Factors Impacting Jordanian Women in Computing Case Study: Hashemite University

Abstract

We consider pursuing the Jordanian women their graduate studies in Information Technology disciplines is a critical problem that needs to be tackled due to its important as an indicator of socio-economic development in any country. In this paper, we present the first study of multi-variate stereotypes that shape the problem by addressing a set of factors that have extensively been studied. The effects of these factor were estimated by applying the linear-regression, one-way ANOVA and Scheffe tests.

Keywords: *Information Technology, Multi-variate Analysis, Women Studies, and Higher Education*

1 Introduction

Women remain under-represented in all scientific and technological fields, in spite of playing predominant role in building the society hand-in-hand with men Moyer et al. (1999). There have been improvements in access for women to Information Technology (IT) over the last two decades, but many women find the prospect of a career in IT to be profoundly unappealing. For that reason, the main objective of this paper is to identify the barriers that discourage Jordanian women from pursing their study in IT and having it as a career.

It is well-known that education is important for both genders because it is the most powerful way to lift people out of poverty. But we believe in its essentiality to women since it helps them claim their rights and realize their potential in politics, economics and social areas. Rashti states that "The rational for a need to focus on women's achievements in higher education is considered a key social development indicator measuring women's statues and conditions in any country" Rashti (2003). Besides that joining graduate studies schools makes the world safer place for women and protects them from any type of abuse or violence. Several studies Feldner (2000); Mayell (2002); Sabbah (2011)

have shown that family reputation is very important issue in several countries in the Middle East such as Jordan. For example; the divorced women and the women who received an abuse from their families bring shame and stigma to their families' reputation when publishing their stories and declaring their situation to the outside agencies. Unfortunately, the effect of this phenomenon is more pronounced on uneducated women Sabbah (2011). However, there is no immunization against abuse or divorce issues; but we could conclude that the more education women get, the more protective they become and the more power they enjoy with.

This study took place on the Hashemite Kingdom of Jordan, because it is a young, moderate, stable, and peaceful country with limited natural resources such as water, gas and oil Mazzola (2011). On the other hand, Jordan awares of the importance of human resource; therefore, it has focused on developing the country by placing great emphasis on education Haddad and Demsky (1994). This makes most of Jordanians equipped with high level of education and professionalism compared to other people in the region. All the world aware that King Abdullah II urged the Jordanian Government's to support and move the Information Communication Technology sector forward. His majesty believes on full role of women in the Kingdom's socio-economic and political life; therefore he has been involved in enacting the necessary legislations to guarantee that.

The skeleton of this paper is as follows: Section 2 gives the state of the art of various obstacles for women's lack to pursue their graduate studies, where Section 3 presents a brief description of the method used, identified stereotypes and the results obtained from this study. Finally, Section 4 draws some conclusions and suggestions to increase the number of women pursuing their graduate studies.

2 State of Art

In public, women form the bulk of the work and men serve as bosses W.Pyle (2012). Men are most likely to be found in positions with the greatest power, pay, and prestige Moyer, Salovey, and Casey-Cannon (1999); Pirouznia (2011); Ramsey and McCorduck (2005). To the best of our knowledge and experience, the disparity between women and men has enduring persisted in the recruitment and retention of women at all levels of IT all over the world. Therefore, a very important question should be raised "Whether IT really needs women, or whether women need IT" Ramsey and McCorduck (2005). The research litera-

ture reports several obstacles in women's pathway in entering the IT disciplines and finding or maintaining their academic or industrial positions. These obstacles are categorized into two groups: Internal and External obstacles. Internal obstacles include: Sex-role stereotyping, lack of aspiration, role conflict, and low self-esteem. External obstacles include: Lack of encouragement and collegial network, little financial support, family responsibilities, lack of mobility, and hiring and promoting practices Beyer et al. (2003); Moyer, Salovey, and Casey-Cannon (1999); Pearl et al. (1990); Pirouznia (2011).

In general, women continue to be under-presented in computer science at both graduate and undergraduate levels Roberts, Kassianidou, and Irani (2002); Moyer, Salovey, and Casey-Cannon (1999); and Pearl et al. (1990). This situation has been justified based on two reasons: (1) Disturbing possibility that the computer science behaving in a way that limits women to be a part of it such as experience with computer Beyer et al. (2003), abstract characteristics of software use Pearl et al. (1990), the cultural values embedded in educational software and computer games Pearl et al. (1990), knowledge about computer science Beyer et al. (2003), and safe access to the work place Pearl et al. (1990). (2) Demographic trend shows an increasing number of males compared to the females entering IT discipline during the next decade Pearl et al. (1990) due to some existing barriers that have been extensively reported in the literature such as discriminatory behavior in classroom environment Beyer et al. (2003); Hall and Sandler (1982), personality Beyer et al. (2003), gender differences and how they correlate to the students performance Beyer et al. (2003); Zappert and Stansbury (1984), scarcity of role model Pearl et al. (1990), and the lack of supportive community Beyer et al. (2003). Further details can be found in the comprehensive study of a set of multi-variate factors that impacts on the number of women studying computer science major Beyer et al. (2003). Roberts, Kassianidou, and Irani (2002) also highlight some suggestions and effective strategies to increase recruitment and retention of women students over the past decade.

The question that should be raised is "Whether the women enjoy with the same ability, experience, and professional skills of men in pursuing their graduate studies in the IT disciplines or not?" the literature reviews confirm that the answer is highly associated with the society view and is most likely correlated with the full role of women in socio-economic and cultural life Beoku-Betts (2004); Gillbert (2002); Hamdan (2005).

The African women, who pursed their graduate studies in scientific disciplines, is affected by gender, race and third world marginality through their

educational goals Beoku-Betts (2004). The author of the paper highlights how the chilly environment faced by African women motivated them to accomplish their goal and to resist the negative racial stereotyping regarding their African identity such as emotional costs, loss of opportunities, the burden of domestic responsibilities, neglect of spouse and children, and shortchanging of their own leisure and long study duration period to accomplish their graduate studies. The Malaysian women have experienced difficulties in obtaining higher education due to structural and attitudinal barriers, the equitable participation of women in higher education and their cultural backgrounds Kamogawa (2003). Other studies state that gender inequality is traditionally structured in all life matters in the Middle East Gillbert (2002); Hamdan (2005). Women's training and education will definitely increase the level of their competence and leaderships to inferior and subordinate the positions of men Smith (1987). This situation applies to many Arab Muslim societies as well as some Western societies Hamdan (2005).

In general, the liberal and Marxist feminists do not consider the inequities of class, race, ethnicity, and disability all over their life matter. Therefore, there is an urgent need to cross borders and ignore their cultural and class differences by collaborating with each other to overcome male dominance in their society.

Finally, it is worthy to highlight that there is no gender differences in the performance quality or ability in the IT disciplines, but the existence of differences in experience Gillbert (2002) leads to less success, non-comfortability, and the lack of confidence among female studying IT major. This does not refer to breach a good balance between the major requirements of spending a long time infront of the computer programming and the satisfaction of family responsibilities such as house-cleaning, child-bearing and child-rearing Beyer et al. (2003); Gillbert (2002); Moyer, Salovey, and Casey-Cannon (1999); Pearl et al. (1990); Ramsey and McCorduck (2005).

Therefore, the need to prove women's academic merit and intellectual competence is considered as a heavy burden on women's shoulders Moyer, Salovey, and Casey-Cannon (1999). In addition to that it is mandatory to teach the women how to relate with each other and how to treat each other as a source of knowledge Smith (1987), because the lack of the role model plays predominant role in the number of women majoring one of the IT disciplines and contributing positively in industry and academia Pearl et al. (1990). This causes a well-known terminology *"Pipeline Shrinkage"* (that is defined as the ratio of women to men involved in computing from high school to graduate school dramatically reduces Gurer and Camp (2001); Ramsey and McCorduck (2005)) that

has been solved by *"Funneling Effect"*, which is defined as a proposed set of strategies used to expand the number of women in academia Moyer, Salovey, and Casey-Cannon (1999). This increases and manages the under-represented group of women with the whole group produces a better solution comparable to having one homogeneous group Ramsey and McCorduck (2005).

The objectives of this paper are to:(1)Increase the people awareness of all these problems associated with pursuing women their graduate studies in IT schools. (2) Let women in other countries know that they are not a lone suffering from a set of obstacles in pursuing their graduate studies.

3 Experimental Results

Here in we briefly explain the method, that we used to obtain the claimed results, by identifying the target sample and the statistical package used to undertake the analysis.

The target population in this study is the Jordanian women in the IT sector of ages range from $18-40$ years. The size of the collected sample is 101 women at the Hashemite University, Zarqa, Jordan. The purpose of the questionnaire was to highlight the main obstacles that prevent Jordanian women from pursuing their graduate studies in the IT sectors, and to determine the frequency with women perceived specific barriers had impacted on their ability to pursue their graduate studies.

The questionnaire was designed to consist of thirty-one questions. The first four questions used to measure the participants' demographic information, while the remaining questions are used to measure women's barriers to accomplish their graduate studies. Each question in the distributed survey had a possibility of five choices, beginning with Always, going to Often, to Sometimes, to Seldom, and to Never. For the purposes of calculation, Always was given the number value of 5, Often was valued at 4, Sometimes was valued at 3, Seldom was valued at 2, and Never was valued as 1. Thus, if a mean score was 2.5, it registered as perceived obstacle between Seldom and Sometimes, if a score was 1.5, it registered as perceived obstacle between Never and Seldom. The mean of the answers for the questions ranged from 1.67 (Seldom to Never) to 4.20 (Always to Often) and the standard deviations ranged from 0.78 to 1.40, as shown in Table 1. Question 14, that concentrates on the innovation and the creativity of the female, registered the lowest value 1.67 (Seldom to Never), thus indicating the least frequency perceived obstacle. Both questions 26 and 27, that concentrate on the cost of graduate studies and economic situation of

the family, respectively, registered the highest value 4.20 (Always to Often), indicating them as the highest frequent encountered obstacles. The detailed of the participants' demographic information and barriers stereotype are explained as follows:

1. **Demographic Variables**
   The questionnaire consisted of four questions related to the age, marital status, academic degree and work sectors. The age classified into three categories $18-22$ with 72.2%, $23-30$ with 23.8% and 31 years and above with 4%. The marital status divided into two groups single and married with percentage of 92.1% and 7.9%, respectively. The academic degree consisted of 28.0% High School students, 3.0% Diploma students, 57.0% Bachelor students, 10.0% Master students, and 3.0% Professors. The remarkable point is that 28.0% of the survey respondents are high school students eager to pursue a graduate study. The result is inconsistent with other countries such as USA, where the high school students are mainly focused on getting college degrees not on getting graduate degrees. Finally, the work sector included four different classifications either not working with 12.9% percentage or working in personal, governmental, or private sector with percentage 1.0%, 83.1% and 3.0%, respectively.

2. **Barrier Stereotypes**
   The questionnaire focused on ranking the most important obstacles that limit the Jordanian women from continuing their graduated studies: Travel abroad, family matters, skills and experience, traditional and cultural differences, scholarship opportunities, financial matters, and language complications. Every single obstacle was measured by a set of criteria as shown in Table 1. Financial matters and language complications scored the highest perceived obstacles with value of 4.08 and 3.59, respectively, while the lowest perceived obstacles were skills and experience, and scholarship opportunities with score of 1.85 and 2.36, respectively. On the other hand, the family matter, travel abroad, and traditional and cultural differences recorded moderate obstacles with values of 3.39, 3.37, and 3.02, respectively.

   The above results are consistent with the nature of Jordanian society in terms of environmental aspects, economics and regulations. Financial situation has a great influence on the probability of Jordanian women to accomplish the graduate study, which is consistently homogenous with all communities in the world. Beside that the language complications, that

record the second highest obstacle, is a natural outcome in the Jordanian society since the tongue language is completely different from the study formal language in the IT field. It is worth to mention that the Jordanian government follows King Abdullahś II recommendations on providing equal chances of internship and scholarship to women to accomplish their academic studies.Therefore, the scholarship opportunity has no influence on our study by recording one of the lowest obstacles. The most interesting result about Jordanian women is the high confidence in their abilities to solve problems and to make appropriate decision, by scoring the lowest perceived obstacle in this study. The reasons behind this phenomenon are the existence of a good supportive mentor, a solid scientific background, an excellent educational atmosphere they have been grown up with it, and the Jordanian women functionally practice their full right in every single aspect to build Jordan hand-in-hand with the men UNIFEM (2010).

Every single stereotype was measured by a set of criteria. Each criterion was ranked based on the participant's respond to evaluate the effect of the perceived stereotype. Then, the results were classified into three categories: High, medium and low in column labeled grade, as illustrated in Table 1. After that, we applied the linear-regression test to measure the effect of the above mentioned stereotypes by assuming that the null hypothesis, H_0, showed that there was no influence of them on the Jordanian women in pursuing their graduate studies in IT field. Finally, we tested the null hypothesis against a set of alternative hypotheses, which were attempt to support our gathered data as shown in Figure 1.

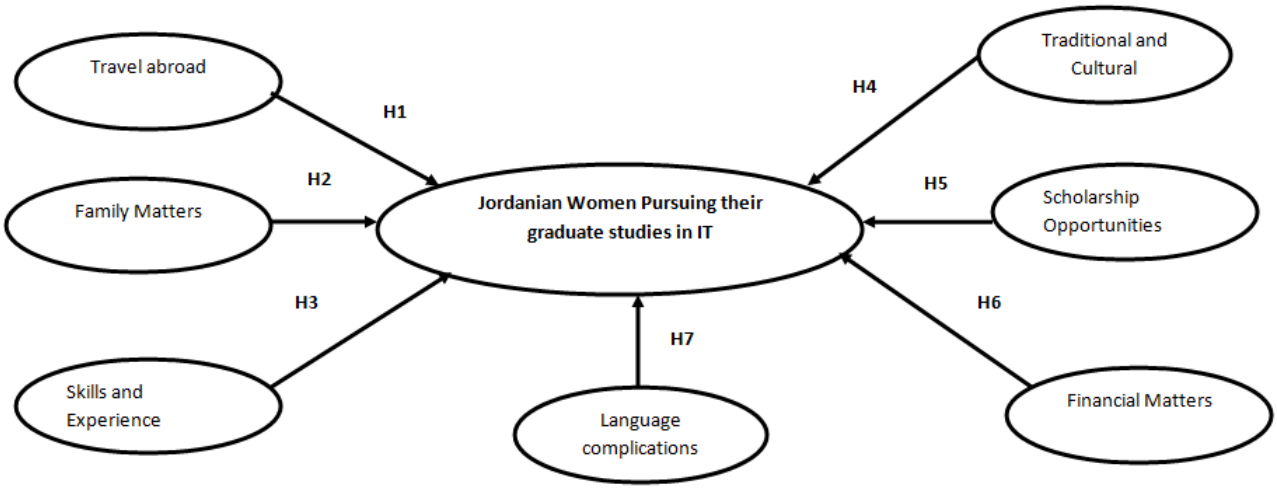

Figure 1: The set of alternative hypotheses

(a) **Travel abroad**:
We found that there is a moderate effect of travel abroad stereotype on the Jordanian women in pursuing their graduate studies in IT field with a value equal to 28.1%, where the value of the regression test, $R = 0.53$ with a positive direction rate. The value of the F-test reached 38.710, with an associated p-value = 0.000, $p < 0.05$. Therefore, the null hypothesis was rejected and the alternative hypothesis was accepted.

(b) **Family Matters**:
A moderate effect of family matters stereotype, was noticed on the Jordanian women that continue their graduate studies in IT field, reached up to 18.7%. The value of the regression test was equal to $R = 0.432$ that had a positive direction rate. The value of the F-test reached 22.775, with an associated p-value = 0.000, $p < 0.05$. Therefore, the null hypothesis was rejected and the alternative hypothesis was accepted.

(c) **Skills and Experience**:
The most interesting observed phenomenon indicated that there was no influence of the skills and experience stereotype on the Jordanian women in completing their graduate studies with a value of 7.6%. This is because of the registered value of the regression test, R reached to 0.276 with a positive direction rate, and the value of the F-test recorded 8.166, with an associated p-value = 0.005, $p < 0.05$. Thus, the null hypothesis was rejected and the alternative hypothesis was accepted.

(d) **Traditional and Cultural Differences**:
We encountered a moderate effect of the traditional and cultural differences stereotype on our study with a value equal to 21.2%, where the value of the regression test, $R = 0.460$ with a positive direction rate. The value of the F-test reached 26.573, with an associated p-value = 0.000, $p < 0.05$. Consequently, the null hypothesis was rejected and the alternative hypothesis was accepted.

(e) **Scholarship Opportunities**:
There was no influence of the scholarship opportunities stereotype on our scope due to the calculated coefficient value of determination equal to 35.4%, and the value of the regression test was equal to 0.595 with a positive direction rate. The value of the F-test reached 54.329, with an associated p-value = 0.000, $p < 0.05$. Hence, the null hypothesis

was rejected and the alternative hypothesis was accepted.

(f) **Financial Matters**:
We found that there is a huge influence of the financial matter stereotype on the Jordanian women in pursuing their graduate studies in IT field with a value equal to 19.6%, where the value of the regression test, $R = 0.443$ with a positive direction rate. The value of the F-test reached 24.195, with an associated p-value = 0.000, $p < 0.05$. Therefore, the null hypothesis was rejected and the alternative hypothesis was accepted.

(g) **Language Complications**:
A huge influence of the language complication stereotype on the studied sample of the Jordanian women recorded a value equal to 13.5%, where the value of the regression test with a positive direction rate was 0.368. The value of the F-test reached 15.492, with an associated p-value = 0.000, $p < 0.05$. For this reason, the null hypothesis was rejected and the alternative hypothesis was accepted.

In this paper, we applied the one-way ANOVA to determine whether the Jordanian women with the various academic degrees agree on perceiving the same obstacles that prevent them from pursuing their graduate studies in the IT disciplines. Moreover, we need to confirm whether the perceived obstacles had the same impacted on the women's ability in pursuing their graduate studies.

As shown in Table 2 the value of the F-test reached 1.236, with an associated significant p-value = 0.301 which is greater than the alpha ($\alpha = 0.05$). The obtained result confirms a total agreement between the various academic degree of Jordanian women in their point of views about the main obstacles that limit their chance in continuing their graduate studies. The Scheffe-test has been used on the study sample to compare their point of views about the perceived stereotypes as illustrated on Table 3. The claimed results indicate that there is no statistical variance differences between the various groups classified by different academic qualifications. We conclude that the above mentioned stereotypes play a predominant role in limiting the opportunity of Jordanian women in achieving their higher degree.

Finally, it is the time to highlight some recommendations in order to win the battle of presenting females in pursuing their graduate studies in IT sector.

1. The entire IT sector needs to be redefined so that it goes beyond systems and theory and combines together with education and research.

Table 1: The statistical summaries of the mean, the standard deviations, the rank, and the grade represented by μ, σ, r, and g, respectively, to every single criterion that belongs to certain stereotype on the collected sample of 101 women in the IT sector where 12 successfully accomplished their graduate studies and 89 looking forward to pursuing their graduate studies.

stereotype	Criteria	*Mean*	*Stdv.*	*Rank*	*Grade*
		μ	σ	r	g
Travel abroad	Visa issue	2.10	1.10	4	Low
	Geographical destination	3.47	1.29	3	Medium
	Availability of graduate programs in Jordan	4.05	1.05	1	High
	Travel Abroad is considered as an obstacle	3.85	1.16	2	High
	Total	3.37	1.15	–	Medium
Family Matters	Family and related responsibilities	4.05	1.09	1	High
	Presence of children	3.86	1.10	2	High
	Family mentioning	2.25	1.01	3	Low
	Total	3.39	1.07	–	Medium
Skills and Experience	Academic experience	1.75	0.91	3	Low
	Data analysis and decision making	2.10	1.05	1	Low
	Innovation and creativity	1.67	0.78	5	Low
	Exerted efforts	2.01	0.87	2	Low
	Scientific background and graduate studies' requirements	1.73	0.86	4	Low
	Total	1.85	0.89	–	Low
Traditional and Cultural Differences	Traditional and cultural differences are considered as a serious obstacle	3.94	1.08	1	High
	Accepting and merging in the new society	3.49	1.09	2	Medium
	Shopping environment	2.63	1.10	3	Medium
	Communication skills	2.04	1.07	4	Low
	Total	3.02	1.09	–	Medium
Scholarship Opportunities	Gender basis priority	1.86	0.97	5	Low
	Promising market avenues	1.96	0.99	3	Low
	Governmental induce women to pursue their graduate studies	1.91	1.10	4	Low
	Age constraint	3.35	1.17	1	Medium
	Studying and working simultaneously are supported in the working sector	2.71	1.40	2	Medium
	Total	2.36	1.12	–	Low
Financial Matter	Cost of graduate studies	4.20	0.84	1	High
	Economic situation of the family	4.20	0.94	2	High
	Suspend the work while studying	3.85	1.19	3	High
	Total	4.08	0.99	–	High
Language Complications	Language presents a problem	3.08	1.29	3	Medium
	Training course is a necessary prerequisite	4.15	0.85	1	High
	The compatibility of the study language with the country language	3.54	1.26	2	High
	Total	3.59	1.13	–	High

2. Women have to be smart, hard worker, decision-maker and risk-taker in their life style.

3. Women need to have strong support, qualified mentor, and continuous training to assist them all a long their pathway.

Table 2: The one way ANOVA is used to test the point of view of the Jordanian women based on their academic degree about their chance in pursuing their graduate studies.

Homogeneity	*Sum of Squares*	*df*	*Mean Square*	$F-test$	*Sig.*
Between Groups	0.363	4	0.091	1.236	0.301
Within Groups	7.045	96	0.073		
Total	7.407	100			

Table 3: The Scheffe-test is used to study the variance differences between the various point of view based on the academic degree about the perceived stereotypes.

Academic Degree	*Academic Degree*	*Mean Difference Between the first two columns*	*Standard Error*	*Sig.*	*95% Confidence Interval.*	
					Lower bound	*Upper bound*
High School	*Diplom*	0.10185	0.16456	0.984	-0.4150	0.6187
	B.Sc.	0.12264	0.06252	0.432	-0.0737	0.3190
	M.Sc.	-0.00185	0.09979	1.000	-0.3153	0.3116
	Ph.D.	0.00309	0.16456	1.000	-0.5138	0.5200
Diploma	*High School*	-0.10185	0.16456	0.984	-0.6187	0.4150
	B.Sc.	0.02079	0.16046	1.000	-0.4832	0.5248
	M.Sc.	-0.10370	0.17832	0.987	-0.6638	0.4564
	Ph.D.	-0.09877	0.22118	0.995	-0.7935	0.5960
B.Sc.	*High School*	-0.12264	0.06252	0.432	-0.3190	0.0737
	Diplom	-0.02079	0.16056	1.000	-0.5248	0.4832
	M.Sc.	-0.12450	0.09287	0.773	-0.4162	0.1672
	Ph.D.	-0.11956	0.16046	0.967	-0.6236	0.3845
M.Sc.	*High School*	0.00185	0.09979	1.000	-0.3116	0.3153
	Diplom	0.10370	0.17832	0.987	-0.4564	0.6638
	B.Sc.	0.12450	0.09287	0.773	-0.1672	0.4162
	Ph.D.	0.00494	0.17832	1.000	-0.5552	0.5650
Ph.D.	*High School*	-0.00309	0.16456	1.000	-0.5200	0.5138
	Diplom	0.09877	0.22118	0.995	-0.5960	0.7935
	B.Sc.	0.11956	0.16046	0.967	-0.3845	0.6236
	M.Sc.	-0.00494	0.17832	1.000	-0.5650	0.5552

4 Conclusions

In this paper, we have presented the first study of multi-variate stereotypes that shape different challenges face Jordanian women in pursuing their graduate studies in Information Technology (IT) disciplines. We have shown that financial matters and language complications scored the highest perceived obstacles, while skills and experience, and scholarship opportunities scored the

lowest perceived obstacles by applying the linear-regression, one-way ANOVA and Scheffe tests.

We foresee numerous venues for future work. First, we are looking forward to building a database for women experts in IT and activating it via social network through universities and colleges. Another avenue is increasing the level of opportunities and quality of services available for women in access, education, and workforce participation of information communication technology.

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