MUNDP 2020
COMMITMENT TO DEVELOPMENT

# RESEARCH REPORT

## UNITED NATIONS EDUCATIONAL, SCIENTIFIC, AND CULTURAL ORGANIZATION (UNESCO)

## PROMOTING THE INTEGRATION OF WOMEN IN BRANCHES OF SCIENCE, TECHNOLOGY, ENGINEERING AND MATHEMATICS (STEM)

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## Basic Overview of the Issue

There are many examples of women lacking opportunities because of their gender throughout history. Although there are important milestones which women accomplished and eliminated some of the privileges men possessed from the 18th century to this day, the world can still feel the inequality between men and women in many areas. One of the areas that men still dominate is the Science, Technology, Engineering, and Mathematics (STEM) field. Despite the few exceptions like Marie Currie, the field has been mainly formed by the men since its beginning. But this situation has changed recently with the help of empowering girls and women to enter STEM fields by both international organizations and the Member States.

More girls are going to school today in the world in general than ever before, and even in the STEM field, the male-female ratio is getting closer. But it is not enough, especially in the majority of the Arab States, where religion and tradition are important factors that determine the role of women in society. According to United Nations Educational, Scientific, And Cultural Organization (UNESCO): "*Too many girls and women are held back by biases, social norms and expectations influencing the quality of the education they receive and the subjects they study*." This situation can be clearly seen in the Arab States. Although women don't have the same or even similar opportunities in some parts of this region, some promising developments give hope to empower women in branches of STEM fields.

The Arab States have been polarized in terms of promoting women in STEM fields. While some of the Arab States are better compared to European countries in terms of participation of women in STEM fields, in some states women sometimes lack basic rights which became huge obstacles in their way. The issue needs to be addressed in a compact way by understanding each Arab States' unique environment and the motivation behind each individual Member States' actions. In addition, it should be reviewed deeply and carefully by examining and taking into consideration the progress countries have had over the years and the foundations they laid for the issue. Finally, since it can be a controversial topic in the Arab States due to tradition and religion pressure, the issue is an important humanitarian problem that affects not only the Arab States but the whole world as well.

## Explanation of Important Terms

*Science, Technology, Engineering, and Mathematics (STEM)*

It is a curriculum focused on four specific disciplines: science, technology, engineering, and mathematics, and it is an interdisciplinary approach. It integrates these subjects into a cohesive learning paradigm based on real-world applications.

*Arab States*

According to UNDP, the states are comprised of 22 countries in Northern Africa, the Levant, and the Arabian Peninsula. The total population of the region is about 350 million people. The Arab States are extended to vast geography and even though the countries share some cultural heritage and have stronger ties, each Arab State has its own unique environment and they differ from themselves in terms of making policies or taking actions about women in STEM.

*Promote*

Supporting or actively encouraging, advancing someone to a more important rank or position. Another world would be used instead of “promote” is “empower” which means giving power or authority to someone, part, or organization. Empowering or promoting women in STEM would suggest supporting women to be successful in STEM fields.

*Integration*

According to the Cambridge Dictionary, integration is the action or process of combining two or more things in an effective way. The integration of women in STEM would suggest having more women in STEM and transitioning women into STEM fields efficiently.

# Detailed Background of the Issue

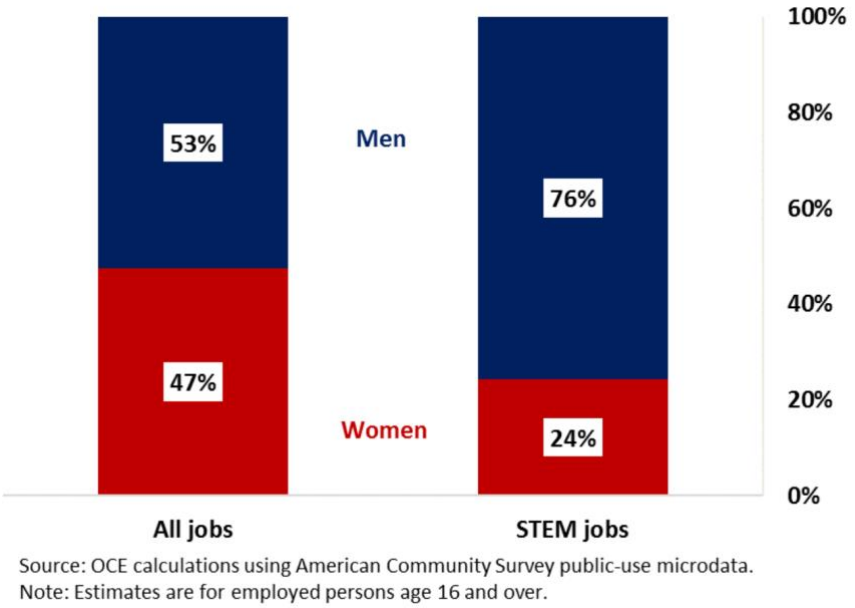
## History of Women in STEM

STEM field has become one of the most important sectors in the current world order. Especially developments in the technology sector and computing made this field very popular among the countries. The economies have been reshaped and policies were made to promote STEM to be competitive in the future world with all kinds of new technologies such as artificial intelligence. The fields of STEM became one of the most demanded majors/subjects in higher education. Thus, the demand to work in this field increased substantially. When it comes to the distribution of workers’ gender in STEM, however, the face of STEM is generally males and the fields are represented mainly by men. From Silicon Valley to Shanghai's Tech Hub, men are more dominant compared to women. Although the ratio gap has decreased among

the past years, it is a fact that men have more opportunities in these fields.

### *The Reasons for Fewer Women in STEM fields*

The fields of STEM have remained predominantly male since the origins of these fields, Age of Enlightenment. Although there are some exceptions where women have been successful despite all against the odds, the STEM field has seen low participation among women. There are several reasons behind it. Historically, men were able to possess more privileges and opportunities, men being perceived more developed and better than women, such as but not limited to the right of voting, right of having land. Having more resources, men were able to pursue their education and research in their respective studies and develop their interests. Being affected by the consequences of what time required men to be in terms of wars and development over the years, men became more inclined to STEM fields. The women, on the other hand, had other rights to advocate and fight for such as suffrage, or in other words right to vote. The same opportunities were not available for women as men, so it had become a challenging field for them to pursue their studies due to a lack of resources.




Source: OCE calculations using American Community Survey public-use microdata.
Note: Estimates are for employed persons age 16 and over.

***Figure 1.*** *Women Percentage Share: All Jobs VS STEM jobs in the North American Countries (the United States and Canada)*

Not only that, in general, in some countries, women were seen by second class humans and were obligated to "produce children" and look after them. So, the environment was not suitable for women to thrive in STEM fields, even in Western

countries which were the most developed countries at that time. Although currently the environment is better for women and girls to thrive in STEM fields and the availability of certain resources is much higher, still the men are more inclined to STEM fields. The reason is a lack of experience, confidence, and interest. In terms of experience, since men were and still are able to get proper education due to past beliefs on the superiority of men, they were able to perform well in the school compared to a limited number of female students who were lucky to get an education in the past; thus, women were not able to find an environment to express themselves and ideas to pursue their careers especially in the STEM fields which led to a lack of confidence. Therefore, women were and still are tended to choose other subjects rather than STEM in their future while men dominate most of the STEM fields.

## Women in STEM in the Arab States

The woman in the Arab States is a grey area. Since the Arab States' political geography is very large, it is impossible to come to a generalization in terms of women's identity and role. The women in the Gulf Area and the Middle East have gained many rights throughout the years which was due to the open-minded perspective the countries undertook rather than the conservative and traditional point of view on women. Transitioning from conservative to a more liberal perspective, women now are not seen as creatures that do not have rights or perceived as less human. The countries in this region such as but not limited to Saudi Arabia, Jordan, Kuwait, Qatar, United Arab Emirates started to emphasize more on education and women's role in society.

Moreover, these countries' economies all rely on oil. Since oil is not a renewable resource, these countries started to put more effort into sustainable plans - such as investing in tourism. One of the areas that have been affected the most is education and STEM fields which promise sustainability in economy. These states realized the importance of education and invested in this sector. There are many American Universities in the Gulf Area that offer great opportunities for students in the region. The efforts are made to integrate women into the sector of education. The funds are dedicated to women's education since some countries realized the importance of women in the economy. Nearly half of the population is female and they wanted to integrate more people into this sector. In the Gulf States, women are

encouraged by scholarships and resources provided by the governments. Also, women have gained rights where the states realized the effect of women in the economy - especially in the Gross Domestic Product (GDP) -, social life, and so on.

However, there are the other Arab States on the other side of the Sinai Peninsula, which separate the Middle East and Northern Africa. After the Arab Spring, which was "*a series of anti-government protests, uprisings, and armed rebellions that spread across much of the Islamic world in the early 2010s" (Britannica)*, the governments in Northern Africa and Sahara were not stable enough to promote women in the STEM fields or to the workforce, overall. Even in Egypt, which can be seen as one of the most developed countries despite the political disputes happening or have happened in the country, the government has put its focus on other areas such as military rather than education. Besides, there are on-going wars, conflicts, and crises in some countries in the region as well, which prohibit these countries to focus on the integration of women into the STEM fields as their focus is much more military-based.

In general, the lack of women's participation in the STEM fields can be seen in the Arab States as well. While some innovative campaigns encourage women into the STEM fields in some Gulf States, the women in other parts of the Arab States are facing several obstacles and encountering a lack of basic rights, for example, right to marry whoever they wanted or the right to vote.

### *Participation of Arab Women in STEM education*

Women in STEM fields in the Arab States is a controversial topic as it solely depends on which perspective you have. The countries in the Middle East that build their economy based on their ideas on innovation, research, science, and technology to form the leaders of a knowledge-based and

| Field | Country | Year | % |
|---|---|---|---|
| Natural Sciences & Engineering | Bahrain | 2015 | 41.1 |
| | Egypt | | 40.03 |
| | Iraq | | 39.03 |
| Agriculture, Fisheries & Veterinary | Egypt | 2014 | 31.96 |
| | Iraq | | 29.76 |
| Health & Medical | Bahrain | 2014 | 14.60 |
| | Egypt | 2015 | 27.96 |
| | Iraq | | 11.57 |
| | Oman | | 4.26 |
| | UAE | | 6.02 |

***Table 1.*** *Women Researcher (FTE) as Percentage of Total Researchers in STEM Fields in Some Arab Countries (UNESCO, 2017)*

competitive economy started to promote women into the STEM education more. For example, while Iran is seen as an oppressive country by the western media, the country is one of the biggest competitors when it comes to participation of women in STEM education. Saudi Arabia, where women got their right to have driving licenses just recently, is once again one of the prominent countries in the region that has put effort into integrating women into the STEM area. According to UNESCO and World Bank: "*In 2014 women comprised 59% of the total student enrollment in Computer Science at government universities in Saudi Arabia. In comparison to the UK and USA, women enrollment in Computer Science was 16% and 14% respectively; those numbers include international students, some of whom came from the Arab region.*" Furthermore, 46% of the United Arab Emirates (UAE) university graduates in STEM are women. Women make 50% of the employees at the UAE's Space Program.

### *The Challenges Pulling Women Away From STEM Fields*

Overall, the percentage of Arab women enrolled in and graduating with degrees in STEM fields is relatively high and it is clear that Arab women who like science, pursue their passion, and even get a degree. However, when these women graduate and attempt to either pursue careers in STEM fields or postgraduate degrees such as the MSc or the Ph.D., they are often excluded on the basis of their gender. The overall rate of participation of women in STEM is low, even in Saudi Arabia, UAE, Iran. According to the World Journal of Education, "*In Kuwait, Qatar, and UAE, 70% of university science students are women, but their numbers are much lower in work related to science and research, in which 12% were women."* So there are two

| Country | Women as Percentage of total labor force (2014) | Average percentage of women in STEM fields (2015) | |
|---|---|---|---|
| | | Enrolled | Graduated |
| Bahrain | 19.6 | 46 | 47 |
| Egypt | 24.1 | 43 | |
| Oman | 13.4 | 64 | 65 |
| Palestine | | 52 | 52 |
| KSA | 15.2 | 39 | 39 |
| Tunisia | 27.0 | 62 | 63 |
| UAE | 13.1 | 63 | 58 |
| **Arab Region** | **22.3** | | |
| **World** | **39.6** | | |

***Table 1.*** Women Percentage Share: Labor Force VS STEM Education in Some Arab Countries

problems to be discussed. First, there are some Arab States like Sudan, Somalia, Mauritania where the overall participation of women in education is really low. Second, even in states where the participation of women in STEM education is high, women are not able to fit into the

STEM industry because of how the industry perceives women. Currently, women are seen not ready to take a big step in the industry by the companies.

In addition, the Arab World is a vast region with many different environments. First, there are some Arab States like Sudan, Somalia, Syria Mauritania where the overall participation of women in education is really low. This is because of ongoing conflicts, and political instability, and wars. Second, even in states where the participation of women in STEM education is high, women are not able to fit into the STEM industry and transition into where they want to be. So, the issue should be separated and viewed independently. Each side has its unique solutions. While on one side, women are not even able to go to university, another side has graduated women but have no place to offer to these women in the industry. The reason behind the difference is about the country's economy and its vision to invest. But the common reason behind all of them is the perception of women in the Arab World.

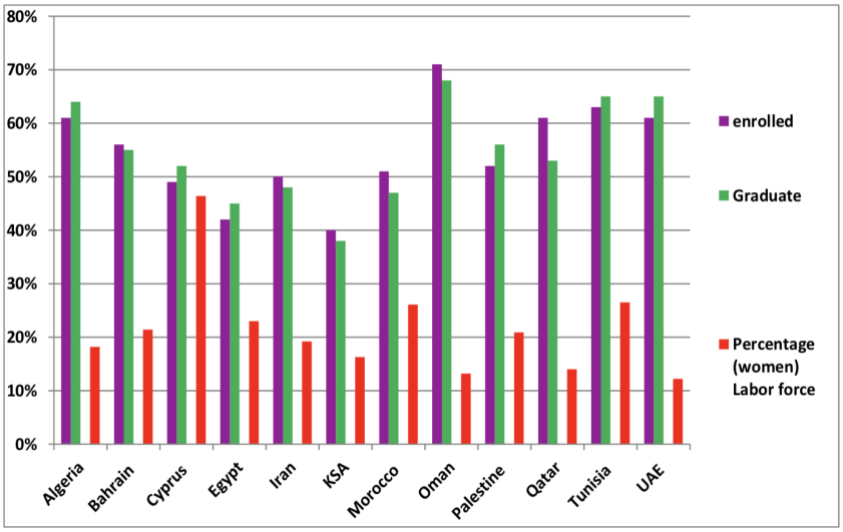



***Figure 2.*** *Women Percentage Share: Labor Force VS STEM Education in Some ME Countries in 2016 (Source: UNESCO Institute of Statistics 2019)*

Although the countries in this region are going through a transition to a more liberal world, tradition and religion still play a huge role in how society perceives women. The reason why tradition and religion play a big role in how society perceives women is the cultural heritage that nearly all Arab States share. From the perspective of tradition and religion, a woman is not free or strong enough to do what men are capable of. Thus, women were not perceived as equals to men who shaped the social norms since the beginning of the 5th century, even before Islam. The women in this region have been second when it came to seizing power and dominance, and still, this is what a large group of men in these Arab societies believe.

It is also important to keep in mind that these norms are hard to break. If women cannot go to university or get a proper education, it is because of the norms that the society has put to women. If women graduate from university but cannot find a place to pursue their careers in the industry, it is because most of the Arab companies still favor men over women in terms

of work ethic, power, experience. The tradition and religion should not be eliminated or cannot be eliminated but there is still a long way to go when it comes to accepting STEM women graduates into the Arabian industry. Arab women who seek jobs abroad and be successful in what they are doing proves the point of a general perception of the industry in the Arab States.

## Major Parties Involved

### *United Nations Educational, Scientific, and Cultural Organization (UNESCO)*

United Nations Educational, Scientific, and Cultural Organization (UNESCO) is a body of the United Nations (UN) that covers the educational, scientific, and cultural topics/issues of the world, including promoting women in STEM. Its objectives are:

- Improving the participation, achievement, and continuation of girls and women in STEM education and careers to reduce the gender gap in STEM professions.
- Strengthening the capacity of countries to deliver gender-responsive STEM education, including through teacher training, educational contents, and pedagogy.
- Enhancing awareness of the importance of STEM education for girls and women.

The body is the primary organization that leads the women in STEM in terms of dedication and started initiatives such as International Women and Girls in Science Day.

### *Saudi Arabia*

Saudi Arabia is one of the role model countries that started to encourage women in STEM fields and fund their education. The country is trying to adapt to the future world and investing in the education sector.

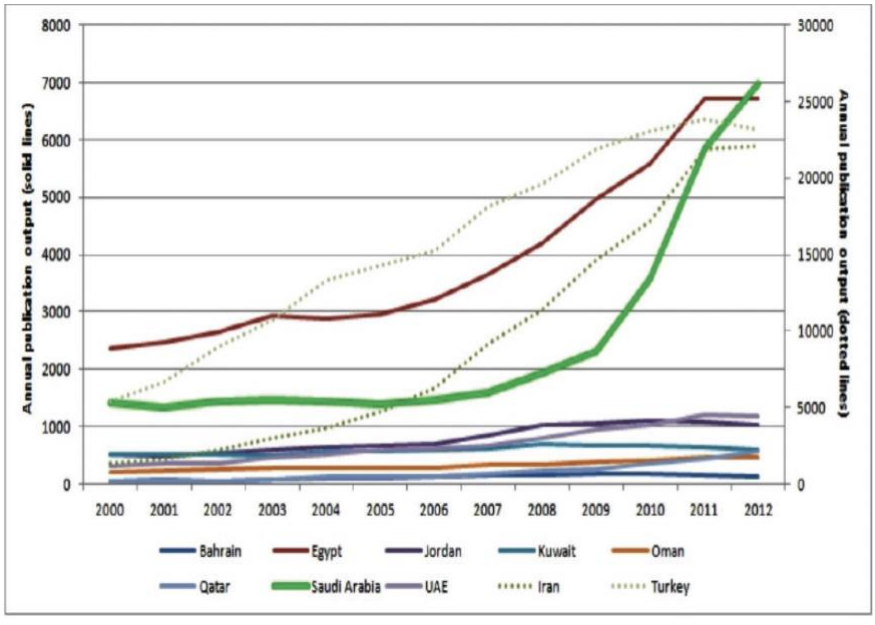



***Figure 3.*** *National Research Output Among Leading Research Economies in Some Middle Eastern Countries (Source: KACST, 2015)*

Although there were only a few universities at the beginning of the 1960s in the country, recent investments into the STEM field have allowed women to have a range of degrees from Computer Science to Health

Sciences. Still, the industry is not as encouraging as the education sector except few companies such as Saudi Aramco.

### *United Arab Emirates (UAE)*

UAE is another promising example of the region. According to the World Economic Forum's Global Gender Gap report for 2017, "*The UAE is a leading country when it comes to women in STEM within the Middle EastA study by consulting firm, Booz Allen Hamilton, confirms that increasing the number of Emirati women's participation in STEM fields to equal those of their male counterparts, could boost the UAE's GDP by an estimated 12% percent. From various educational programs to gender equality programs, the ecosystem in the UAE has been developing to encourage more women very successfully into STEM*." The country also has been taking steps to support and involve STEM in schools.

## Chronology of Important Events

| **Date** | Description of Event |
|---|---|
| **2750 BCE to 3rd century CE** | First examples of women in STEM in ancient history |
| **10th Century** | Middle Ages and Golden Ages for the Arab World. Astronomer Mariam al-Asturlabi: astrolabes. |
| **1220s** | Zulema the Astrologist |
| **1970** | Samira Islam became the first Saudi Arabian person to earn a Ph.D. in pharmacology. |
| **1976** | The Saudi Aramco established the Special Clerical Training Center for Saudi women |
| **2007** | Physicist Ibtesam Badhrees was the first Saudi Arabian woman to become a member of the European Organization for Nuclear Research (CERN) |

| | |
|---|---|
| **2015** | Ms. Huda Al-Ghosn became Saudi Aramco's Executive Director of Employee Relations and Training, overseeing more than 65,000 employees. (the first in the company's history.) |
| **22 December 2015** | *"The General Assembly decided to establish an annual International Day to recognize the critical role women and girls play in science and technology."* (UNESCO) |
| **11 February 2019** | The latest International Day of Women and Girls in Science event was held in Paris |
| | |

## Relevant International Documents

- Resolution /A/RES/70/212) International Day of Women and Girls in Science
- **Against Wind and Tides:** A Review of the Status of Women and Gender Equality in the Arab Region (Beijing +20), Distr. (GENERAL E/ESCW A/ECW/2015/3), 7 January 2016.
- **UNESCO science report, towards 2030, (**SC.2015/WS/24).
- **Women in Science,** UNESCO SDG Fact Sheet No. 51 June 2018 (FS/2018/SCI/51)

## Past Attempts to Resolve the Issue

**International Day of Women and Girls in Sciences**

According to UNESCO: "*The International Day of Women and Girls in Science celebrated on 11 February, is implemented by UNESCO and UN-Women, in collaboration with institutions and civil society partners that aim to promote women and girls in science. This Day is an opportunity to promote full and equal access to and participation in science for women and girls.*" Even though the solution is set globally and the locations that hold the events are not in the Arab Region, the principles of the initiative have been implemented into the region really well. UAE had its own expositions and events where women in STEM presented their

works, shared their ideas, and tried to find the right connections to take a step towards the industry. The same applies to Saudi Arabia, Qatar, and Kuwait as well.

Apart from the initiative, the Arab World, especially in the Gulf Region, has begun to promote the education of women not only in the STEM field but also in their transition to the industry. In 2019, UAE held one of the biggest Science-Technology Fairs and encouraged women to participate by funding the event. Besides, on the western side of the Arab World, Morocco has been dedicated to educating its women in STEM fields and has been successful since 2015. The role models like Dr. Hayat Sindi have put effort to raise awareness around the globe and search for possible support with TED Talks.

## Solution Alternatives

While trying to solve the issue, the delegates should be aware of the importance of religion and tradition in the respective Arab States. Even though some countries are more open-minded and liberal towards innovations, there are some conservative countries within the Arab States. In addition, there are serious conflicts happening in some regions, especially in the Middle East. So, the delegates should bear in mind that there are several factors affecting the issue. The solutions should be more focused on the long-term and the delegates should have some short-term solutions that will be the foundation of more sustainable solutions. These short-term solutions should provide sustainability to other possible solutions.

In terms of the long-term solution, national and international action is needed. The issue cannot be only solved by raising awareness in the respective Arab States since the environment is not suitable for some of the short-term solutions now. The Arab States or International Organizations should take action to create long-term solutions since promoting women into the STEM fields require so many resources, diplomatic relations between countries, and effort. Calling member states to cooperate and operating the proposed plans by the member states to maintain sustainability would be key to find solutions.

In the Arab League, countries like the United Arab Emirates (UAE) should be a role model and encourage the more conservative countries despite the disputes between the states to stabilize the region. A Member State from the Arab States would be the most feasible option for being role models to the other Arab states because of the cultural similarities between them. A country from Europe would not be as effective as to be a role model since the Arab States

are more similar to each other. But it should not be only obligated to the Arab States. The issue is global and women working in STEM fields in the Arab States would affect the whole world economy and possibly contribute to the common world knowledge heritage among all women.

"The role models" in the Arab States should be chosen by looking at some criteria. These criteria can be efforts that have been put into empowering women in STEM, a thriving economy, and political stability. The role models can be chosen by the United Nations Member States by looking at the indexes of the UN to understand whether the country is qualified for being a role model or not. If the Arab League members and the Arab States are not satisfied with the role model countries and have some disputes, the Arab States should come to the ultimate decision. When the role models are selected, these countries could offer to create a committee in the Arab League, monitored by the United Nations and some respective Member States who are leaders of "Women in STEM" to maintain the flow of the organization. The body or organization could be called "Promoting Women into STEM workforce" or "Women in STEM and Petroleum Fields."

Further, the body could have a President country and two Vice President countries. The selected President delegation could be replaced by another role model annually to share the workload and maintain sustainability. If the Arab States are not satisfied with the President, the committee could go to voting to select one of the Vice President delegations as the new president of the body. If there is a drastic change in a country in terms of the number of women in STEM, the country could be nominated by the President of the committee to become the Vice President delegation.

Moreover, the committee's vision, promoting women into STEM fields, should take consideration of the Arab State's economic & political situation, tradition, and religion. The President of the committee should be a pioneer to invest in education for girls and be responsible for finding sufficient funds and organizations. The President country should not be the only contributor to the project, however, but rather the manager of the operation and play the role of a "bridge" between the monitoring countries outside of the Arab League which are going to help and monitor the committee and the Arab States to meet the requirements for the projects.

In countries or parts of the countries where education is not offered/encouraged to girls, the committee should take action to encourage respective Member States to make policies about it. In short-term, international organizations and Member States can hold events in the

Arab States which are on the topic of STEM fields and women, thus can further inform the public about the importance of these fields. While international organizations can raise awareness, the committee should organize campaigns in selected countries annually to promote the field. The committee should make policies, fund education, start campaigns to encourage girls, create higher education institutions while also taking into consideration the several social and economic factors.

Apart from the committee proposal, there can be an international organization founded by the UN members dedicated to girls' education in the Arab States. This organization could not be as effective as the Member States themselves when it comes to making policies or encouraging the Arab States, but it can be an unbiased/neutral organization whose goal is only to educate girls and give them a proper education. After their first initiative, which is determining the regions with low participation girls not only in STEM but also in major subjects as well and providing fundamental education, the organization can focus on higher education and provide funding to young women in the Arab States who want to improve themselves in the STEM field but do not have enough resources. This would be a hard process to maintain flow and sustainability since the region's political situation is not stable and often some Arab countries don't open themselves to the outside world but if it shows progress in more stable environments in the region, it might and will be effective.

## Bibliography

- "What Is STEM Education?" *LiveScience*, Purch, https://www.livescience.com/43296-what-is-stem-education.html.
- "Women, Girls, Science, Technology, Education, Advancement, Equality." *United Nations*, United Nations, https://www.un.org/en/events/women-and-girls-in-science-day/.
- "UNESCO UIS." *UNESCO UIS*, http://uis.unesco.org/.
- "Women in Science: Explore the Data: United Nations Educational, Scientific and Cultural Organization." *Women in Science: Explore the Data | United Nations Educational, Scientific and Cultural Organization*, http://www.unesco.org/new/en/natural-sciences/priority-areas/gender-and-science/improving-measurement-of-gender-equality-in-stem/women-in-science-explore-the-data/.
- "About the Arab States." *UNDP in the Arab States*, https://www.arabstates.undp.org/content/rbas/en/home/regioninfo.html.

- "Girls and Women in STEM." *Smithsonian Science Education Center*, 1 Apr. 2019, https://ssec.si.edu/girls-and-women-in-stem.

- "Women in STEM: STEM Women: Statistics." *W1siziisimnvbxbpbgvkx3rozw1lx2fzc2v0cy9tdgvtiedyywr1yxrlcy9wbmcvbg9nby5wbmcixv0*, https://www.stemgraduates.co.uk/women-in-stem.

- "Women in STEM: STEM Women: Statistics." *W1siziisimnvbxbpbgvkx3rozw1lx2fzc2v0cy9tdgvtiedyywr1yxrlcy9wbmcvbg9nby5wbmcixv0*, https://www.stemgraduates.co.uk/women-in-stem.

- "Get the *Solving the Equation* Report." *AAUW*, https://www.aauw.org/resource/get-the-solving-the-equation-report/.

- "5 Ways to Promote Women in STEM: Lessons from the Science Festival in Ghana." *GEO Observations Blog*, https://www.earthobservations.org/geo_blog_obs.php?id=368.

- Pittman, Olivia, et al. "7 Organizations That Promote Women in STEM - College Raptor." *College Raptor Blog*, https://www.collegeraptor.com/find-colleges/articles/college-majors-minors/7-organizations-working-to-promote-women-in-stem/.
- *Against Wind and Tides: A Review of the Status of Women* ... https://sustainabledevelopment.un.org/index.php?page=view&type=400&nr=2283.

- Staff, Study International. "The Rise of Women in STEM in the Arab World." *Study International*, 14 Feb. 2019, https://www.studyinternational.com/news/the-rise-of-women-in-stem-in-the-arab-world/.

- *IEEE Xplore Full-Text PDF:* https://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=7494771.

- AmyLeask. "Women of STEM History: A Timeline of 20 Great Minds." *Enable Education*, 11 Nov. 2016, https://enableeducation.com/women-of-stem-history-a-timeline-of-20-great-minds/.

- 7dnews.com. "UAE a Platform for Women in STEM." *7dnews.Com*, 7DNews, 17 Mar. 2019, https://7dnews.com/news/uae-a-platform-for-women-in-stem.

## Useful Links

- A Review of the Status of Women and Gender Equality in the Arab Region: https://sustainabledevelopment.un.org/content/documents/2283ESCWA_Women%20and%20Gender%20Equality%20in%20the%20Arab%20Region_Beijing20.pdf
- UNESCO science report, towards 2030: https://unesdoc.unesco.org/ark:/48223/pf0000235407
- Equality and the Economy: Why the Arab World Should Employ More Women:

https://www.think-asia.org/bitstream/handle/11540/7523/bdc_20161207_equality_in_me_en.pdf?sequence=1

- *Data for Sustainable Development*: http://uis.unesco.org