

Underrepresentation of Women in Management Information Systems: Gender Differences in Key Environmental Barriers

Asli Yagmur Akbulut

Abstract—Despite a robust and growing job market and lucrative salaries, there is a global shortage of Information Technology (IT) professionals. To make matters worse, women continue to be underrepresented in the IT workforce and among IT degree holders. In today's knowledge based economy and society, it is extremely important to increase the presence of women in the IT field. In order to do so, it is necessary to reduce entry barriers and attract more women to pursue degrees in various IT fields including the field of Management Information Systems (MIS). Even though MIS is considered to have a more feminine nature, women still tend to avoid majoring in this field. Unfortunately, there is a lack of research that investigates the specific factors that may deter women from pursuing a degree in MIS. To address this research gap, this study examined a set of key environmental barriers that might prevent women from pursuing an MIS degree and explored whether there were any gender differences between female and male students in terms of these key barriers. Based on a survey of 280 students enrolled in an introductory level MIS course, the study empirically confirmed that there were significant differences between male and female students in terms of the key contextual barriers perceived. Female students demonstrated major concerns about gender discrimination related barriers, whereas male students were more concerned about negative social influences. Both male and female students were equally concerned about not being able to fit in well with other MIS majors. The findings have important implications for MIS programs, as the information gained can be used to design and implement specific intervention strategies to overcome the barriers and attract larger pools of women to the MIS discipline. The paper concludes with a discussion of the findings, implications, and future research directions.

Keywords—Gender differences, MIS major, underrepresentation, women in IT.

I. INTRODUCTION

UNDERREPRESENTATION of women in IT careers continues to be a worldwide well-known problem. Recent statistics indicate that although women comprise more than half of the entire workforce in the U.S. economy, they hold only 25 percent of IT jobs [1]. Moreover, in 2014, women earned only 17% of undergraduate IT degrees and, alarmingly, the proportion of women pursuing IT degrees has been steadily declining [1]. Similar trends have also been reported in Europe as well as globally [2]. Given the major IT talent gap worldwide; failure to include half of all qualified individuals presents a major problem for the viability of the IT

discipline, as well as of the advancement of our economy and society.

In order to increase the representation of women in the IT workforce, it is imperative to understand the barriers that might deter them from participating in the IT field.

To date, a number of studies have been conducted in the IT domain to address the role of gender and identify the barriers faced by women, e.g. [3]-[10]. Most of these studies have investigated all IT fields together as one group or focused on women's underrepresentation in Computer Science (CS). However, the IT field covers a broad group of disciplines including the more CS discipline, as well as the relatively newer and more applied disciplines such as Information Science, Informatics, and MIS among others [11]. Different disciplines in IT have certain inherit differences and these differences might result in different challenges for women. Recent research has argued that certain IT subfields such as MIS may be more attractive to women than CS, because of their applied emphases and because of their association with professional cultures in which women are generally better represented [11]. Regardless, even though MIS is considered to have a more feminine nature, because of its greater social component [12], women still tend to shy away from the MIS field.

Unfortunately, research on gender issues in MIS is underdeveloped. Compared to more established technical IT disciplines such as CS and to other more established business disciplines such as marketing, finance, and accounting; MIS is a relatively newer area of study and career option, which many students may be unaware of or may misunderstand, suggesting the need for discipline-specific understanding of MIS major and career choices [13]. An individual's decision to pursue an MIS career usually takes place in conjunction with the individual's educational choices, years before entering the workforce [11]. Therefore, in order to increase the representation of women in the MIS field, we need to address the bottleneck issues as early as possible and increase the number of women majoring MIS. In this respect, this study focused on a set of key environmental barriers that might hinder women's interest in and choice of an MIS major and investigated whether female and male students differed in their perceptions about these barriers. As a result, the correct mix of intervention strategies can be devised and implemented to overcome the barriers women face at this early juncture in the MIS pipeline.

Asli Yagmur Akbulut is with the Management Department, Grand Valley State University, Grand Rapids, MI 49504 USA (phone: 616-331-7302; fax: 616-331-7495; e-mail: akbuluta@gvsu.edu).

II. BACKGROUND LITERATURE

A. Role of Perceived Barriers

Barriers are defined as the factors, either within the person or the person's environment that have the potential to make academic and career progress difficult [14]. Research about career barriers was first introduced to examine the factors that are unique to the career psychology of women in an attempt to explain the gap between women's abilities and their achievements [14]. Over the years, a wide variety of barriers have been cited in the literature including; lack of confidence, job market considerations, gender/racial discrimination, multiple role conflict, disapproval by significant others, discouragement from choosing non-traditional careers, difficulties with networking and socialization, inadequate preparation, financial constraints, instructional barriers, lack of role models, among others [15], [16]. Even though researchers have not been able to reach a consensus regarding the specific type and range of potential barriers that people may perceive, they agree that the construct of barriers is extremely important in understanding students' academic and career choice processes [17]. Moreover, researchers agree on focusing on perceived barriers as opposed to actual barriers, as perceptions exert more influential force on career related behavior [17]. In this respect, perceived barriers play an important role in high school and college students' educational and career goal attainment [18]. For example, research has found a negative relationship between barriers and a variety of occupational outcomes, including career salience, career maturity, as well as career indecision and career choices [14], [16], [18]. Along the same lines, researchers emphasized that perceived barriers might be particularly influential in the career development of women and minorities, arguing that women and minorities perceive substantially greater number of educational and career related barriers [15], [19]-[21].

Perceived barriers might arise from personal (e.g. self-efficacy, motivation to achieve) and/or environmental (e.g. gender discrimination, social influences) sources [22]. Although several researchers have treated personal and environmental barriers as conceptually equivalent, it is important to differentiate between these two categories as these factors do not represent a single, monolithic source of influence [23]. In this respect, this study focuses on a set of key environmental barriers that might impede women's pursuit of an MIS major. More specifically, we focus on barriers related to gender discrimination, social influences, and social fit [23].

Gender discrimination barriers refer to the degree to which an individual perceives that he or she would be discriminated because of his/her gender if he/she pursues an MIS major. Social influence barriers refer to degree to which an individual perceives that the people who are important to him or her would not be supportive of or would discourage his/her decision to pursue an MIS major. Social fit barriers refer to degree to which an individual perceives that he or she would not be able to fit in with the other students in the MIS major.

III. RESEARCH METHOD

A. Sample and Procedure

The study was conducted at a large state university located in the United States. The sample consisted of students enrolled in different sections of an introductory level MIS course at the business school of the university. An online survey was used to collect the data for the study. Participation in the study was voluntary. A total of 280 usable responses were obtained, of which 55% were male and 45% were female. The respondents averaged 20.8 years of age ($SD = 3.26$).

A comprehensive review of the literature was undertaken to identify existing measures. Existing scales were utilized directly to take advantage of their proven psychometric qualities [24]. All the items that were used to measure the different barriers were derived from previously validated scales developed by [14] and [23]. The scales were modified to reflect the context accordingly. As suggested by [24], all scales were subjected to rigorous pretesting in separate studies. Likert-type scales were used. Gender discrimination barriers were measured using nine items. Social influence barriers and social fit barriers were measured using four and three items, respectively.

B. Data Analysis and Results

The sample was divided into two groups according to gender. Independent sample t-tests were employed to identify whether there was a significant difference between female and male students in terms of the barriers they perceived in pursuing an MIS major. The results are provided below.

1. Gender Discrimination Barriers

This category of barriers consisted of items referring to students' perceptions about whether they would face gender discrimination if they pursued an MIS major. The specific items and t-test results are provided in Table I.

For gender discrimination barriers, for all individual items, female students' mean scores (range 2.17 to 3.13) were higher than male students' mean scores (range 2.00 to 2.30), showing that females were relatively more concerned about gender discrimination than males. Further analysis was conducted to evaluate whether there were any significant statistical differences between females and males regarding their perceptions about gender discrimination. With the exception of a couple items, significant differences surfaced between female and male students. Compared to male students, female students were more concerned about feeling discriminated because of their gender ($t = 2.34, p < .05$). Another concern that was voiced by females was about feeling like an outsider because of their gender if they pursued a major in MIS ($t = 2.38, p < .05$). They were also more worried about receiving negative comments because of their gender ($t = 2.25, p < .05$) and not having the same opportunities as males if they pursued an MIS major ($t = 2.35, p < .05$). Female students were also more worried about pursuing a path that might be considered non-traditional ($t = 6.61, p < .001$) or even not appropriate for their gender ($t = 2.50, p < .05$). No significant differences were found between female and male students in terms of the

remaining three items about being looked down on, not being treated fairly because of their gender, and being considered unfeminine/unmasculine.

2. Social Influence Barriers

This category of barriers consisted of items referring to students' perceptions about the lack of support or discouragement they would receive from the important people in their lives if they pursued an MIS major. The specific items and t-test results are provided in Table II.

For the social influence barriers, for all individual items, female students' mean scores (range 2.33 to 2.46) were lower than male students' mean scores (range 2.56 to 2.86), showing

that females were relatively less concerned about negative social influences than males. Further analysis was conducted to evaluate whether there were any statistical differences between females and males regarding their perceptions. With the exception of one item, significant differences surfaced between female and male students. Male students were more concerned about feeling pressure from important people in their lives to change to a different academic and career path ($t = -3.03, p < .01$), as well as not receiving support ($t = -2.40, p < .05$) or approval ($t = -2.21, p < .05$) from important people in their lives for their pursuits in the MIS discipline.

TABLE I
GENDER DISCRIMINATION BARRIERS

Items	Females		Males		Comparison	
	M	SD	M	SD	t-value	
Bar-Gen1: I would feel discriminated against because of my gender.	2.34	1.51	2.03	1.36	2.14	*
Bar-Gen2: I would feel that other people would look down on me because of my gender.	2.24	1.44	2.00	1.33	1.74	NS
Bar-Gen3: I would feel like an outsider because of my gender.	2.38	1.56	2.04	1.31	2.38	*
Bar-Gen4: I would feel like I was not being treated fairly because of my gender.	2.32	1.47	2.11	1.37	1.43	NS
Bar-Gen5: I would receive negative comments because of my gender.	2.33	1.46	2.02	1.29	2.25	*
Bar-Gen6: I would not have the same opportunities as people of the other gender.	2.56	1.56	2.20	1.46	2.35	*
Bar-Gen7: I would be pursuing a path that is non-traditional for my gender.	3.13	1.74	2.11	1.32	6.61	***
Bar-Gen8: I would be pursuing a path that is not considered appropriate for someone of my gender.	2.52	1.50	2.15	1.45	2.50	*
Bar-Gen9: I would be considered unfeminine /unmasculine because my major is nontraditional for my gender.	2.22	1.42	2.19	1.39	0.25	NS

* $p < .05$, ** $p < .01$, *** $p < .001$ M = mean average item score. SD = average item score standard deviation

TABLE II
SOCIAL INFLUENCE BARRIERS

Items	Females		Males		Comparison	
	M	SD	M	SD	t-value	
Bar-Inf1: I would feel pressure from important people in my life to change to a different major.	2.41	1.42	2.86	1.48	-3.03	**
Bar-Inf2: I would receive negative comments or discouragement about this choice from important people in my life.	2.33	1.42	2.56	1.34	-1.70	NS
Bar-Inf3: I would not receive support about this choice from people who are important to me.	2.46	1.47	2.78	1.40	-2.40	*
Bar-Inf4: I would not get approval from people who are important to me.	2.40	1.47	2.72	1.36	-2.21	*

* $p < .05$, ** $p < .01$, *** $p < .001$ M = mean average item score. SD = average item score standard deviation

TABLE III
SOCIAL FIT BARRIERS

Items	Females		Males		Comparison	
	M	SD	M	SD	t-value	
Bar-Fit1: I would not fit in socially with other people in this major.	3.48	1.58	3.45	1.68	0.19	NS
Bar-Fit2: I would not know many people in my major.	4.38	1.75	4.32	1.69	0.72	NS
Bar-Fit3: I would not have much in common with other people in my major.	3.79	1.72	3.72	1.56	0.66	NS

* $p < .05$, ** $p < .01$, *** $p < .001$ M = mean average item score. SD = average item score standard deviation

3. Social Fit Barriers

This category of barriers consisted of items referring to students' perceptions about their concerns about not being able to fit in with the people in the MIS major. The specific items and t-test results are provided in Table III.

For the social fit barriers, the mean scores of responses from both female and male students tended to be higher compared to the previous categories of barriers. For all individual items, female students' mean scores (range 3.48 to 4.38) were higher than male students' mean scores (range 3.45 to 4.32), showing that females were relatively more concerned

about whether they would fit in with other MIS majors. Further analysis was conducted to evaluate whether there were any statistical differences between females and males regarding their perceptions about social fit. No significant differences emerged between female and male students.

IV. DISCUSSION AND CONCLUSION

The findings of this study provide important insights into understanding the underrepresentation of women in MIS. This study focused on a set of key contextual barriers that might hinder women's pursuit of the MIS major. The study found

significant differences between male and female students in terms of gender discrimination and social influence barriers; whereas no significant differences between genders were found for social fit barriers.

Regarding gender discrimination barriers, our findings indicated that female students were more concerned about being discriminated in the MIS field compared to male students. Similar to what is observed in technical IT subfields, women tend to perceive MIS as a more male-dominated field and have concerns about following a non-traditional path for their gender and being discriminated in the field. In terms of social influences, our study again found significant differences between female and male students. However, female students seemed to be less concerned about negative social influences compared to male students. Male students reported higher concerns about discouragement and disapproval from important people in their lives if they majored in MIS. In terms of social fit barriers, there were no significant differences between female and male students. However, the mean scores for both female and male students in this category were higher than the mean scores that were recorded for the other two categories of barriers. This finding might indicate that both groups of students were more concerned about their ability to fit in with the MIS students than they were concerned about gender discrimination and negative social influences. These findings together indicate that while gender differences exist in terms of perceived barriers when it comes to majoring in MIS, these differences may vary based on the type of the barrier. Some barriers might be more valid and worrisome for women such as gender discrimination, whereas others, such as concerns about negative social influences might bother men more. Moreover, there might be certain barriers such as the social fit barrier identified in this study that might be perceived similarly by both genders.

The findings have important implications for theory and practice. Understanding the barriers that are important to students in general and female students in particular would prove extremely helpful in devising intervention strategies to increase the number of students pursuing MIS degrees and to increase the representation of women in MIS majors and careers. In this respect, familiarizing students with the MIS major and careers is important. Compared to other more established business majors such as marketing, finance, and accounting, MIS is a relatively newer area of study and career option, which many students may be unaware of or may misunderstand. Providing students with a thorough understanding of the MIS major and the different career options that are available to MIS professionals and helping them understand the differences between MIS and more technical IT fields would be influential in changing the barriers perceived by students. Exposing students to same sex role models and mentors in this field would also prove helpful, especially in changing female students' concerns about gender related barriers. Establishing opportunities for students to network with peers in the MIS major might help students see that they might share some similar traits with MIS students and might decrease their concerns about their ability to fit in.

Encouragement from the students' family members, friends, significant others, as well as professors and advisors would also play an influential role in changing perceptions of barriers to pursuing an MIS major and career.

The findings of the study must be interpreted in the light of its limitations. This study focused on gender differences in terms of certain key contextual barriers, but did not investigate any casual relationships between these factors and students' pursuit of the MIS major. Therefore, further research is clearly needed to investigate the direct and indirect effects barriers might have on women's interest in and pursuit of MIS majors and careers. Moreover, the barriers investigated in this study represent a relatively limited subset of the potential barriers that could plausibly affect women's academic and career choices. Future research should consider and validate a wider range of personal and environmental barriers. In addition to perceived barriers, it is also important to identify and investigate support factors that can potentially alleviate the impact of perceived barriers.

The sample used could also limit the ability to generalize the study findings. Since the study only surveyed students enrolled in introductory MIS courses at a single American university, the sample was relatively homogenous. As such, the issue of generalization is best addressed through replication in different contexts using contemporary samples.

This study focused only on college students. By the time students reach college, they might have already decided on what major and/or career to pursue. Therefore, at the college level, it might be too late to persuade them to major in MIS. Future studies should focus on investigating the impact of role models at earlier stages in students' lives. Along the same lines, in order to gain a better understanding of the barriers women face in the MIS field, it is necessary to conduct longitudinal studies. The current study presents an initial step towards understanding of the underrepresentation of women in MIS majors and careers and can be easily leveraged to address additional research questions.

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