A Multicultural Analysis of Factors Influencing Career Choice for Women in the Information Technology Workforce

Eileen M. Trauth, Ph.D.
College of Information Sciences and Technology
The Pennsylvania State University
1-814-865-0077 (phone)
1-814-865-6426 (fax)
etrauth@ist.psu.edu

Jeria L. Quesenberry, Ph.D.
Information Systems Program
Carnegie Mellon University
1-412-268-4573 (phone)
1-412-268-9592 (fax)
jquesenberry@cmu.edu

Haiyan Huang
College of Information Sciences and Technology
The Pennsylvania State University
1-814-865-8952 (phone)
1-814-865-6426 (fax)
hhuang@ist.psu.edu

A Multicultural Analysis of Factors Influencing Career Choice for Women in the Information Technology Workforce

ABSTRACT

The under representation of women in the information technology (IT) workforce, coupled with increased cultural diversity emanating from the globalization of the IT sector, highlights a problem both for the research and the practice domains of the IT field. In an effort to contribute to these domains, this paper presents an analysis of cultural factors influencing the career choices of women in the IT workforce. A review of the literature on cultural factors suggests the need for both greater analysis of cultural influences on women in the IT workforce and more nuanced theorizing about gender and IT. Hence, we employ the individual differences theory of gender and IT as a theoretical lens for examining, in greater detail, the variation in ways that perceptions of women's roles in society that are embedded in a culture influence female IT career choices and how socio-cultural factors moderate these influences. In order to do so, we analyzed a qualitative data set of interviews with 200 women from four separate studies of women in the IT workforces in Australia, Ireland, New Zealand and the United States. The themes that emerged from this analysis speak to the influence of cultural attitudes about maternity, childcare, parental care and working outside the home on a woman's choice of an IT career. Further, we saw evidence that additional socio-cultural factors served to add further variation to gendered cultural influences: gendered career norms, social class, economic opportunity, and gender stereotypes about aptitude. These results lend further empirical support to the emergent individual differences theory of gender and IT that endeavors to theorize within-gender variation with respect to issues related to gender and IT. They also point to areas where educational and workplace interventions can be enacted to address the under representation of women in the IT field.

Keywords: IT workforce, IT personnel, IT profession, global IT, outsourcing, culture, cultural differences, diversity, multicultural issues, under represented groups, women, gender, qualitative, individual differences theory of gender and IT

INTRODUCTION

The twenty-first century is witnessing the emergence of a robust, globalized information technology (IT) sector. There are two significant factors contributing to this global phenomenon. First, countries around the world are recognizing the economic benefits that accrue from the development of an IT workforce capable of engaging in the deployment of computer hardware, software, and information services (Irwin, 2000; Shiva, 1989; Trauth, 2000). Second, sophisticated networking technologies that have made both asynchronous and real-time communications between different regions and countries feasible, have enabled both new ways of working and increased collaboration (Huang and Trauth, 2006). Consequently, the variety of countries who have become equipped with a maturing IT sector and a pool of talented IT workers, has significantly increased the diversity of the IT workforce (Trauth et al., 2006a).

At the same time, there is evidence of social exclusion in the IT sector (e.g. Finquelievich, 2003; Schienstock, 1999; Trauth and Quesenberry, 2006). The focus of this paper is on the under representation of women in all segments of the information technology career pipeline, from enrollment in secondary school and university courses, to positions in the IT workforce, to IT management positions (Camp, 2002; Margolis and Fisher, 2002; Teague, 2002; Women and Minorities in Information Technology Forum, 1999). In the U.S., for example, women comprise approximately half of the American labor force, yet they are under represented in the American IT workforce. The Information Technology Association of America's (ITAA) Blue Ribbon Diversity Panel revealed that in 2004 women represented only 32.4 percent of the U.S. IT workforce, a figure down from 41 percent in 1996 (ITAA, 2005). The under representation of women

is also documented by the gendered response to the dot.com bust. The data shows that men were far more likely than women to return to the IT profession as the market recovered. For example, from 2003 to 2004 the unemployment rate of skilled men in the IT field workers dropped 34.4 percent while the number of unemployed skilled women dropped only 5.15 percent (ITAA, 2005).

The number of women working in IT occupations in Canada has also declined over the last decade from 28 percent in 2001 to 25 percent in 2003 (Downie et al., 2004). In addition, women account for only 14 percent of the IT industry in India (Pande, 2006). The Workforce Aging in the New Economy (2004) reports that with regard to Europe, the industry and policy initiatives to attract more women into the profession have not been met with success. For instance, in the UK and Germany, men outnumber women five to one in computing professions; in the Netherlands it is seven to one. Furthermore, in 2001, women accounted for only 23.6 percent of the Australian IT workforce (Australian Bureau of Statistics, 2002). Based on the information compiled by Statistics New Zealand, Hembry and Presley (2006) noted that in New Zealand women accounted for only 11 percent of systems technician occupations and 16 percent of application engineer occupations in 2001. In the case of Ireland, in 1998, women accounted for near 31 percent of Irish IT workforce but this number dropped to 27.5 percent in 2004 (Organization for Economic Co-operation and Development, 2007). We can conclude that the IT workforce is at the same time diverse and not diverse, depending upon the dimensions of diversity that one considers. The IT workforce is diverse with respect to nationality but not sufficiently diverse with respect to gender.

The under representation of women in the IT workforce, coupled with increased cultural diversity emanating from the globalization of the IT sector, highlights a problem both for the practice and the research domains of the IT field. The problem for practice is to develop interventions to increase the under representation of women. The problem for research is to theorize the issue and compile data in such a way that actionable interventions can result. Galpin (2002), for example, explains that the participation of women in the global IT workforce is influenced by complex cultural and societal factors that differ from country to country. As a result, he argues that when considering gender and IT issues it is important to take into account the cultural context. Investigations of the influential factors in gender and IT research need to account for cultural contexts so as to maximize the potential that solutions developed to improve the social inclusion of women in IT will have far reaching effects. Therefore, in an effort to contribute to both practice and theory, this paper presents an analysis of cultural factors influencing the career choices for women with respect to the IT workforce. Specifically, it investigates: 1) the ways in which perceptions of a woman's role that are embedded in the culture of a given society influence IT career choice; and 2) how other societal factors moderate gender influences.

This paper is structured in the following way. We begin by reviewing the literature about cultural influences on gender and IT. We then present the theoretical framework that has been employed in a multi-year, multi-country research program that is examining the experiences of women in the IT workforce, followed by the way in which this theoretical framework was used to inform the methodology. Finally, we

present the findings from analysis of multiple field studies of women in the IT workforce and the implications of our results for theory and practice.

LITERATURE REVIEW

The under representation of women in the IT workforce has been a major concern of educators, practitioners, and researchers (e.g. Adam et al., 2002; Arnold and Niederman, 2001). Studies have shown that the under representation of women in IT is a worldwide phenomenon as manifested in enrollment in IT related disciplines and the number of women employed in the IT workforce (Galpin, 2002; Huyer, 2005; Rosser, 2005; Sanders, 2005). Further, it has been observed (Galpin, 2002) that there is wide variation in participation levels of women in IT with no clear pattern to explain these differences. Schinzel (1999) notes that this indicates a need to take a closer look at cultural influences on gender relations with respect to the IT field. In the sections below we consider the literature that has examined the ways in which cultural influences come into play in research on the topic of gender and the IT workforce. We categorize this literature into three themes: cultural influences within a country, multicultural influences within a country, and cultural influences across countries.

Cultural Influences within a Country

Frieze et al. (2006) argued that researchers and practitioners need to recognize the importance of cultural issues as these factors have a significant influence on the career options available to women. A wide variety of issues have been investigated regarding why women are under represented and how to narrow the IT gender gap within a given

country. These studies examine the underlying cultural influences in a given context and a number of interesting findings have been made regarding the role of family dynamics, and how gender identity and stereotypes are shaped by social and political ideology.

Several researchers have concluded that family dynamics and the role of parents are an important component of cultural influences on women and their relationship with IT. Medeiros (2005) conducted a study of the decreasing participation of Brazilian women in IT-related activities and occupations. The author explains that women constitute 51 percent of Brazil's population and the amount of IT related work is increasing due to outsourcing. Yet, women are still under represented in computer related professions in the country. The author concluded that improving the participation of women in the IT workforce hinges on the family, since parental influence in Brazil plays a significant role in career choice and self image. Hence, the author argues for increased informal education of parents, which calls attention to the advantages of IT jobs for women.

In contrast, Adams et al. (2006; 2003) examined the role of cultural factors in Mauritius that have enabled an increasing number of women to study IT. Their results show that from 1990 to 2003, there have been rapid increases in computer science and engineering enrollments in Mauritius. For instance, by 2003, the representation of women was 37 percent in computer science and engineering, 51 percent in information systems, and 49 percent in computer science and multimedia. The percentage of women graduating from computing programs has also increased. They believe that cultural factors were the major reasons for these increases. Specifically, the authors concluded that the following cultural dynamics were important: families that placed a high value on

females having IT careers; a national culture that strongly promotes IT, and the single-sex high school system which allows girls to develop aptitude and interests towards technology in the absence of male peer pressure to conform to gender stereotypes about technology.

Researchers have also concluded that the social and political ideology about gender identity and stereotypes are an important component of cultural influences on women and their relationship with IT. Ecevit et al. (2003) studied professional women who work as system analysts and computer programmers in Turkey. They found that Turkish women hold a higher share of computer related occupations compared to other male-dominated occupations such as law, medicine and engineering in the country. In addition, the presence of professional women in computer programming occupations in Turkey is also high compared to the statistics in the U.S. and the Netherlands. They explored the historical, social, and cultural factors contributing to this phenomenon. These include the emphasis on gender equality, the political ideology of Turkey with its attendant educational policies that support this ideology, and the family's encouragement of its daughters to be educated in science and technology fields. They also investigated various strategies used by professional women to reconcile professional and marital roles. Their conclusion is that it is critical to recognize women's own agency in shaping their own positions and responses to relationships with technology.

Multicultural Influences within a Country

Researchers have also investigated multicultural influences on gender and IT within a specific societal context. Taken together, these studies show how the diversity of cultural backgrounds of women in a single country can result in wide variation in their

relationships with IT. An example is the way in which geography and social class have been shown to influence women and their relationship with IT. Shen and Ge (2006) investigated technology adoption and IT careers among women in China. Their findings indicate that the number of Chinese female Internet users is increasing, yet the distribution is severely skewed with respect to age, region, and occupation. For instance, in China, the majority of female Internet users is younger in age (ranging from 15-30), resides in urban regions, is highly educated, and holds professional occupations. The authors add that while the social status of women is improving and the gender gap is becoming narrower in urban areas, there are still significant issues with respect to improving the participation of women in the IT workforce.

Researchers have also found that race influences women's relationship with IT. Clarke and Teague (1994a; 1994b) analyzed interview data with Asian and Caucasian computer science and engineering students in Australia. The authors found that the Asian female students did not see computing as a male domain. Rather these students experienced direct encouragement from their families to pursue computing related secondary studies. Clarke and Teague's work mentioned earlier (1994b) pointed out that:

"… the differences within gender groups are greater than the differences between gender groups" [italics added] (p. 259).

In a later study, Nielsen et al. (1998) also investigated Asian and Caucasian female students enrolled in IT disciplines in Australia. Their study showed that both Asian and Caucasian females had similar views about the IT professions. However, Asian female students were more inclined to choose IT related subjects despite their

negative perceptions of IT professions because of the future prospects of employment opportunities (Nielsen et al., 1999; 1998). The authors argued that this view is influenced by the collectivist characteristic of Asian culture and is based on practical considerations, as compared to the individualistic "free-choice" decision making model in most Western cultures.

Researchers have also found that religion and ethnic identity account for variation in cultural influence on women and their relationship with IT. Eidelman and Hazzan (2006; 2005) examined how the Arabic and Jewish cultural backgrounds of different students may shape their relationships with IT differently in Israel. They concluded that the percentage of female high-school students who study advanced-level computer science is higher among Arab students than their Jewish counterparts. The authors attributed this difference to cultural and familial differences between Arab and Jewish adolescents (Eidelman and Hazzan, 2006; 2005). Specifically, the authors argued that a collective characteristic of Arab culture is centered on strong family and peer influences that stress high scholastic achievement for social status improvement. On the other hand, the authors found that the influence of parents and friends is lower in the Jewish culture. They stressed that in order to not be inferior in the eyes of their family:

"… in particular and their society in general, it seems that Arab female students are highly motivated to study computer science since they consider these studies as a way to prove their skills and capabilities" (Eidelman and Hazzan, 2006, p. 1097).

Cultural Influences across Countries

Several researchers have conducted comparison studies across multiple countries in order to investigate how women's relationship with IT varies by country. The primary intent of this research is to understand the nuances of different socio-cultural influences on gender and IT. For instance, Minguez (2005) found political ideology to have an influence on women's relationship with IT. She compared statistics on computer and Internet use among several European countries and found unequal access to computing technologies based on gender to be more significant in Southern European countries, particularly in Spain. Minguez attributed this to the focus of the Franco regime on perpetuating the traditional family model of a male as primary bread-winner. She concluded that this ideology has, consequently, limited the opportunities for women to participate in the labor market.

Researchers have also found temporal shifts in political ideologies with respect to influences on women and their relationship with IT. Hersh (2000) examined survey data from a research project on the changing position of women in engineering careers in 55 countries from the 1960-1997. The author stressed that women are still under represented in the engineering profession in the majority of countries despite significant increases in their participation over the last two decades. Yet, there are significant differences among the countries, and among different institutions within the same country. For example, the author reported that the participation of women in engineering careers in Eastern Europe has increased in recent years. The author explained that this growth was due to dramatic changes in economic development (i.e. the need for more engineers for industrial

development) and ideological systems (i.e. the equal roles of men and women in the workplace in communist regions, the availability of child-care facilities, etc.):

> "Thus, change in images and attitudes was facilitated by the changes in political climate and ideology from 1945 onward. It was probably, at least in part, due to the increasing importance of the development of industry in the state communist period, resulting in the need for more engineers and other technically qualified workers. This will have reinforced the ideological commitment to equalizing the roles of men and women in the workplace (at least at the lower levels). The availability of child-care facilities and the encouragement for women to enter paid employment will also have had an additional effect" (Hersh, 2000, p. 6).

Gender stereotypes related to IT have also been shown to vary by country. For instance, Durndell et al. (2000) compared computer self-efficacy and gender of college students in Scotland and Romania. Their findings showed that for within-country comparisons, males were more confident about their computer skills than females in both Scotland and Romania. Yet, for across-country comparisons both males and females in Romania were more confident about their advanced computer skills than their Scottish counterparts. Likewise, Makrakis and Sawada (1996) studied 773 ninth-grade students in Japan and Sweden in order to measure and compare male and female attitudes towards computers. Their findings show that males in both countries reported higher scores of usefulness, aptitude and interest in computers. They also found differences in the perception of computers and mathematics among males and females. Japanese students

perceived more strongly than Swedish students that computers and mathematics are male domains. Swedish students' gender stereotypes appeared to be less strong than was the case for Japanese students. According to these authors the differences reflect the Japanese cultural norm of "good wife, clever mother,"[i] which affects Japanese girls' choice of a gender stereotypical education suitable for a wife and mother. This is the case in spite of the fact that, in principle, there seem to be equal opportunities applied to both genders in Japanese society.

Cultural analysis of the first exposure to computers across China and the UK has also revealed an important difference in the influence on women and their relationship with IT. Li and Kirkup (2007) investigated underlying cultural factors for both similar and different use patterns of the Internet by women in China and the UK. Their results indicate that gender differences in computer ownership may no longer exist for young adults at universities in China and the UK. The authors felt that the situation in China could be attributed to the parental value placed on education and computing skills. The authors felt that in the UK, the findings could be attributed to the pervasiveness of the computer. The authors also found that gender differences within the British group were more significant than those within the Chinese group. The authors argued that it might be due to the differences in first time computer use. The British women in their study tended to have negative computer experiences in the early stage of computer use. On the other hand, the Chinese women in their study were typically exposed to computers for the first time at school where the educational setting helps to provide equal opportunities for students of both genders. However, their findings indicate that in spite of the increase of computer ownership, there were significant gender differences in computer and Internet

usage in both Chinese and British groups. Men in both countries were more likely to use the computer and the Internet for personal interests such as playing games and/or using chat rooms, and they were more confident about their computer skills as well.

Finally, technophobia, or the perceived fear of computers, was found to vary with respect to its relationship to gender and IT. Weil and Rosen (1995) examined the level of technophobia among first year university students from 23 countries, including the U.S., western and eastern European countries, Israel, and countries in Asia, South America, and Africa. Their results indicated that gender was only mildly correlated with technophobia and appeared in less than one-fourth of the countries. In addition, past experiences with computers decreased the appearance of technophobia in the majority of the countries. According to their results, females in Israel and Hungary showed more computer anxiety than males in these two countries, and males in Thailand, Italy and Kenya showed more computer anxiety than females in these three countries. Hence, the authors concluded that "there is no worldwide consensus on who are more technophobic – males or females" (p. 102). Rather, they concluded that the country's cultural characteristics serve as one of the important factors affecting the level of technophobia in that country.

Summary of Cultural Influences Research

Research on cultural influences on career choices for women in the IT workforce can be classified into three categories. One stream of research focuses on studying the relationships between gender and IT in a particular national context and revealing the underlying cultural influences (e.g. Adams et al., 2006; 2003; Ecevit et al., 2003;

Medeiros, 2005). Another stream of research situates multicultural influences on gender and IT within a specific societal context while studying how the diverse cultural backgrounds of different women may influence their relationships with IT (e.g. Clarke and Teague, 1994a; 1994b; Eidelman and Hazzan, 2006; 2005; Nielsen et al., 1999; 1998; Shen and Ge, 2006). The third stream of research consists of comparison studies that investigate how and why women's participation in IT varies across countries (e.g. Durndell et al., 2000; Hersh, 2000; Li and Kirkup, 2007; Makrakis and Sawada; 1996; Minguez, 2005; Weil and Rosen, 1995).

This extensive body of research provides evidence of two things. First, it shows that cultural factors are highly relevant in the consideration of factors affecting gender and IT. Second, while there are some common themes there is also wide variability across different countries, or across different groups within a given country. Thus, the research to date demonstrates that both gender and IT are socially constructed, and historically and culturally shaped (Huang, 2006; Li and Kirkup, 2007; Trauth et al., 2006b). At the same time, there is also wide variation in the ways in which culture shapes women and the particular factors at work.

Thus, several issues remain with respect to research on culture, gender, and IT. First, there is a need for additional research that articulates how cultural factors influence the image of gender, the image of technology, and gender relations with respect to technology. Without in-depth understandings of the influential factors from the surrounding socio-cultural contexts, solutions intending to improve the social inclusion of women in IT may only have limited effect and may not be far reaching. Second, while those studies acknowledge the diverse relationships between gender and IT across

different countries, there is limited research recognizing that such diverse relationships also exist within gender groups in the same country. Gender is only a part of an individual's social identify. Taking a human agent as a whole, gender interacts with other social constructs such as race, ethnic background, age, and social class. Both the study by Eidelman and Hazzan (2006; 2005) and the study by Nielsen et al. (1999; 1998) indicate that the cultural influences from one's ethnic and family background are important to shaping one's relationship with IT. Third, it should be realized that these streams of research are mutually informative, particularly with the increasing trends of globalization of the IT industry, offshore outsourcing, and the mobility of the IT professions. Frieze et al. (2006) argued that appropriate local interventions in the micro-culture may have a large effect. Thus, we can see that the topic of diversity in the IT sector is not simple and that research about this topic cannot be simplistic.

THEORETICAL FRAMEWORK

One common theme that runs through the three streams of research discussed above is that perceptions of women's roles in society and in the IT sector are socio-culturally constructed. Further, we can note from the review of the literature that these perceptions vary across countries. For example, the study by Ecevit et al. (2003) reveals that the emphasis on gender equality and the political ideology of Turkey play important roles in the high percentage of women in the Turkish IT sector. Similarly, Hersh (2000) attributed the increase of women in engineering careers in Eastern Europe to economic, political and cultural influences, including the need in these countries for more engineers, the equal roles assigned to men and women in the societies, and the availability of

childcare facilities in these countries. On the other hand, Minguez's study (2005) illustrates a counter example of Spain whereby the traditional family model of men as the bread-winners had a negative influence on women's participation in the IT sector. Makrakis and Sawada (1996) provided another example of how the traditional cultural norm of a woman's role being limited to wife and mother affects the career choices of Japanese females.

Another cultural dimension emphasized across these streams of research is the influence of family on women's career choices. For example, Adams et al. (2006; 2003) pointed out that in addition to the strong national efforts promoting IT in Mauritius, families placing high value on females holding IT careers is another key factor affecting the increasing number of women studying IT. Findings from other studies also support this argument in different cultural contexts: Turkey (Ecevit et al., 2003), Brazil (Medeiros, 2005) and China (Li and Kirkup, 2007). In addition, The studies by Nielsen et al. (1999; 1998) and Eidelman and Hazzan (2006; 2005) show how the different values that families place on IT education and IT careers influence career choice among different women within the same country, even though the socially constructed perception of women's roles in the engineering and IT fields are similar.

Thus, the research literature demonstrates the need to understand the nuances of different socio-cultural influences on gender and IT both within a country and across different countries. This recognition, in turn, suggests the need to incorporate this understanding into the development of interventions to improve women's participation in IT that fit with a specific socio-cultural context. Finally, the literature points to the need to conduct theoretically-informed investigations of these nuances. However, what

17

appears to be missing in cultural studies of gender and IT are sufficient gender and IT theories that can help to explain this variation in cultural influences on gender and IT.

In response to this need, Trauth has proposed an individual differences theory of gender and IT (Trauth, 2002; Trauth and Quesenberry, 2006; Trauth et al., 2004), which endeavors to characterize the variation in factors that account for women's under representation in IT. These differences exist with respect to the ways women experience and respond to characteristics of IT work, the IT workplace and societal messages about women and IT. The theory addresses the need for greater nuance in the examination of gender and IT in that it conceptualizes women as individuals, having distinct personalities, experiencing a range of socio-cultural influences, and therefore exhibiting a range of responses to the social construction of IT. More specifically, the theory examines the individual variations across genders as a result of both personal characteristics and environmental influences in order to understand the participation of women in the IT profession. Hence, the individual differences theory of gender and IT focuses on the differences *within* rather than *between* the genders through the understanding of specific influencing factors.

The focus of the individual differences theory of gender and IT on within-gender variation in response to societal-level gender influences regarding IT (Trauth, 2002; Trauth and Howcroft, 2006; Trauth and Quesenberry, 2007; 2006; 2005) is concerned with the question of why some women persist in the IT field in the face of systemic gender biases in both education and the workplace. The premise is that women do vary with respect to the factors that help to explain their under-representation in the IT profession. The theory posits that the answer can be found in the combined influence of

endogenous and exogenous factors that influence an individual's personal development and subsequent IT career decisions (Trauth et al., 2004). That is, while all females in a particular society may be exposed to similar messages about gender roles and IT, both the interpretation of these messages and the response to them will vary as a result of individual factors. Thus, the individual differences theory of gender and IT searches for the causes of gender under-representation by examining the factors that account for the varied ways that individuals internalize and respond to gendered messages. It seeks to understand the sources of individual agency that enable some women to overcome systemic negative influences.

According to this theory, an understanding of individual responses to common societal influences can be obtained from an understanding of the combination of personal characteristics and environmental influences, hence, the focus on differences *within* rather than *between* genders. The theory also views women as individuals who possess different technical talents and inclinations and respond to the social shaping of gender in unique and particular ways. This theory acknowledges that common social shaping messages are conveyed to subgroups in a culture (e.g. to women by age, race, etc.). But at the same time it also takes into account the varied influence of individual background and critical life events that result in a range of responses to those uniform messages (i.e. not all women of a certain age group respond in the same way to commonly received messages).

This theory is comprised of three general constructs that, together, explain women's decisions to enter and remain in the IT field. The *individual identity construct* includes both personal demographic items (e.g. age, race, ethnicity, nationality, socio-

economic class, and parenting status) and career items (e.g. industry in which one currently does or will work, IT discipline – computer science, information systems and information science – one is studying). The *individual influence construct* includes personal characteristics (e.g. educational background, personality traits and abilities) and personal influences (e.g. mentors, role models, experiences with computing, and other significant life experiences). Finally, the *environmental influence construct* includes cultural attitudes and values (e.g. attitudes about IT, about women in IT, about race/ethnicity) related to the geographic area in which one lives, as well as economic and policy influences in that region/country. The individual differences theory of gender and IT posits that, collectively, these constructs account for the differences among women in the ways they relate to the IT field, and societal messages about women and IT.

Research to date, has investigated a number of dimensions of variation among women. Morgan et al. (2004) developed a framework of the varied responses of women to male dominated social networks in the IT workplace. Regional and national factors that help to explain the variation in women's participation in the IT workforce were considered in a set of papers (Trauth et al., 2008; 2006b; 2005). Quesenberry and Trauth (2005) examined the ways in which women employ ubiquitous computing technology in order to achieve work-life balance. Quesenberry et al. (2006) investigated the different ways in which women accommodated to motherhood and their IT careers. Finally, Quesenberry and Trauth (2007) explored variation in career anchors among women IT professionals.

In this article, the theory is used to illuminate the investigation of cultural influences on gender and IT by facilitating examination of possible connections between

cultural factors and the experiences of women in the IT workforce. This theoretical application allows for analysis of women *in a societal context.* The argument for considering women's experiences in a societal context stands in contrast to research which de-contextualizes women's experiences by generalizing from a single data set to all women everywhere. Researchers have demonstrated that investigations of gender as a single construct can be problematic (e.g., Llewellyn and Usselman, 2001; Woszczynski et al., 2004). As an alternative, this article illustrates the benefit of considering the *relationship* between two constructs such as gender and societal context.

In order to address the need for greater theoretically-informed analysis of cultural influences on women in the IT workforce, we consider the following research questions in this paper:

RQ1. What are the ways in which perceptions of a woman's role that are embedded in the culture of a given society influence IT career choice?

RQ2. How do other societal factors moderate these influences?

METHODOLOGY

In order to address these research questions, we examined four datasets of interviews conducted between 1990 and 2006 with women working in the IT workforce in four countries: Australia, New Zealand, Ireland and the U.S. These investigations were all conducted by the first author.[ii]

The dataset about women working in Ireland comes from two separate field studies of women in Ireland's IT sector. The first of these datasets came from interviews conducted in 1990 as part of a larger, Fulbright sponsored, investigation of the influence of socio-cultural factors -- culture, economy, infrastructure and economy -- on the evolution of Ireland's information economy (Trauth, 2001; 2000; 1999). Gender was one among many factors examined in this study.[iii] The questions about gender that were part of the interviews focused on the role of women in Irish society at the time and the subsequent effect on women's potential for participation in the information economy (Trauth 2000, pp. 101-141; 1995).

The second Irish dataset came from interviews conducted in 2003 as part of a Science Foundation Ireland funded study of socio-cultural impacts of Ireland's information economy. The purpose of these interviews was to note differences in perceptions about a woman's role in Irish society, participation in the Irish information economy, and the effect of Ireland's new found economic health on the position of women.

The third dataset came from an investigation of women working in IT in Australia and New Zealand that was conducted in 2000 in conjunction with an Australian Research Council funded study -- Women and IT (WinIT) -- that was being conducted at Griffith

University in Brisbane, Australia (Trauth, 2002; Trauth et al., 2003). The purpose of these interviews was to investigate the ways in which individual identity and individual influences helped to moderate negative societal messages about women's participation in the IT sector.

The final dataset came from a multiyear, National Science Foundation funded investigation of women in the U.S. IT workforce (2002-2007). The purpose of these interviews was to collect empirical data in order to develop and test an emergent theory about the role of individual differences in the social shaping of gender and IT. The goal was to better understand the factors that help to account for the under representation of women in the American IT sector.

All four of these studies were interpretive field studies in which the first author conducted face-to-face, open-ended interviews with female IT practitioners and academics. Strategic, convenience sampling techniques were used to facilitate geographical representation of the women in the studies.[iv] Women were asked open-ended questions about their educational backgrounds, work experiences and about family and socio-cultural factors that influenced them to become IT professionals. The women were also asked about factors that have either enhanced or inhibited their participation in the IT sector (see Appendix A).

The results of the first Irish study inspired the subsequent gender studies. While gender was one among many socio-cultural factors examined in the first Irish study, gender was the explicit focus of the Australian/New Zealand study. The theoretical insights resulting from that study, in turn, formed the basis of the NSF proposal that

enabled the conduct of the U.S. study. The second Irish study was conducted contemporaneously with the U.S. study.

All of the interviews lasted between 60 and 120 minutes in length. A total of 200 interview transcripts were analyzed for this paper. Forty-six of these interviews were conducted in Ireland, 31 were conducted in Australia/New Zealand, and 123 were conducted in the United States (see Table 1). The interviews were recorded and transcribed in order to facilitate coding and analysis. Transcripts from the first Irish study were coded by the first author. Themes that emerged from the first Irish study, relevant gender literature and the constructs of the emergent individual differences theory of gender and IT formed the basis for the coding of the Australian/New Zealand data,[v] the data from the U.S. study and that from the second Irish study. The second Irish study and the U.S. study were coded by all three authors. Generic database software[vi] was used to facilitate computer-based analysis of the dataset from the first Irish study. The other three datasets employed the same special purpose qualitative analysis software[vii] for analysis. Analysis of the interview data was also supplemented by participant observation notes about the women and their socio-cultural environment as well as by literature about the culture of the regions/countries in which the data was collected. These notes were compiled by the first author who lived in each country while the interviews were being conducted there.

Table 1. Interviews by Country of Residence

Country of Residence	Year(s) Conducted	# of Interviewees
Australia/New Zealand	2000	31
Ireland	1990	25

Ireland	2003	21
United States	2002-2006	123
Total	**1990-2006**	**200**

FINDINGS

Participants

These women represent considerable variation with respect to demographics and personal characteristics. The women range in age from 21 to 65 years old with a median age of 41 years.[viii] Twenty-six of the women are single, 106 women are married or in a partnered relationship, 11 women are divorced (not remarried) and one woman is widowed (not remarried).[ix] Sixty-six of the women have no children, 20 women have one child, 40 women have two children, and 18 women have three or more children.[x] The women have followed a range of (IT and non-IT related) educational paths and (undergraduate and graduate) degrees. The women also represent a diverse background with respect to IT work experience. Collectively, they include roles in: academia; information and requirements analysis; systems design and development; quality assurance; systems administration and support; consulting; training and management.

Considerable cultural variation exists in this combined data set. First, cultural differences are represented by virtue of the four countries in which the participants were living. Second, the participants in each of these countries come from a range of racial and ethnic backgrounds including: Asian (China, Korea, Japan, Taiwan, Vietnam, India), Pacific Islander (Fiji, Australia, New Zealand), Caribbean (Jamaica, Trinidad, St. Thomas and Puerto Rico), Hispanic / Latino, Middle Eastern (Lebanon, and Egypt) eastern European (Poland, and Bosnia and Herzegovina), western European (France, Germany,

Italy, Ireland and the UK) (See Table 2). As a result, these women embody a rich variety

of cultural influences that are manifested in a variety of ways in their professional lives.

Table 2. Participant Racial / Ethnic Identity by Country of Residence

Participant Racial / Ethnic Identity by Country of Residence	# of Participants
American Participants	**123**
White American	**99**
Black American	**10**
African American	7
Afro-Caribbean	3
Asian American	**10**
Vietnamese	1
Chinese	3
Taiwanese	1
Japanese	1
Korean	1
Indian	3
Hispanic / Latino	**2**
Middle Eastern	**2**
Egyptian	1
Lebanese	1
Australian Participants	**31**
Australian Caucasian	12
New Zealand Caucasian	9
American Caucasian	1
Asian Australian	4
Indian	1
Chinese	1
South Korean	1
Fiji	1
European Australian	5
Bosnia and Herzegovina Caucasian	1
Irish Caucasian	1
Polish Caucasian	1
United Kingdom Caucasian	2
Irish Participants (1990)	**25**
Irish Caucasian	25
Irish Participants (2003)	**21**
Irish Caucasian	21
TOTAL	**200**

To demonstrate how cultural influences on gender and IT are manifested in the lives of female IT practitioners and academics, we explored the perceptions of women's role in society that are embedded in a culture and how this influences career choice. In doing so, we investigated the following themes: maternity, child care, perceptions of women working outside of the home and parental care responsibilities. During this analysis a number of additional themes about cultural influences emerged from the data. These themes center around cultural factors influencing career choice determinates among women. Specifically, these were grouped into the following categories: choosing a career you *want* to do versus what you *can* do, social class influences, economic opportunities, and gender stereotypes about aptitude. These themes are discussed in more detail in the remainder of this section.

Perceptions of Women's Role in Society Influencing IT Career Choice

A prevalent manifestation of cultural influence on the experiences of women in the IT workforce relates to maternity and motherhood. One aspect in particular highlights the temporal nature of cultural influences and how societal messages evolve over time. During the data collection in the first Irish study a common theme expressed by the participants was that women, in particular mothers, should not work outside the home. As Patricia explained:

> *"This is a very traditional society... It is still frowned upon for a mother to work"* [Patricia].

Likewise, Siobhann explained that in the 1980s a 'marriage tax' in Ireland made it very difficult for married women to work because they did not have a personal tax free allowance:

> *"[The Irish tax rates were very high and the laws] added together the husband and wife's salaries and taxed them as one. So, the husband got all the tax free allowances and the wives would not get any. [As a result] every hourly salary is taxed at the high rate" [Siobhann].*

A decade later, the sentiment in the 2003 interviews changed and many of the Irish women that were interviewed felt the position of women in their country has improved. For instance, Norah felt that the position of women is "definitely better" and there are more opportunities for women particularly in the sciences. Dymphna explained that working women are no longer viewed as taking a job away from a man who is supporting a family. She felt this was mainly because people have learned that dual-income couples are necessary in the new economic reality of increased costs and mortgages. Although, the position of women has improved, barriers to their participation in the IT workforce still remain however. For example, Iaobh recognizes that it is more difficult for women to climb the corporate ladder of success:

> *"I think [climbing the corporate ladder] depends on children. I think that is one thing that can hold some women back. … But I think that is changing, men are getting more involved" [Iaobh].*

Another theme about motherhood and careers that was raised by women in our studies relates to how communist or centrally-planned societies shape their views of women working outside of the home. For example, Anita, who is from Bosnia and Herzegovina, explained that communist and socialist ideologies, as opposed to capitalist ideologies, typically have a different view of female employment. She felt that the former Soviet Union and other communist countries had very little gender segregation in high paying careers because of an importance placed on gender equality issues. Likewise, Charlene, an Australian woman who grew up in communist Poland, felt that communist and socialist ideologies were more open to women working because of pure economics. She felt this paradigm was a result of a "different society structure" where both women and men had careers and shared domestic responsibilities:

> *"I feel coming from a communist country, I was raised in a little bit different way than girls are raised [in capitalist western cultures]. There was more expectation on us to get to any field we wanted and gender was not really an issue. And because of economical reasons, our mothers had to work. As such, they were also our bread winners as much as our fathers. I guess, there was a bigger awareness or let's say, acceptance of women [working]" [Charlene].*

Many women also spoke about the role of government-provided child care and maternity leave. Brianna, an Irish woman, felt that the Irish national policies on maternal

and paternal leave are extremely beneficial for working mothers. By taking a short amount of paid leave from work, mothers and/or fathers are able to spend quality time with newborn children, but are not punished when returning to the workforce. Likewise, Iaobh and Dearbhla, also Irish women, believed that there has been an increase in the acceptability of mothers working outside of the home in Ireland in recent years.

A theme raised by many participants was the influence of family dynamics on their careers. These women spoke about how their families influenced their perceptions of the acceptability of women working outside of the home. For instance, Jada, an India woman working in America, explained that her parents always encouraged her to have a career outside of the home:

"The message you got from your mother and father was always that you were going to have a career and get to go to college?" [Interviewer].

"Oh absolutely, yeah. And one of the things, the key things, that I tell people when I am talking about my influences is that for us college was not optional. It was always expected" [Jada].

At the same time, other participants spoke about how their cultures were more family-centered than work-centered. For instance, Rose, who is Japanese American, explained that her parents' traditional values dictated that she became a stay-at-home mother:

"The Japanese culture in particular does not put a lot of emphasis on

women, in particular, going out of the household. There was a lot of

emphasis on the Japanese women staying home and taking care of the

children and as well taking on certain kinds of duties like finances and

keeping, certain traditions alive" [Rose].

Rose went on to explain that being raised in America gave her a hybrid view of the role of women: a traditional Japanese view mixed with an assimilated American view. Another Asian American, Samantha, also felt her cultural impressions about the role of women working outside of the home are influenced by her Korean traditional background and her assimilated American upbringing.

The women, particularly those who spoke about female family responsibilities, also revealed a number of options available to them to help balance work and family. For example, Karen, an Indian woman working in America, explained:

"Traditionally in an Indian environment, when the girl is pregnant, when

she is in her 3rd trimester, she would go to her mom's place and have the

baby there. And come back after the baby is a few months older. It is a

very traditional thing to do, because the mom's side of the family offers a

lot more support" [Karen].

Mitul, an Australian woman originally from India, explained that in India the grandparents typically care for a child while the parents are at work. Otherwise, child

care facilities are available, although this option can be costly. Furthermore, as observed by the third author of this paper who is Chinese, it is not uncommon for Chinese women studying or working in America to send their newborn babies to China to be raised by the grandparents during the initial stages of infancy.

With respect to work-life balance, several Asian women spoke about the expectations to care for their parents and in-laws as they get older. For instance, Carol, a Chinese American woman, explained that in China domestic responsibilities include taking care of your children, and "taking care of your parents and your husband's parents." When asked if this perception differed from that of her American co-workers, she responded:

"I think [a] difference is that probably they do not have to take care of their parents. That is the big difference I can see" [Carol].

The women also noted that pleasing parents and in-laws factored into the choice of career and lifestyle. Several Asian women spoke about the expectations that their parents and in-laws would be involved in decision making about whom to marry, where to work, and when to have children. Karen explained that it would have been "impossible" to marry her husband if his parents would not have been supportive. Mitul considered herself to be lucky because her parents and her in-laws did not object of her working once she had a child. She added that if they had objected it would have been a difficult situation and she "probably would not have gone against their wishes."

Socio-Cultural Moderators Influencing IT Career Choice

One theme that repeatedly surfaced in the interviews was the difference in career choice decision factors. Women in the U.S. study felt the American societal message of career choice centers on what you *want to be*. Yet, in other countries the societal message of career choice centers on what you *can be* or what you *should be.* For instance, Cynthia, an Australian woman from China, explained that in China the decision to enter a certain career depends more on strong academic marks than a particular interest in the subject. She explained that she did not have an interest in the IT field per se, but was encouraged to pursue a career in the field because she performed well on university entrance exams. Karen explained that she wanted to pursue a career in the humanities, but was discouraged because she earned very strong grades in school. When asked if she was oriented toward sciences, she replied:

> *"Yes. Although, that is not where my passion lies. It was more because I was compelled to take sciences in India. Humanities and arts were not considered something that smart kids would do. Although I was more interested in literature and the arts, my mom wanted me to go into engineering, although I wanted to do journalism" [Karen].*

Rosalie, who grew up in Taiwan also felt that pursuing a career in the IT field would be prestigious for her parents. She explained that she was the youngest daughter so she had a lot of freedom in her career decisions, but she wanted to make her parents proud of her career decision by entering a esteemed field. Mitual echoed these

sentiments. She explained that in India she was a "topper," a high scoring student on exams:

> *"I was really intelligent. I was a topper. So that is why [people said I would become a doctor]... I had good marks, [but not enough to go into medicine]... I didn't want to give up. I wanted to be a professional"* [Cynthia].

Mitul added that, in India, exam scores only determine what a woman can be, but social class determines what a woman should be. She explained that in the highest social class, the expectation is that women will not work, in contrast to women in middle or lower classes who are expected to work. As a result, Mitul felt it might be easier for Indian women from the middle class to enter the IT workforce than those from the upper class.

Another career choice theme that was expressed by a few women from Ireland and China centers on the idea of "clean" work. Some women explained that traditional factory or agrarian careers required a large amount of physical labor in which workers were expected to get their hands dirty. The emergence of information work has brought a shift in the nature of work. A career in the IT workforce is generally consider "clean" since an employee does not interact directly with dirt or factory machinery. For example, Deirdre explained that when choosing a career her Irish school counselor and her father persuaded her to select an IT career because you do not "get dirty." In addition, Carol, a Chinese American, explained that her parents encouraged her to pursue an IT career

because she could work in an office on a computer rather than being exposed to harsh conditions out-of-doors, as is the case with some careers. Likewise, Sibyl, who grew up in China, first became interested in an IT career because of her experience in financial accounting, which she believes is perceived as an "ideal profession for girls in China."

Yang, an Australian woman from South Korea, and Sue an Australian Caucasian, offered insights into how the differences in societal messages about career choice can be manifested. They believe women in Australian technology courses at their universities are typically Asian because they are preparing for high paying careers in their home countries. Since IT careers are in demand in many nearby countries (Malaysia, Thailand, Singapore, Indonesia and the Philippines) a larger number of the students come to Australia to seek an IT education.

A final theme noted by a number of women related to the varying messages about gender aptitude stereotypes surrounding IT. In some cultures the societal stereotype is that women are not well suited for technical work. Yet, in other cultures the stereotype is the opposite. This conflicting depiction of women's relationship with IT was frequently discussed in the interviews. For instance, Linda, an American woman from India, explained that she was never "blocked" when she pursued IT as a field of study. In addition, Carol explained that in China it is not viewed as inappropriate for women to work in IT as she feels it is in the U.S. Likewise, Haiyan, also a Chinese American, explained that women in her school in Hong Kong were encouraged by teachers to pursue studies in math and science. She also explained that this attitude was consistent among teachers in China, Hong Kong and Taiwan, although other cultural differences often exist

among them. In addition, Cynthia spoke at great length about the differences between Chinese and Australian perceptions of women doing technical work:

"I think more women in China study engineering than [in Australia]. In China, our country says a woman and a man are equal. There is no [stereotype that IT] is men's work" [Cynthia].

The conflicting stereotypes about aptitude are further complicated by cultural messages about gender, race, and class. Some of the women felt that gender was not the primary distinguishing factor in stereotypes in their countries. Rather, race and class demographics were typically the primary targets of stereotypes. For example, Allison, an American woman from Jamaica, explained that negative stereotypes in Jamaica are not focused on gender. She explains that because the country is so diverse "the issue is not race and gender, it is status and money." As a result she has a difficult time reconciling race or gender discrimination she faces in the U.S. In addition, Candace, an Australian woman from Fiji, explained that gender is not the primary factor in societal stereotypes. She explained that ethnic background such as European, Fijian or Indian is the primary distinguishing factor in Fiji:

"To be honest, nobody really cared that much about male-female [differences], because the main focus was between Fiji and Indian culture [differences]. That was the huge cultural dichotomy that existed. … Everything else kind of paled in comparison to that" [Candace].

Lu, a Vietnamese American, spoke about how the gender stereotypes are compounded by ethnic stereotypes in the U.S. She explained that she likes math and hence, many people associate her with the stereotype that Asians are good at math:

"The majority of [my family and Asian American friends] are good at math and we excel at math and science. I think that it is kind of funny. I mean I know some people who do not fit in that stereotype whatsoever - the studious, hard working science oriented person. But I think that almost all of my family fits in that so it just kind of makes me laugh when I think about it" [Lu].

Another aspect of gender aptitude stereotypes centers on the interpretation of the term "geek." Carol explained the differences in America and China with respect to women being geeks. She feels that in the U.S. it is generally considered insulting to refer to females as geeks. As a result, a number of young girls she has met do not want the negative label associated with an interest in IT and chose not to pursue IT careers. Yet in China, Carol adds it "is just the opposite" since referring to a female as a geek is a positive comment and, in many ways, a complement.

DISCUSSION

In this paper we present the results of our investigation of cultural influences on women in the IT field that was conducted in order to empirically address our research questions. These results show the importance of including a cultural perspective in gender and IT research. We present evidence of different cultural influences on women in the IT field that are related to differences in nationality and ethnicity. Further, we classified the manifestation of these cultural influences into two themes found in prior literature about perceptions of women's role in society that are embedded in its culture and socio-cultural moderators (Ecevit et al., 2003; Eidelman and Hazzan, 2006; 2005; Hersh, 2000; Nielsen et al.1999; 1998): perceptions of women's role *that are embedded in the culture* of a society influencing IT career choice; and socio-cultural moderators influencing IT career choice.

With regard to perceptions of women's role that are embedded in a society, themes about maternity, childcare, parental care, and women working outside of the home emerged from the data. With regard to socio-cultural moderators, themes about gendered career norms, social class, economic opportunity, and gender stereotypes about aptitude emerged from the data. Our analysis demonstrates how these themes influence variation in female IT career choice by culture within a country, by cultural differences within a country and by culture across multiple countries. (This analysis is depicted in Figure 1).

Figure 1. A Model of Cultural Factors Influencing Career Choices for Women in the IT Workforce
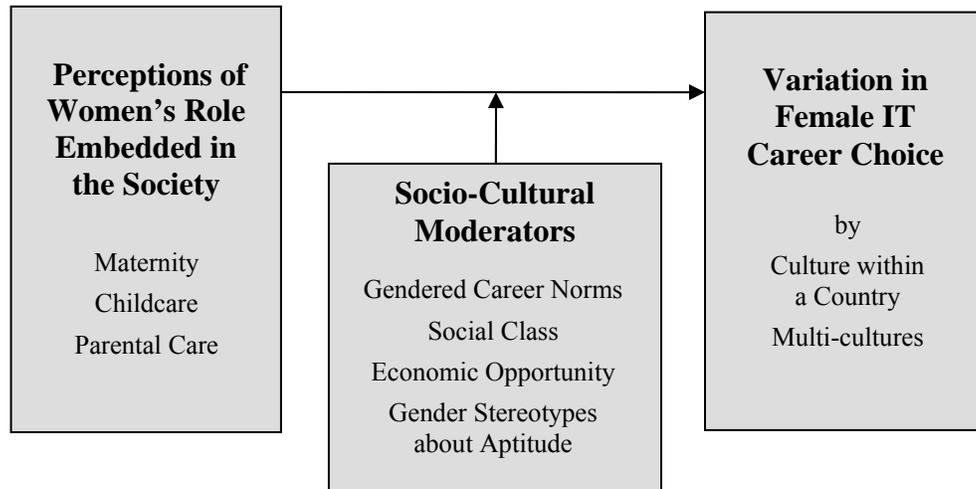
Our analysis shows that while themes related to parenting, family and economics might be evident in studies of women in each societal context; the *ways* in which these themes are experienced by the women vary across cultures. That is, not all women experience economic or parenthood issues in the same ways. Finally, the results of this research have clear implications for the theoretical underpinnings of gender and IT research. The evidence of varying cultural influences on women in the IT labor force and varying responses by women to common experiences such as parenthood, suggest the need for deeper examination of factors affecting women's recruitment into and retention in the IT field.

We explored these themes for several reasons. First, the themes build on prior work with the individual differences theory of gender and IT by investigating the influence of environmental context on women in the choice of IT careers (e.g. Trauth et

al., 2008). In doing so, we explored historical and current economic and cultural factors present in the environmental context. Second, the themes, when holistically examined, represent a range of diverse influences such as the effect of: political, economic, and geographical context on gendered messages in the culture, family dynamics and expectations on career choice, and differences in support structures on career enactment. Finally, these themes demonstrate the importance of considering cultural factors when conducting gender and IT research inasmuch as they appear to significantly influence women's choice about an IT career. Doing so will become increasingly important as the IT field continues to globalize and the cultural diversity of the domestic IT workforce continues to grow.

The findings presented in this study make a contribution to both research and practice. With respect to research, our analysis points to areas of cultural influence that warrant further academic study. In addition, our findings make a contribution to theory by lending further empirical support for the theoretical insights offered by the individual differences theory of gender and IT. This theory challenges essentialist assumptions that do not consider context when concluding that the reasons for the under representation of women can be found within women themselves. That is, this theory challenges the assumption that women either are not interested in or not capable of achieving in the IT field. At the same time, evidence that different cultures exert different influences on women also adds nuance to the social construction of 'female roles' and 'gendering of IT' as they relate to the choice of a career in the IT field. We believe this theoretical lens addresses the knowledge gap about under representation in the IT field by offering a

means of better understanding and articulating the varied influences on women's career choices, brought about in part, from cultural factors.

This work also makes a contribution to practice. The problem for practice relates to IT employers, policy makers, and IT educators. First, IT workforce employers need to develop interventions to increase the under representation of women that focus on recruitment and retention. One important implication of our findings is that these interventions must take into account the varied cultural influences on women. Thus, for example, childcare provisions may not be sufficient in some countries; elder care or telecommuting provisions may be needed as well. In addition, multinational corporations may need to consider whether their human resource policies are consistent with cultural pressures on women in a particular country. It is also critical to recognize women's own agency in shaping their own positions and responses to cultural factors and their subsequent relationships with technology. As the women in this study have shown, a "one size fits all" approach can be problematic.

Second, public policy can serve to enhance or hinder the recruitment of women into and their retention in the IT field in very practical ways. Our findings suggest the need to (re)visit maternity, child care, elder care policies. As pointed out in the first Irish study, tax laws provided a disincentive for some women to participate in the labor force. Policy makers interested in redressing the gender imbalance in the IT fields of their countries can look to the role that work leave, tax, antidiscrimination and other such policies might be playing in either enhancing or inhibiting women's participation.

Finally, pre-college educators play a crucial role in increasing the under representation of females in the IT field. Employers and IT educators need to work in

collaboration with primary and secondary educational institutions to conduct outreach programs for students and their parents. By providing a 'face' of the IT worker to whom these young women and their parents can relate, we may be able to change both the image and the composition of the IT profession.

CONCLUSION

For those engaged in IT workforce research, it is important to reexamine the discourse regarding diversification of the IT workforce in a critical and broad sense: what diversity means and how to address diversification issues from multiple integrated perspectives. Trauth et al. (2006a) argue that we should take a comprehensive view of diversity that builds upon the notion of "diversity as difference," and include in our consideration not only demographic differences, but also socio-cultural and individual differences. Other researchers have also pointed out that the IT gender gap is not an isolated phenomenon and stress the need to address the gender issues in conjunction with other issues such as class, race, ethnicity, etc. (Kvasny, 2003; Naryayan, 1998). This results presented in this paper contribute to the growing body of IT workforce research literature that is focused on gender and the IT workforce. It does so by examining cultural variation in gender and IT issues. The analysis of two themes (perceptions of women's role in society and socio-cultural moderators) reveals a wide range of influences on women's choice of an IT career based upon nationality and ethnicity. These results reinforce the need to move away from theoretical lenses that reinforce monolithic analyses of gender and IT and that assume a common experience for all women. Instead, we argue for the need to move toward more robust and nuanced

analyses that take into account the wide variation of both influences on women in the IT field and women's varied responses to them.

ACKNOWLEDGMENTS

REFERENCES

Adams, J.C., Bauer, V., and Baichoo, S. (2003). "An Expanding Pipeline: Gender in Mauritius." In the *Proceedings of ACM SIGCSE Conference*, Reno, Nevada, February 19-23, 2003, New York, New York: ACM Press, 59-63.

Adams, J. C., Baichoo, S., and Bauer, V. (2006). "Women Embrace Computing in Mauritius." In Trauth, E.M. (Ed.), *Encyclopedia of Gender and Information Technology,* Hershey, Pennsylvania: Idea Group Publishing, 1258-1266.

Adam, A., Howcroft, D. and Richardson, H. (2002). "Guest Editorial." *Information Technology and People,* 15(2), 94-97.

Arnold, D. and Niederman, F. (2001). "The Global Workforce." *Communications of the ACM,* 44(7), 31-33.

Australian Bureau of Statistics. (2002). "Special Tabulation." Unpublished. Cited in Staehr, L., Byrne, G. and Bell, E. (2006). "Gender and the Australian IT Industry." In Trauth, E.M. (Ed.), *Encyclopedia of Gender and Information Technology*, Hershey, Pennsylvania: Idea Group Publishing, 467-473.

Camp, T. (2002). "Reprints: The Incredible Shrinking Pipeline." *ACM SIGCSE Bulletin*, 34(2), 129-134.

Clarke, V. A. and Teague, G. J. (1994a). "Encouraging Girls to Study Computer Science - Should We Even Try?" *Australian Educational Computing,* 9(1), 17-22.

Clarke, V. A., and Teague, G. J. (1994b). "A Psychological Perspective on Gender Differences in Computing Participation." In the *Proceedings of the ACM SIGCSE 1994 Conference*, New York, New York: ACM Press, 258-262.

Downie, R., Dryburgh, H., McMullin, J. and Ranson, G. (2004). "A Profile of Information Technology in Canada." *Workforce Aging in the New Economy International Report, Number One.* Retrieved on February 16, 2007, from http://www.wane.ca/PDF/IR1.pdf.

Durndell, A., Haag, Z., and Laithwaite, H. (2000). "Computer Self Efficacy and Gender: A Cross-cultural Study of Scotland and Romania." *Personality and Individual Differences,* 28, 1037-1044.

Ecevit, Y., Gündüz-Hoşgőr, A., and Tokluoğlu, C. (2003). "Professional Women in Computer Programming Occupations: The Case of Turkey." *Career Development International,* 8(2), 78-87.

Eidelman, L. and Hazzan, O. (2006). "The Shrinking Pipeline in Israel High Schools." In Trauth, E.M. (Ed.), *Encyclopedia of Gender and Information Technology,* Hershey, Pennsylvania: Idea Group Publishing, 1092-1098.

Eidelman, L. and Hazzan, O. (2005). "Factors Influencing the Shrinking Pipeline in High Schools: A Sector-based Analysis for the Israeli High School System." In the *Proceedings of the ACM SIGCSE Conference*, St. Louis, MS, February 23-27, 2005, New York, New York: ACM Press, 406-410.

Finquelievich, S. (2003). "Civil Society and the New Economy." Social Science Research Council. Retrieved on February 7, 2007, from http://www.ssrc.org/programs/itic/publications/knowledge_report/memos/finquelievichmemo2.pdf

Frieze, C., Hazzan, O., Blum, L., and Dias, M. B. (2006). "Culture and Environments as Determinants of Women's Participation in Computing: Revealing the "Women-CS" Fit." In the *Proceedings of the ACM SIGCSE Conference*, Houston, TX, March 1-5, 2006, New York, New York: ACM Press, 22-26.

Galpin, V. (2002). "Women in Computing Around the World." *ACM SIGSCE Bulletin,* 34(2), 94-100.

Hembry, O. and Presley, A. (2006). "IT Proves to be a Turnoff for Women." Retrieved on March 12, 2007, from: http://www.nzherald.co.nz/topic/story.cfm?c_id=498&objectid=10370311

Hersh, M. (2000). "The Changing Position of Women in Engineering Worldwide." *IEEE Transactions of Engineering Management,* 47(3), 345-359.

Huang, H. (2006). "The Cross-Cultural Dimension of Gender and Information Technology." In Trauth, E.M. (Ed.), *Encyclopedia of Gender and Information Technology,* Hershey, Pennsylvania: Idea Group Publishing, 147-153.

Huang, H. and Trauth, E.M. (2006) "Cultural Diversity Challenges: Issues for Managing Globally Distributed Knowledge Workers in Software Development." In Yoong, P. and Huff, S. (Eds.), *Managing IT Professionals in the Internet Age.* Idea Group, Inc.: Hershey, Pennsylvania, 254-276.

Huyer, S. (2005). "Women, ICT and the Information Society: Global Perspectives and Initiatives." In the *Proceedings of the International Symposium on Women and ICT: Creating Global Transformation,* Baltimore, Maryland, June 12-14, 2005. New York, New York: ACM Press.

Information Technology Association of America (ITAA). (2005). "Untapped Talent: Diversity, Competition, and America's High Tech Future – Executive Summary." Retrieved on April 17, 2006, from: http://www.itaa.org/eweb/upload/execsummdr05.pdf.

Irwin, L. (2000). "Gender Inequities in Technology in Developing Nations: Females and Computers in Traditional Cultures," *Intercultural Education*, 11(2), 195-200.

Kvasny, L. (2003). "Triple Jeopardy: Race, Gender and Class Politics of Women in Technology." In Mandviwalla, M. and Trauth, E.M. (Eds.), *Proceedings of the 2003 ACM SIGMIS Conference on Computer Personal Research*, Philadelphia, Pennsylvania, USA, ACM Press: New York, 112-116.

Llewellyn, D. and Usselman, M. (2001). "Ethnic Differences in Female Applicants to Engineering and IT Majors." *American Educational Research Association Conference (AERA),* Seattle, Washington.

Li, N. and Kirkup, G. (2007). "Gender and Cultural Differences in Internet Use: A Study of China and the UK." *Computers and Education,* 48(2), 301-317.

Makrakis, V. and Sawada, T. (1996). "Gender, Computers and Other School Subjects among Japanese and Swedish Students." *Computers and Education,* 26(4), 225-231.

Margolis, J., and Fisher, A. (2002). *Unlocking the Clubhouse: Women in Computing.* MIT Press: Cambridge, Massachusetts.

Medeiros, C. B. (2005). "From Subject of Change to Agent of Change – Women and IT in Brazil." In the *Proceedings of the International Symposium on Women and ICT: Creating Global Transformation,* Baltimore, Maryland, June 12-14, 2005, New York, New York: ACM Press.

Minguez, A. M. (2005). "New Technologies as Social Fact: Gender and Digital Divide in Spain in Compared Perspective." In the *Proceedings of the International Symposium on Women and ICT: Creating Global Transformation,* Baltimore, Maryland, June 12-14, 2005, New York, New York: ACM Press.

Morgan, A. J., Quesenberry, J. L., and Trauth, E. M. (2004). "Exploring the Importance of Social Networks in the IT Workforce: Experiences with the 'Boy's Club.'" In Luftman, J. (Ed.), *Proceedings of the Americas Conference on Information Systems,* New York, New York, USA, 1313-1320.

Naryayan, U. (1998). "Essence of Culture and a Sense of History: A Feminist Critique of Cultural Essentialism." *Hypatia: A Journal of Feminist Philosophy,* 13(2), 86-107.

Nielsen, S., von Hellens, L. A., Greenhill, A., and Pringle, R. (1998). "Conceptualising the Influence of Cultural and Gender Factors on Students' Perception of IT Studies and Careers." In *Proceedings of the 1998 ACM SIGCPR Conference,* Boston, Massachusetts, USA, New York, New York: ACM Press, 86-95.

Nielsen, S., von Hellens, L., Pringle, R., and Greenhill, A. (1999). "Students' Perceptions of Information Technology Careers: Conceptualising the Influence of Cultural and Gender Factors for IT Education." *GATES,* 5(1), 30-38.

Organization for Economic Co-operation and Development (OECD). (2007). ICTs and Gender. Retrieved on May 8, 2007, from: http://www.oecd.org/dataoecd/16/33/38332121.pdf

Pande, R. (2006). "Digital Divide, Gender and the Indian Experience in IT." In Trauth, E.M. (Ed.), *Encyclopedia of Gender and Information Technology,* Idea Group Reference: Hershey, Pennsylvania, 191-199.

Quesenberry, J. L., Trauth, E. M., and Morgan, A. J. (2006). "Understanding the 'Mommy Tracks': A Framework for Analyzing Work-Family Issues in the IT Workforce." *Information Resources Management Journal,* 19(2), 37-53.

Quesenberry, J.L., and Trauth, E.M. (2005). "The Role of Ubiquitous Computing in Maintaining Work-Life Balance: Perspectives from Women in the IT Workforce." In *Designing Ubiquitous Information Environments: Socio-Technical Issues and Challenges.* C. Sorensen, Y. Youngjin, K. Lyytinen, and J.I. DeGross (Eds.), New York, Springer: 43-55.

Quesenberry, J.L. and Trauth, E.M. (2007). "What Do Women Want?: An Investigation of Career Anchors among Women in the IT Workforce," *Proceedings of the ACM SIGMIS Computer Personnel Research Conference,* St. Louis, Missouri, April, New York, New York: ACM Press, 122-127.

Rosser, S. V. (2005). "Women and ICT: Global Issues and Actions." In the *Proceedings of the International Symposium on Women and ICT: Creating Global Transformation,* Baltimore, Maryland, June 12-14, 2005. New York, New York: ACM Press.

Sanders, J. (2005). "Gender and Technology in Education: What the Research Tells Us." In the *Proceedings of the International Symposium on Women and ICT: Creating Global Transformation,* Baltimore, Maryland, June 12-14, 2005, New York, New York: ACM Press.

Schienstock, G. (1999). "Social Exclusion in the Learning Economy." Presented at the European Socio-Economic Research Conference, Brussels. Retrieved on March 12, 2007, from: http://www.uta.fi/laitokset/tyoelama/sowing/report/SocExcLearningEcon.pdf

Schinzel, B. (1999). "The Contingent Construction of the Relationship between Gender and Computer Science." In the *Proceedings of International Symposium on Technology and Society: Women and Technology,* New Brunswick, New Jersey, July 29-31, 1999, 299-311.

Shen, C. Y. and Ge, J. (2006). Women and ICT: from the Chinese Perspective." In the *Proceedings of the International Symposium on Women and ICT: Creating Global Transformation, Baltimore,* Maryland, June 12-14, 2005. New York, New York: ACM Press.

Shiva, V. (1989). *Staying Alive: Women, Development, and Ecology in India.* Zed Press, London, UK.

Teague, J. (2002). "Women in Computing: What Brings Them to It, What Keeps Them in It?" *SIGCSE Bulletin,* 34(2), 147-158.

Trauth, E.M. (2002). "Odd Girl Out: An Individual Differences Perspective on Women in the IT Profession." *Information Technology and People,* 15(2), 98-118.

Trauth, E.M. (2001). "Mapping Information-sector Work to the Workforce: The Lessons from Ireland." *Communications of the ACM,* Special Issue on The Global IT Workforce, 44(7), 74-75.

Trauth, E.M. (2000). *The Culture of an Information Economy: Influences and Impacts in the Republic of Ireland.* Kluwer Academic Publishers: Dordrecht.

Trauth, E.M. (1999). "Leapfrogging an IT Labor Force: Multinational and Indigenous Perspectives." *Journal of Global Information Management,* 7(2), 22-32.

Trauth, E.M. (1995). "Women in Ireland's Information Industry: Voices from Inside." *Eire-Ireland,* 30(3), 133-150.

Trauth, E.M. and Howcroft, D. 2006. "Critical Empirical Research in IS: An Example of Gender and IT," *Information Technology and People*, Special Issue on Critical Research in Information Systems, 19(3), 272-292.

Trauth, E.M., Huang, H., Morgan, A.J., Quesenberry, J.L., and Yeo, B. (2006a). "Investigating the Existence and Value of Diversity in the Global IT Workforce: An Analytical Framework." In Niederman, F. and Ferratt, T. (Eds.), *Managing Information Technology Human Resources*, Information Age Publishing: Hershey, Pennsylvania, 331-360.

Trauth, E.M., Nielsen, S.H., and von Hellens, L.A. (2003). "Explaining the IT Gender Gap: Australian Stories for the New Millennium." *Journal of Research and Practice in IT,* 35(1), 7-20.

Trauth, E.M. and Quesenberry, J.L. (2007). "Gender and the Information Technology Workforce: Issues of Theory and Practice." In *Managing IT Professionals in the Internet Age.* Yoong, P. and Huff, S. (Eds.) Hershey, PA: Idea Group Publishing: 18-36.

Trauth, E.M. and Quesenberry, J. (2006). "Are Women an Underserved Community in the Information Technology Profession? *Proceedings of the International Conference on Information Systems*, Milwaukee, Wisconsin, December.

Trauth, E.M., and Quesenberry, J.L. 2005. "Individual Inequality: Women's Responses in the IT Profession." In Whitehouse, G. (Ed.), *Proceedings of the Women, Work and IT Forum,* Brisbane, Queensland, Australia, June, 23-24.

Trauth, E. M., Quesenberry, J., and Huang, H. (2006b). "Cross-Cultural Influences on Women in the IT Workforce." In the *Proceedings of the 2006 ACM SIGMIS CPR Conference*, April 13–15, 2006, Claremont, California, USA, ACM Press: New York, New York, 12-19.

Trauth, E.M., Quesenberry, J.L., and Morgan, A.J. (2004). "Understanding the Under Representation of Women in IT: Toward a Theory of Individual Differences." In Tanniru, M. and Weisband, S. (Eds.), *Proceedings of the 2004 ACM SIGMIS Conference on Computer Personal Research,* Tucson, Arizona, USA, ACM Press: New York, 114-119.

Trauth, E.M., Quesenberry, J. and Yeo, B. (2008). "Environmental Influences on Gender in the IT Workforce," *The Data Base for Advances in Information Systems.*

Trauth, E.M., Quesenberry, J.L. and Yeo, B. 2005. "The Influence of Environmental Context on Women in the IT Workforce" *Proceedings of the ACM SIGMIS Computer Personnel Research Conference,* Atlanta, Georgia, April, 24-31

Weil, M. M. and Rosen, L. D. (1995). The Psychological Impact of Technology from a Global Perspective: A Study of Technological Sophistication and Technophobia in University Students from Twenty-Three Countries." *Computers in Human Behavior,* 11(1), 95-133.

Women and Minorities in Information Technology Forum. (1999). "Causes and Solutions for Increasing the Numbers in the Workforce Pipeline." Women and Minorities in Information Technology Forum, Old Dominion University, Hampton Virginia.

Workforce Aging in the New Economy (WANE). (2004). "Europe, Phase One: A Selection of Initial Findings on Employment Diversity." Retrieved on April 16, 2006, from: http://www.wane.ca/PDF/EUBriefing.pdf

Woszczynski, A., Myers, M., Beise, C., and Moody, J. (2004). "Diversity within the Ranks: How Ethnicity Affects Choices in IT." *Proceedings of the Tenth Americas Conference on Information Systems (AMCIS),* August 5-8, New York, New York.

APPENDIX A: INTERVIEW TOPICS

First Irish Study (1990)
Demographic background (country of origin, country of residence at time of interview)
Personal background (educational background, IT work experience)
Experiences as a woman working in the IT field in Ireland

Australian/New Zealand Study (2000)
Demographic background (country of origin, country of residence at time of interview)
Personal background (educational background, IT work experience)
Experiences as a woman working in the IT field in Australia or New Zealand

U.S. and Second Irish Study (2002-2006, 2003)
Demographic background (age, race/ethnicity, country of origin, country of residence at time of interview)
Personal background (relationship status, parenthood status, educational background, IT work experience)
Experiences as a woman working in the IT field in the US or Ireland

Note: While for the two earlier studies the question about experiences as an IT professional in the country was asked in a very open-ended fashion, for these two studies the questions were more directive. That is, participants were specifically asked to discuss significant influences on career progression such as people and experiences in their lives. Nevertheless, women in each study were asked to relate their experiences as an IT professional to the societal and cultural context in which they lived, studied and worked. Thus there was consistency in the data that was collected that was used in this paper.

FOOTNOTES

[i] The Japanese cultural norm of "Ryosai Kenbo" (translated to "good wife, clever mother") can be traced back to the late 1800s during the Meiji reign. It is still influential today for Japanese girls from all social classes to pursue an education that is suitable for a good wife, and clever mother.

[ii] The second and third authors were involved in the data analysis for the U.S. and the second Irish studies.

[iii] For a complete set of factors examined in this larger study see Trauth (2000, pp. 387-390).

[iv] In the case of the two Irish studies and the Australian/New Zealand study women throughout the country were interviewed. In the case of the American study the geographical representation was limited to three states: Massachusetts, North Carolina and Pennsylvania. This was done because of the size of the American population in contrast to that of Ireland, Australia and New Zealand. Limiting the geographical representation, thus, facilitated more focused socio-cultural analysis. (See, for example, Trauth et al., 2008)

[v] The Australian/New Zealand transcripts were coded by the first and second authors.

[vi] A retrieval system based on Foxpro was developed.

[vii] QSR N6.

[viii] Age data was not collected for all participants in the original Ireland and Australian studies. Hence, the age statistics do not include information for 25 Irish women and 10 women from the Australian/New Zealand study.

[ix] Relationship status was not collected for all participants in the original Ireland and Australian/New Zealand studies. Hence, the relationship statistics do not include information for 25 Irish women and 31 Australian/New Zealand women.

[x] Motherhood status was not collected for all participants in the original Ireland and Australian/New Zealand studies. Hence, the motherhood statistics do not include information for 25 Irish women and 31 Australian/New Zealand women.