



Advancing Enterprise Education for Women in Science, Technology, Engineering and Mathematics (STEM) among MENA Countries

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Challenge

In 2020, Saudi Arabia will host the G20 Summit during the unprecedented COVID-19 pandemic and calls for social and political transformation among MENA countries. Calls for reform include the need to strengthen enterprise or entrepreneurship education for women in science, technology, engineering, and mathematics (STEM). This need is evidenced in below average performance of MENA countries among 80 countries surveyed in the OECD (2018) *Program for International Student Assessment*. The assessment measured 15-year-old students' reading, mathematics and science literacy, as well as problem solving and skills to 'meet real-life challenges.' With respect to enterprise education, an UNESCO (2013, p. 18) study of Arab countries recommended, "a national strategy for the integration of entrepreneurship education in the educational and training systems and curricula during general education, technical or professional education and higher education." Similar recommendations are advanced by the World Economic Forum (2010).

Challenges facing women in STEM are also reported. While agencies, such as UNESCO (2017) and the World Bank (2020), report that the engagement of women in STEM across MENA countries is high (relative to more developed countries) few women graduates pursue STEM careers. Thirteen of 15 countries with the lowest rate of female participation in the workforce are Arab countries (World Bank, 2020). This reflects 'lost' economic opportunity and return on investment from STEM education. In recognizing the importance of STEM credentials as the foundation for employment in the digital economy, associated challenges are twofold. First, is a need to imbed enterprise education in STEM curricula to help students develop entrepreneurial attitudes, skills and competencies, and to improve their abilities to meet 'real life challenges'. Second, entrepreneurship education within STEM disciplines will encourage women to pursue business startup as a career option, and enhance their ability to scale and growth their businesses. Such measures will contribute to women's economic empowerment and economic growth across the MENA region.

To this extent, this Policy Brief addresses the lack of:

1. Formalized enterprise curricula in MENA educational and training systems
2. Enterprise education within STEM disciplines within most MENA states
3. Small business support services beyond startup within most MENA states
4. Small business support services for startups operating within MENA's STEM sectors
5. Mentors and role models for women STEM entrepreneurs in MENA states.

The policy brief informs an issue of significant importance to the G20 economies, and in particular, MENA states by advancing strategies to:

1. Educate and train a billion people in the next decade. The focus on entrepreneurship and STEM will prepare young women for careers in the Fourth Industrial Revolution.
2. Build capacity and mobilize knowledge needed to create businesses to drive economic growth in the Fourth Industrial Revolution.

Women in STEM

Many Arab countries are global leaders in the participation of women in STEM. For example, approximately 34 to 57 percent of STEM graduates are women, a percentage that is significantly higher than most Western economies (UNESCO, 2015). This is important because engagement in STEM is associated with innovation, research and development, technology transfer and economic prosperity. STEM professionals solve complex global and local challenges. This is of paramount importance for Arab countries seeking to diversify strategically from economic dependence on oil, and countries struggling with economic instability, unemployment and poverty. Multiplier effects are expected, given that women small business owners are more likely than men small business owners to hire women and retain women in managerial and leadership roles (Ommundsen & Kteily, 2018).

Yet, Arab women are underrepresented within STEM occupations and small business ownership. Cultural norms and formal and informal institutional regimes constrain professional opportunities for women in STEM. The absence of enterprise education in STEM disciplines also plays a role. Political will and policy measures are needed to plug the 'leaking pipeline' (Afiouni & Karam, 2017). The following challenges stymie inclusion and economic growth within Arab countries:

1. *Career readiness in STEM education.* Despite their academic qualifications, many women in STEM are unprepared for employment and entrepreneurial careers. This is due, in part, to limited internships and industry placements, work experience during their academic studies, and lack of engagement with industry leaders, entrepreneurs and prospective employers.
2. *Absence of employment and enterprise skills in STEM curricula.* Curricula typically excludes employment, entrepreneurship and small business training. This impedes students' knowledge and experience in negotiation, communication, management, leadership, commercialization of innovation and marketing. Such knowledge is sought after by prospective employers and essential for business startup and scaleup.
3. *Mobility and flexibility for career advancement.* STEM careers often entail international travel, sequential and short-term posts, long days, and work in laboratories away from the home. Women with caregiver responsibilities often struggle to accommodate mobility and flexibility. In rapidly advancing STEM fields, women can fall behind.
4. *Lack of roles models and mentors.* Despite the number of women graduates in STEM, there are few role models and mentors. By exception, Nermin Fawzi Sa'd is an Arab woman entrepreneur, engineer, role model and mentor. In 2012, she launched *Handasiyat.net*. The company provides virtual engineering services to customers operating in the MENA region through a customized online platform. *Handasiyat.net* prioritizes employment of women who wish to use their engineering qualifications while working from home.
5. *Absence of enterprise support tailored for professional women in STEM.* Gender barriers in entrepreneurial ecosystems remain throughout the MENA region. Women entrepreneurs in STEM struggle to find suitable small business support services tailored to their professional needs and sectors (e.g., incubators, accelerations, industry associations).

Enterprise Education in STEM

Gibb (2008, p. 6) provides a useful definition of enterprise in the context of education: *“Behaviours, skills and attributes, applied individually and/or collectively, to help individuals and organisations of all kinds, to create, cope with and enjoy change and innovation involving higher levels of uncertainty and complexity as a means of achieving personal fulfilment and organisation effectiveness’. Enterprise education is the process by which these behaviours are practiced and supported.”*

Based on the principles of enterprise education, experiential learning provides students with opportunities to develop and apply a range of skills that are essential to employment and startup, and that tend not to be innate qualities. Enterprise education is also seen to influence *entrepreneurial mindsets* and enhance skills associated with opportunity recognition, problem-solving, communication, teamwork, time management, collaboration and leadership. Other competencies include creativity, determination, initiative, adaptability, and resilience. Students

are typically encouraged to learn from their failures and successes. Enterprise education is also seen to be beneficial to those students who struggle with traditional curricula.

Women in STEM Entrepreneurship

To address gender disparities within STEM disciplines in Arab countries, policy and program interventions are needed to encourage women's entrepreneurship. Change is happening, albeit slowly. For example, in Arab countries, one in three start-ups are women-founded or women-led. Globally, this compares to one in ten technology entrepreneurs (ITU, 2019). Several explanations are advanced to explain the presence of Arab women in tech. First, the technology industry is relatively new. Second, 70 percent of the population in Arab countries is under 30 years of age, a demographic that is highly engaged in the digital economy. Third, the internet is helping to overcome physical boundaries of work in homes, cities and countries, where gender and other systemic biases persist. Finally, many women entrepreneurs in the MENA region believe that technology is one of the few occupational spaces where everything is possible, including breaking gender norms (The Economist, 2013). Yet, gender barriers remain, specifically: family and societal pressures to stay at home; digital and financial literacy gaps; and challenges for women entrepreneurs in accessing capital. Nevertheless, women entrepreneurs are finding creative ways to overcome barriers to start-up and scale-up. Key to these efforts is the digitalization of commerce and capacity to employ the internet to reach new markets and serve customers. Women working in the home can also circumvent cultural constraints, concerns about travel and physical safety, and the costs of transport. At the same time, working from home can be isolating, limit the development of professional networks, and expose women to domestic violence.

Within MENA countries, the economic contributions of women in the workforce is estimated to be \$2.7 trillion by 2025. There are numerous stories from Arab women who have successfully fused STEM credentials and start-up, and who are helping to lead digital transformation accelerated by the COVID-19 pandemic (McKinsey, 2015). Advancing enterprise education for women in STEM among MENA countries is an economic imperative. Illustrative initiatives follow.

In Jordan, *INJAZ* has partnered with MIT to develop a program that encourages girls to pursue entrepreneurial STEM careers. *INJAZ* has also launched an incubator to support women students and entrepreneurs. Social entrepreneur Hadeel Anabtawi has established *GO Girls* and *The Alchemist Lab*, initiatives recognized by the United Nations Sustainable Development Goal Award. In Dubai, the mandate of the investment platform *Womana* is to encourage gender diversity and inclusion in technology. It also supports professional networks for women and is increasing the presence of women business owners in STEM (Acwa Power, 2019).

Role model Asrar Damdam is a Saudi woman entrepreneur who obtained a Bachelor degree in Electrical and Computer Engineering from Effat University in 2016, Master's degree in Electro-physics from King Abdullah University of Science and Technology (KAUST) in 2018, and is currently completing doctoral studies in Nanotechnology at KAUST. She has also launched Silicon Valley start-up *UVera*, a firm that is tackling food waste problems. While still in its infancy, *UVera* technology is adding value to domestic and commercial kitchens. Asrar Damdam's entrepreneurial journey began with a Misk Foundation Fellowship in 2019. Funding enabled her to attend entrepreneurial training at Draper University in the United States. After winning the university's pitch competition, she launched *UVera* in 2019. Intellectual property

rights to UVera technology have been approved by the US Food and Drug Administration. Such initiatives align with the findings of a UNESCO (2017) commissioned study which finds mentorship programmes improve girls' and women's participation and confidence in STEM studies and careers. The study also affirms that women role models in STEM mitigate negative occupational stereotypes and offer girls a realistic understanding of STEM careers.

Recognizing that innovation is a characteristic of growth-oriented enterprises, the World Bank has launched the MENA Gender Innovation Lab (MNAGIL) — Evidence for Policy Research Hub. The MNAGIL Lab is a first of its kind in the region and serves as a platform to generate rigorous evidence-based insights and interventions in the design and implementation of gender-based policies and programs. The lab will do so by conducting impact evaluations and undertaking randomized control trials to understand what works, what does not work, and how to further empower women in MENA countries. The lab will partner with regional policymakers and global development practitioners to improve policy interventions to eliminate gender disparities. The lab is predicated on three-pronged strategic pillars (referred to as "the 3 As"): A1: advance women's workforce development; A2: accelerate access to financial capital; and A3: agency and voice (Mottaghi, 2019; World Bank, 2020).

Finally, there remains a significant gap among male and female entrepreneurs in accessing start-up and growth capital and securing investment. Between 2012 and 2017, the number of investors in the MENA region increased by a compound annual rate of 31 percent (officially, from 51 investors in 2012 to 195 in 2017). The majority of investors are in the UAE (32 percent), Saudi Arabia (17 percent), Lebanon (13 percent) and Egypt (10 percent). Despite the investment community being dispersed among early-stage funders (such as, angel investors, seed funders and incubator programs), and later-stage venture capitalists and corporate investors, few investors or recipients are women.

Policy Recommendations:

1. Provide enterprise education, including experiential and entrepreneurial approaches to learning, to equip students with entrepreneurial mindsets and other personal competencies that contribute to society.
2. Introduce gender-sensitive educational policies and programs to bolster women's participation in technology and innovation and to create inclusive and diverse labour markets. Interventions must move beyond the 'feminization of responsibility and obligations' to engage both men and women as parents and encourage a partnership approach that enable women to achieve their economic and professional potential.
3. Create global labs, connections and networks for women in STEM to build social capital, commercialize intellectual capital, and mobilize knowledge across the MENA region.
4. Conduct research on Arab women in digital and STEM entrepreneurship to gain a better understanding of career pathways for STEM graduates. The current emphasis of research is economic macro-level indicators. There is an absence of women-focused studies to understand the complex social, cultural, and ethnical mechanisms that impact individuals and their firms.

5. Facilitate mentoring programs to support Arab women in digital and STEM enterprises, whereby young women are mentored by women role models. Mentoring programs should adopt an entrepreneurial knowledge transfer partnership model innovating the United Kingdom's KTP model used over the last 40 years to improve the competitiveness and productivity of businesses. In the UK, the KTP lasts between 12 and 36 months, and enables a business to bring in new skills and the latest academic thinking to deliver a specific, strategic innovation project through a knowledge based partnership between the business, an academic or research organization, and a graduate who works at the business for the duration of the KTP.
6. Mandate inclusive STEM entrepreneurship ecosystem support, identifying and training tech talent, mentors and consultants through workshops and courses that employ real problems, scalable solutions and innovative business models. Incubators, accelerators, entrepreneurship learning hubs, and workshops exist. Gaps point to the lack of inclusive support services rather than quantity of service providers.
7. Train investors, educators, researchers and policymakers about equity diversity and inclusion, including unconscious biases, to increase investment in and support of women STEM entrepreneurs.

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