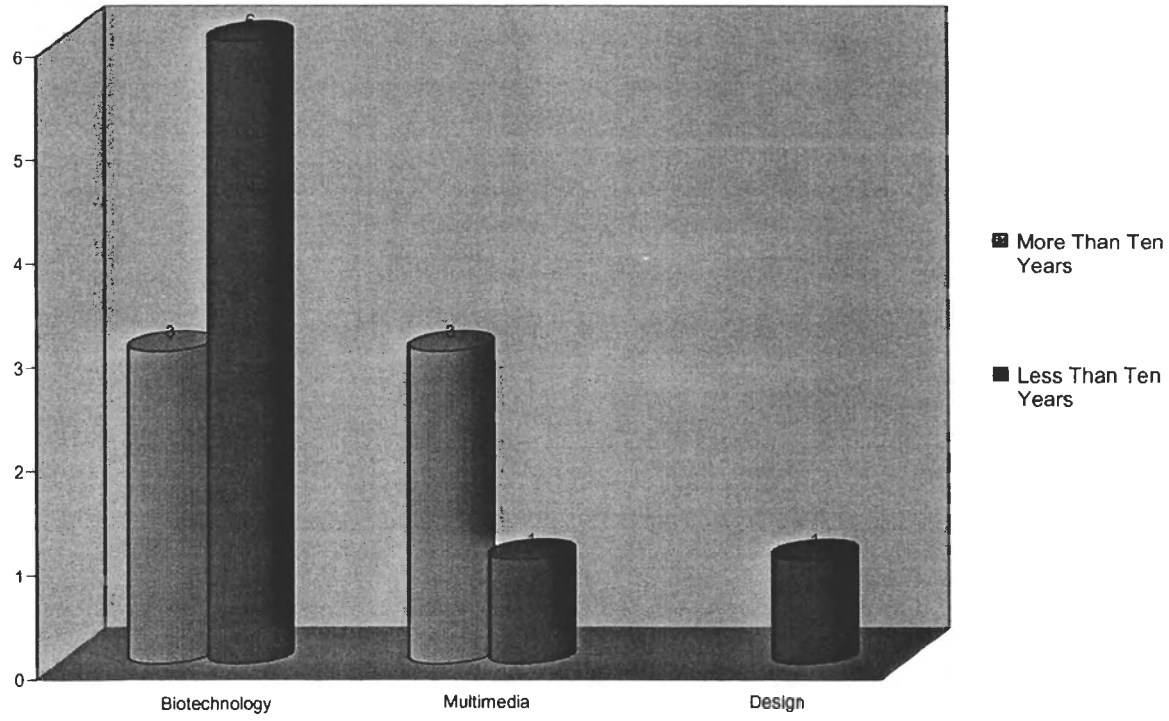
Organisation for Economic Co-operation and Development (OECD)
"Oslo Manual" 2nd edition (1996)

APPENDIX N

Nature of Employment by Industry



Years of Experience by Industry



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