GENDER CHALLENGES FOR WOMEN IN THE CANADIAN ADVANCED TECHNOLOGY SECTORS

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Abstract

Women remain significantly under-represented in the Canadian advanced technology sectors. Women who are employed in high-tech firms are also significantly less likely than men to pursue entrepreneurial opportunities. This study seeks to better understand the association among personal perceptions about gender equity and organizational and industry culture. Results are based on two sequential, on-line surveys targeted to women members of Canadian Advanced Technology Association (CATA). This study documents that many (but not all) women in the advanced technology sector believe they face "gender-specific" career challenges. The challenges are pervasive and embedded at all levels in the worker/employer and business owner/market relationship. Work-life balance dominated the challenges perceived by the women respondents: more than sixty-percent ranked obtaining work-life balance among their top three challenges. Improving leadership skills (team building, people management practices and communications) and lack of women mentors followed. Gender was also seen to influence self-efficacy (sense of credibility, perceived lack of credentials, confidence, know-how), performance expectations (e.g., different performance benchmarks), lack of social capital, networking opportunities, and sense of belonging ("this is a man's world"). Firm and industry level resolution strategies are discussed.

Introduction

Feminist theory and empirical studies have documented gender barriers to women's careers within both the small firm[1] and large organization[2] settings. This study seeks to further inform the literature by exploring perceived barriers to women's advancement in the Canadian advanced technology sectors and potential resolution strategies. To do so, the paper will draw on

[1] For example, Ahl's (2006) review of the literature in the small firm context reports gender differences in the following: owners' personal background and firm profiles; attitudes toward entrepreneurship and intentions to start a business; management practice and strategy; networking and impact on family; access to capital, and organizational performance.

[2] Corporate studies have also documented gender barriers associated with Canadian managers' attributes and perceptions, management practices, organizational culture, and career outcomes (Stroth et al., 1992; Burke & Nelson, 2002; Bank of Montreal, 1991; Women's Executive Network, 1999; Duxbury, Dyke, & Lam, 1999, 2000; Leck, 2002; Rosin & Korabik, 1990). Sector specific studies have also reported on industry influences associated with gender barriers to Canadian women's career outcomes, including: women in the law (Catalyst, 2006a); women in politics (Wicks & Lang Dion, 2007); women in film and television (Women in Film & Television, 2007) and women in information technology (Cukier, 2007).

quantitative and qualitative responses from two sequential on-line surveys women entrepreneurs[3] and corporate managers working in advanced technology firms who are members of the Canadian Advanced Technology Association (CATA). The importance of this study stems from several roots.

- First, women remain significantly under-represented in the technology sectors.[4] While this is partially explained by the general scarcity of women in natural sciences, engineering and mathematics, it is not clear that this difference fully accounts for the under-representation.
- Second, even given the lower frequency of women's participation in technology sectors, women who are employed in high-tech firms are significantly less likely than men to pursue entrepreneurial opportunities. According to Duxbury, Dyke, Lam (2000: 2-23):

  > *"Men are more likely than women (21% versus 9%) to see themselves ultimately working in an area that really interests them (i.e., technical orientation) or owning their own company (21% versus 3%). Women on the other hand, were more likely to say that they were already where they wanted to be (16% versus 3%) or that they wanted to get out of the high technology area completely (18% versus 3%)."*

- Third, Duxbury, Dyke and Lam (2000: 1-16) cited have noted that most empirical studies of technology workers have examined managerial, technical and project

[3] In the spirit of Acs and Audretsch (2005: 6) we define "entrepreneurship" as embracing "…all businesses that are new and dynamic, regardless of size or line of business, while excluding businesses that are neither new nor dynamic as well as all non-business organizations."

[4] Cukier (2007: 7) reports: "…women in the [IT] industry account for 23% of its workforce, which is well below the average across industries (Statistics Canada, 2004) and there is evidence that this percentage may be dropping. More recently, Statistics Canada (2006: 113) reports that women remain a minority among professionals employed in the natural sciences, engineering, and mathematics. "In 2004, just 21% of professionals in thee occupations were women, a figure that has changed little since 1987 when women accounted for just under 20% of professional in these highly technical fields. In addition, it is unlikely that female representation in these occupations will increase in the near future, because, as reported in Chapter 4, women continue to account for relatively small shares of tital university enrolments in these fields. Also see Catalyst (2006b) and a recent report of the Information and Communications Technology Council (2007).

orientations. This research expands the occupational orientation by examining gender-specific challenges within the large and small firm contexts.

- Fourth, Ahl (2006) challenges scholars to look beyond traditional study rationales and calls for research that considers issues such as gender equality and gender/power relations. In response, this study seeks to better understand the association among personal perceptions about gender equity and organizational and industry culture.

The study is a first step in a larger initiative to understand personal, organizational and industry factors that dissuade nascent women entrepreneurs from transitioning to business start-up and/or encourage women to exit the sector. It is anticipated that findings drawn from the initiative may help inform remedial solutions for women who are confronted with gender-related barriers.[5] As such, this work seeks to inform women business owners, women enterprise centers' staff, and public policy and corporate project. The report will also inform the development of a "gender diversity scorecard", a metric to measure progress of women within technology sectors.

To accomplish the study objectives, the paper is organized as follows. A brief review of the literature follows. A description of the study methodology, respondent profiles and quantitative data analysis are then presented. Findings from the qualitative phase of analysis are then discussed. The paper closes with a discussion of findings and an outline of next steps in the research initiative.

Women in Canadian Technology

[5] For example, support programs and women-focused initiatives have been introduced to address the needs of Canadian women business owners, managers and employers. In the SME context, sample initiatives include provincial/regional women's enterprise centres (e.g., Women's Enterprise Initiative, Women in Business Initiative), mentoring and counseling (e.g., Royal Bank of Canada (RBC) "Step Ahead One-on-One Mentoring Program", Women Executive Network's WXN e-mentoring), conferences, business awards, and related events, trade associations (e.g., CATA WIT, Canadian Women in Communications), and private and crown corporation consortia (e.g., Global Banking Alliance; Business Development Bank of Canada (BDC) & Réseau des femmes d'Affaires du Québec). Similar corporate diversity initiatives have also been introduced.

Women entrepreneurs and corporate managers are significantly underrepresented within Canadian technology sectors. Two examples illustrate this observation.

- Carrington (2006) reports that in 2004, majority women-owned businesses accounted for approximately 17 percent of all SMEs — but only 13 percent of knowledge-based enterprises (KBIs) were majority-owned by women.
- Women also represent almost half (46.7 percent) of all Canadian workers — but less than one-third (28.1 percent) of workers in the information technology sub-sector are women (SSHRC, 2005 as cited by Cukier, 2007). Even within the information, technology and communication environments, women are concentrated within particular professional occupations. For example, women account for the majority of writers (74 percent), graphic designers and illustrators (61 percent) while men account for the vast majority of sector managers (80 percent), engineers (91 percent, except software), software engineers (87 percent) and technicians (85 percent). Across management ranks, anecdotal evidence also suggests that women are engaged primarily in "outbound" activities such as sales, public or customer relations. Few women retain power within the executive rank or are involved in strategy and market development and business planning (Ottawa Business Journal, 2006).

A number of theoretical rationales have been advanced to explain gender differences in occupational role orientation and disparities in career advancement, theories that reflect social, economic, and psychological influences that underlie the gendering of organizational culture and enterprise performance. Five are summarized presently.

Socialization theory: Socialization processes result in gender differences in attitudes, self-perceptions (e.g., "diminish girl's interest in related career aspirations" (Cukier, 2007)) and

human capital (e.g., compared to men, fewer women possess math and technology-focused degrees such as computer engineering and advanced mathematics). Socialization is also reflected in an individual's social capital (that is, access to and membership within business networks, social skills). In the corporate context, Canadian research has documented gender differences in access to networks, mentorship opportunities, and confidence with respect to managerial and technical competencies and experience among male and female managers and executives (Orser, 2000). In the small firm context, women entrepreneurs bring to the enterprise, on average, less managerial, social and financial capital (Reuber and Fischer, 1995; Orser, Cedzynski and Thomas, 2007). Consequently, majority women-owned Canadian firms are smaller, less profitable and less likely to grow (Carrington, 2006).

Role investment theory: According to role investment theory, spousal partners employ trade-offs about their respective roles within the family. Women tend to invest in household roles (parenting, home making) while men invest time in the paid workforce. Marriage and motherhood facilitates specializing within the home and is often to the detriment of women's earning power (Lobel, 1991; Bielby and Bielby, 1998; England, 1984). Role investment is manifest in gender differences in time allocation to commercial tasks and perceptions about work/life balance, management expectations (unrealistic or excessive demands on time) and availability of workplace support (initiatives to support dependent/family responsibilities such as flexibility, dependent/children sick days, employee assistance programs).

Industry culture and organizational capital: This rationale is potentially useful in that it provides the opportunity to examine potential gender differences in perceptions about organizational fit. This theoretical rationale suggests that corporate fit and culture are associated with organizational performance, where "culture" is reflected in procedures, informal rules of

behavior, incentives, and organizational priorities (Carrillo and Gromb, 2006: 744). The management challenge is to match the skills and attitudes of the individuals and the organizational environment in which they operate. Hence, organizations strive to select and retain employees who are "good fits" for the culture. A poor organizational or industry fit may motivate employees to seek other employment opportunities. For example, a survey of 393 Canadian women executives and managers reports that almost half (48 percent) were motivated in part to leave their previous employer because of "inhospitable corporate culture". Carrillo and Gromb (2006) also comment on "cultural inertia:" organizations that are "maladapted to their environment and do not adapt the changed environmental conditions" (e.g., lack of adaptability or flexibility). They suggest that uniformity of cultures and the availability of good fits in the labour market are determinants of inertia. For example, organizations are more likely to adopt the culture for "specialists" (e.g., engineers, those with technical expertise) than to "generalists" (e.g., administrators), given market availability of skills. Cost incentives are therefore required to stimulate change in the organizational culture and hence, industry (e.g., "agents leaving the organization voluntarily or through firing"). In the context of this study, we suggest that organizational and industry "fit" or conversely, "misfit" and "cultural inertia" are gendered constructs. Gender differences are exemplified in studies that report perceptions held by women managers and entrepreneurs about the lack of executive commitment to change, "executive talk without the walk", "lack of diversity performance targets", tolerance of sexist behaviour such as bullying by (often high performance) employees, bravado, machismo, chauvinism, sexist jokes (Orser, 2000; Orser, Riding and Townsend, 2004)

Occupational crowding: According to Peitchinins (1998), occupational crowding refers to market segregation in which men are more likely to be employed in primary positions (for

example, those with protective unions, internal rules) and women are more likely to be employed in "secondary" markets that are characterized as unstable. Women would also be over-represented in particular industry sectors (for example, social services, health care, education) and within sectors, in particular roles or professions. Occupational segregation is embedded in perceptions about the lack of development and promotion opportunities (fewer women to mentor women, referral for training, high-profile and international assignments), and constrained access to power and resources (for example, perceptions often voiced by women entrepreneurs that they have less access to resources requisite to enterprise growth such as equity capital and power brokers (Ragins, 1989; Ragins and McFarlin, 1990; Burke, 2002)).

Discrimination: This explanation subsumes prejudices and cultural and corporate traditions (practices imposed by employers) that systemically limit professional opportunities and remuneration. Discrimination may be reflected in tolerance to sexual harassment, gender differences in compensation, including remuneration that does not meet industry standards and cultural and religious tradition (for example, men who refuse to work with women).

Drawing on this taxonomy of rationales and given the apparently declining engagement of women in the advanced technology sector, it is anticipated that many of the barriers to personal and organizational advancement in the advanced technology sectors mirror the challenges cited in previous Canadian studies. To explore the above theoretical rationales that seek to explain gender-specific barriers to women's career advancement, the study methodology is now discussed.

Methodology and Data

The results of this study results are based on two sequential, on-line surveys targeted to members of CATA. The surveys, conducted in 2005 (n = 169) and 2006 (n=115), sought information with respect to respondent profiles, role orientation or rank (executives, managers,

professional, other), size of firm (number of employees, revenues), perceived challenges to career advancement and related interests of women in the technology sector. The surveys employed slightly different questions to examine gender and career success.

The first survey (2005) asked respondents to rank, in order of importance, a list of nine challenges "faced as a woman with a career in high tech," anchored with 1 "being most important and 8 being least important."[6] The challenges were:

- Work-life balance
- Leadership skills
- Shortage of women mentors
- Breaking the glass ceiling
- Lack of career advancement opportunities
- Management skills
- Networking opportunities
- Information on financing
- Other

In addition, an open-ended question asked respondents to: "Please briefly describe, in one or two paragraphs, the most difficult challenge in your career and how you overcome it?"

The second survey, conducted in 2006, asked respondents to "Please identify the challenges or obstacles you regularly face in advancing your career/establishing your own business and the solutions you feel would help you better overcome them."

The emphasis of this report is on the findings from the 2005 surveys. Data from the 2006 survey serve to augment these findings. Qualitative data were analyzed using NVivo software.

[6] These data were subsequently recoded as follows: 1 to 3 = 1 (high), all other = 0 (other).

Empirical Findings

Respondent Profiles

The majority of respondents (54%) owned or was employed in firms comprising fewer than 50 individuals and 46 percent worked in firms with more than 500 employees. Respondents who were firm owners or executives were significantly (p value ≤ 0.000) more likely to work in firms with less than 50 employees while managers, professionals and other employees or contract workers were more likely to be employed in firms with more than 500 employees. Revenue categories reflected employment size. Sixty percent of respondent had been in their current role for less than five years and one-third for less than two years. Most respondents were sector-oriented in their careers. Ninety percent of respondents had been engaged in the advanced technology sector for more than 6 years and 70 percent for more than 10 years. Tables 1 and 2 provide a summary of respondents' profiles.

Table 2 summarizes the sector profile of respondents. The largest category of response (n=47) was "other", including fields such as IT (software engineering, security, telecommunications, broadcasting), aerospace, e-commerce, outsourcing, consulting, scientific instrumentation and engineering. The second largest group were professional, scientific and technical services (19 percent) followed by educational services, a category that likely reflected advisors and consultants. This observation points to the need for refinement of occupational or sector on future related surveys. The categorization and responses also limited the ability of the researchers to examine sector influences.

[INSERT TABLES 1 & 2 ABOUT HERE]

Perceived Challenges and Resolutions

The 2005 survey asked respondents the following: "Please briefly describe, in one or two paragraphs, the most difficult challenge in your career and how you overcame it." A total of 99 replies were obtained. The 2006 survey asked respondents: "Please identify the challenges or obstacles you regularly face in advancing your career/establishing your own business and the solutions you feel would help you better overcome them." A total of 80 responses were obtained from this question.

The responses were entered into NVivo, a widely-used computer program that facilitates the analysis of qualitative data. Responses from both questions were analyzed and categorized into types of challenges. Responses that described solution strategies to challenges were analyzed and categorized into categories of means by which challenges were addressed.

Perceived challenges

In order of ranked importance, work-life balance by far dominated the challenges perceived by the women respondents: more than sixty-percent ranked obtaining work-life balance among their top three challenges. The second challenge ranked most-frequently among the top three was the lack of best practices for women with respect improving leadership skills (team building, people management practices and communications). The lack of women mentors and coaches was the third challenge ranked most frequently among the top three. These issues were followed by breaking the glass ceiling, lack of career opportunities, lack of management skills, networking opportunities and information about financing.

[INSERT TABLES 3 & 4 ABOUT HERE]

To examine potential associations between role orientation and firm size with career challenges, cross tab analysis of contingency tables was undertaken with the results shown in

Table 4. Table 4 shows that a perceived shortage of women mentors was significantly correlated with size of firm and this perception was understandably more severe in smaller enterprises. Table 4 also reveals that lack of management skills was correlated with rank or role orientation (owner/executive, manager/director, professional). Lack of management skills was more likely to be cited as a concern by professionals (cited among three biggest challenges by 62 percent of professionals) and managers (cited by 50 percent of managers) than by executives and business owners (cited by 18%).

In addition to the eight barriers listed on the questionnaire, respondents identified a total of 179 examples of other perceived barriers. Statements were categorized by drawing on qualitative data analysis.

The most frequently mentioned (72 statements) category may be described as those comprising *"gender-based" personal barriers*. Gender was seen to influence self-efficacy (sense of credibility, perceived lack of credentials, confidence, know-how), performance expectations (e.g., different performance benchmarks), lack of social capital, networking opportunities, and sense of belonging ("this is a man's world"). Examples of some of the statements in this category are listed in Table 5. These statements illustrate the multi-faceted and inter-related influence of gender in the organizational and industry context. For example, several respondents cited concerns about: occupational roles that are honoured in the sector (for example, technicians, engineers, software developers versus soft skills); perceptions about being marginalized by their profession; and the notion that IT is a man's world. Respondents also expressed concern about colleagues' inappropriate and dismissive assumptions with respect to their performance, merit and career advancement. In both the small and large firm context, the implications of being female were also cited (for example, perceived differences in treatment by

lending institutions). The statements also suggested that both men and women may have responsibility for the gendering of occupational roles and organizational practices (for example, "women who do not help women", "men hire men"). Personal-level challenges also included several non-gendered statements such as concerns about geographic mobility, lack of technical expertise, and obtaining business know-how.

The second most frequently cited set of perceived barriers (37 statements) could be termed as systemic organizational issues. Non-gendered barriers were also noted with respect to lack of organizational leadership, challenges of handling firm growth, limited marketing knowledge, lack of training and resources.

Industry-related barriers were the next most frequently cited category (19 statements), statements that reflected the working conditions and culture in high tech sector. Respondents spoke about industry volatility, pace of change, requisite hours and travel, intense competition and technical versus strategic considerations. Gender was reflected within the decline of women in the sector. Relationship management and competencies were identified in 16 statements and reflected challenges associated with human resource practices, and relationship and human capital management (such as hiring, retention, teamwork, dealing with business partners and co-workers, recruitment, retaining subject experts, building teams while maintaining control, sales and communication skills such as meeting sales quotas.

[INSERT TABLE 5 ABOUT HERE]

Response strategies

Respondents were asked how they had overcome the barriers they had identified. The statements were again categorized by drawing on qualitative data analysis software, with the sample statements shown in Table 6, and summarized presently. The single most frequently

mentioned form of response (22 mentions) reflected individual-level strategies such as changes in one's actions, behaviour, education, work ethics, and/or some aspect of personality. Examples include women who thought they had to work harder than their male counterparts to prove they belonged ("I had to work twice as hard as my male colleagues to prove that I belonged at the company alongside them"), women who built up their confidence in order to overcome the assumptions about their ability ("Through confidence building, I have learned to take those initial assumptions in stride"), and women who sought education in order to overcome cross-cultural and other barriers ("I overcame these challenges by studying the local languages and working hard to be sensitive to local custom" and "To overcome it, I equipped myself with as much knowledge as I could").

[INSERT TABLE 6 ABOUT HERE]

The second most-frequently mentioned (16 mentions) form of response comprised use of mentors or networks. This category reflected psycho-social support to help overcome career challenges. Mentoring was also cited as a means for women to band together to address career issues. Some respondents identified a specific mentor or coach who helped overcome problems or advice from female managers about how to integrate male versus female styles ("To overcome this you have to learn to recognize the symptoms and then have a supportive manager to help turn the situation around"). Non-gendered statements reflected factors such as the need to access marketing mentors and coaching on how to prioritize and delegate to meet work-life balance demands ("I overcame the challenge by sharing issues with a seasoned mentor who coached me on how to better prioritize and delegate activities so that I could maximize time with my ill mother").

Some women (8 mentions) indicated that they had overcome past challenges by leaving the job or the organization or by ignoring the barriers. As such, statements included women who

left after trying to find a compromise, women who ignored the issue without getting bitter, and women who left for a higher position ("I moved on – in recognition that there is a proper time for everything" and "After trying to find a compromise, I gave up and changed jobs!").

Another set of responses (7 statements) were targeted directly or indirectly to external organizations such as an industry-level body or the government. Examples include bodies to lobby banks to assist small businesses, services to provide business models to service companies, and corporate-funded initiatives such as the "Judy project."[7]

In addition, some statements reflected corporate changes in management or human resource policies such as revisions in training, reward systems and hiring practices. Other statements referred to strategies to address team or group dynamics including communications improvements and redistribution of responsibilities and some women said that they had not found an acceptable solution to their challenges.

Generally, many of the solutions suggested that resolution of gender challenges remains the responsibility of the individual. Interestingly, no respondent suggested mentorship programs to be put in place on an organizational or industrial level, the resolution that seems most likely to remove long-term gendered obstacles.

Table 7 shows the correlation between perceived challenges and the resolution strategies articulated by respondents to the 2006 survey question: "Please briefly describe, in one or two paragraphs, the most difficult challenge in your career and how you overcame it." From Table 7, it appears (number of observations are too low to apply statistical tests) that mentoring is used disproportionately more often for solving personal challenges. The use of mentoring to resolve personal career challenges is consistent with the literature that suggests women who are

[7] The Judy Project, An Enlightened Leadership Forum for Executive Women, is designed to advance more women into CEO positions and build stronger organizations.

mentored are more likely to have a positive assessment of their marketability and to be exposed to powerful networks (Eddleston, Baldridge & Veiga, 2004). Mentoring is also associated with increased career mobility, increased information, insight and power, and gaining feedback, access to resources and better understanding about organizational politics (Burke & McKeen 1990; Collins, 1983, Headlam-Wells, 2004; Lineham & Walsh, 1999; Ragins, 1996; Ragins & Cotton, 1999; Scandura, 1992 as cited by Leck and Orser, 2007).

Discussion of Findings

Work/life balance is an industry concern of primary importance. Cukier (2007) also writes that in the technology-sector, the "leaky pipeline" in large part reflects unrealistic management expectations with respect to time and personal demands. Canadian observations are reinforced by British findings, where 70 percent of mothers indicate "being a mother adversely affected their career;" 54 percent said that being female worked against them with disadvantages reflected in lack of recognition by male bosses, reduced earnings and lack of career prospects (jobboard.com as cited by the Globe and Mail, 2006). Hence, it is argued that the ability of executive teams to help resolve work/life balance concerns is a key indicator of the inclusiveness for many Canadian women. This assertion is not unique to the advanced technology sectors. For example, Canadian women managers and executives rank "demonstrated commitment to work/life balance" as a lead indicator of corporate gender diversity performance (Orser, 2000: 21). The current study finding indicates however that industry leadership is required to examine and implement innovative "best practices" solutions to resolve work/life balance concerns in order to attract and retain well-educated, professional and mobile talent.

This study also documents that many (but not all) women in the advanced technology sector believe they face "gender-specific" career challenges. The challenges are pervasive and embedded at all levels in the worker/employer and business owner/market relationship. The predominance of personal-level resolution strategies may help to explain why such career challenges remain obscure. And again, the challenges mirror those documented in other Canadian and international cross-sector studies. These are important observations for several reasons. Barriers to women's advancement is not a new management issue. Yet, related research indicates that many executives and industry leaders assume that such issues have been addressed in modern corporate cultures (Orser, 2000, 2001). It is also likely that industry leaders and managers are knowledgeable about the rationales for addressing gender-specific concerns (e.g., arguments about the business case for retaining and advancing top talent, cost implications of industry exits, decline of women in high tech, etc). Yet, this study provides evidence that current and/or past corporate and industry strategies to address such barriers are insufficient. Managers and policy makers are also aware of the concern voiced about lagging Canadian productivity and rates of innovation.[8] While it is not clear the extent to which gender effects dissuade sector entry and encourage exit, it is argued that cultural inertia to address gender-specific barriers likely influences the engagement of many competent women in the sector and hence, ultimately industry performance. Given the importance of the technology sector to Canadian job creation, inventive activity and the commercial production of new economic knowledge ─ these results indicate that study of "best practices" within-industry, between-industry and across other nations

[8] For example, the 2007 Conference Board report *How Canada Performance. A Report Card on Canada* ranks Canada 14th among 17 comparator countries with respect to innovation performance (where innovation is defined as the creation, diffusion, transformation and commercialization of knowledge and associated public policies). "Anecdotal evidence from many sectors suggests that Canadians are complacent and generally unwilling to take risks… This culture holds Canada back in entrepreneurial and technological innovation." (p3)

is warranted as Canada seeks to remain a leading industrialized nation. It is also time to move beyond complacent arguments about "the business case" for retaining and advancing talented women and to recognize that gender barriers in the advanced technology sector is aligned with Canada's economic welfare.

Finally, industry leaders must become better informed about the gender-specific challenges identified in this and other studies, including gaining an understanding about the underlying sources of the gender concerns articulated by the study respondents. Mechanisms should also be put in place to encourage stakeholders to direct energy towards industry- and organizational-level resolution strategies rather than continuing to rely on individual-level strategies. For example, the US banking sector has recently sought to ease the return of female financiers to the industry (Hofman, 2007:13): "Several investment banks have held recruitment events targeted at those women that have taken a break from the industry… The message is one of flexibility, inclusiveness and non-linear careers." Finally, internal organizational strategies include more focus on productivity versus "presenteeism," positioning employment on drivers other than money (e.g., high-quality colleagues, deriving meaning and purpose, and working on innovative projects) and presenting role models who candidly articulate personal challenges, first-hand experiences and resolution strategies in addressing gender challenges. Concerted management attention is also required to track employees, including women that are re-entering the organization and/or partaking in women-focused initiatives to ensure that they are neither stigmatized nor sidelined to peripheral career assignments. Such tracking would help to avoid documented concerns about cultural inertia including executives who fail to walk the talk and concerns voiced about window dressing treatments (Orser, 2000, Hofman, 2007). Industry-wide performance metrics, similar to those employed in operational practices (e.g., entry and retention

rates, percentage of women across all levels of the hierarchy, engaged in international assignments and within higher income strata) are required to ensure that gender-focused program outcomes surpass current industry performance. Such initiatives require top-down leadership given that CEO commitment has been linked with sustained opportunities for women (Orser, 2002).

The personal resolution mechanisms reported by the study respondents also provides another concrete idea about how gender-related challenges might be addressed. The disproportionate use of mentoring suggests that business leaders in the technology (and perhaps other) sectors might explore organized mentoring programs as a mean of encouraging women to enter the field and as a means of addressing the challenges they face. Respected Canadian organizations such as Canadian Women in Communication (CWC) should be consulted on potential industry-level strategies.

Finally, further inquiry is required to determine the cost implications of the issues identified to organizational productivity. While it is not yet clear the extent to which personal versus organizational versus industry effects moderate the performance of women and men in the Canadian advanced technology, these results provide an initial indication that gender is a potential moderator of industry engagement and hence performance. The work of Carrillo and Gromb (2006) provides a useful theoretical framework and economic model with which to examine the structure of organizational and industry culture. The anticipated next step in the research initiative is to understand better the determinants of cultural inertia given demographic changes in Canadian and international labour markets.

Study limitations: A number of study limitations are noted. Quantitative responses were based on a forced ranking of criteria. No provision for "not applicable" was included in the survey scales. As such, results are likely inflated. The research team was also unable to estimate non-response bias. The surveys were targeted to women only. This study does not assume that some or all of the issues documented are unique to women. For example, it is not clear the extent to which work/life balance is a primary barrier to career advanced for men in the advanced technology sector. To further examine potential gender differences in the barriers to career advanced, future research will employ matched samples of male and female respondents. Categorization of firm and respondent profile information also limited the ability of the research team to examine similarities and differences between corporate managers/executives and women entrepreneurs. Again, it is anticipated that the follow-up studies will employ more robust parameters to estimate organizational size and occupational role. Finally, the sample population from which the study results are drawn (CATA members) may not be representative of the larger high-technology sector. It is expected therefore that subsequent work will also seek a broader sample of sector participants.

Next steps: The next phase of the research entails gathering stakeholder input about these research findings, future research questions and potential and practical response strategies to address the issues cited. Tentative research questions include:

- What are the attrition rates of male and female workers, by level and occupational role, across the advanced technology sectors?
- Why factors differentiate organizations with gender differentiated retention and advanced rates? Who are the industry leaders in retaining and advancing women? What performance benchmarks are used to estimate industry leadership?
- What criteria should be employed to determine "best practices"? What industry metrics are most helpful in responding to stakeholder concerns?

- What factors discourage women from seeking business start-up compared to their male counterparts? What "best practices" support women entrepreneurs in the advanced technology sectors? What performance benchmarks are used to estimate industry "best practices"?

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Table 1: Frequency of Role-Orientation by Survey

	2005 Survey (N=152)		2006 Survey (N=98)	
Role orientation	**N**	**%**	**N**	**%**
Executive/Owner	52	34.2	63	64.3
Manager/Director	49	32	15	15.3
Professional	22	2	17	17.3
Other	29	14.5	3	3.1

Table 2: Sector Profile

Sector	**n=141**	**%**
Professional, Scientific and Technical Services	27	19.0%
Educational Services	16	11.0%
Public Administration	8	6.0%
Information and Cultural Industries	7	5.0%
Management of Companies and Enterprises	5	4.0%
Voluntary and Not-for-profit	5	4.0%
Agriculture, Forestry, Fishing and Hunting	4	3.0%
Health Care and Social Assistance	4	3.0%
Finance and Insurance	4	3.0%
Mining, Oil, and Gas	4	3.0%
Manufacturing	3	2.0%
Arts, Entertainment and Recreation	2	1.0%
Transportation and Warehousing	1	1.0%
Utilities	1	1.0%
Other	50	35.0%

Table 3: Rankings of Perceived Gender Challenges for Women in Advanced Technology

Challenges	**Rank**	**Percentage of Respondents Who Ranked Item Among Top Three Challenges**
Work-life balance	1	60.8%
Leadership skills	2	42.6%
Shortage of women mentors	3	41.7%
Breaking glass ceiling	4	36.9%
Lack of career advancement opportunities	5	34.0%
Management skills	6	34.0%
Networking opportunities	7	32.4%
Information on financing	8	27.7%

Table 4: Crosstab of Perceived Barriers with Rank and Firm Size

		p-values associated with			
(N=89)		**Contingency Coefficient**	**Pearson R**	**Spearman R**	**Chi-square**
Mentorship	Rank	0.486	0.454	0.397	0.486
	Firm Size	**0.043**	**0.019**	**0.019**	**0.043**
Glass Ceiling	Rank	0.968	0.748	0.796	0.968
	Firm Size	0.968	0.748	0.796	0.606
Work-Life Balance	Rank	0.118	0.506	0.358	0.118
	Firm Size	0.153	1.000	1.000	0.153
Leadership Skills	Rank	0.512	0.409	0.471	0.512
	Firm Size	0.510	0.315	0.318	0.51
Management Skills	Rank	**0.013**	0.174	**0.074**	**0.013**
	Firm Size	0.098	0.075	0.077	0.098
Financing Information	Rank	0.827	0.498	0.442	0.827
	Firm Size	0.327	0.903	0.912	0.327
Networking	Rank	0.137	0.794	0.943	0.137
	Firm Size	0.703	0.510	0.513	0.703
Advancement Opportunities	Rank	0.889	0.972	0.949	0.889
	Firm Size	0.267	0.150	0.151	0.267

x

Table 5: Barriers to career advancement cited by women in technology

Category	Sample statements
Personal (n=72)	• "Was informed years later that some men in my organization actually believed I was having an affair with the boss to achieve my position rather than it being merit based - this was completely untrue, based on nothing, unchanageable [sic] and degrading to all." • "Women supporting women to succeed. Once some women have broken the glass ceiling they quickly seal it shut to other women." • "The most critical one: lack of public respect for women in technology" • "The most difficult was accepting that there are some situations where men strongly believe that a woman cannot do a particular job, because they are a woman." • "Being forced out of a management position so they could put someone from the 'old buddy network' in that spot." • "Women are marginalized in specialized professions." • "Banking and other financial or financing organizations think of women run businesses as 'word processing' and put them in a different category than male run companies."
Organizational (n=37)	• "Another challenge is that as a woman in a managerial role with eight years work experience continued opportunities for additional growth are slow. To move from a manager to more senior levels. The expectations are that you have to work for 20 years plus and earn the merit. It should be encouraged to stream women to senior women sooner." • "Having an overbearing, know-it-all, women manager who everyone at the company was afraid of and who had a need to keep proving she was better than everyone else. I believe this women's defensiveness as being a woman manager." • "When your manager is a man, he may not appreciate your qualities with the same values, priorities and understandings." • "The challenge faced was adapting communications at the varying levels of management." • "I think management issues and leadership are the biggest barrier." • "I started in an area of lower esteem … and it hampered my salary increases and my ability to move up."
Industry (n=19)	• "The decline in the number of women entering high technology fields. In my industry, software technology and related services, the percentage of men and women is 70 percent male, 30 percent female. The high technology melt-down over the last four years has not encouraged women to seek careers in this area." • "This situation occurs primarily in treatment from other male managers who have a primarily technical background and limited management training. I am not sure if this is a gender bias issue or if it is driven by a lack

	of big picture management thinking – something which I believe is a crisis in the technical world." • "Constant challenge is to manage those people who would be considered more senior in terms of technology capability. I suspect that one of the most difficult challenges for us as women is to make the personal iteration from technology centric to management centric, especially when confidence and comfort are gained from the former." • "The IT Industry's current volatility!!" • "The high number of hours required of the work combined with travelling [sic] a lot."
Relationship management and competencies (n=25)	• "Many normal HR practices do not seem to be in place in IT." • "Obtaining good training in areas such as financial management, maintaining French skills, etc. It is also important that we be able to constantly improve our presentation skills." • "Working with different business partners - 'surviving divorces'."
Work-life balance (n=10)	• "Dealing with a terminally ill mother while balancing work responsibilities as a newly promoted CEO of a sizable company." • "No one to look after your family while you are not there." • "The most difficult challenge is that of children. Most employers do not understand some of the challenges mothers have while balancing a career and children."
International (n=8)	• "Gender discrimination is even more insidious in Canada than in the US because it is polite." • "Dealing with men who are from another culture who are convinced my contribution in a technical role was going to be impossible." • "Being a Canadian consulting in the US, cross border hassles are enormous. Also lack of recognition in Canada." • "Cross-cultural challenges of working overseas."
No gender issues (n=8)	• "I don't think the challenges I face as a woman are any different from any other person working in technology." • "Really, none of the categories in 11 have been challenges to me. My challenges have been the same as others in my field have faced and have not been woman-specific. I don't know what the glass ceiling category means." • "The choices are absurd. They imply that there are or have been sexist or gender bias impacts on my career…. We all encounter obstacles and mine have only been based on the relationships I establish with those around." • "This is an extremely sexist survey and assumes there HAVE been challenges to my success. No I have never had a female mentor or coach but it has not made a difference to my career."

Table 6: Strategies to overcome barriers to career advancement cited by women in technology

Category	Sample statements
• Personal (n=22)	• "I had to work twice as hard as my male colleagues to prove that I belonged at the company alongside them." • "Through confidence building, I have learned to take those initial assumptions in stride." • "Work harder than men, which most of us do anyway, stay focused, and service your clients to the point that they won't go anywhere else and if they do, they beg to come back."
• Mentors/ network (n=16)	• "To overcome this you have to learn to recognize the symptoms and then have a supportive manager to help turn the situation around." • "A network of professional experienced women would be a real asset to younger folks in the field."
Moved on or ignored issue (n=8)	• "I moved on - in recognition that there is a proper time for everything." • "It could not be overcome other than to ignore it - most unsatisfying." • "All I could do was move on without getting bitter about it."
• Organizational (n=7)	• "In a well run organization where people are rewarded on performance and there is an atmosphere of mutual respect gender is not an issue." • "Still working on it, although recent management changes within our organization may have an impact on success in this."
Industry (n=7)	• "It would be great if there was a safety net to help women establish their own businesses (and if something like this exists, it would be helpful to know about it.)" • "I would benefit from getting research and statistics about what is coming that is hot in the industry so I am prepared."
No solution (n=5)	• "How did I overcome it? I didn't... yet." • "Can't say a satisfactory solution was found."
Group or staff roles (n=3)	• "Thereby, we have distributed responsibility that was previously bottlenecked at the top." • "Using common sense, making things (process) simple, delegating work to capable staff, and being genuine and encouraging harmony among staff...while clearly communicating the common goal of our team...and working towards together."

Table 7: Perceived Challenges and Resolution Mechanisms

	Personal Challenges	Organizational Challenges	Industry Challenges	Other Challenges	Total
Personal solution	15	2	3	2	22
Mentor, network	11	2	1	1	15
Moved on, ignored	3	3	0	2	8
Government solution	2	5	0	0	7
Organizational solution	3	2	2	0	7
No solution	3	0	1	1	5
Group solution	2	0	0	1	3
Total	39	14	7	7	67