WOMEN ENGINEERS ASSOCIATION FOR TRANSFORMING THE FUTURE: OBJECTIVES, MOTIVATIONS AND ACTIONS

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Abstract

Women who study engineering degrees continue to be a minority despite the efforts made by academic institutions and other organizations to improve this situation. In Spain, female students are only 26% of those enrolled in engineering and architecture degrees; however, only in engineering degrees does this value drop to 12% or even less in computer science degrees. In this context, the Women Engineers Association, founded by students and lecturers of the Miguel Hernandez University in Elche (Alicante), has recently emerged. The main objective of this platform is increasing the number of female engineers in Spain. This paper presents in detail the dissemination actions and activities carried out by this association in order to close the gap between men and women in engineering studies and professions.

Keywords: women, engineering.

1 INTRODUCTION

Engineering is responsible for inventing, creating, and designing so that people can live in a better world. However, this vocation to innovate until now has not attracted many women, possibly as a consequence of the multitude of barriers that women have had in this professional branch, as in many others, that they have had to overcome throughout history.

1.1 Background

Women continue to represent a significantly lower percentage than men in the field of Engineering studies particularly, and in general in all areas of STEM (Science, Technology, Engineering and Maths) [1][2].

Despite the fact that currently 54% of Spanish university students are women, only 26% of students choose to take an Engineering and Architecture degree; however, only in Engineering degrees does this value drop to 12% or even less in Computer Science degrees [3]. Although the European average of women engineering graduates is around 26.6% - very similar to the values in Spain-, the problem is aggravated, when analysing the data on the percentage of women who are employed in the engineering sector, just a 16.9% according to Eurostat data [4][5].

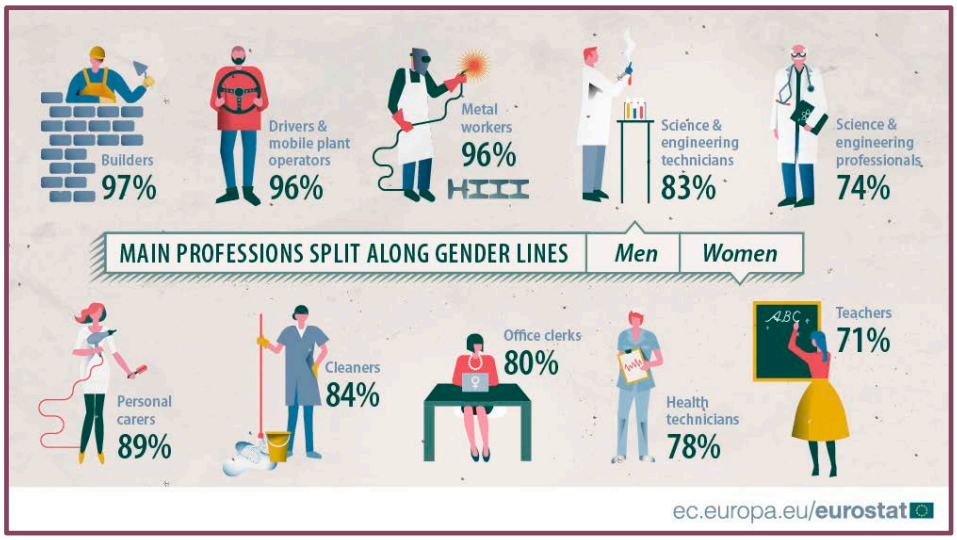

Figure 1. A graphic interpretation of how jobs still split along gender lines [5]

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Tertiary education graduates by sex, 2014
(share of graduates in the respective field of education - %)

	Total		Social sciences, business & law		Engineering, manuf. & construction		Health and welfare		Humanities & arts		Science, mathematics & computing		Education	
	Men	Women	Men	Women	Men	Women	Men	Women	Men	Women	Men	Women	Men	Women
EU	**42.1**	**57.9**	**39.3**	**60.7**	**72.8**	**27.2**	**25.3**	**74.7**	**32.8**	**67.2**	**57.6**	**42.4**	**19.7**	**80.3**
Belgium	40.2	59.8	40.6	59.4	76.4	23.6	23.5	76.5	36.5	63.5	67.8	32.2	20.7	79.3
Bulgaria	40.0	60.0	34.1	65.9	67.1	32.9	30.8	69.2	29.5	70.5	49.8	50.2	22.7	77.3
Czech Republic	39.9	60.1	32.9	67.1	71.9	28.1	17.4	82.6	29.5	70.5	61.4	38.6	16.3	83.7
Denmark	41.7	58.3	44.7	55.3	63.9	36.1	21.2	78.8	32.2	67.8	64.1	35.9	29.6	70.4
Germany	49.5	50.5	44.0	56.0	80.7	19.3	30.0	70.0	29.9	70.5	61.7	38.3	23.2	76.8
Estonia	33.6	66.4	25.8	74.2	67.7	32.3	10.5	89.5	25.6	74.4	54.0	46.0	7.6	92.4
Ireland	47.7	52.3	46.5	53.5	85.0	15.0	24.0	76.0	39.7	60.3	63.5	36.5	28.6	71.4
Greece	42.2	57.8	38.5	61.5	68.2	31.8	27.7	72.3	26.7	73.3	53.8	46.2	23.6	76.4
Spain	43.9	56.1	40.5	59.5	74.7	25.3	26.1	73.9	40.6	59.4	64.6	35.4	21.6	78.4
France	44.1	55.9	39.4	60.6	74.4	25.6	25.9	74.1	30.5	69.5	61.8	38.2	24.6	75.4
Croatia	40.2	59.8	32.9	67.1	69.4	30.6	20.4	79.6	27.9	72.1	54.5	45.5	3.8	96.2
Italy	40.3	59.7	41.3	58.7	66.0	34.0	31.8	68.2	27.9	72.1	46.9	53.1	10.1	89.9
Cyprus	37.1	62.9	40.0	60.0	71.5	28.5	35.2	64.8	27.7	72.3	46.4	53.6	15.6	84.4
Latvia	34.8	65.2	29.5	70.5	71.9	28.1	12.2	87.8	20.7	79.3	61.4	38.6	9.4	90.6
Lithuania	37.0	63.0	28.4	71.6	77.3	22.7	17.5	82.5	26.9	73.1	55.0	45.0	19.6	80.4
Luxembourg	45.1	54.9	46.0	54.0	74.8	25.2	21.2	78.8	33.3	66.7	70.8	29.2	38.0	62.0
Hungary	37.4	62.6	31.1	68.9	75.0	25.0	23.3	76.7	32.8	67.2	63.0	37.0	16.2	83.8
Malta	45.2	54.8	41.2	58.8	77.2	22.8	27.4	72.6	40.7	59.3	70.7	29.3	20.1	79.9
Netherlands	43.4	56.6	46.2	53.8	76.9	23.1	25.7	74.3	42.4	57.6	72.6	27.4	21.2	78.8
Austria	44.5	55.5	40.4	59.6	78.2	21.8	28.6	71.4	30.1	69.9	66.4	33.6	16.6	83.4
Poland	34.0	66.0	30.6	69.4	61.4	38.6	26.7	73.3	24.3	75.7	52.3	47.7	14.7*	85.3*
Portugal	40.7	59.3	38.2	61.8	67.4	32.6	21.0	79.0	39.4	60.6	43.1	56.9	20.6	79.4
Romania	41.3	58.7	33.5	66.5	64.3	35.7	29.1	70.9	36.7	63.3	40.6	59.4	2.9	97.1
Slovenia	40.1	59.9	30.9	69.1	75.8	24.2	21.2	78.8	30.6	69.4	58.5	41.5	11.3	88.8
Slovakia	36.8	63.2	31.8	68.2	68.4	31.6	19.6	80.4	32.6	67.4	54.3	45.7	22.2	77.8
Finland	39.6	60.4	35.7	64.3	78.5	21.5	15.2	84.8	26.4	73.6	57.4	42.6	17.6	82.4
Sweden	37.7	62.3	36.8	63.2	69.4	30.6	18.5	81.5	37.5	62.5	60.0	40.0	18.9	81.1
United Kingdom	42.9	57.1	46.8	53.2	77.6	22.4	22.9	77.1	37.2	62.8	53.9	46.1	23.3	76.7
Liechtenstein	67.2	32.8	70.8	29.2	48.9	51.1	75.0	25.0	-	-	-	-	-	-
Norway	41.4	58.6	41.3	58.7	80.7	19.3	17.0	83.0	38.5	61.5	66.9	33.1	25.6	74.4
Switzerland	51.7	48.3	51.9	48.1	85.3	14.7	25.8	74.2	38.8	61.2	67.8	32.2	30.7	69.3
Serbia	42.2	57.8	40.4	59.6	64.8	35.2	26.9	73.1	27.7	72.3	54.6	45.4	16.7	83.3
Turkey	50.8	49.2	52.0	48.0	73.0	27.0	33.0	67.0	37.7	62.3	50.0	50.0	36.0	64.0
FYR of Macedonia	43.9	56.1	42.1	57.9	57.9	42.1	24.7	75.3	32.7	67.3	60.9	39.1	25.4	74.6
Japan	51.1	48.9	60.8	39.2	87.3	12.7	36.4	63.6	31.2	68.8	74.8	25.2	28.4	71.6

- No graduates in this field.
* Doctoral level (ISCED 8) Education graduates are included in the field "Social sciences, business and law".
The source dataset can be found here.

ec.europa.eu/eurostat

Figure 2. Engineering, manufacturing and construction dominated by male graduates [5]

Globally, data from women graduates in STEM areas lead to a paradox: the more egalitarian a country is, the fewer women study science and technology. This paradox is known as “the gender equality paradox” [6][7]. The analysis of the statistics of the students according to their gender and university studies concludes that the more gender equality there is in a country (according to the World Economic Forum's Gender Equality Index), the lower the percentage of women who study engineering and technical careers. The most relevant aspect of this research, which is based on the academic results of 472,242 adolescents in 67 countries, is to discover that the more egalitarian a country is, the more capable women for science and engineering choose to study other university degrees not related to STEM.

This paradox of gender equality explains that countries like Albania and Algeria have a higher percentage of women among their engineering graduates than countries acclaimed for their high levels of gender equality, such as Finland, Norway or Sweden. In the US, female engineers do not reach 14%, while in Algeria, women represent 41% of university graduates in the fields of engineering, science or technology [6].

Studies on the evolution of the labour market indicate that a significant number of the jobs that will be created in the future will require knowledge of engineering and technology. If we consider that they also correspond to the so-called positions of power, well paid and with high social recognition, the gender inequality is worrying, which will tend to accentuate if the participation of women in these university degrees is not corrected.

1.2 “Women engineers” association

Fortunately, in recent times, female empowerment in all professional areas has allowed more and more professional women's work groups and associations; in Spain the AMIT association is a benchmark for women researchers and technologists [8]. In this context, a group of students and lecturers of the Miguel Hernandez University in Elche (Alicante) founded the “Women Engineers” association in February 2019 with the following objectives:

- Increase the number of female engineers in Spain

- Promote the interest of girls and women, and in general, of Spanish youth, in professional development in the areas of engineering, technology, science and mathematics.
- Promote and disseminate the opportunities that engineering, technology, science and mathematics represent for the professional development of girls and women, and in general, of Spanish youth.
- Promote gender equality in the areas of engineering, technology, science and mathematics in both educational and professional fields
- Promote the importance of education in the areas of engineering, technology, science and mathematics in different compulsory educational levels (children, primary and secondary schools) in civil society, public and private educational organizations and administrations, small and large companies).

The logo of the “Women Engineers” association wants to show simplicity, modernity and freshness. The central female figure is inspired by the figure of Hedy Lamarr, a popular Hollywood actress and the inventor of today's WiFi system [9]. The circle represents the unity reminiscent of a globe. And the combination of the electrical symbol of earth and the three stars, denotes the breadth of areas in which engineering work is carried out.

Figure 3. The logo of the “Women Engineers” is at the top and on the left of this composite image with members of the association at various events.

2 METHODOLOGY

2.1 Motivation

The idea of creating this platform emerged among a group of engineering professors after attending a conference by the Spanish engineer Nuria Oliver [10] in which the paradox of gender equality was highlighted [11]. The title of the conference was “Engineering, Informatics, Technology… Where are the women?”; and it was like a slap in the face for the female engineers who were there right then and there. We all think: *"We are here now, and we are going to tell everyone*".

2.2 Organization

"Women Engineers" is a national and non-profit association. Its main objective is to increase the aspirations of women and girls regarding their professional development, promoting as an option the areas of engineering and technology.

Being a member is free and any person, company or institution that wants it can help us financially. Thanks to these financial aids we can print brochures, maintain the web, have T-shirts and bracelets, as well as other products that identify us and allow us to spread our goals. The association motto is ***"Transform the future***".

The association has a web page where it reports all the activities it carries out. And it also has social networks to spread its messages and activities. Figure 4 compiles all the social network accounts relative to "Women Engineers" association.

Figure 4. Digital platforms where you can find information on "Women Engineers" association.

3 RESULTS

In this section we present some of the activities and events that the association has carried out since its inauguration until today.

3.1 Events at Miguel Hernández University

The Women Engineers Association is linked to the University because its founding members are mostly academics and engineering students from that institution. In this way, the association can hold its meetings and activities on the university campus and participate in the different events that take place periodically.

3.1.1 Presentation day, march 8th

This association is very recent, in fact, its opening and presentation day was held on March 8, 2019. The event took place at the Higher Polytechnic School of Elche, belonging to the Miguel Hernández University. The event consisted of the presentation of the association and a series of conferences related to women and their work environment, highlighting the importance of increasing the number of women in engineering and in the technological business world.

The media in the area (press, radio and television) were very receptive, so we managed to promote our objectives locally.

Figure 5. Presentation day poster

3.1.2 Members meetings

Three association member meetings have been held, always within the Miguel Hernández University campus. And in these meetings, academic and business events are planned and organized where the association can participate to spread their ideas.

3.1.3 Others events

The association tries to be present in most of the student events that take place at the university. Of course, we also celebrate two important dates, February 11th (*International Day of Women and Girls in Science*) and June 23th (*International Women Engineering Day*).

Figure 6. Celebrating the February 11th in 2020 (International Day of Women and Girls in Science)

3.2 Talks in primary schools

Talks in primary schools are one of the activities that the association considers essential. It is important for girls to learn early about what engineering is and that there are many women who have made great strides in this field. These talks are always given by female engineers, so that the young girls are able to see first hand that there are female engineers. And that studying engineering at the university allows you to get good job options.

Figure 7. Talks in primary schools.

3.3 Radio broadcasting

The association periodically broadcasts a radio program on the Miguel Hernandez University station (provincial level) in which they interview different people, always with the underlying theme that defines us, which is women and engineering. Women engineering professionals and female students who actively participate in engineering projects inside and outside the university are usually interviewed.

Figure 8. An image of one of the interviews that take place in the radio show.

3.4 Actions and contests via instagram

Currently, the most popular social network among young people is Instagram; therefore, from our account we carry out dissemination actions and contests, where we give away t-shirts and bracelets with our logo.

Figure 9. Some of the photos published on instagram

4 CONCLUSIONS

It is necessary to look at engineering with a gender perspective, since society will benefit from it. The value of an engineering degree allows that young woman to design a better world.

In an increasingly technological world, leadership in any space will involve hiring staff with extensive knowledge of science and technology. If women are not trained in these disciplines, a future job with great possibilities will be closed to them. And they will lose, in this way, the opportunity to participate in relevant advances for society, and the opportunity to lead and decide what is investigated and financed. And with this, inevitably, the wage gap will continue to reign. In engineering equality has not been achieved and of course there is still a long way to go.

From the “Women Engineers” association we want to help spread the world of engineering to young Spanish women and thus manage to close the gap in this highly relevant academic and professional field.

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