

”Build it and they will come!” Reversing the gender gap: women enrolling in engineering programs and preparing for careers in the oil and gas industry in the UAE

Dr. Sami Ainane, Petroleum Institute Abu Dhabi UAE

PERSONAL DATA

Sami Ainane Petroleum Institute PO Box 2533 Abu Dhabi UAE Tel: 971-2-607-5983 Mobile: 971-50-2334717 Email: sainane@pi.ac.ae

EDUCATION

PhD Mechanical Engineering, University of Maryland, College Park, MD, 05/1989. MS Mechanical Engineering, University of Maryland, College Park, MD, 05/1983 BS Maitrise Mecanique, Université Joseph-Fourier, Grenoble, France-, 06/1980 Lean Six Sigma Black Belt, Villanova University, 01/2009

PROFESSIONAL EXPERIENCE

Head, General Studies 2013-Present Associate Professor, Department of Mechanical Engineering Petroleum Institute, Abu Dhabi UAE

Dean, Student Affairs 2010-2013 Associate Professor, Department of Mechanical Engineering

Visiting Associate Professor, Department of Mechanical Engineering 2009-2010 Petroleum Institute, Abu Dhabi UAE

Director Undergraduate Studies Advisor, M.S. Mechanical Engineering 1998-2009 Advisor, ENPM (Mech. Engrg and Sustainable Energy Options) Department of Mechanical Engineering University of Maryland, College Park

Faculty Director : Engineering Professional Development 1989-1998 UMBC Training Center

Adjunct Faculty 1993-1998 Department of Mechanical Engineering University of Maryland, Baltimore County

Mechanical Engineer 1989-1995 EEC Consulting Rockville, MD

President, Dome Enterprises 1989 - 1993 Bethesda MD

HONORS AND AWARDS

Best Presentation Award, ICESEEI 2016 : 18th International Conference on Educational Sciences and Effective Educational Instructions. Paris France 2016 Outstanding Service and Commitment to the Enrichment of the Science and Technology Program, Eleanor Roosevelt H.S., Greenbelt MD, 05/2003

SELECTED PUBLICATIONS

1. A. Bouabid, B. Bielenberg, S. Ainane, N. Pasha, ”Learning Outcomes Alignment across Engineering Core Courses”, 18th International Conference on Educational Sciences and Effective Educational Instructions Proceedings, Paris France 2016.
2. S. Ainane, A. Bouabid, W. El-Sokkary, ”Improving the Engineering Design Process Assessment”, First Year Engineering Experience (FYEE) Conference Proceedings, Columbus, OH 2016.
3. J. Mohamed, S. Ainane, ”Establishing a Sustainability Component in an Engineering Design Course” ASEE Annual Conference Proceedings, Montreal Canada 2015.
4. Y. Wang, A. H. El-Sinawi, S. Ainane ”Improving a pipeline hybrid dynamic model using 2DOF PID”, International Conference VIBROENGINEERING-2016: DYNAMICS OF STRONGLY NONLINEAR SYSTEMS Moscow, Russia 2016

PROFESSIONAL ACTIVITY Memberships 1. American Society of Mechanical Engineers. 2. American Society for Engineering Education 3. Society of Automotive Engineering

PROFESSIONAL SERVICE ABET Program Evaluator Member, Board of Advisors, Prince George’s Public Schools Project Lead the Way U.S. Representative for IJSO (International Junior Science Olympiads)

Dr. Ali Bouabid

“Build it and they will come”

Reversing the gender gap, women in the UAE enrolling in engineering programs and preparing for careers in the oil and gas industry

Abstract

The low percentages of women studying engineering around the world especially in northern America is a well-known issue in higher education. Despite many efforts from academic institutions and industry, the number of women enrolled in undergraduate engineering programs in the United States has stagnated around 17-19 percent since 2003. However, in the Middle-Eastern GCC countries in general and in the United Arab Emirates UAE in particular, a different picture emerges. There has been significant progress in women enrolling in STEM programs, especially engineering, in the GCC over the past few years. In the case of the UAE, the vision of the government leadership, as evident in the constitution and in government initiatives provides some insight into some of the support leading to this phenomena.

The Petroleum Institute PI in Abu Dhabi admitted its first cohort, of male students, 2001. Five years later, the institute opened its doors to female students. Initially, the numbers of enrolled female students were low as no on campus housing was available for them. In 2014 female dormitories became available and the number of female students surged. Over 63% of the 2020 class are female. This surge in interest by young Emirati women in engineering is of particular interest as all PI graduates begin their careers with the Abu Dhabi National Oil Company (ADNOC), in the Oil and gas industry, an industry with one of the lowest percentages of female employees.

This paper examines the PI female students' performance. It also explores their motivation, expectations, career choice as well as the kind of support they receive. The findings shed some light on the reasons why they chose to pursue a career in the oil and gas industry, where they would be interested to work, and who encourages them. The discussion also examines if they feel that the oil and gas industry offers the same opportunities for female employees as for male employees and that women can reach top management positions within the oil and gas industry.

It seems there are several factors contributing to the current increase in the percentage of women in engineering. It is probably a combination of factors such as the vision of the government and the motivation of the young women to serve their community and make their families proud.

Introduction

Women in engineering programs

Literature on student population in STEM disciplines in general, and in engineering in particular shows that women are still underrepresented. Despite an increase of the women student population in engineering programs in the US during the past decades, the percentage of female engineering students remains low, 18 percent to 20 percent only.¹ Research shows that female engineering students perform as well as men, however, they have a higher percentage of dropping out of engineering and changing major than male students. The most commonly cited reason is that they believe they do not have the skills or they do not fit in engineering. Similarly, women are also underrepresented in leadership positions in STEM departments in American universities. Indeed, only 10 percent of chair positions in departments of engineering, mathematics and physical sciences are held by women.² On the other hand, in the United Arab Emirates (UAE), the percentage of female engineering students is higher than that of most western countries. The percentage of female students in engineering ranges from 30 percent to 35 percent.³ At the Petroleum Institute in Abu Dhabi, the percentage of women in engineering is even higher than 60 percent!

Women in the gas and oil industry

Harsh working conditions, a less than convenient work schedule, living arrangements and family obligations make the oil and gas industry one of the least attractive industries for women. They account for Less than 8% of the global work force in the oil and gas industry⁴. A lower percentage occupy engineering positions and only 11% of board positions in the top 100 oil and gas companies are occupied by women.⁵

Contributing factors

The UAE constitution guarantees women access to education, healthcare and social welfare and the same right to practice professions as men. In 2015, the UAE Gender Balance Council was established with the goal of enhancing the inclusion of women in leadership positions especially in the public sector. The UAE is the first country in the Arab world to enforce quotas for women on public company boards. In addition, they have gained access to key positions in the cabinet, parliament, judiciary and diplomatic corps.

"Nothing could delight me more than to see a woman taking up her distinctive position in society... nothing should hinder her progress. Like men, women deserve the right to occupy high positions according to their capabilities and qualification."
The late President and Founder of the UAE, Sheikh Zayed bin Sultan Al Nahyan.⁶

The UAE vision 2021 calls for a strategy based on knowledge, innovation, research, science and technology. The large investments made by the government in renewable energy, high tech manufacturing, biotechnology, pharmaceuticals, telecommunications equipment, and aerospace will make the need for engineers and scientists soar in the next few years. Abu Dhabi National Oil Company (ADNOC) plans on increasing its oil output capacity to 3.5m barrels/day by 2020, requiring the recruitment of 1000 engineers every year. ADNOC also adopted an ambitious goal that targets 75 percent Emiratisation quota by 2017.

Over 95 % of Emirati women who graduate from high school enroll in a higher education institution, compared to 80% of male students. Women perform better than their male counterparts academically and are making strides in majors previously considered male dominated. Forty six per cent of the country's graduates in science, technology, engineering and mathematics (STEM) are women. At the Masdar Institute of Science and Technology in Abu Dhabi, 60 per cent of Emirati graduate students are female.

With a population of one million citizens and with women making up 71.6% of students in public universities and 50.1 % in private ones, it is unconceivable that the ambitious goals that the UAE set for itself could be reached without their active involvement. In 2016, ADNOC announced that 15% of top management positions in its group will be reserved for women and that a woman will be appointed as CEO of one of the group companies. The company also introduced a "gender policy framework" and set up its first women's network and a leadership development program specifically for women. The role of female graduates will be vital in reaching these goals

The Petroleum Institute (PI)

The PI was I founded in Abu Dhabi UAE in 2000, it admitted its first class, which consisted of 139 male undergraduate students, in 2001. The first cohort of 104 female students joined the institute in 2006. The Institute is sponsored by the Abu Dhabi National Oil Company (ADNOC) and its international partners (BP, Shell, Total, and the Japan Oil Development Company), The PI offers B.S. and M.S. and Ph.D. degrees in Chemical Engineering, Electrical Engineering, Mechanical Engineering, Petroleum Engineering and Petroleum Geosciences. Currently, 1547 undergraduate and 650 graduate students are enrolled at the PI. All undergraduate students have signed an agreement to work for one of the ADNOC group of companies for as long as they have attended the PI. Most of the 1573 PI graduates are currently employed by the ADNOC group.

Female students were admitted by the PI five years after their male counterparts began their studies at the institute. Between 2006 and 2009 the number of female students rose steadily to reach a plateau of approximately 35% of the total undergraduate population. During this period, there was no housing available for female students on the PI campus limiting access to only students from the city of Abu Dhabi. Soon after dormitories for female students became available, in 2014, the numbers soared to eventually surpass those of male students as illustrated in Figures 1 and 2. The class of 2020 currently has 63% female students.

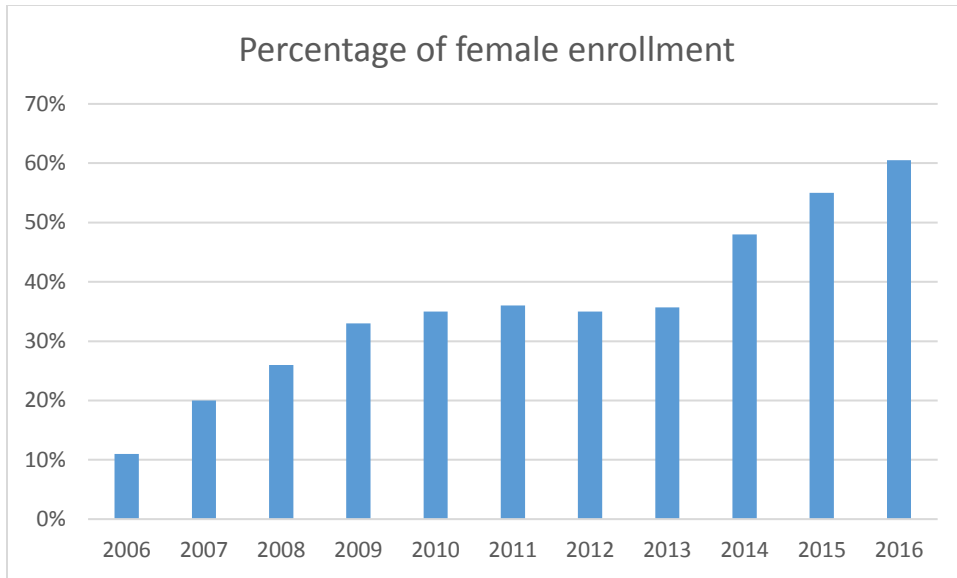


Figure 1 Female Students at the PI

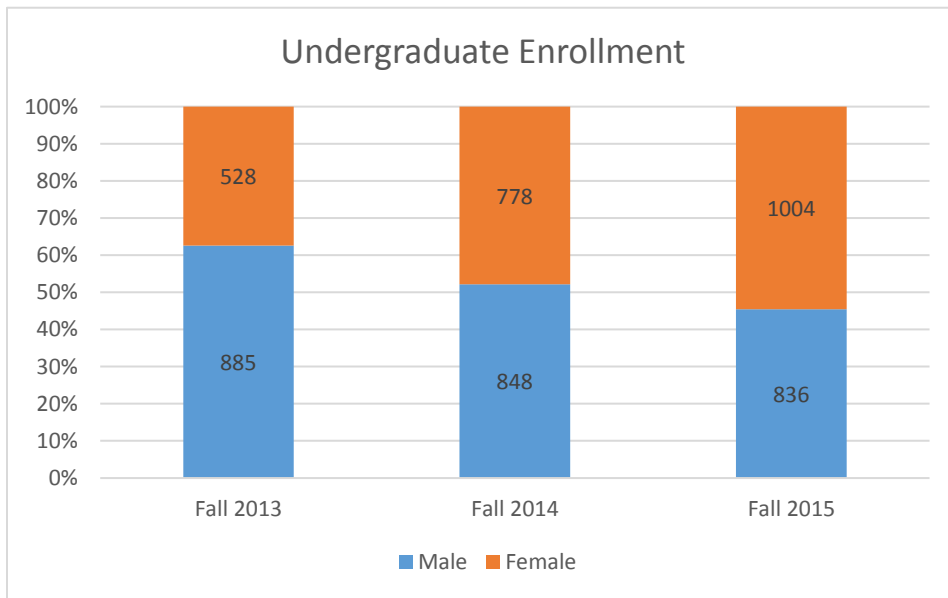


Figure 2 Undergraduate Enrollment at the PI

Figure 3 shows that the largest increases occurred in the departments of Chemical and Petroleum engineering a clear indication of the commitment of these students to the oil and gas industry.

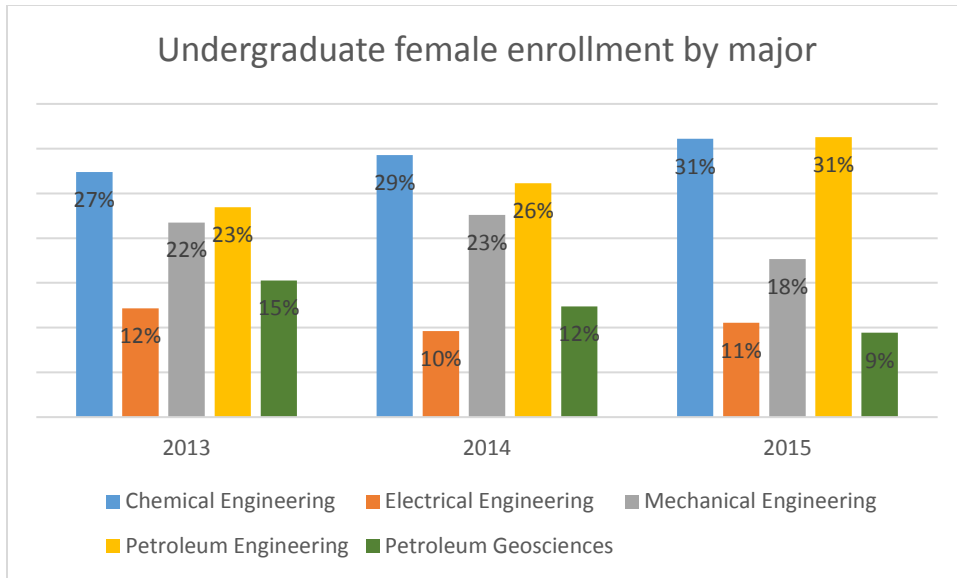


Figure 3 Undergraduate Female Student by Major

While the numbers of female students rapidly increased, their academic performance remained consistent. Their average GPA at graduation was consistently around 3.0/4.0, matching that of the male students, as shown in figure 4.

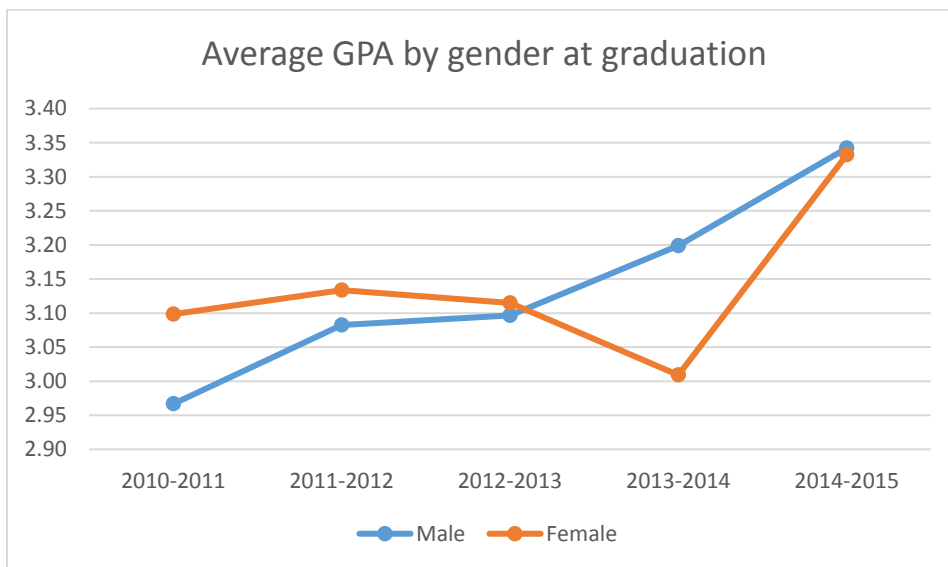


Figure 4 Average GPA at Graduation

With this background, the PI female students' perceptions, career choices and motivation offered an opportunity for further investigation and a survey was conducted for that purpose.

Methodology:

A survey titled “Interest in Engineering” was conducted to gather information related to the students beliefs about their career choice as well as collect their background information. The survey was formatted mostly as a multiple choice bubble sheet that can be read and further analyzed by a special computer program utilizing Optical Mark Reader technology (Remark Office OMR™). Further analysis of the results was done using Microsoft Excel statistical analysis functions to find correlations among the sample groups and the questionnaire items. Section A of the survey covered personal information and basic demographic data related to age, gender, marital status, nationality, high school system, current academic level, engineering major and current GPA of the participants. Section B was labeled “Career Choices” and included multiple choice questions. The topics covered in that section include why they chose to enroll at the PI and pursue a career in the oil and gas industry, where they would be interested to work, who encourages them and if there are any engineers in their families. The last section of the survey was titled “Beliefs about Engineering” and it was basically a five-point Likert-type scale questionnaire ranging from “Strongly Agree” to “Strongly Disagree” with ten statements. The section collects data to show whether the participants agree or disagree that they want to be engineers and that their families want them to be engineers. It also checks their agreement levels with the notions that the PI will prepare them well for their career, that the oil and gas industry offers the same opportunities for female employees as for male employees, that women can reach top management positions within the oil and gas industry, and that they will be able to raise a family and pursue a successful career in the oil and gas industry at the same time. The section also gathered data to see if they felt supported by their families, instructional teams and friends to pursue a career in the oil and gas industry and if they were planning on pursuing a graduate degree afterwards.

Sample size and demographic data:

The number of PI students who participated by filling out the survey was 106 students. They were all enrolled in the four Freshman/Sophomore courses offered by General Studies Department. These courses cover the following topics: Introduction to Engineering, Introduction to the Oil and Gas Industry, Engineering Design 1 and Engineering Design 2. Naturally, around 60% of the participants were sophomore students aged 19-20. While 35% of the participants were male students, around 65% were females. The majority of the sample, almost 90%, were UAE nationals. Finally, only 11% of the participants reported a GPA of 2.0 or less.

Table 1 Demographic Data

Section A: Personal Information (*Personal information will be kept confidential*)

Age:	17	18	19	20	21	22	Gender:	M	F	
	0%	9%	35%	23%	11%	4%		35%	65%	
Marital Status:	Single		Engaged		Married					
	75%		4%		5%					
Nationality:	UAE	Expat	High School System:			Government	Private			
	84%	16%				52%	36%			
Academic Level:	Freshman		Sophomore		Junior	Senior				
	15%		53%		16%	3%				
Major:	Chemical	Electrical	Mechanical	Petroleum	Petroleum Geosciences	Undeclared				
	26%	7%	39%	13%	5%	0%				
GPA:	>3.7	3.5-3.7	3.0-3.4	2.5-2.9	2.0-2.4	<2.0				
	18%	13%	20%	24%	11%	0%				

Results:

Both male and female responses were analyzed and significant differences will be highlighted but the main emphasis will be on the responses provided by the female students. In the section titled Career Choices, 41% of the female sample indicated they chose to enroll at the PI because of their interest in science and engineering followed by 35% seeking a promising career with Abu Dhabi National Oil Company. Family encouragement came next at 30% of their responses. Male students showed a similar pattern except in family encouragement which showed a much lower percentage of only 10% of the male respondents.

Table 2 Career Choices

1. I chose to enroll at the PI because	Female	Male
My family encouraged me to	24%	10%
My interest in Science and Engineering	37%	30%
A promising career with the ADNOC group	31%	24%
Don't know	6%	5%
Other	5%	0%

The next item posed a question regarding the reason for joining the oil and gas industry and the choices provided were; high salaries, social status, the opportunity to serve my country, or other reasons. The top reason for female students was serving the country as reported by almost half the female respondents. It was followed by high salaries and social status. On the contrary, the male students reported high salaries as the top reason while serving the country was reported by only 24% of the males compared to double that percentage reported by their female counterparts. The correlation between the two group responses regarding the reasons for joining the oil and gas industry showed the weakest among all survey items standing at 0.82.

Respondents were then asked about the location where they prefer to work. The three options provided were; in an office, in the field or no preference. The female responses were not as expected (based on the general public perception that a job in the oil field in such a hot climate is not as attractive as an office job). The results showed that 36% of the female respondents indicated they prefer the field jobs while only 22% of the male students opted for the fields.

The next item gathered data about the people who encourage the participants to seek a career in Engineering when they are not sure about their career choice. Parents were reported to provide the most encouragement as they were mentioned 75% of the time.

The last item in this section checked whether there were any engineers in the family. None of the participants' mothers are engineers while

20% listed the father as an engineer. Other male members were 58% while other female members were 33% and 9% declared there were no engineers in their families.

The final section of the survey was titled "Beliefs about Engineering" and it was a five-point Likert-type scale questionnaire ranging from "Strongly Agree" to "Strongly Disagree" with ten statements regarding their beliefs. Participants mostly agreed with all ten statement with the exception of the following: *"I believe that the oil and gas industry offers the same opportunities for female employees as for male employees."* Only 50% of the participants agreed with this statement while the rest either disagreed or selected "Neutral" as their response. This statement received the highest disagreement level among all questionnaire items. The other statements received a disagreement level of 0% to 3% while this statement about equal opportunities for female employees in the oil and gas industry received 14% disagreement.

Discussion

The reason for joining the oil and gas industry

Choices: high salaries, social status, the opportunity to serve my country

The top reason for female students was serving the country as reported by almost half the female respondents. It was followed by high salaries and social status. On the contrary, the male students reported high salaries as the top reason while serving the country was reported by only 24% of the males compared to double that percentage reported by their female counterparts. The correlation

between the two group responses regarding the reasons for joining the oil and gas industry showed the weakest among all survey items standing at 0.82 which is still a positive correlation.

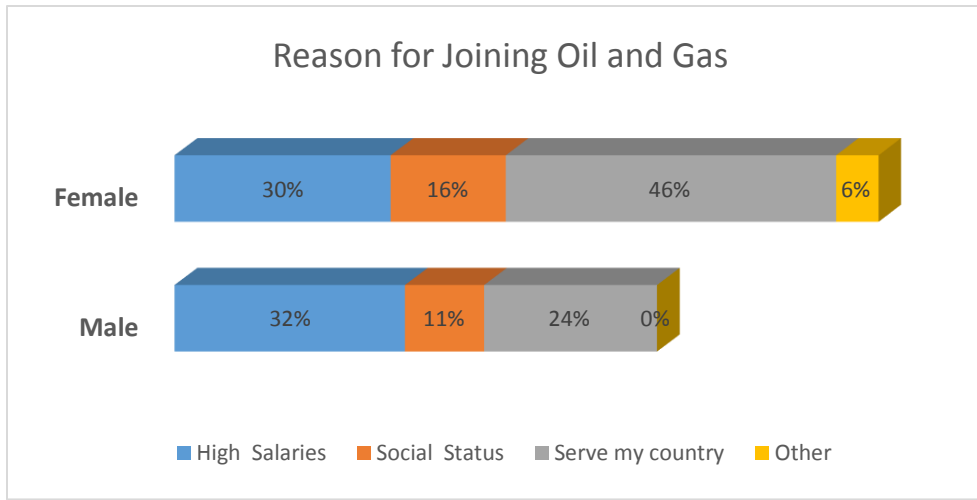


Figure 5 Reason for Joining Oil and Gas

The findings here match those in the Study done by the Economist where data suggested that women are driven more by an aspiration to be of service to the greater good, and seek opportunities to help their society.⁷ More than four-fifths of their respondents chose to study a STEM-related subject because they wanted to give back to the UAE, while almost two-thirds felt that society respects people who work in a science related field, such as an engineer. They state that Emiratis are very patriotic and understand their country's development depends on their acquisition of relevant skills. Additionally, the study concluded that cash is a key attraction, as over four-fifths of their respondents believed that studying STEM will secure high salaries.⁷

The location where they prefer to work

Choices: in an office, in the field, no preference.

The female responses were not as expected based on the general public perception that a job in the oil field in such a hot climate is not as attractive as an office job. Additionally, most of the country's industrial facilities are far outside the cities and female engineers are usually compelled to drive back and forth from the worksite due to the lack of proper facilities for women to stay overnight. This sometimes leads to female engineers getting much less of a site experience than their male colleagues. When women engineers arrive at the field, they can face other difficulties such as the lack of adequate safety gear for women on site. Despite all of this, the results showed that 36% of the female respondents indicated they prefer the field jobs while only 22% of the male students opted for the fields.

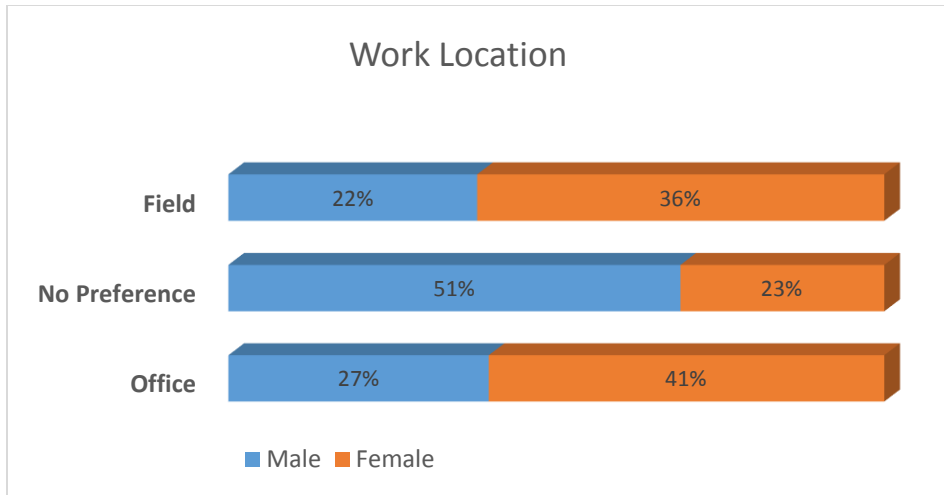


Figure 6 Work Location Preference

Equal opportunities (Oil and Gas)

“I believe that the oil and gas industry offers the same opportunities for female employees as for male employees.”

Only 50% of the participants agreed with this statement while the rest either disagreed or selected “Neutral” as their response.

This statement received the highest disagreement level among all questionnaire items as shown in figure 7.

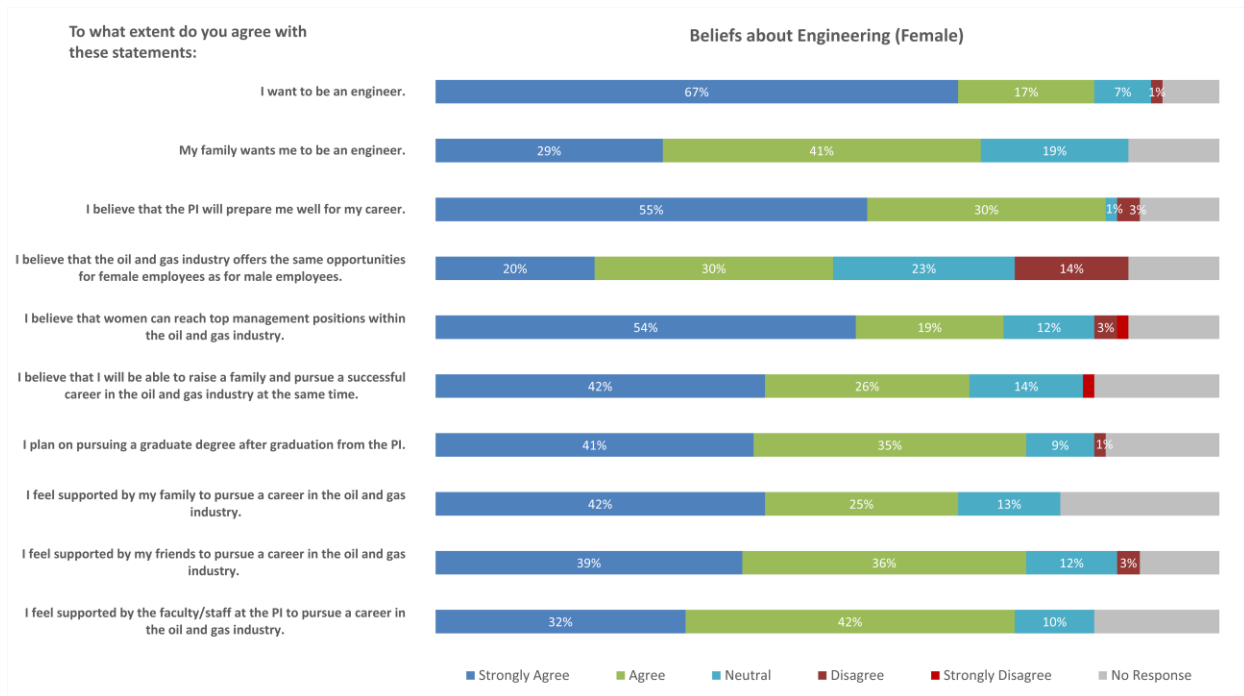


Figure 7 Beliefs about engineering

Figure 8 shows similar disagreement regarding equal opportunities from both male and female respondents.

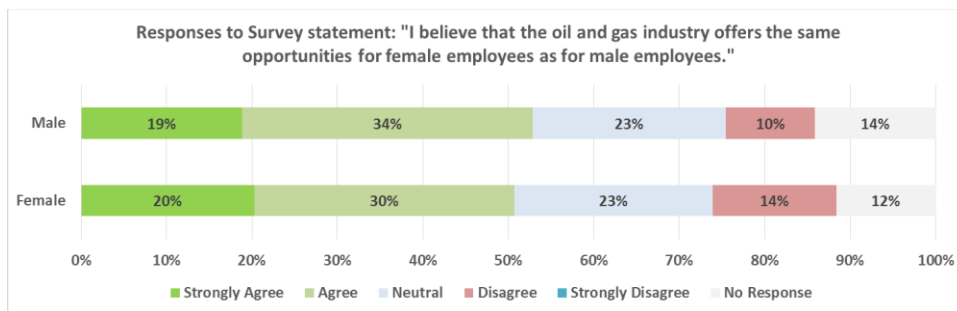


Figure 8 Perception of equal opportunities by gender

The other statements received a disagreement level of 0% to 3% while this statement about equal opportunities for female employees in the oil and gas industry received 14% disagreement.

This finding matches the Study done by the Economist where around 66% of their participants saw cultural issues as an obstacle to women in science and engineering.⁷ Over two-thirds of respondents with work experience in a science and engineering job recognized that women face the general belief that engineering related fields are a better fit for men. More than two-fifths of their participants identified gender as being an obstacle.⁷

Conclusion

Despite the low percentages of women studying engineering around the world, the Middle-Eastern GCC countries in general and the United Arab Emirates in particular, unveil a totally different picture. There has been substantial increase in the number of women enrolling in STEM programs, particularly engineering. This is not unique to the UAE. According to IGU/UNESCO, women make up around 60% of the engineering students at university in the Gulf region⁸. It seems there are several factors contributing to the current increase in the percentage of women in engineering. It is evidently a combination of factors such as the vision of the government and the motivation of the young women to serve their community and make their families proud. The case presented in this paper deals mainly with one university but it is not a unique phenomenon. Other publications⁷ seem to support the findings gained from this case study. The female students' performance, motivation, expectations, and career choices seem to be quite similar in the GCC region. The findings shed some light on the reasons why so many of them chose to pursue a career in the oil and gas industry. A major outcome of this surge of enrolment coupled with the motivation and drive of the participants is that women will certainly reach top management positions within the oil and gas industry in the region.

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