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Republic of Armenia

Leveling the STEM Playing Field for Women

Differences in Opportunity and Outcomes in Fields of Study and the Labor Market

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EUROPE AND CENTRAL ASIA



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Contents

Acknowledgments.....	vii
List of Acronyms.....	viii
Executive Summary.....	ix
I. Women and Work: Europe and Central Asia.....	1
II. Women in Armenia: Overview of Trends	4
II.1 Armenia’s Global Gender Gap score	4
II.2 Armenia’s Legal Framework for Gender Policy.....	6
II.3 Imbalanced Sex Ratios in Armenia.....	8
II.4 Armenian Women’s Access to Land and Finance	8
III. Why STEM is Important for Women in Armenia	10
IV. Barriers to Translating Academic Success into Labor Market Participation.....	12
V. Women and Education in Armenia.....	14
V.1 Overview of Armenia’s Educational Structure	14
V.2 Overview of STEM Education in Armenia	18
V.3 TUMO Center for Creative Technologies	20
V.4 Barriers to Women’s Education in Armenia.....	22
V.4.1 Access.....	22
V.4.2 Information asymmetries	22
V.4.3 Institutional failures in implementation	22
V.4.3.1 Mainstreaming action on equality between women and men	22
V.4.3.2 Textbooks.....	23
V.4.3.3 Teaching staff.....	25
V.4.3.4 Response to incentives for men	25
V.4.4 Stereotypes	26
V.4.4.1 Gender bias.....	26
V.4.4.2 STEM stereotypes	27
VI. Women and Work in Armenia	30
VI.1 Overview of Women’s Employment in Armenia	30

VI.2	STEM Jobs by Sector.....	32
VI.2.1	Information and communication technology.....	37
VI.2.2	Construction.....	38
VI.2.3	Mining.....	38
VI.2.4	Scientific institutions.....	38
VI.2.5	Electricity.....	39
VI.3	Barriers to Women’s Employment in Armenia	39
VI.3.1	Time constraints.....	39
VI.3.2	Systems failure.....	41
VI.3.2.1	Stereotype threat: What is women’s work?	41
VI.3.2.2	STEM fields and the “hungry engineer”	42
VI.3.2.3	Workplace practices	44
VI.3.2.4	The glass ceiling	44
VII.	Conclusions: What Can Be Done to Improve Equality of Opportunity and Outcomes in STEM? 46	
ANNEX 1:	Explaining Inequality between Men and Women in Education and at Work	50
	Explaining Inequality in Education.....	50
	Access.....	50
	Information factors.....	50
	Educational failure: Systems.....	51
	Stereotype threat.....	51
	Explaining Inequality at Work.....	52
	Time	52
	Access.....	54
	Access to land	54
	Access to finance.....	55
	Institutional and market failures	55
	Information gaps.....	55
	Structures.....	56
	Bias	56

• At home... ..	56
• At work.....	57
Summarizing the Relative Importance of These Factors in Combination	58
ANNEX 2: Overview of Qualitative Research Methods	60
Methodological Approach	60
Research Participants.....	61
Key Informant Interviews	62
In-depth Interviews with Employees	62
Focus Groups.....	62
ANNEX 3: Equity in Education and at Work: Global Best Practice.....	64
EQUALITY FOR MEN AND WOMEN AT SCHOOL	65
○ Changing Systems	65
○ Overcoming Stereotype Threat	67
○ STEM-Specific Policies	68
EQUALITY FOR MEN AND WOMEN AT WORK	72
○ Mainstreaming gender.....	72
○ Time.....	72
○ Access	73
○ Overcoming Market and Institutional Bias.....	74
The promise of behavioral design.....	74
STEM-Specific Policies.....	75
REFERENCES	77

Figures

Figure 1: Labor force participation rate: % of female population age 15+	1
Figure 2: The Global Gender Gap.....	2
Figure 3: World Economic Forum Global Gender Gap scores in ECA, 2016	4
Figure 4: Armenia’s Global Gender gap score indicators	5
Figure 5: Armenia country score card.....	6
Figure 6: Sex ratios at birth in developing Asian economies: male births per female births.....	8

Figure 7: Share of private versus state schools in Armenia.....	14
Figure 8: Structure of Armenia’s education system	15
Figure 9: Female and male students in preliminary vocational education by specialization, academic year 2015	16
Figure 10: Female and male students at BA graduation by specialization, academic year 2015	17
Figure 11: Graduation from MA programs by gender and specialization, academic year 2010..	18
Figure 12: Share of male and female employees by nonagricultural economic activity, 2012 ...	31
Figure 13: Share of men and women within economic activity, 2015	32
Figure 14: Employed persons by type of economic activity, 2010–2015	33
Figure 15: Average monthly wage level in 2015 and real growth between 2013 and 2015 by economic activity	34
Figure 16: Hourly wage for men and women and share of women among total employed by economic activity, 2015	35
Figure 17: Wages by gender for defined STEM- and non-STEM-related jobs, 2015	36
Figure 18: Employment benefits by gender for defined STEM- and non-STEM-related jobs, 2015	36
Figure 19: Perceptions of how useful education has been in finding a job for defined STEM- and non-STEM-related jobs, 2015	37

Tables

Table 1: Summary of barriers to equality of opportunity and outcomes in STEM in Armenia	13
Table 2: Frequency of representation of female and male personalities and characters in textbooks (text and graphics, 2015)	24
Table 3: Policy options to improve equality of opportunity and outcomes in STEM in Armenia	47

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List of Acronyms

ADB	Asian Development Bank
CRRC	Caucasus Research Resource Centers
ECA	Europe and Central Asia
GGG	The Global Gender Gap
ICT	Information communications and technology
LFS	Labor Force Survey
NGO	Nongovernmental organization
NSS	National Statistical Service of the Republic of Armenia
OECD	Organisation for Economic Co-operation and Development
PISA	Programme for International Student Assessment
STEM	Science, technology, engineering, and mathematics
TUMO	TUMO Center for Creative Technologies
VET	Vocational education and training
WEF	World Economic Forum

Executive Summary

This report summarizes the challenges facing Armenian women at school and in the workplace with a special focus on STEM-related employment. As the world transitions to an increasingly digital economy, jobs in science, technology, engineering, and mathematics (STEM) will become a powerful driver of economic growth in the twenty-first century. Changes in economic productivity brought through technological innovation require countries to focus on STEM; these high-productivity fields are increasingly in demand in the global economy, and are the key to competitiveness and gross domestic product (GDP) growth. For countries facing demographic threats that include drastic increases in dependency ratios, the scope and flexibility of STEM work may represent a particularly attractive priority for growth policies.

Jobs in STEM are also good for women. They provide increased flexibility in terms of time compared to other sectors—a crucial factor for women who serve as the primary caretaker of family members. These jobs offer better career prospects and opportunities to develop transferable skills that can be easily adapted to different types of jobs across a woman’s lifecycle.

Parity between men and women was one of the major achievements of socialist regimes in Eastern Europe and Central Asia. However, the transition has taken a toll in terms of women’s labor force participation, particularly in STEM fields. In Armenia, women’s wages have dropped considerably, and women no longer outnumber men in STEM fields. This report uses a mixed-methods approach to understand the barriers facing women at school and work from participating in the workforce.

Cultural stereotypes about the types of work women should engage in and their responsibilities at home present the strongest barrier to equality between women and men in Armenia. This is due to a resurgence of conservative biases that emerged after the collapse of the Soviet Union—with notions that equality was unattainable—as well as to financial crisis and economic stagnation. Unemployment and underemployment became a challenge for both men and women. Moreover, the prestige of STEM suffered as the stereotype of the “hungry engineer” emerged—a Soviet-educated professional with diminished job prospects.

Although access, enrolment, and achievement rates are gender-equal in Armenia, women and girls tend to self-select out of STEM education tracks and career fields. This pattern not only deprives women from reaping the many benefits of high-paying and flexible jobs (underutilizing their skills and leading them to take on a larger share of nonremunerative

activities in the home) – it also threatens the competitiveness of the country as a whole and will prevent Armenia from achieving its poverty reduction and growth goals.

The good news is that stereotypes can be overcome with focused policy actions delivered through three main channels: educational institutions, the workplace, and the general society. The policy actions listed below are based on evidence emerging on good practice based on a global literature review, as well as nascent findings emerging from Armenia. The options reflect a range of approaches, some of which are feasible to implement in the short term within two to three years, albeit with sufficient level of political will and aligned incentives.

(1) At the level of education institutions, policy actions can address issues of access, information, biases, and system-wide changes to promote gender neutrality. In the short term, schools can engage teachers and students in discussions about the benefits of STEM fields of study and careers, encourage girls to embrace their interest in math and science, and provide positive role models of women who work in STEM careers. In the medium to long term, recommended actions include:

- Setting goals to create equal opportunities for boys and girls to succeed in STEM subjects
- Integrating a gender perspective in the primary/secondary STEM school curricula by developing gender-neutral/sensitive class materials
- Creating opportunities within the curricula to discuss gender bias and how it affects opportunities at work and within the home
- Monitoring and coaching teachers to help them remain gender-neutral
- Building on the principles of TUMO Center for Creative Technologies’ existing STEM programs and conducting outreach to inform government policies and offer examples for other VET institutions
- Using financial incentives (tuition fees and scholarships) to encourage women, especially from rural areas, to pursue STEM fields of study

(2) Policy action can help women make the school-to-work transition and promote their career advancement once they are working. Some “low-hanging fruit” options include pairing women working in the STEM industry as mentors to female college and university students, rewarding companies that develop and then monitor progress against gender action plans, and encouraging companies to contract with higher education institutions to organize field visits, apprenticeships, and other networking opportunities that target female students. Further policy actions can address issues of access, time, and market failure, and include:

- Mainstreaming gender considerations of equality across human resources functions at STEM companies, possibly starting with having a target number of women on the Board

of Directors and in top management positions, and then ensuring gender neutrality throughout the pipeline

- Evaluating the “Edge Certification” process for wider use across Armenia
- Raising awareness of STEM professions as career opportunities that provide flexibility for women
- Helping employers provide women-friendly environments and conditions at the workplace, and then actively promoting successful programs to change public opinion about women in STEM careers
- Facilitating STEM employers to develop daycare solutions at work, flexible schedules, telework options, and job-sharing for women, while encouraging men to take paternity leave

(3) At a national level, policy and regulatory actions can address systemic issues of bias, market failure, and information. Even at this level, some quick wins are feasible. The government may consider whether public information campaigns are needed to promote positive aspects of STEM careers to students in middle school and above, such as greater income, flexibility, and status, as well as launch a media campaign to promote and celebrate positive female role models in STEM. The government may also consider reducing any gender distortions in education funding (such as unintended consequences resulting from financial aid packages). Other policy actions include:

- Supporting the *Gender Policy Concept Paper* (2010) recommendations and committing to an action plan with a timeline to meet specific goals
- Translating principles of equal opportunities for women and men into the *State Program on Education Development for 2016–2025* (currently under development), including the process of ensuring gender neutrality in education standards, curricula, and textbooks in all subjects and levels of the educational system
- Filling the “legislative gap” in two areas where the absence of a legal provision may impede the hiring of women in formal firms: prohibit prospective employers from asking about family status and mandate nondiscrimination based on gender in hiring
- Evaluating the use of edutainment to change perceptions of the traditional roles of women and men (e.g., through Armenian sitcoms or other media)
- Following up on recommendations from the World Bank study of Armenian textbooks
- Considering a quota system to address women’s overrepresentation in lower faculty positions and underrepresentation in senior positions of research staff in STEM fields
- Evaluating the admissions requirements for STEM-oriented specialties, which are lower compared to other fields of study

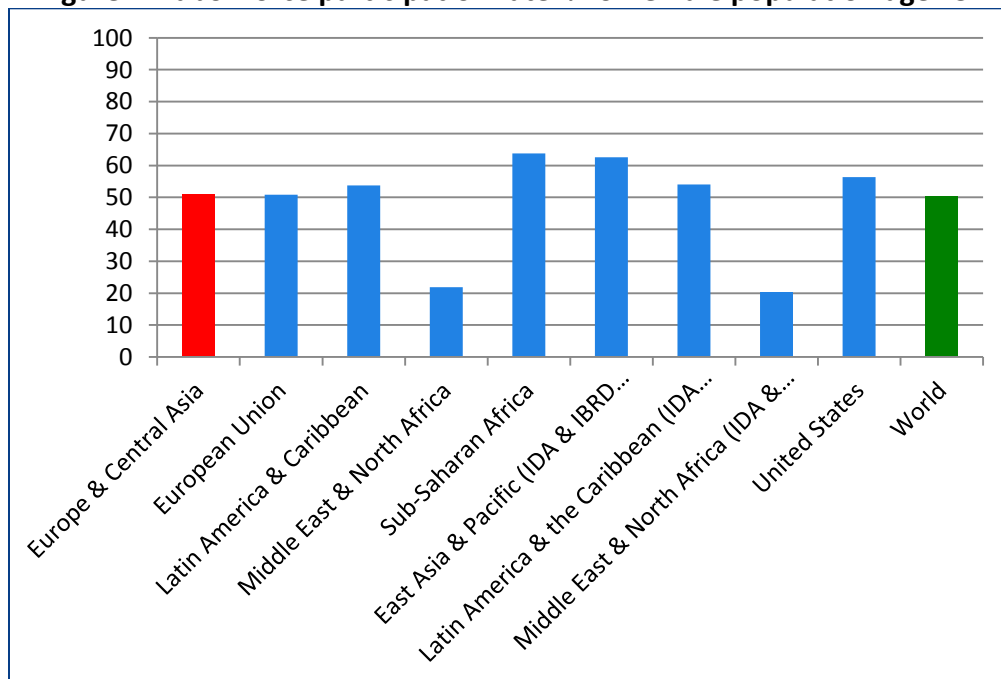
Over time, this three-pronged approach should advance Armenian women’s entry into STEM professions, enhancing their welfare and contributing to Armenia’s overall competitiveness and ultimate development. STEM sectors are an important source of growth for Armenia given the country’s geography and closed borders. Also, considering Armenia’s adverse demographic trends, lifting women’s participation in key growth potential sectors, including STEM, is increasingly critical.

I. Women and Work: Europe and Central Asia

Parity between men and women was one of the major achievements of socialist regimes in Eastern Europe and Central Asia (ECA). Today in low- and middle-income countries in the ECA region, rates of female education and labor force participation are comparable to those seen in high-income OECD (Organisation for Economic Co-operation and Development) countries (World Bank data, 2014). Although the region is characterized by a high degree of heterogeneity, many gender-related challenges are common to all countries.

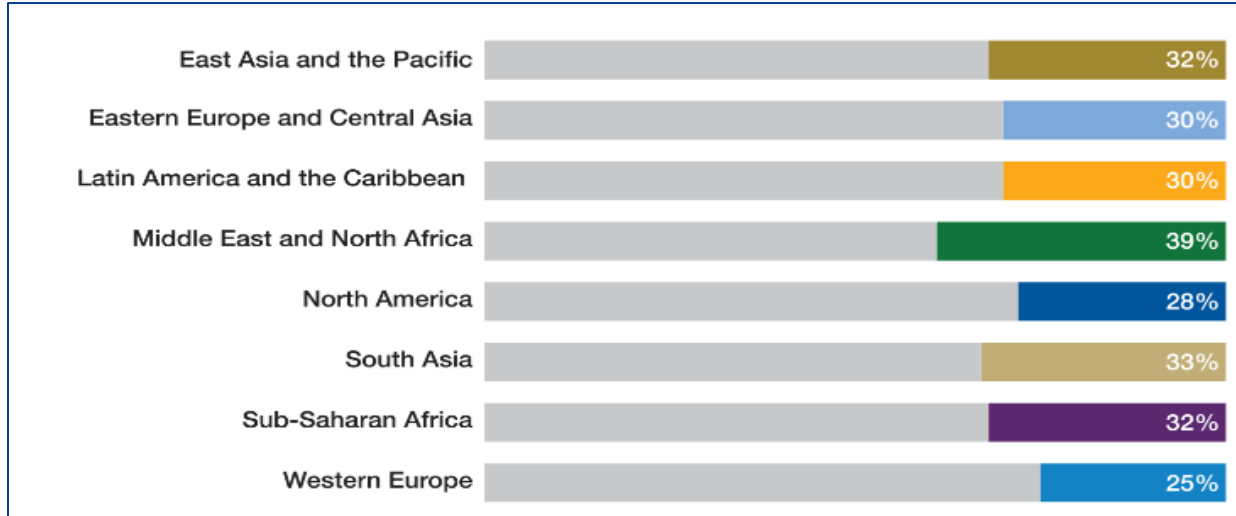
Women’s unemployment and poverty increased following the transition from communism, and women’s employment rates are considerably lower than those of men across the ECA region. Female labor force participation in Eastern Europe declined from 56 percent in 1980 to 50 percent in 2009—likely reflecting institutional changes associated with (1) regime change, whereby participation in market work ceased to be a mandate for most women, and (2) the retrenchment of some support structures such as childcare (World Bank 2012). And the gender wage gap persists, ranging from 7–53 percent (UNDP 2016).

Figure 1: Labor force participation rate: % of female population age 15+



Source: World Bank data 2014.

Figure 2: The Global Gender Gap¹



Source: WEF 2016.

In ECA, female-managed firms pay higher interest rates than their male-managed counterparts (0.6 percent on average), with even higher price discrimination against female entrepreneurs in the region's least financially developed countries (Muravyev, Schafer, and Talavera 2009). As a result, value added per worker is 34 percent lower in firms managed by women than in those managed by men in urban areas (Sabarwal, Terrell, and Bardasi 2009).

The proportion of women in national parliaments remains below the global average of 22 percent in 10 countries in the region, and violence affects approximately 29 percent of women, with marked country variance (UNDP 2016).

According to the World Bank (2013), four important challenges with disproportionate negative impact on women will face the ECA region over the next 20 years:

- *Demographic shifts will result in a predominantly female elderly population* (60 percent), for which pensions and social safety net systems are not prepared.
- *A shrinking labor force and falling male labor force participation rates* will require policies such as childcare provision that will enable women to enter and then remain in the labor force.

¹ **The Global Gender Gap Index** was introduced at the World Economic Forum in 2006 to measure gender parity and track a country's progress over time. An index score is the percentage of the gap between women and men that has been closed. The index measures gender parity across four sub-indexes including: Economic Participation and Opportunity; Educational Attainment; Health and Survival and Political Empowerment. To date, the Economic Participation and Opportunity gender gap has been closed by 59% globally.

- *Productivity growth is constrained by the quality and quantity of tertiary education.* Although women constitute the majority of students in higher education, they are less likely to pursue careers in fields with stability and good wages, such as in science, technology, engineering, and mathematics (STEM).
- *Women do not tend to own businesses,* leaving this entrepreneurial resource untapped.

Although women fill close to half of all jobs in many economies of ECA, they tend to be disproportionately concentrated in non-STEM-related jobs (i.e., jobs in the service sector), with a very small share of female employment in STEM-related jobs.

The Soviet legacy means that more women study STEM in ECA than in other regions. In Europe and many OECD countries, the proportion of women graduating from STEM fields in tertiary education is very low, particularly in engineering. A particularity in the ECA region is that countries with a “thick” cultural legacy from the Soviet period tend to show stronger gender parity in education than other countries with a similar income level. In many ECA countries, the OECD’s Program for International Student Assessment (PISA) results for 2015 show that 15-year-old girls outperform their male counterparts in reading, mathematics, and science. However, this skills advantage does not translate into women entering STEM fields of tertiary education or careers; indeed in many of these countries the share of women graduating from STEM fields in post-secondary education deteriorated following the transition from communism.

II. Women in Armenia: Overview of Trends

II.1 Armenia's Global Gender Gap score

Armenia slipped 20 places on the World Economic Forum (WEF) Global Gender Gap ranking over the last decade, to 102nd out of 144 countries. The country received 0.669 points on the 2016 index, and was located near the bottom of the list, between Hungary and Brunei (Figure 3).

Figure 3: World Economic Forum Global Gender Gap scores in ECA, 2016

EASTERN EUROPE AND CENTRAL ASIA		
Country	Overall rank	Overall score
Slovenia	8	0.786
Latvia	18	0.755
Estonia	22	0.747
Lithuania	25	0.744
Moldova	26	0.741
Belarus	30	0.737
Poland	38	0.727
Bulgaria	41	0.726
Serbia	48	0.720
Kazakhstan	51	0.718
Albania	62	0.704
Croatia	68	0.700
Ukraine	69	0.700
Macedonia, FYR	73	0.696
Russian Federation	75	0.691
Romania	76	0.690
Czech Republic	77	0.690
Kyrgyz Republic	81	0.687
Bosnia and Herzegovina*	83	0.685
Azerbaijan	86	0.684
Montenegro	89	0.681
Georgia	90	0.681
Tajikistan	93	0.679
Slovak Republic	94	0.679
Hungary	101	0.669
Armenia	102	0.669

Across the index's four indicators, Armenia ranked most poorly on *Health and Survival* (second to last after China due to highly skewed sex ratio at birth in both countries) and on *Political Empowerment*, where it ranked 125th (Figure 4). In terms of *Economic Participation* Armenia ranked 69th, given issues of wage inequality and labor force participation. The labor force participation gap between men and women is around 17 percentage points and despite the

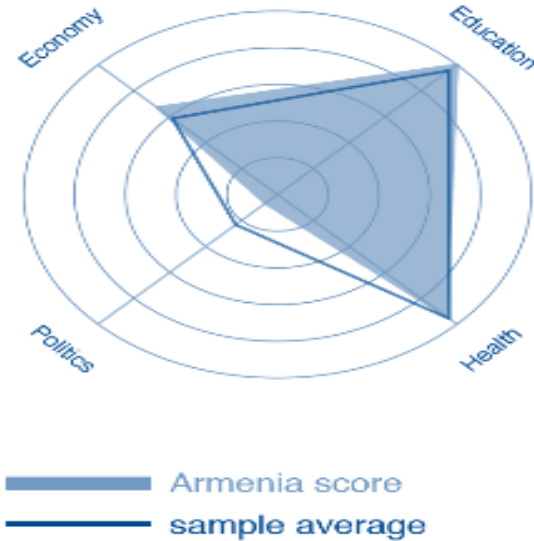
narrowing differential with respect to earnings, women still earn an average 36 percent less than men (World Bank 2016a). *Educational Attainment* was the strongest indicator—the country ranked 27th, with high literacy rates and higher enrolment across primary, secondary, and tertiary education for girls and women, compared with their male counterparts.

Armenia’s WEF Global Gender Gap score shows that Armenian women are highly educated, yet their participation in the labor market and representation in political decision making remain relatively low, while sex-selection and high female abortion rates are of great concern.

The gap between women’s wages as a proportion of men’s over the last decade has been narrowing, with women’s monthly wages as a proportion of men’s reaching 53 percent in 2004 and 64.4 percent in 2012. However, the wage gap increased significantly during the 1990s, when it fell from 74 percent in 1989. Thus women’s salaries relative to men’s have not yet recovered to pre-independence levels (National Statistical Service of the Republic of Armenia 2013). Furthermore, this gap remains one of the largest in the ECA region (ADB 2015).

The wage gap is even more pronounced in the informal sector (ILO 2012).

Figure 4: Armenia’s Global Gender gap score indicators



Armenia inherited an official policy of equality between women and men during the Soviet period. This led to important improvements in the legal and social status of women as well as their active participation in the labor market. Education and paid work outside the home were promoted; mutual consent was made a requirement for marriage; and dowries were banned. However, in private life, women were still seen as responsible for childcare and all domestic work (OECD 2014).

Figure 5: Armenia country score card

COUNTRY SCORE CARD					
	rank	score	avg	female	male
Economic participation and opportunity	69	0.671	0.586		
Labour force participation	83	0.769	0.665	59	76
Wage equality for similar work (survey)	50	0.681	0.622	—	—
Estimated earned income (US\$, PPP)	96	0.526	0.502	5,689	10,823
Legislators, senior officials, and managers	62	0.463	0.358	32	68
Professional and technical workers	1	1.000	0.862	64	36
	rank	score	avg	female	male
Educational attainment	27	1.000	0.955		
Literacy rate	52	0.999	0.897	100	100
Enrolment in primary education	1	1.000	0.980	89	80
Enrolment in secondary education	1	1.000	0.970	91	79
Enrolment in tertiary education	1	1.000	0.930	48	40
	rank	score	avg	female	male
Health and survival	143	0.939	0.957		
Sex ratio at birth	143	0.885	0.918	—	—
Healthy life expectancy	1	1.060	1.043	66	59
	rank	score	avg	female	male
Political empowerment	125	0.068	0.233		
Women in parliament	117	0.120	0.269	11	89
Women in ministerial positions	103	0.125	0.238	11	89
Years with female head of state (last 50)	68	0.000	0.204	0	50

Source: WEF 2016.

II.2 Armenia's Legal Framework for Gender Policy

The role of women in public life has reduced in the 20 years since the collapse of the Soviet Union. Armenian society largely rejected much of what was considered “Soviet” in nature and with it, patriarchal views and customs resurged (ADB 2015). Today, women are particularly affected by the ongoing transition to a market economy, low economic productivity, and high unemployment (OECD 2014). However, the post-Soviet decades saw a growth of diverse women’s civil society organizations in the country, dedicated to advancing women’s rights and equality between women and men (ADB 2015). Armenia also developed a solid legal and policy framework for the protection of equal rights and ratified the Convention on the Elimination of All Forms of Discrimination Against Women (CEDAW) in 1993, and the Optional Protocol on Violence Against Women in 2006.

The primary institutions responsible for gender policy are the Council on Women’s Affairs (under the Office of the Prime Minister) and the Division of Family, Children and Women’s Issues within the Ministry of Labor and Social Affairs, which regularly engages with international

organizations and local nongovernmental organizations (NGOs). The newly enacted equal rights law calls for creation of an institution devoted to the articulation of policy that promotes equality between women and men (and monitors its implementation).

According to a recent gender assessment by the Asian Development Bank (ADB 2015), the term “gender” is not widely understood in Armenia outside of specific spheres—selected government offices, civil society organizations, and academia. Many view it as a concept brought to Armenia from elsewhere. The unfamiliar nature of gender terminology partly explains why sex-disaggregated data and gender statistics are lacking in most sectors. Capacity to collect such data is limited to the National Statistical Service of the Republic of Armenia (NSS) and has not been developed in other government agencies.

Armenia’s Constitution enshrines the right to equality between women and men and outlaws all forms of discrimination on the basis of gender and other characteristics (Article 14.1). In 2013, Armenia adopted the *Law on Equal Rights and Equal Opportunities for Men and Women*, which reiterates the country’s commitments under the Constitution and international conventions. While adoption of the Law is a significant step forward, the challenge now is to enforce and comprehensively monitor its implementation.

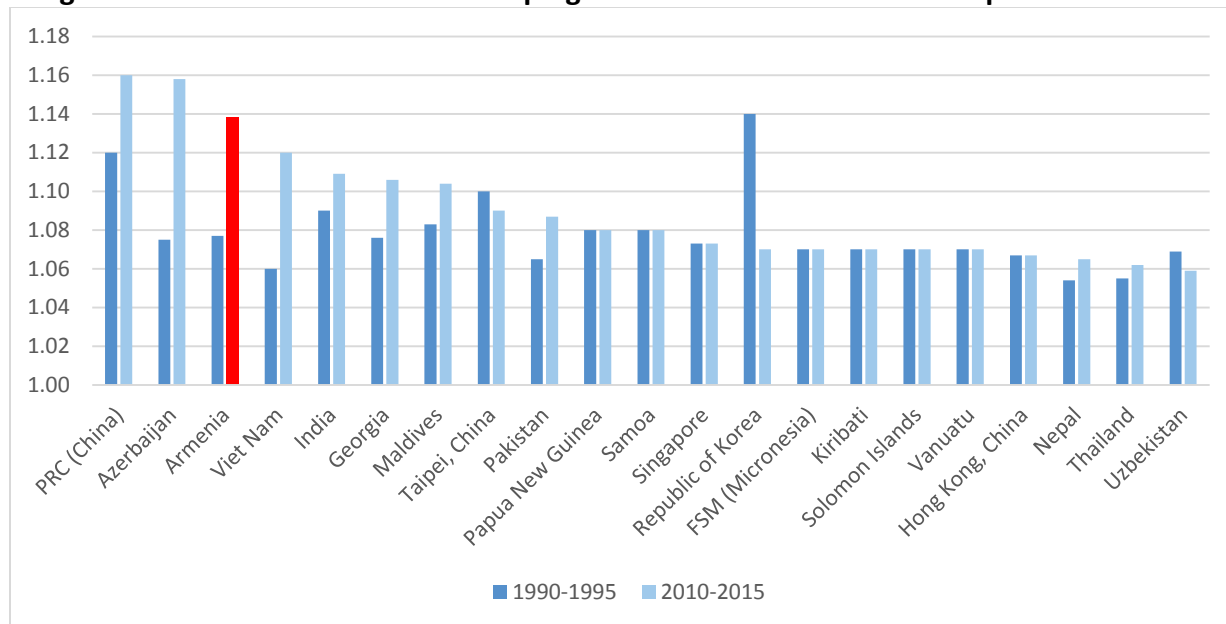
Overall, Armenia has a relatively good track record on gender and the law, with a couple of key exceptions. Armenia has almost no overtly discriminatory laws but two specific “legislative gaps” provide an enabling environment for employers with a preference for not hiring women because of gender biases or perceptions about lower productivity. Specifically, there is an absence of any legal prohibitions for prospective employers to ask about family status, and an absence of a mandate for nondiscrimination based on gender in hiring. Legislation that promote equality between women and men include (IFC, *Gender and the Law*, 2016):

- No legal differences exist between women and men (unique in the region).
- It has quotas for Parliament (20 percent women required).
- Of nine justices on the Constitutional Court, two are women.
- Women have equal property rights and inheritance.
- Childcare is provided for children under primary school age, the government provides a child allowance to parents, and employers must provide sick leave for parents.
- Maternity leave (140 days) and paternity leave (60 days) are fully paid.
- Although there are no domestic violence protections under the law, or criminal penalties for domestic violence, legislation exists on sexual harassment in employment.

II.3 Imbalanced Sex Ratios in Armenia

Sex ratios in Armenia are cause for concern. While sex ratios at birth fluctuate naturally, the widespread availability of affordable means to discover the sex of an early fetus has caused wide distortions in the sex ratio. Falling fertility rates have combined with a strong social norm of favoring sons to make improved prenatal diagnosis technology a tool for prenatal sex selection. There are 113 boys born for every 100 girls (well above the benchmark incidence of 106), reflecting many parents' preference for sons (World Bank 2016a) (Figure 6). The phenomenon became more pronounced in the past 20 years, and gender imbalances in Armenia grew at a much faster pace than in other countries. Media advocacy is being tried in Armenia to correct the problem; while these efforts have not yet been formally evaluated, they have been found effective elsewhere in altering a wide range of norms and behaviors (Das Gupta 2015).

Figure 6: Sex ratios at birth in developing Asian economies: male births per female births



Source: ADB 2015.

II.4 Armenian Women's Access to Land and Finance

Armenian law guarantees women and men equal rights to ownership and use of land and other property, but in practice, women are the minority of registered property owners. In part, this is based on traditions of registering property in the name of male family members and passing it down to male heirs. Women's earning power is also less than men's, limiting their opportunities to independently purchase property such as land, homes, buildings, or vehicles. State land privatization schemes carried out in the early 1990s awarded land to the head of the

household, regardless of gender. In reality, however, women only gained ownership of land in the absence of a male head of the family (ADB 2015).

According to a survey conducted by the Caucasus Research Resource Centers (CRRRC), the number of women who have bank accounts more than doubled in Armenia, from 15 percent in 2011 to 34 percent in 2012, with the most recent figures approaching the number of men with bank accounts. Although the share of women who reported that they have personal savings did not show such an increase (a change from only 7.1 percent to 10.3 percent over the same period), these figures too are comparable with men's reported savings patterns (ADB 2015). A recent survey of female entrepreneurs conducted by the ADB suggests high taxes, a lack of sales, and the cost and quality of utilities as major obstacles to business for women, before lack of financing. Respondents noted that although they could access loans, interest rates were often prohibitive. They also expressed a need for advisory services on finance, as well as tax and marketing support (Alanakyan 2014; Sevoyan and Agadjanian 2015).

III. Why STEM is Important for Women in Armenia

Economists are still debating the exact magnitude of women’s increased labor force participation on gross domestic product (GDP),² although emerging evidence suggests it is significant. According to the recent McKinsey report *The Power of Parity*, advancing women’s equality could add as much as US\$12 trillion to annual gross national product globally by 2020 (McKinsey Global Institute 2015). Cuberes and Teignier (2015) estimated the loss of income per capita due to gender gaps in entrepreneurship and workforce participation in OECD countries to be about 15 percent. They found substantially higher losses when extending the model to developing countries. In Armenia, women’s low participation in employment and entrepreneurship results in a loss of 14 percent foregone expansion in GDP (World Bank 2016a).

Leveling the playing field to include more women in the labor force is of vital economic importance for various countries with a falling birth rate. Research shows that when women have equal access to economic opportunity, social empowerment, and higher wages, their children also often benefit. Women are more likely than men to save and invest their increased wages in their communities and families, which leads to improved education and health outcomes for their children, including improved survival rates of girls and higher rates of child nutrition. Women spend roughly 90 percent of their income on their families; by contrast, men contribute 30–40 percent (Forston 2003). Evidence also exists that gender-diverse teams lead to better outcomes, and should therefore be encouraged as part of successful business strategies (Wooley et al. 2010).

STEM jobs are increasingly in demand in the global economy. As the world transitions to an increasingly digital economy, jobs in STEM will become a powerful driver of economic growth in the twenty-first century. Data suggest that pursuing jobs in STEM could be a good tactic for women. Jobs in STEM can advance the equality and status of women in several ways:

- *Demand:* Employment of STEM-skilled labor is increasing, and is expected to continue growing, primarily due to rising demand for specific products and the replacement of

² The restricted job opportunities for women in the Asia-Pacific region are estimated to cost between US\$42–46 billion per year, and similar limitations have led to the loss of enormous economic potential throughout the Arab states, which have the widest gender gap in economic opportunity (Tandon 2012). Another study found that the impact of an increase in the talent pool in the US economy between 1960–2008 saw aggregate output per worker increase by 15–20 percent; casting the recruitment net more widely to include women and minorities paid off (Hsieh et al. 2013).

retiring workers. Indeed, this sector was less affected than others by the global financial crisis of 2009–2010 (EC 2014).

- *Skills growth*: ICT-oriented jobs can offer women much better growth opportunities compared to stereotypical “female jobs” (Powell and Chang 2016). The irony is that women originally outnumbered men in ICT; the shift to a male-dominated field was accompanied by wage growth and prestige. Jobs in STEM offer the chance to build skills that are transferable not only within the field, but also to other sectors (Powell and Chang 2016).
- *Flexibility*: STEM jobs often have the potential to offer flexible hours and locations, which helps women to balance household and professional responsibilities. STEM also offers a range of self-employment options (Goldin 2015).
- *Pay*: Jobs in STEM pay more, and gender wage gaps in these occupations are lower than in other sectors (Olivetti and Petrongolo 2016).
- *Voice*: As women become increasingly active users of technology, their participation in designing and developing tech products and services will help to enhance technology’s relevance (Powell and Chang 2016).

IV. Barriers to Translating Academic Success into Labor Market Participation

A literature review (summarized in Annex 1) reveals that barriers to young women successfully participating in the labor market are first encountered at school and then replicated in the workplace. Men and women acquire different skills as part of formal education, and that determines differences in employment and remuneration (World Bank 2012). Women also receive different messages at school regarding what is possible in terms of goals and future careers: schools are not value-free, neutral environments that prepare all students equally (Stromquist 2002). These barriers can be summarized under three general categories: information asymmetries, institutional failures, and stereotype threat. In some cases access is also an issue.

At work, inequality may be related to structural factors rooted in economic and institutional systems, both formal and informal. Often, these factors work in concert, which may trap women in a vicious cycle of low productivity. Three broad factors explain the gender productivity and pay gap in labor markets:

- Time constraints that result from differences in household responsibilities
- Access to productive inputs such as land and finance
- Systems failure, including market and institutional failures that constrain women's entry and progression in certain fields, especially STEM

A mixed-methods analysis was conducted to evaluate these global findings against the Armenian context. Quantitative data were collected from the NSS and the Labor Force Survey (2014),³ and a qualitative analysis was conducted to examine the presence and relative influence of factors that prevent Armenian women from translating academic success into productive careers in the STEM field. Focus groups were conducted in 4 of Armenia's 23 STEM-focused VET (vocational education and training) institutions; in 4 of its 29 STEM-focused universities; and in 5 of Armenia's 25 leading STEM employers. In addition, focus groups were conducted in 4 non-STEM VET institutions and universities and in the TUMO Center for Creative Technologies in Yerevan (the capital) and in Shirak and Gegharkunik *marzes* (provinces). In-

³ The LFS 2014 data present some issues. The data are organized monthly, thus the selection of the month is arbitrary. Almost two-thirds (63 percent) of the sample do not have information on industry/profession or degree studied in tertiary education, thus the number of cases may not be large enough to make valid inferences.

depth, one-on-one interviews were also conducted (see Annex 2 for a methodological overview).

Table 1 summarizes the different factors that constrain women from studying STEM fields and pursuing STEM careers. Each is explored using both qualitative and quantitative data. Educational constraints are discussed in section V, while constraints to work are presented in section VI.

Table 1: Summary of barriers to equality of opportunity and outcomes in STEM in Armenia

At School	<p>Access</p> <ul style="list-style-type: none"> • Unequal access to quality education in rural areas • Education fee in STEM-oriented private high schools
	<p>Information Asymmetries</p> <ul style="list-style-type: none"> • Lack of career counseling: impact of stream choice on future career prospects • STEM education and careers are not perceived as popular and prestigious in Armenia: Economics and Law are preferred
	<p>Institutional Failures</p> <ul style="list-style-type: none"> • Male students get deferment from obligatory military service through higher education scholarships, resulting in a higher number of male recipients of STEM scholarships
	<p>Stereotype Threat</p> <ul style="list-style-type: none"> • Pressure from families and self-selection of girls into traditionally “female” fields • Strong messages that men are more intelligent than women
At Work	<p>Time Constraints</p> <ul style="list-style-type: none"> • Women with children have to interrupt their careers to take maternity leave, and childcare becomes prioritized: they lose opportunities for promotion and skills development • Men are expected to be the head of the family, key “breadwinner,” and decision maker; as such, they rarely take paternity leave
	<p>Access to Productive Inputs</p> <ul style="list-style-type: none"> • Women miss out on opportunities to develop skills since they are averse to long hours and travel
	<p>Systems Failure: Stereotypes and Bias</p> <ul style="list-style-type: none"> • Gender segregation: men comprise the technical and professional-track careers at STEM firms, whereas women mainly hold non-STEM positions (accountants, human resources, public relations, administrative, and office staff) • Glass ceiling: women who graduate from STEM institutions generally hold mid-level positions while managerial positions are held by men • Women earn less than men • Success stories of women in STEM are not widely disseminated
Other	<ul style="list-style-type: none"> • While STEM employment is well paid, careers in the field are perceived as unstable and risky • STEM workplaces are lacking in regions outside Yerevan

V. Women and Education in Armenia

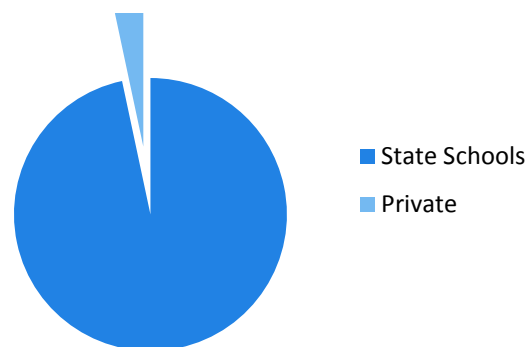
V.1 Overview of Armenia's Educational Structure

Education has long been regarded as an important factor in Armenia's national identity, survival, and progress. As a result, it remains highly valued by the public and a priority for the government. Since independence in 1991, significant reforms have been implemented across all aspects of the education system, with some vestiges of the Soviet system retained.

- **360,000 students attend 1,438 general schools:** 11 primary schools, 487 basic schools, 809 general secondary schools, 21 colleges/lyceums (grades 5–12), and 110 high schools (grades 10–12)
- **Post-secondary education:** 97 state and private institutions with 84,591 students enrolled; vocational schools enroll 24,300 students
- **Administration of schools:** Decentralized to the capital city of Yerevan and 10 *marzes* (provinces)

Figure 7: Share of private versus state schools in Armenia

Source: NSS accessed 2016

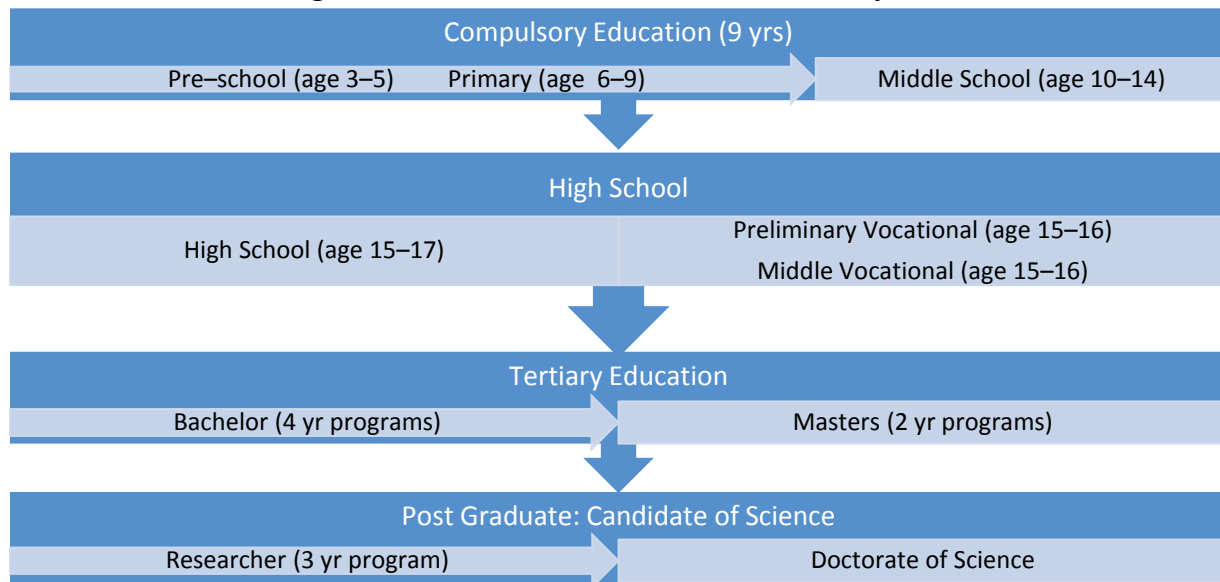


The 12-year school education system requires grade 9 graduates to continue their education in a high school or choose a VET institution

(Figure 8). This streaming approach requires students to choose either a “general” stream (in Natural Sciences, Mathematics, Humanities, or General) or a “vocational” stream. Within the general stream, students have three options: Humanities (with subjects focused on languages and history); Physics-Mathematics; and Chemistry-Biology (which usually leads the pupil to a medical career path). Large schools also offer Economics and/or Law classes—currently among the most popular career choices in Armenia.

STEM fields can be pursued along both general and vocational streams. In some geographical areas, though, schools only operate up to grade 9, and students are obliged to continue their education in high schools or VET institutions located in the closest urban communities. Several factors can affect stream choice: the poor quality of education and availability of teachers in rural areas; a lack of professional orientation sessions; and lack of understanding of what each stream entails regarding future career prospects.

Figure 8: Structure of Armenia’s education system

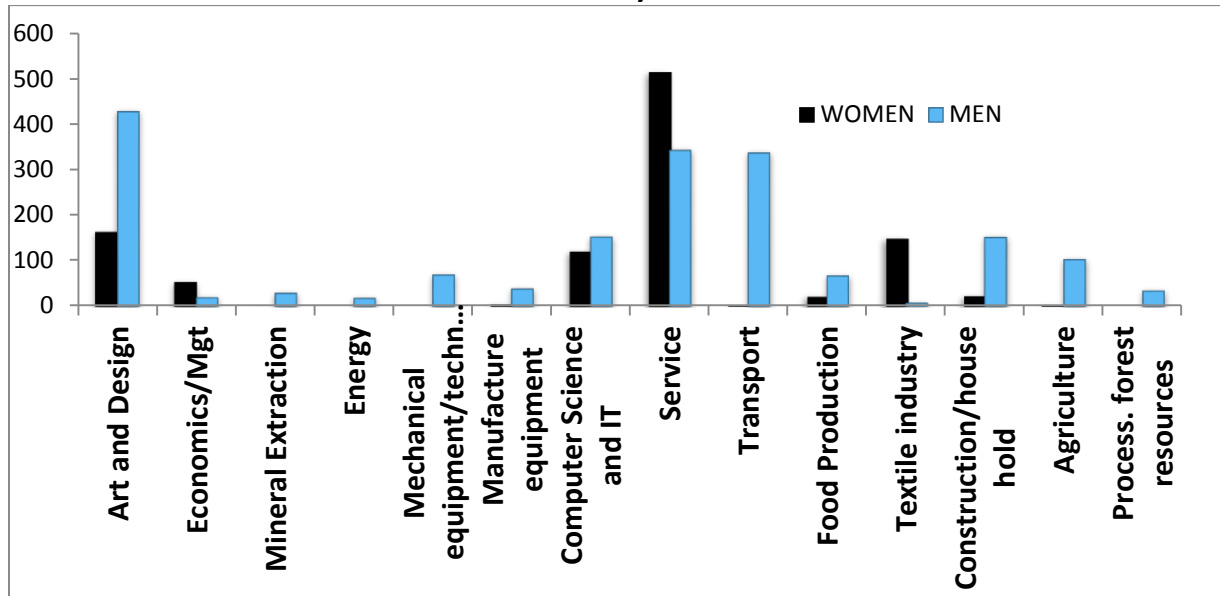


More Armenian girls are enrolled across the education system from primary to higher education, compared with boys. Additionally, virtually no difference in academic achievement exists among girls and boys. In fact, girls tend to outperform boys on international student achievement tests such as the Trends in International Mathematics and Science Study (TIMSS) although these differences are not statistically significant. (Armenia participated in TIMSS rounds for years 2003, 2007, and 2011. Although the country did participate in the 2015 TIMSS assessment, the results were not published.⁴)

Women do very well in terms of educational achievement and attainment. Armenia stands out in the region for its high tertiary education enrollment—46 percent in 2012 (Sondergaard et al. 2012). Enrollment figures show that girls tend to stay in education for a greater number of years, up to the level of post-graduate education. More boys, on the other hand, enter preliminary vocational education after having completed basic or general education (at the preliminary vocational level, 72.4 percent of students are men) (Figure 9). At the middle vocational level, the gender balance switches, with 47.1 percent male enrolment and 52.9 percent female. At the tertiary level, more women (52.1 percent) are enrolled at higher professional educational establishments than men. Thus no clear barriers keep women from accessing higher education. However, women do tend to fall off the academic track at the doctoral level.

⁴ Note that TIMSS 2015 were not disclosed by Armenia due to incomparability issues across years. The country has never participated in OECD PISA.

Figure 9: Female and male students in preliminary vocational education by specialization, academic year 2015



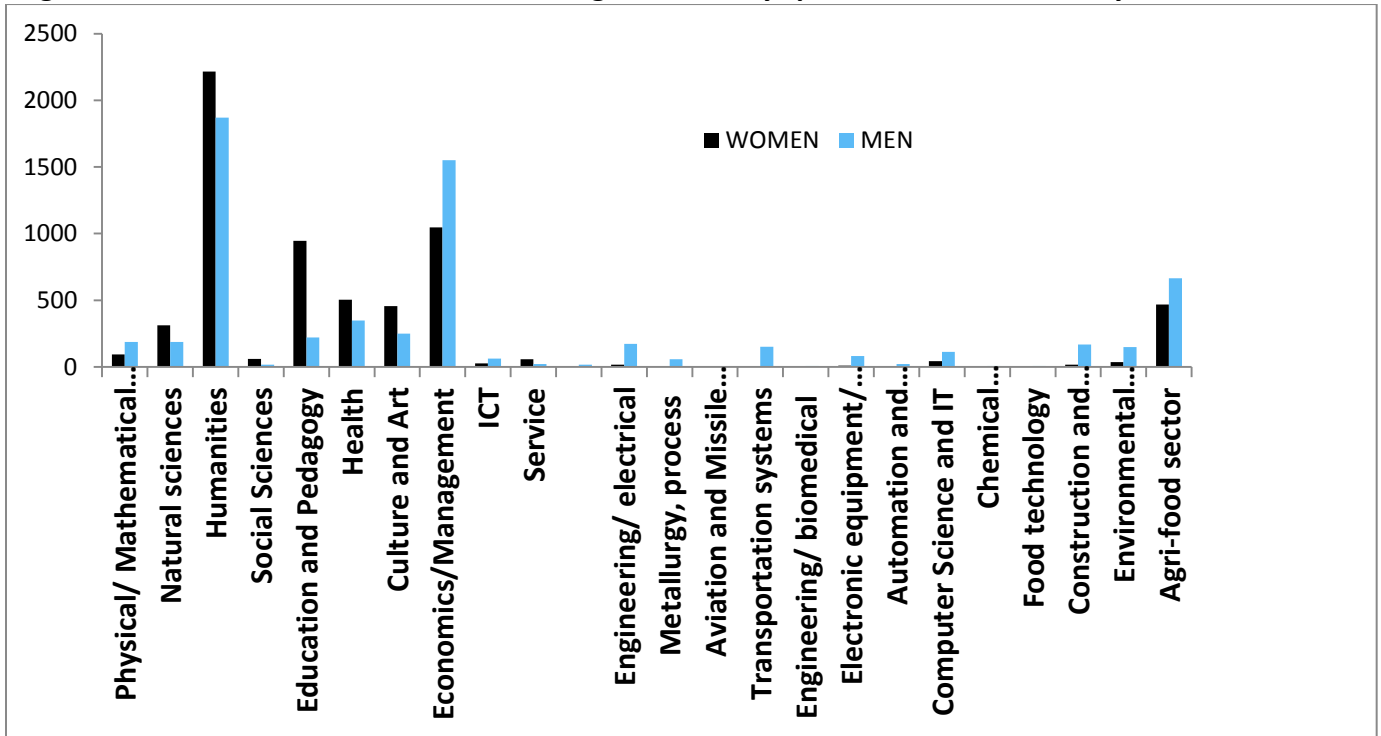
Source: NSS accessed 2016

Women’s education choices show stark patterns of gender segregation.⁵ From preliminary and middle vocational educational levels, women are concentrated in traditionally “female fields of study” such as teaching, health, the arts, and services, whereas young men tend to enter a more diverse array of technical fields, particularly construction, transport, machine building, and computer engineering.

The patterns are similar in higher education, with women concentrated in the humanities and men in technical areas (Figure 10). It is important to note that this is a recent occurrence: during the Soviet era, Armenian women outnumbered men in universities; they formed the largest majority in the faculties of medicine, art, education, foreign languages, and Oriental studies (70–90 percent). A significant increasing trend was also visible in such specializations as radio electronics, information technologies, and chemistry as well as management, banking, marketing, international relations, and law. The ratio of female to male researchers involved in academic institutions and in the Academy of Sciences averaged 39–46 percent from 1996 to 1997. The number of female students continued to rise from 2002 through 2005. By 2005–2006, women outnumbered men in almost all specializations, with the exception of law, agriculture, transport/communication, and industry/construction (Khachatryan, Grigoryan, and Serobyanyan 2015).

⁵ Source for enrolment and graduation data: NSS, accessed December 2016.

Figure 10: Female and male students at BA graduation by specialization, academic year 2015



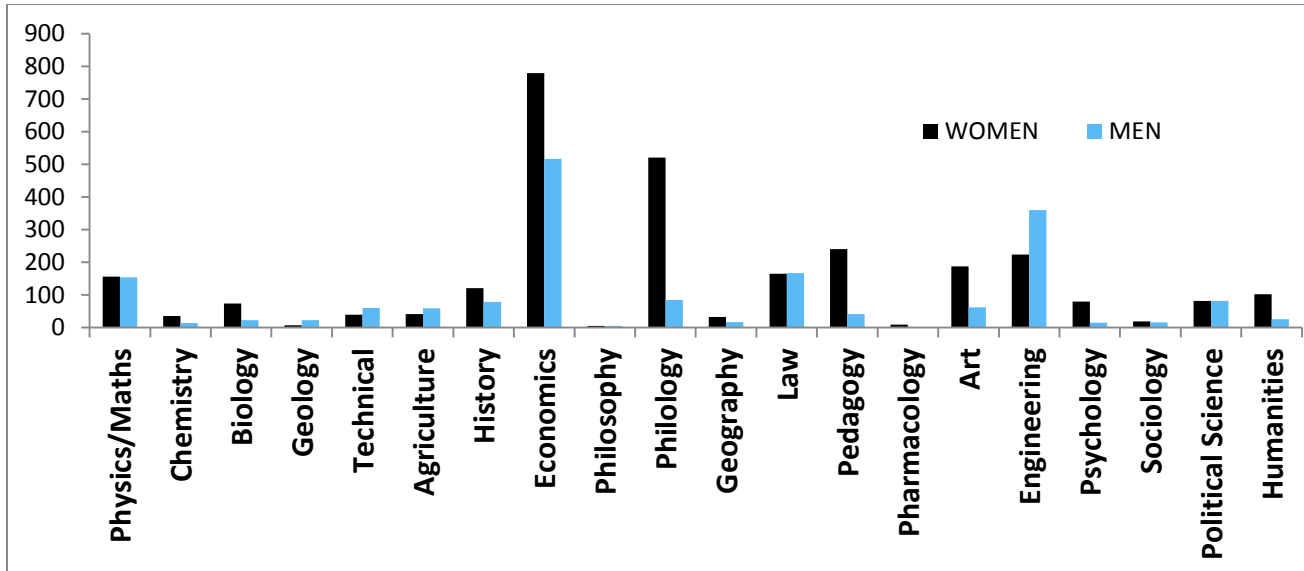
Source: NSS accessed 2016

Thus the education that women receive may not correlate with labor market demands (ADB 2015). Among the numerous young women who complete higher education, many do not become employed after graduation, either because their qualifications do not meet labor market demands or because they marry (World Bank 2016b). That said, an encouraging trend emerging at the Masters level, where there is more gender parity in terms of choice of and diversity of field, including STEM subjects (

Figure 11).

Figure 11: Graduation from MA programs by gender and specialization, academic year 2010

V.2 Overview of STEM Education in Armenia



Source: NSS accessed 2016

A number of STEM-oriented high schools are operating, mostly in Yerevan. The majority are private and fee-based. Students who study at these institutions are often motivated by their families to choose a STEM career path. These schools are considered to be high-quality, with pupils usually winners of awards or school olympiads. They also provide professional orientation sessions to help students assess job prospects in STEM. As a rule, graduates of these schools enter STEM VET institutions and universities without additional effort such as private tutoring. Graduates of regular high schools who want to continue their education at university usually attend additional private lessons to be able to pass entrance exams.

The number of VET institutions and universities operating in Armenia has slightly decreased since 2012, as has their student enrollment. Similarly, although the number of students enrolled in universities is much higher than in VET institutions, enrollment in STEM fields has decreased, and the number of students enrolled in STEM fields is lower than in the humanities and social sciences.⁶ According to information acquired through key informant interviews, the percentage of women enrolled in STEM courses at VET institutions has *decreased*, but the percentage of women enrolled in STEM courses at universities has *increased*.

STEM education fees in Armenia are lower than non-STEM education fees in both VET institutions and universities. For example, at Yerevan State University, which has the largest number of students and offers different STEM and non-STEM education paths, the ICT department's tuition fees are about US\$1,200 per year and other STEM departments' fees are about US\$890 per year; in contrast, social sciences courses are about US\$1,320 per year.⁷ According to the qualitative research conducted for this report,⁸ low tuition fees and scholarships in STEM motivate both male and female students to enter these fields of study.

"I was considering different universities and professions. I wanted to study medicine, then law. But the tuition fees there were very high. I didn't want my education to become a financial burden for my parents. That's why I have chosen physics. This profession gives me an opportunity to become an IT specialist and also provides a smooth transition to other professions." (Yerevan, STEM University, female student) Source: World Bank focus group conducted 2016, see Annex 2 for methodological overview.

VET institutions try to enroll as many students as possible, through the simplification of admission criteria, and agreements with universities;⁹ they also try to tailor courses to labor market needs. VET institutions offer three- to four-year courses, and graduates of 12-year high schools can enter VET institutions for a shorter period. VET institutions' tuition fees are low compared to those of universities, and they offer scholarships based on social, economic, and educational criteria. Universities have more limited scholarships but offer discounted fees for top students. For students from low-income families and from remote regions bordering Azerbaijan, VET institutions and universities often find a way to reduce the fees irrespective of

⁶ <http://www.armstat.am/file/doc/99499398.pdf> (pp. 129–135).

⁷ http://www.atc.am/files/Dimord%202016/masn_cucak2016.pdf

⁸ The quotes from the qualitative research were selected to reflect the sentiments that were representative of the interviews and focus groups, unless otherwise noted. When contradicting or opposing sentiments emerged from different participants, the quotes most representative of the spectrum of opinions were selected for inclusion.

⁹ Most VET institutions have agreements with corresponding universities. Based on those agreements, graduates of VET institutions who have excellent and good marks can enter the university either without exams or can start from the third semester.

grades. Male students who took part in the so-called “Four-Day War”¹⁰ also receive discounted educational fees.

Increasingly, STEM VET institutions and universities are deepening linkages with industry so that students are better prepared for the workplace. Students have more opportunities to get involved in the professional community through students’ committees, international conferences, and other events. They also have opportunities to communicate with representatives of professional organizations, which facilitates future employment opportunities. Synopsis, an ICT company, supports scientific and research programs at select STEM universities, whereby students who pass relevant examinations can choose to participate in a program where additional Synopsis system-based disciplines are taught. Students receive instruction from lecturers from both the traditional university departments and Synopsis, thus deepening the relevance of the curriculum. Finally, some mining companies have contracts with universities to organize field visits and subsidize the fees for eligible students who in exchange are asked to fill job vacancies in remote areas for a couple of years after graduation.

V.3 TUMO Center for Creative Technologies

Non-formal, or extracurricular, STEM programs are increasingly available, largely through facilities operated by the TUMO Center for Creative Technologies located in Yerevan and in several major regional cities. TUMO was launched in 2012 and aims to achieve effects beyond the formal education system by stimulating the interests of young people in ICT careers through free animation, game developing, film making, and web design of educational programs for children aged 12–18.¹¹ TUMO is a two- or three-year program that takes participants through an introductory curriculum that touches on all four focus areas, followed by a succession of increasingly challenging projects, and then a final project focusing on one of the focus areas. TUMO also incorporates a set of artistic and professional skills development that are considered essential across all four areas.

TUMO has a self-sustaining financing model, the result of generous support from a foundation. Sam Simonian, co-founder of the telecommunications company Inet, and his wife, Sylva, invested in constructing the building in which the Yerevan center of TUMO is located. The TUMO Center occupies some of the floors in the building and others are rented to technology companies. While the Simonian family initially covered the cost of program development and any budget shortfall, the rental income is now sufficient to offer the program free of charge to any interested youth. Each of the additional locations outside Yerevan was made possible due

¹⁰ In April 2016, fighting intensified on the Armenian-Azeri border in a continuation of the long-standing territorial dispute.

¹¹<https://www.tumo.org/program/focus-areas>

to a collaboration between the Simonian family and a partnering organization that agreed to fund its establishment and operations. TUMO seeks cost efficiencies by circulating staff among its various centers, while also depending on over 100 professionals who volunteer their time to contribute to seminars and learning labs.

TUMO projects are often connected to real life opportunities. Participants are encouraged to submit their projects to international and domestic STEM competitions and festivals, or to publish in online venues and app stores. The learning experience at TUMO is punctuated by a variety of ad hoc events that are both internal and open to the public. STEM specialists are invited to give lectures on topics related to the TUMO curriculum.

There are advantages and disadvantages to TUMO operating outside the formal education system. TUMO has the flexibility to make changes to its curriculum based on participants' interests, and demonstrates market orientation and alignment to industry trends and demand. On the other hand, while TUMO participants create an in-depth portfolio during the two-year program, they do not earn a formal certificate or diploma. Thus young people interested in pursuing a STEM university degree must fulfill a separate set of requirements. As a result, TUMO participants in the 16–18 years-old range may drop out because of lack of time for extracurricular programs.

Despite such challenges, TUMO remains a highly popular program in Armenia. About 14,000 are registered at the four sites, with 10,000 of them assessed as active participants by the TUMO administration. TUMO has a good reputation, including coverage by international media such as CNN and Al Jazeera. The center uses mass and social media outlets to recruit new participants.

As part of its deliberately neutral and inclusive stance TUMO does not collect gender disaggregated data on participants. Key informants interviewed for this study noted that approximately half of the participants are female, with girls representing a larger share in programming and web design programs. No specific actions are undertaken to target and/or recruit female participants –yet some factors do provide gender balance at TUMO:

1. Non-discriminatory environment and spirit: the CEO of TUMO is a woman, and girls are welcomed as equally as boys in TUMO's "gender-blind" application process;
2. Gender balanced team of coaches working with participants. Although no specific actions are undertaken to provide gender balance among coaches, half of the coaches at the Yerevan center are women; and
3. Success stories of male and female TUMO participants disseminated equally through social media. Messages about female participants avoid the dismissive stereotype of "She is a girl, BUT she is smart" and focus on "She is smart."

Other factors in TUMO’s gender-neutral approach contribute to TUMO’s success. They include:

1. All TUMO services provided for free;
2. Adherence to a simple enrollment procedure, with applicants only required to provide a birth certificate and their parents’ names (no examination or other requirements are in place);
3. Comfortable modern physical environment paired with an innovative curriculum that has evolved in the past five years; unmatched by adaptations made in formal VET institutions and universities;
4. Emphasis on the advantages of pursuing STEM careers, including that they are well-paid and provide a wide range of employment opportunities and flexibility; and
5. Programs customized to fit participants’ skills level (beginner, intermediate, and advanced). Programs are modular, so every three months, participants who do not successfully complete a level can repeat it.

In short, TUMO instills a passion for STEM in both girls and boys, and brings a level of prestige to STEM. No formal evaluations have been conducted on the program’s outcomes, so it is difficult to generate quantitative evidence supporting the factors linked to the anecdotal success stories. However, even without a formal evaluation, specific elements of the TUMO curriculum and approach could be scaled up or adapted for use within Armenia’s formal education system.

V.4 Barriers to Women’s Education in Armenia

V.4.1 Access

Armenian families traditionally try to avoid separating young women from their families, yet high-quality education is concentrated in urban areas such as Yerevan. That means that more male students from other regions have opportunities to study in Yerevan than do young women. This inequality grows proportionally with the distance between students’ homes and Yerevan.

V.4.2 Information asymmetries

The Gender Barometer Survey (GBS) conducted in 2014 studied gender attitudes in Armenian society.¹² In the survey, 60 percent of respondents recognized that inequality exists between

¹² The first nationwide survey of its kind, the survey was conducted by the Yerevan State University (YSU) Center for Gender and Leadership Studies (CGLS 2014) from September to December 2014, in Yerevan and in all regions of Armenia with a sample of 2,134 respondents.

men and women in Armenian society. More than half of respondents (55 percent) thought that the main reason for inequality was the low level of awareness about women's rights in society.

V.4.3 Institutional failures in implementation

V.4.3.1 Mainstreaming action on equality between women and men

The Armenian government has taken several steps to emphasize equality in the articulation of public policy. In fact, integration of gender parity principles into Armenia's educational system was explicitly cited as a priority area for the government. This commitment was reflected in the adoption of the *Gender Policy Concept Paper* (Republic of Armenia) in 2010 and the *Law on Securing Equal Rights and Equal Opportunities for Women and Men* in 2013, which identified priority areas for education reform to promote gender parity.

The *Gender Policy Concept Paper* (Republic of Armenia 2010) states that education reform efforts should be focused on: (1) creating optimal conditions to maximize the creative and intellectual development of both sexes by further improvement and democratization of the education sphere; (2) educating socially active and responsible citizens, shaping an egalitarian gender culture, supporting equality of women and men in society, social justice, and enjoyment of social freedoms; and (3) establishing gender-balanced representation at all levels of the education sphere. The paper identifies the primary directions of gender policy in the education sphere as:

- The formation of an egalitarian notion of gender relations
- Drafting of new education curricula and manuals directed at the creation and implementation of principles of gender parity
- Overcoming of traditions that encourage patriarchal gender stereotypes
- Integration of gender education into the curricula as a mandatory component at all levels of the education system

While the articulation of this gender policy paper is a laudable first step toward promoting equality for women and men in the education sector, this commitment has not been translated into practicable laws, and has changed little in teaching or curriculum. For example, the *Law on the Adoption of the State Program of Educational Development (2011–2015)* and the second draft of the *State Program on Educational Development for 2016–2025* do not identify gender parity as an explicit principle of the state program. Similarly, the principles of equality for women and men have not been consistently translated into education standards, curricula, and textbooks in all subjects and levels of the educational system.

State standards provide a general framework for education content development, as yet unexploited. As such, they play an important role in setting the direction for a more concrete

elaboration of the actual curricula, syllabi, assessment, teacher guides, and textbooks. A disconnect remains, however, between policy and processes (e.g., standards, syllabi, teacher guides, and textbooks). Most of the school curricula and textbooks currently used were developed and published before these policy commitments were made and therefore did not undergo a gender analysis during or upon their production.¹³ Guidelines regulating a university’s activity also lack specific provisions on equal opportunities for women and men.

V.4.3.2 Textbooks

A World Bank study of Armenian textbooks analyzed nine high school textbooks in civics (grades 10 and 11), history (grades 10, 11, and 12), and Armenian literature (grades 10, 11, and 12) (Osipov and Sargizova 2015). In addition, the study analyzed academic standards, syllabi, and teachers’ guides for the same subjects.¹⁴ It found that continued imbalanced representations about women in school textbooks were perpetuated, that school textbooks are still predominantly written by men, and that stereotypes are pervasive in the broader school culture. The study made detailed suggestions on female historical figures whose contributions to art and science could be included in the next round of textbooks.

Table 2: Frequency of representation of female and male personalities and characters in textbooks (text and graphics, 2015)

Subject	Representation of women	Representation of men
Civics	17.5%	82.4%
Civics (grade 10)	18.4% (120)	81.6% (531)
Civics (grade 11)	16.4% (53)	83.6% (269)
Civics (grade 12)	17.9% (103)	82.1% (472)
History	4.2%	95.8%
History (grade 10)	5.8% (28)	94.2% (450)
History (grade 11)	2.5% (20)	97.4% (769)
History (grade 12)	4.4% (29)	95.5% (625)
Armenian Literature	19.5%	80.5%
Armenian Literature (grade 10)	18.9% (316)	81.1% (1358)
Armenian Literature (grade 11)	19.9% (342)	80.1% (1376)
Armenian Literature (grade 12)	19.8% (744)	80.2% (506)

Source: Osipov and Sargizova 2015.

The analysis of textbooks found that across all textbooks and grade levels, women are less frequently identified in their professional

In most Armenian textbooks, women are not only less visible than men, but they are also presented in stereotypical ways, often appearing as passive, submissive, and dependent on men. Women and girls are principally linked to their family status, particularly to being a mother, wife, daughter, and grandmother. In the 10th grade Armenian literature textbook, images of women frequently appear in the context of motherhood, highlighting their modesty, beauty, humility, propriety, and readiness to sacrifice themselves for the sake of their husbands and homeland.

¹³ For example, the state educational standards were developed by men.

¹⁴ The study deployed a coding methodology that identified gender representations.

capacities compared to men. When they are, the range of professions and occupations is generally limited to that of teachers and nurses. In contrast, men are presented as decision makers, shapers of political history, political and religious figures, advisors, generals, heroes, and cultural figures. They appear to occupy prestigious professions such as scientists, civil servants, doctors, governors, war participants, persons of arts, writers, clergymen, philosophers, and others.

For example, the grade 12 social studies textbook discusses achievements related to equality for women and men through the narrow lens of birthrates, rather than labor market integration or wider opportunities within society. Similarly, the grade 10 civics textbook generally portrays women through the lens of motherhood (as caregivers and child-bearers), often showing women in the context of their families and children. Principles regarding equality for women and men are not referenced in the state standards for Armenian language, literature, and history at the secondary level, and they are subsequently absent in curriculum content, syllabi, teacher guides, and textbooks (Osipov and Sargizova 2015).

V.4.3.3 Teaching staff

While the numbers of men and women on academic teaching staffs at universities are balanced, women are overrepresented in lower faculty positions and underrepresented in senior positions of research staff. And a large disparity persists within disciplines: women are

underrepresented in a number of fields of study and disciplines, including physics and mathematics, technical sciences, earth science, agricultural science, architecture and construction, philosophy, history, and political science (Khachatryan, Grigoryan, and Serobyan 2015). This status quo will be hard to shift without a quota system, since women are extremely underrepresented in the governing boards and scientific councils of higher education institutions, and according to regulations, 25 percent of university councils must be selected from existing faculty members. Candidates are supposed to have advanced academic degrees in relevant fields, which also limits women’s participation, since the number of female doctorate holders and professors is considerably fewer than male doctorate holders. The lack of women in the academic pipeline who pursue doctorates means that few break into the higher echelons of academia. Although women are pursuing Masters programs, only a fraction go on to pursue a PhD—data from 2015 show that only 2 women graduated with doctorates compared to 11 men.

The number of women gradually decreases at every higher-level professional position in research and education. This picture illustrates that there indeed exist real impediments to women’s academic career advancement to higher levels.

Source: Khachatryan, Grigoryan, and Serobyan 2015.

V.4.3.4 Response to incentives for men

Another crucial factor that pushes more men toward a STEM education path is obligatory military service. Usually, male students have to halt their studies at age 18 for two years of military service; however, admissions requirements for STEM-oriented specialties are lower compared to other fields of study, and scholarships allow for military service deferment.¹⁵ Thus, male students can both study for free and avoid military service. Service can be further delayed if the male student continues on to the post-graduate level, and can be avoided entirely if the student gains a PhD.

“Military service is an issue. The first impulse is to come and study here. Concurrence is low. Enrollment rate is low. The probability to get the scholarship and avoid the army is high enough. But don't think that army is the only reason to study here.” (Yerevan, STEM University, male student)

“There are more male students, who study for free. Military service is an issue.” (Yerevan, STEM University, female student)

V.4.4 Stereotypes

V.4.4.1 Gender bias

According to the ADB (2015), gender roles and norms have considerable influence in Armenian society, particularly notions about the roles that are acceptable for women and men. Strong perceptions associating women primarily with the private and family sphere are prevalent, and often limit women’s opportunities for self-realization in public life. Gender stereotypes contribute to women’s lower levels of representation in politics, in formal employment, and as business leaders. Men can also be negatively impacted by stereotypes, especially those that portray men as solely responsible for providing for their families financially—norms that are often increasingly difficult to fulfill given the realities of the labor market in Armenia today. This gender stereotyping starts at home and at school.

One survey found that traditional gender stereotypes are pervasive among Armenian high school teachers and students. Approximately half of the teachers interviewed believed that *“women and men should keep traditional professions”*; furthermore, 56 percent of teachers felt that a man can have any profession that he wants. The same survey confirmed traditional gender stereotypes among high school students themselves. In particular, only 43 percent of surveyed students believed that *“a woman can pursue any profession she wants,”* while half of the respondents stated that *“there are some professions that a woman should not have.”* Of all

¹⁵ Compulsory military service deferment for the duration of four years of undergraduate studies is granted according to the 14th article of the Republic of Armenia Law on Military Service Conscription. As the number of military deferment spots each university receives is limited, the process of receiving military deferment is competitive.

respondents, the majority of surveyed boys (73 percent) believed that *“there are some professions that a woman should not have”* (Andresson 2013).¹⁶

The same survey found that teachers treat male and female students differently. Students confirmed that they face different treatment and discrimination by their teachers. Furthermore, the survey revealed that teachers lack an understanding of what constitutes a gender-neutral approach to teaching and learning. The results indicated that 57 percent of teachers believed that they can change traditional stereotypes and that they do it in their work, while 14 percent responded that they can change traditional stereotypes in their teacher role but that they do not attempt to do it in their classrooms; 27 percent stated that their role is simply educational. When asked about the possibility of integrating a gender perspective in the curriculum, 32 percent of surveyed teachers responded that they would eagerly do it, while 33 percent responded that they would not like to teach it, and 36 percent did not know.

V.4.4.2 STEM stereotypes

In higher education, where women constitute the majority of all students, traditional gender roles persist. Gender stereotypes held by parents and students influence educational choices in Armenia. A 2013 survey of male and female students at Yerevan State University (Yerevan State University Center for Gender and Leadership Studies 2014)¹⁷ revealed that the vast majority of young people (over 90 percent of men and women) think *“a woman should have a good education.”* However, a considerably smaller percentage of surveyed students agreed that it is important or very important *“for a woman to have a successful career”* (46 percent of men and 62 percent of women). Women in STEM fields are seen as masculine. And male students in non-STEM fields of study get unpleasant messages about their choice, too. The focus groups and key-information interviews undertaken for this report found similar attitudes about men and women from students and employees alike.

“If a woman is involved in mining and construction, she is trespassing the scope of her femininity. She is losing femininity.” (Gavar, STEM University, Key Informant, female)

“Have you ever seen a female mechanic? Girls hear the word design and decide that it is a female profession.” (Yerevan, STEM VET Institution, administrative staff male representative)

“When I tell people that I study physics, they ask if I am crazy or look at me thoughtfully and say that’s a good choice. My goal is to show people that this profession is as good as any other.” (Yerevan, STEM University, female student)

¹⁶ The survey included 283 high school students and 50 teachers from three schools in Yerevan.

¹⁷ The survey included responses from 205 female students and 173 male students between the ages of 16 and 25.

Beliefs that male students are more intelligent than female ones were often expressed by both male and female respondents of different ages. This is considered the main reason for the dominance of men in STEM education.

“Male students are told: you have to study well, you are boys, this all is for you. Aren’t you ashamed that the girl studies better than you?” (Gyumri, STEM University female student)

“Female students are more hard-working, but male students are more intelligent. They take most awards, win competitions, especially foreign awards.” (Yerevan, STEM VET Institution, male representative)

“Girls who study with us have no chance to get excellent marks because their intellect is different from that of boys. History knows hundreds of famous male scientists, but no woman is mentioned.” (Yerevan, STEM University, male student)

“Unfortunately, in the last years we have more female students. The main goal of the mathematics faculty is to shape scientists. There are very few female mathematicians, 90% are male. If there are 60% female students, then the chances to have scientists decrease.” (Yerevan, STEM University Dean, Male)

“It depends. I have a female classmate. She is the best in our group. But such cases are very rare.” (Yerevan, STEM University, male student)

The dominance of male students in STEM and female students in non-STEM educational institutions creates a vicious cycle, whereby women are prevented/deterred by their families and peers from entering male environments, and vice versa. Boys are perceived to be non-masculine within non-STEM/female educational environments, and girls are perceived to be masculine within STEM/male educational environments.

“At the Linguistic University, all students are female. If a boy wants to go there, he will have to deal with the resistant position of family members. The same stereotypes are applied if a girl wants to enter the Polytechnic University.” (Yerevan, STEM VET Institution, male student)

“I wanted to become an engineer. But my father didn't let me. He is an architect and says that it is not a women's job, because you need to deal with builders and be involved in the construction process. It's not comfortable to work with men.” (Yerevan, STEM University, female student)

“One of the best programmers at our office was female. She told me that she wanted to enter the Polytechnic University, but once she entered the university cafeteria there were no girls there. All the boys stared at her, and she felt uncomfortable. That’s why she entered YSU, where more girls study in STEM compared to the Polytechnic University.” (Yerevan, STEM VET Institution, male student)

Nevertheless, both male and female students participate equally in all lessons and practical exercises. Both are given the opportunity to take part in different professional events and awards—in fact, women are more motivated to take part in such events than men.¹⁸ Furthermore, female students in STEM see themselves as privileged, compared to non-STEM students. Female students see themselves as more intelligent, self-confident, and even beautiful. Female STEM students are also generally more satisfied with the educational services provided by STEM universities and VET institutions than male students, who tend to be less optimistic about their STEM education, are more critical of their educational programs, and are unsure about their future employment and income possibilities¹⁹.

*“I like that the society considers me intelligent. People ask my opinion and take it into account.”
(Yerevan, STEM University, female student)*

“I am always very proud to say that I've graduated as a hydro engineer and have appropriate professional job and position.” (Yerevan, STEM female employee)

“In non-STEM (humanities) faculties you hear only girls' voices. Here in STEM we don't need to concur about our look. We are always beautiful.” (Yerevan, STEM University, female student)

¹⁸ The situation is different within the architecture track, where female students often start to lag behind their male peers as they avoid getting involved in building and planning exercises. Consequently, they do not have enough practical skills later, and are rejected from some activities since they only have theoretical knowledge.

¹⁹ The female students quoted in this section are “exceptional” in that they studying or working in STEM fields.

VI. Women and Work in Armenia

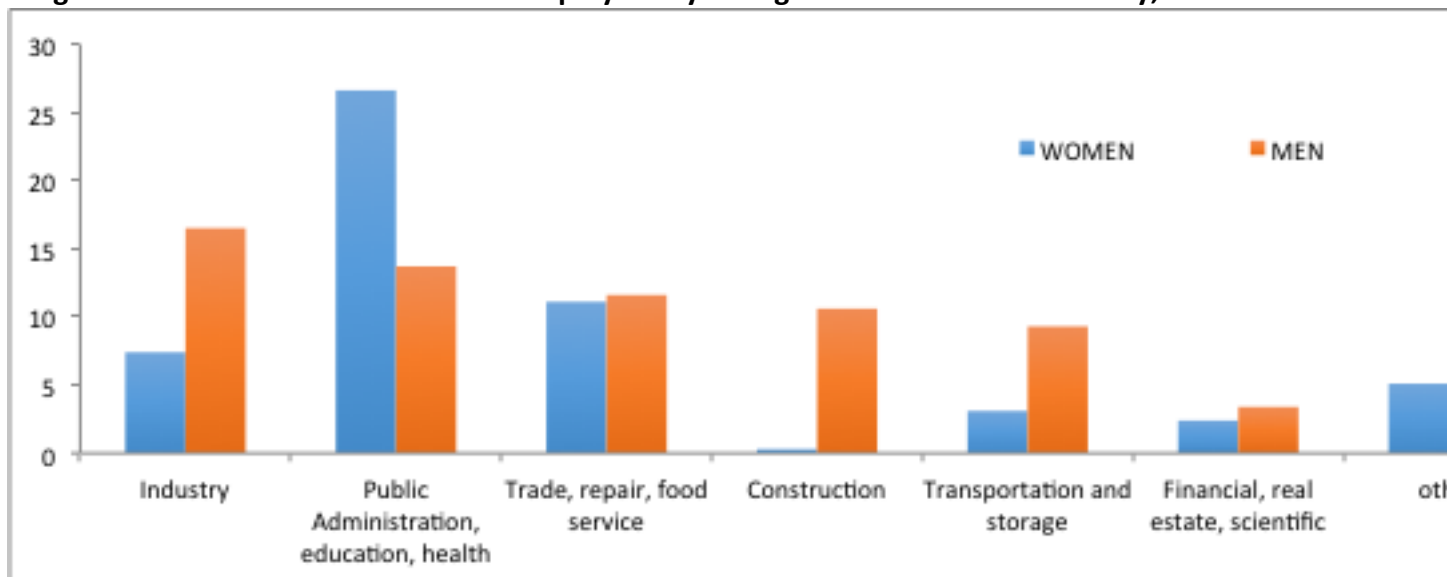
VI.1 Overview of Women's Employment in Armenia

Low-productivity employment is a challenge across the labor market in Armenia, where most jobs do not pay enough to lift people out of poverty. Nearly 40 percent of workers are concentrated in the agriculture sector, where nonmechanized work fails to reap productivity gains. By contrast, the modern, high-productivity sector is nascent (Rutkowski 2012). Low-earning jobs are defined as those that earn less than two-thirds of the median wage—in Armenia, one-quarter of jobs fall into this category—a significantly higher share compared to other European countries, where the incidence of low pay is within the 15–20 percent range. The significant presence of informality in nonagriculture sectors is another factor that contributes to low-productivity and low-earnings employment (World Bank 2015).

Marked inequality between women and men exists in Armenia's labor market. Just over half (54.2 percent) of women (15–75 years old) are economically active, compared with 72.6 percent of men. Armenia's large gender pay gap is largely due to labor market stratification: men tend to engage in a more diverse range of economic activities and higher-paying fields, while women are concentrated in the lower-paying fields of education, health services, and trade (ADB 2015).²⁰

²⁰ In the field of education, 84 percent of employees are women, yet they account for fewer than 40 percent of school directors (ADB 2015).

Figure 12: Share of male and female employees by nonagricultural economic activity, 2012



Source: NSS accessed 2016.

Decisions made at university carry into the labor market. Working women are concentrated in education, health services, and trade, while men are predominant in STEM fields and tend to engage in a more diverse range of economic activities in general.²¹ A comparison of labor market data for the last decade provides a mixed picture of the trends in economic activities of women and men. In some fields, gender segregation remained quite static, as is the case for construction employment. Fields such as financial activities and hospitality were always more gender-balanced, and women made important advances in some STEM fields such as ICT, financial and insurance activities, and wholesale and retail trade. But women are still underrepresented in upper management: about 67.8 percent of managers are men, while the number of female senior managers declined from 27 percent in 2012 to 23 percent in 2013 (ADB 2015).

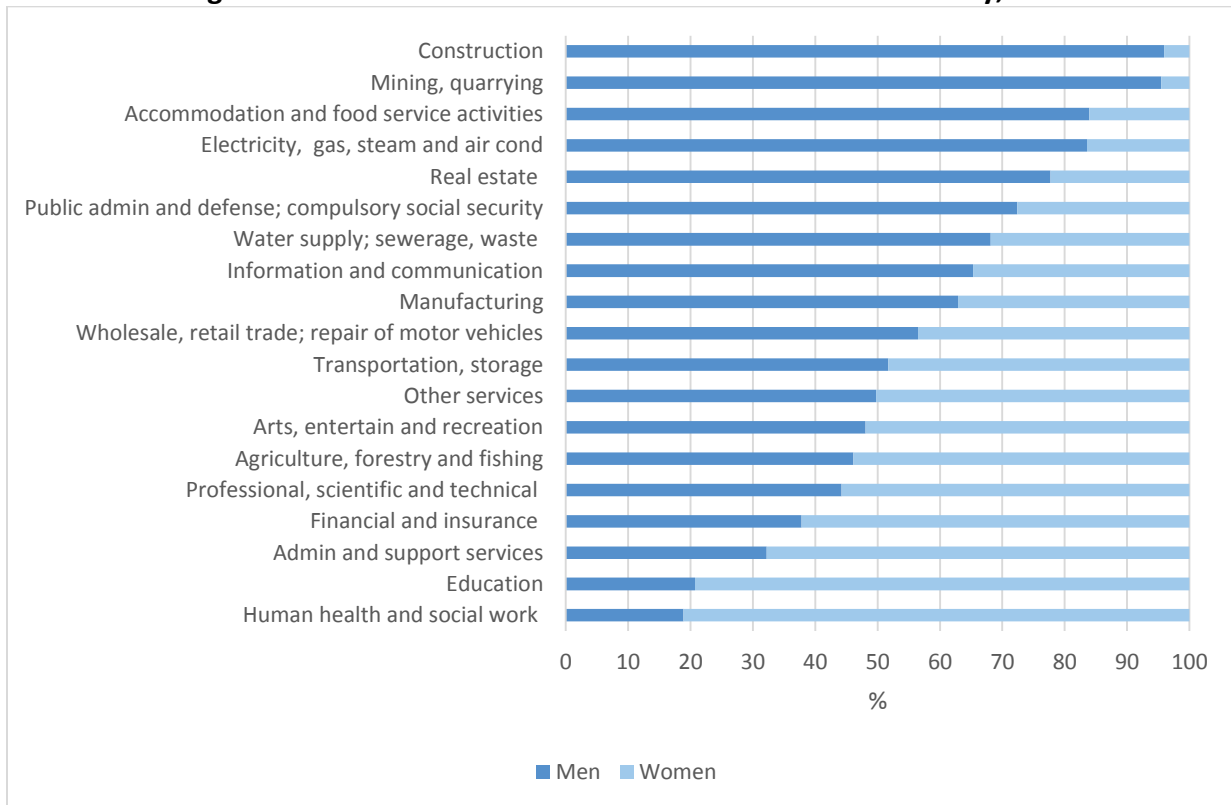
A significant proportion of women are engaged in informal work, or do not enter the labor market due to marriage. This leaves them without the protection of the Labor Law (e.g., a lack of maternity or childcare leave). Women represent a larger share of the registered unemployed and tend to spend a longer time searching for work than men. Men are more likely to become unemployed at the end of seasonal work, while women are much more likely to stop working due to family circumstances (ADB 2015). It should also be noted that large disparities arise between women who live in rural and urban areas of the country, with higher unemployment rates reported in the latter (Dallakyan and Bakhtavoryan. 2011).

²¹ Note this largely excludes the largest employment sector, agriculture, which employs the majority of workers: in Armenia, 44 percent of women and 31 percent of men are engaged in agriculture (ADB 2015).

VI.2 STEM Jobs by Sector

As in many other countries, gender patterns are observed in the sectors of employment for men and women. Although the majority of both men and women work in agriculture, men diversify more than women and are represented in other sectors as well. Data from the Labor Force Survey 2015 show that economic activities where men are overrepresented (80 percent of employed or more are men) are construction, mining and quarrying, accommodation and food services, and electricity and gas (Figure 13). In the activities related to STEM jobs,²² women comprise a smaller share in the case of information and communication (35 percent), while they are the majority of those employed in professional, scientific, and technical activities (66 percent) (Figure 13).

Figure 13: Share of men and women within economic activity, 2015

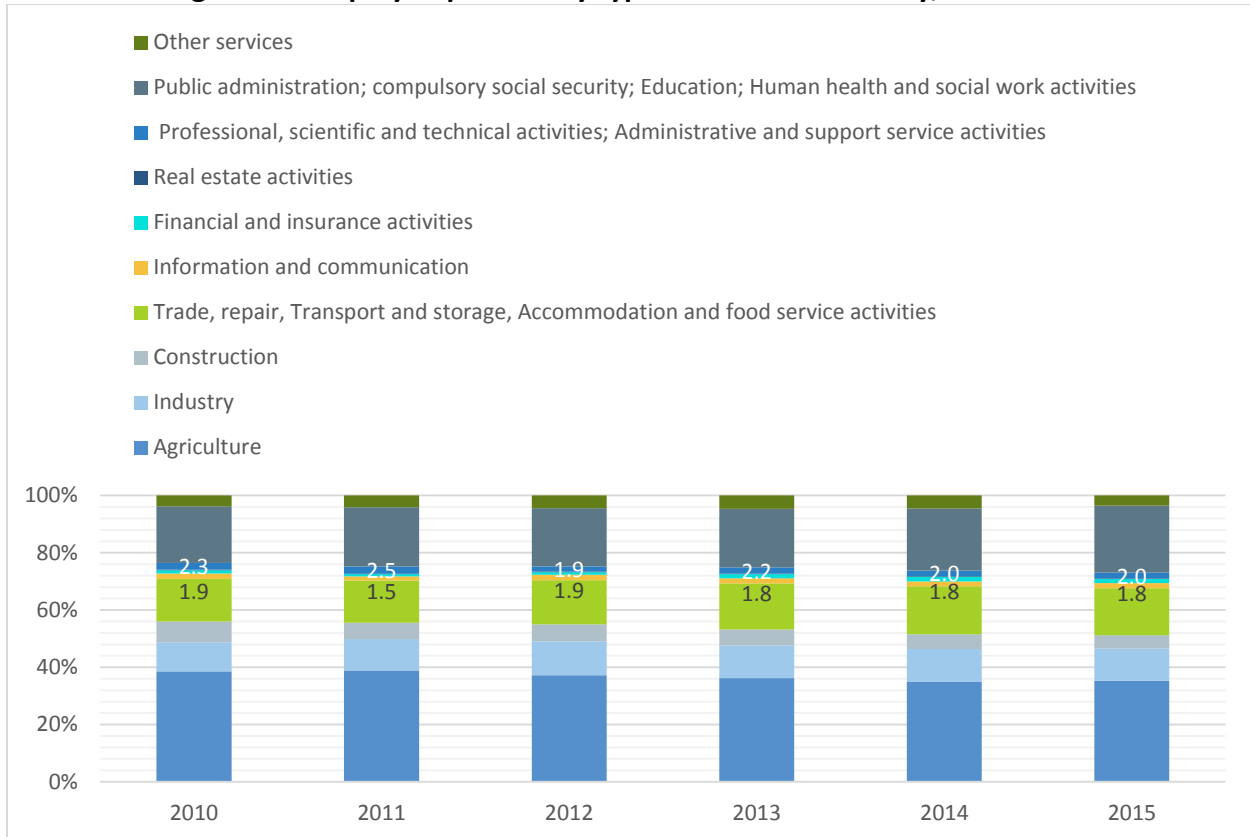


²² The classifications of economic activity and occupation available in LFS at one-digit code of the NACE and ISCO classifications are not precise enough to allow accurate description of employment in STEM-jobs. Unless otherwise noted, STEM jobs are approximated by two economic activities referenced in the NSS LFS 2010-2015: “professional, scientific and technical activities (and administrative and support service activities for employment data)” and “information and communication.” This definition approximates to a narrow identification of STEM-related jobs, potentially leaving out engineers in a variety of economic activities, however restricting the maximum inclusion type of error.

Source: LFS 2015, World Bank estimations.

The proportion of people working in STEM-related jobs was relatively small between 2010–2015, with most employed in the non-public sector and predominantly as wage employees. Figure 14 shows that the two economic activities that serve as approximations for STEM jobs each comprised only 1.8–2 percent of the labor force.

Figure 14: Employed persons by type of economic activity, 2010–2015

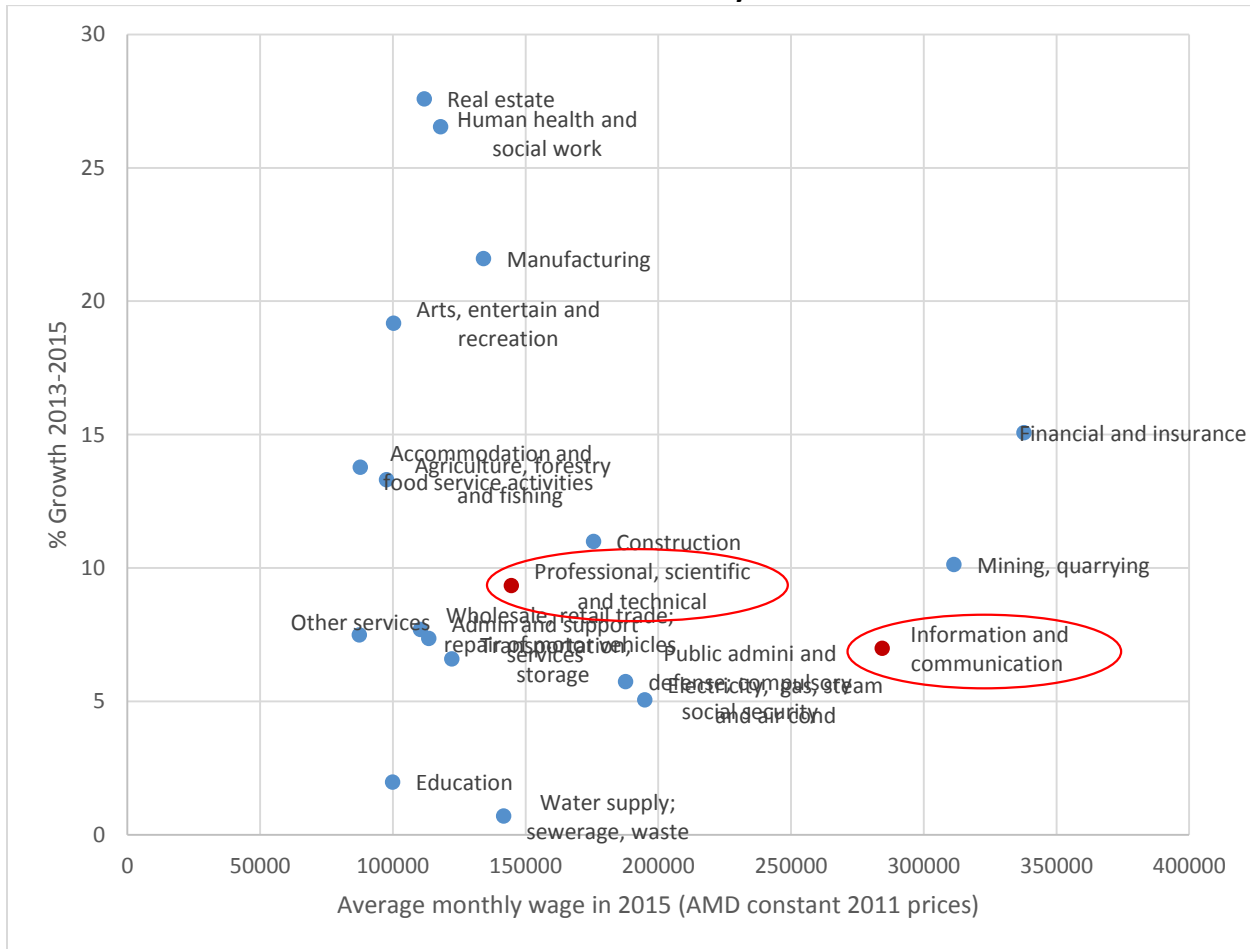


Source: NSS of RA. <http://armstat.am/en/> (Accessed March 27, 2017).

With respect to wages, the information and communication sector was among the three economic activities paying the highest wages in Armenia in 2015. Professional, scientific, and technical activities paid just below the average monthly wage in Armenia and are among those activities for which wages in recent years have grown relatively below the average (Figure 15).²³

²³ Figure 15 shows on the horizontal axis the average monthly wage not adjusted by hours worked. A more precise comparison of wages adjusting by hours worked is shown in Figure 16.

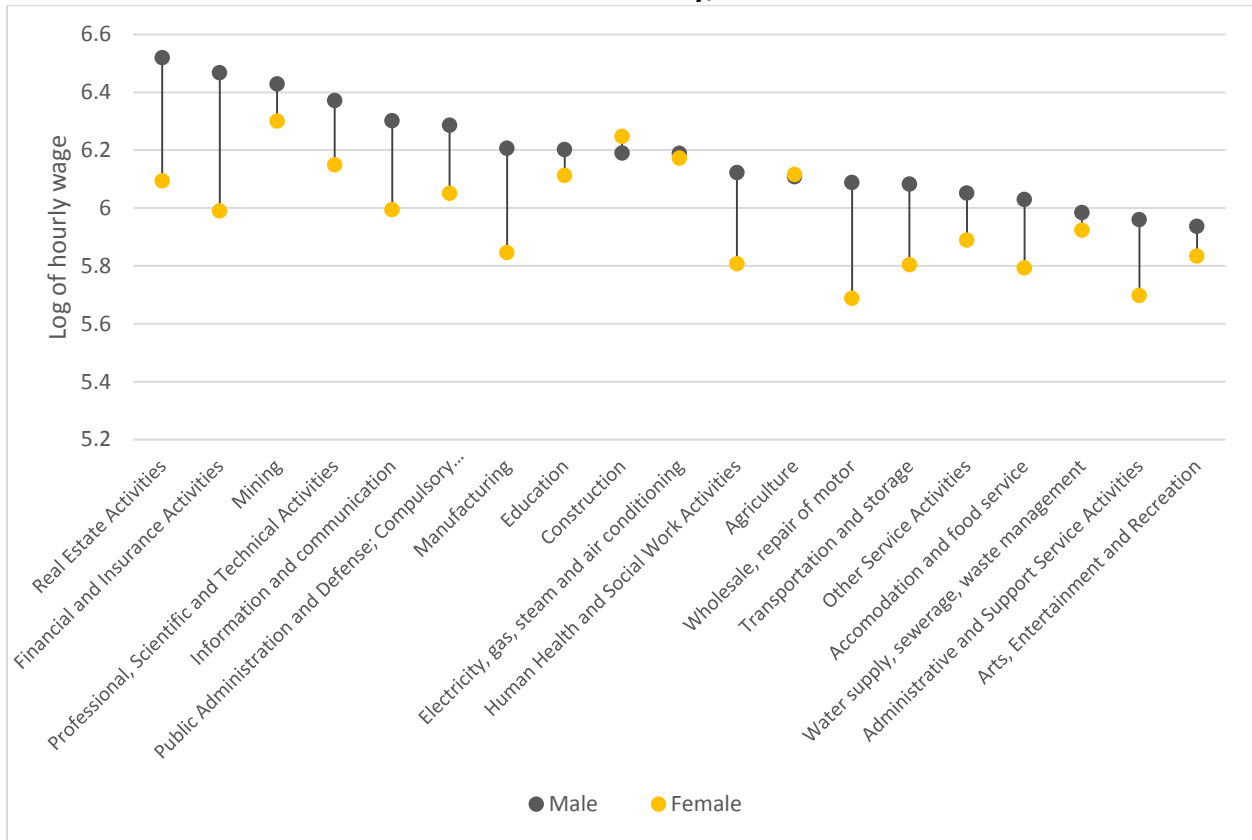
Figure 15: Average monthly wage level in 2015 and real growth between 2013 and 2015 by economic activity



Source: NSS of RA. <http://armstat.am/en/> (Accessed March 27, 2017)

Labor statistics show that women earned on average 33.5 percent less than men in 2015 (World Bank 2016a). A rough comparison of the average hourly wage for men and women by economic activity shows that the best paid economic activities for men are not the same for women given gender wage gaps within each activity. Professional, scientific, and technical activities and information and communication activities rank fourth and fifth among those with the highest hourly wages for men (Figure 16). Women earn 30 percent lower wages than men in professional, scientific, and technical activities (ranking fourth among highest wages for women). Wages in information and communication economic activities are 18 percent lower for women than for men and rank ninth in terms of highest paying wages. Although these are not the activities in which gender wage gaps are the widest, they are important given the representation of women in these two activities, particularly in professional, scientific, and technical activities, where women make up to 65 percent of the total people employed.

Figure 16: Hourly wage for men and women and share of women among total employed by economic activity, 2015

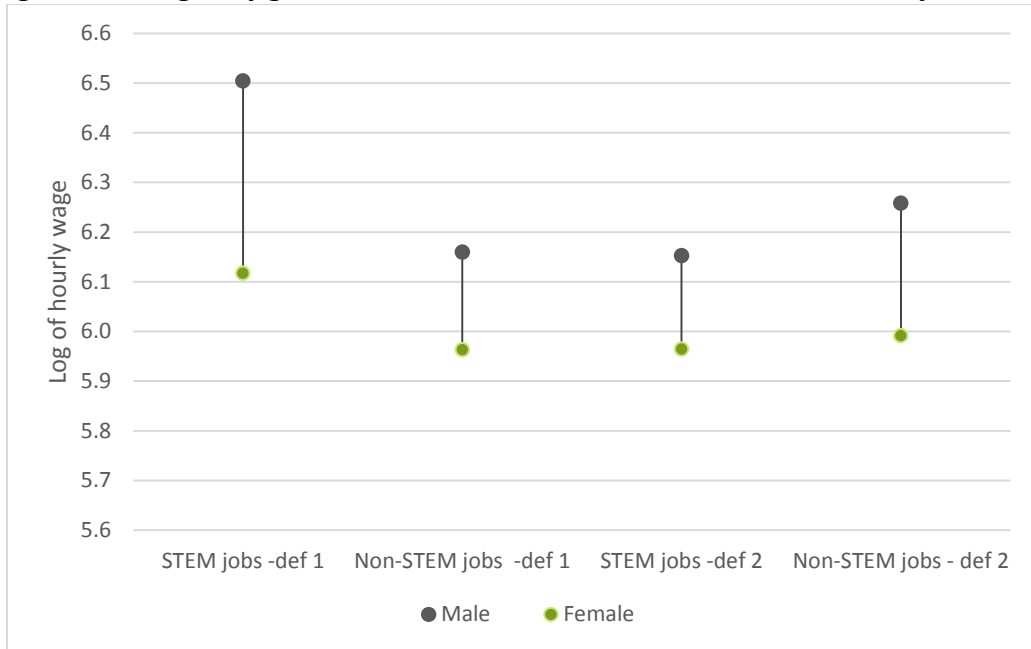


Source: LFS 2015, World Bank estimations.

Important disparities emerge when examining wages, benefits, and perceptions among STEM and non-STEM jobholders by gender. Women earn 32 percent less than their male counterparts in STEM jobs and 26 percent less in non-STEM jobs, when using the “constrained” definition of STEM jobs applied thus far. Under a “broader” definition,²⁴ the gender wage gap is higher in non-STEM jobs, with women earning 18 percent less than men (Figure 17). Examining workers eligible for different type of benefits shows that among STEM jobs, there is higher probability of men and women having paid leave, paid sick leave, medical insurance provided by the employer, and pregnancy/child care leave (Figure 18).

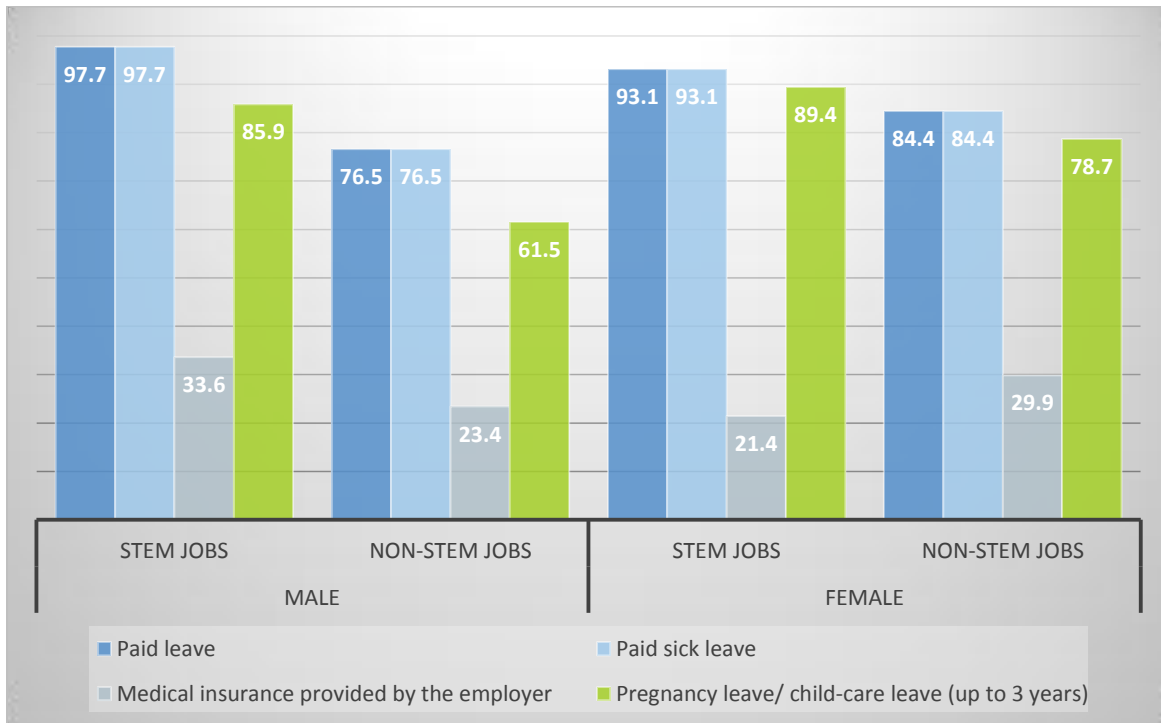
²⁴ To allow a broader approximation to STEM-related jobs, this definition includes those employed in agriculture; mining; electricity and gas; water and sanitation; construction; transportation and storage; professional, scientific, and technical activities; and economic activities related to information and communication at the same time classifying by occupation in professional, technical, and professional activities and including skilled agricultural workers. Although this definition allows inclusion of professionals in different sectors, for instance engineers in construction, electricity, or agricultural activities, it also increases the risk of inclusion type of error.

Figure 17: Wages by gender for defined STEM- and non-STEM-related jobs, 2015



Source: LFS 2015, World Bank estimations.

Figure 18: Employment benefits by gender for defined STEM- and non-STEM-related jobs, 2015

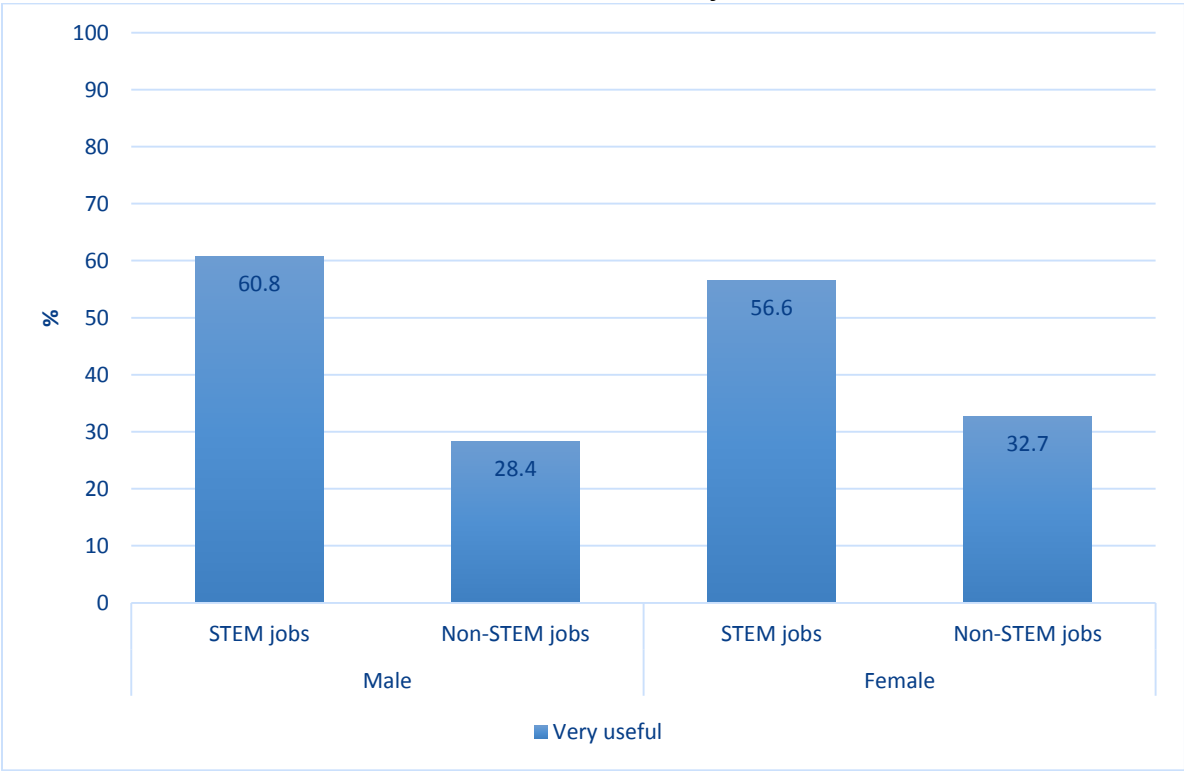


Source: LFS 2015, World Bank estimations.

The LFS data also show that perception of one’s education or qualification being useful in finding a job is significantly higher among STEM jobholders (Figure 19). Such differences in

self-perception are important in the context of improving school-to-work transitions and better understanding the linkage between skills formation and the labor market. The following section provides a discussion of select sectors (ICT, construction, mining, scientific institutions, and electricity) based on information gathered through the qualitative study conducted for this report

Figure 19: Perceptions of how useful education has been in finding a job for defined STEM- and non-STEM-related jobs, 2015



Source: LFS 2015, World Bank estimations.

VI.2.1 Information and communication technology

High pay scales and opportunities for skills enhancement make ICT a highly desirable field for students. ICT is a developing and prestigious sector in Armenia, with high employment and income prospects.²⁵ This is mirrored in the growing number of students and the high tuition fees within ICT departments at universities. At the company interviewed for this report, women comprised 40 percent of the staff, although they were concentrated in lower-skilled areas. While creativity is actively rewarded at the company, according to their own statistics, male employees predominantly win the patents and awards. The company has a diverse reward

²⁵ Enterprise incubator foundation website (<http://www.eif.am/eng/researches/>)

system for work progress and effort, with both financial and nonfinancial incentives in place, training/retraining possibilities, team-building, and awards.

VI.2.2 Construction

Few women work in these sectors since the associated jobs are often highly perceived as “male”: crane driver, welder, engineer, builder, hydro technician, construction worker, architect, etc. Women avoid doing these jobs and are not considered effective construction leaders, capable of coordinating and managing the work of male employees and clients. Clients mostly trust and prefer to work with male builders and architects.

“A woman has almost nothing to do at the construction sites.” (Yerevan, STEM Employer, female, 65 years old)

“In the construction area, the employer will choose a man out of equal male and female candidates. I can’t put on a hard hat and go stand at the construction site and coordinate the work of men. I can’t. The conditions at the construction place are inappropriate for me: uncomfortable temporary settlements, lack of hygiene, etc. I wouldn’t go even in case of high reimbursement.” (Yerevan, STEM female Employee, 33 years old)

VI.2.3 Mining

Employees in this industry are mostly male engineers and construction workers. These jobs often require business trips to remote areas, and overtime, features that make them less attractive to women. Women are employed in administrative positions and as technical support staff, and tend to be older and therefore part of the Soviet era cohort of female engineers. Most women lost their jobs after the collapse of Soviet Union, with only a few managing to keep their positions. Mining industry complexes are located in remote provinces such as Teghut, Drmbon, Kashen, and Alaverdi—an issue for women with families in Yerevan. Both men and women get similar employment packages: healthcare benefits, benefits for children, etc. Anecdotal evidence suggests that women are put off by the negative environmental effects associated with mining.

“I refused the job offer from the mining company. I know how they damage my village (Shnogh). I will not work for them.” (Yerevan, non-STEM University, female student)²⁶

VI.2.4 Scientific institutions

In the state-run scientific organizations, salary rates are the lowest compared with the other sectors reviewed for this report (approximately US\$120–140 per month), making this an unattractive option for both sexes. Both science and physics are traditionally seen as male-

²⁶ This quote represents a sentiment that is an anomaly among those expressed in the focus groups.

dominated fields with dwindling opportunities, and thus appear unattractive to the younger generation.

VI.2.5 Electricity

The company that participated in the qualitative study is privately held and the largest employer in the Republic of Armenia. It serves approximately 985,000 electric utility customers. The electric company mostly hires men for field work. The 24-hour workload makes working at this particular company unattractive for women. Coupled with low salaries and development opportunities, this sector is generally unattractive to the younger generation.

VI.3 Barriers to Women's Employment in Armenia

VI.3.1 Time constraints

Data collected for this report and also from a study by the Caucasus Research Resource Centers (CRRC 2013) found that the problem of work-family balance exacerbates labor market discrimination. The CRRC survey showed that the current Armenian labor market shows marked difference between married and unmarried women due to employers' preferences for hiring unmarried women. They are perceived as well educated, ambitious, and more likely to seek career advancement, therefore working harder to rise to a better position and status. The survey found that the majority of unemployed women are not working because of family commitments, and that child rearing is seen as a traditionally female role. Time also plays a role in how men and women choose their jobs. Women look for work in NGOs, the educational system, or services and prefer part-time work or work with a flexible schedule. In contrast, men seek well-paid jobs in finance, or in technical/managerial positions at state institutions.

Although paternity leave is an option, it is neither widely advertised nor socially acceptable in Armenia. According to the qualitative research conducted, when women interrupt their professional employment for maternity leave, employers seem to presume that they will forget everything they had learned hitherto. Mothers therefore see their chances of entering the workforce as diminished, especially in STEM fields, since an uninterrupted employment record is highly valued.

The traditional Armenian approach is paternalistic. It implies that wives have to be home before their husbands come back from work so they have enough time to cook dinner and serve it before 6 p.m. Parents usually guide their daughters' career choice, and when they take into account such cultural norms for women, workload becomes an important part of the decision-making. Working hours have to be limited so that a woman will be flexible enough to

handle both work and family responsibilities. Similarly, female students stressed that a career path has to provide opportunities to combine family and paid work, without damaging the traditional family unit, and woman's role therein. This implies a short working day, such as that associated with teaching.

"I want to teach at a school or university, because it is the most appropriate work for a woman. The time schedule is very comfortable from 8 a.m. to 4 or 5 p.m. That means I can finish all the household activities by the time my husband is back. As the Armenian tradition demands, it has to be done by the woman. The man works to provide for the family. Wives can't earn more than their husbands. I dream of being a lecturer or scientist. A low income doesn't matter. I will get married (laughing)." (Yerevan, STEM University, female student)

Some of the characteristics of "the ideal job for a woman" cited during the focus groups are:

- Does not require long working hours or frequent business trips – to avoid long absences from home (family, children, and husband).
- Is ideally located within a female-dominated environment– so as not to provoke husbands' jealousy and family conflicts.
- Has lower pay than the woman's husband – as a woman as the breadwinner is not desirable to either spouse.
- Could provide useful skills even if the woman is not employed –being trained as a nurse, doctor, or teacher is convenient in households where child/eldercare and education are needed.
- Does not involve hard physical labor.

STEM fields are considered by the majority of respondents as antithetical to the responsibilities of family and childcare. Many respondents, both male and female, consider the use of childcare as a non-viable option, which makes women's employment virtually impossible after having children. However, one important cultural factor is in place to support female employment— the use of grandmothers to take care of grandchildren is widely accepted (though not always possible).

"If my wife wants to continue education and career, I will not let her. I won't accept a baby-sitter for my child." (Yerevan, Non-STEM VET institution, male student)

"One can hire a baby-sitter. But I don't want my child to be raised by a non-family member." (Yerevan, non-STEM VET Institution, female student)

"My classmate is married, has a baby, her mother helps her with the child. She manages to study, but doesn't want to continue her study in the Medical University. She will graduate from the VET institution and work as a nurse." (Yerevan, non-STEM VET Institution, female student)

"Both career and family are important. But if I am forced to choose, I will choose the family. It is more important." (Yerevan, non-STEM VET Institution, female student)

“We can spend all our time on science and our careers. Men have more time and freedom. We can concentrate ourselves on science. But women have a lot of problems. Female students have to do household work even during the years of education. And when they marry and have their own family, all the household activities take a lot of time.” (Yerevan, STEM University, male student)

VI.3.2 Systems failure

VI.3.2.1 Stereotype threat: What is women’s work?

Gender stereotypes held by parents and students influence career choices in Armenia. A strong “traditional” undercurrent runs across genders and age groups and focus groups revealed a diversity of opinions, although the more progressive ones were not widely shared. The predominant stereotype that leads to gendered career choices was the traditional dynamic of the husband as breadwinner and the wife as homemaker, a view usually held by parents but also by some students. The view that it is not possible to simultaneously have a happy family and succeed in a career was also expressed.

“Girls’ careers fail. When they become self-confident professionals by the age of 30-35, nobody wants to marry them and they grow old alone with their cats.” (Yerevan, STEM VET Institution, male student)

“I remembered a Soviet Film «Love story at the workplace.” The female director is unhappy there. Women have to sacrifice their careers to be happy.” (Yerevan, STEM Employee, Engineer, Male)

“My father always said that his daughter would become a doctor. And this is a goal for me. That’s why I study here.” (Yerevan, non-STEM VET Institution, female student)

“My grandpa was a lecturer; my grandma was teaching for 40 years. So, I didn’t need extra private lessons. My brother brought me here, because he studies here as well.” (Yerevan, STEM University, female student)

The practice of a husband prohibiting his wife’s employment was often cited during the focus groups and interviews. This was seen as more likely to occur in the *marzes* of Shirak and Gegharkunik—considered to be the most conservative regions of Armenia. This stereotype varies from “softer” versions—whereby a woman can work, but it is a man’s ultimate obligation to care for the family — to beliefs that a wife’s employment is considered a husband’s disadvantage or even failure, implying that he is unable to care for his family. Consequently, he is not “masculine” and has no “dignity.” In some cases, women are forbidden to work by their spouses because of jealousy. Male respondents who expressed this stereotyped position about women’s employment also mentioned their fears that women who are paid more than their husbands will become spoiled, disobedient, independent decision makers, which will reflect poorly on them. Paradoxically, the high salaries offered in STEM careers can be considered a barrier for women. According to these patriarchal stereotypes, a woman cannot earn a higher salary than her husband as the perception is that it would adversely impact family relations and

provoke conflict, and challenge traditional gender roles. Both men and women feel uncomfortable with this situation.

“My aunt graduated from this college and her husband doesn’t let her work. In some cases, married women are forbidden to be employed by their husbands.” (Yerevan, STEM VET Institution, female student)

“Men are supposed to have better jobs, higher incomes etc. but I don't understand why don't they let women work and be independent.” (Gyumri, Non-STEM University female student)

“We have a stereotype that women shouldn't work. I think that a woman may work, but unlike men they are not obliged to work.” (Gyumri, STEM University, key informant, male)

“Women tend to get spoiled: if they are successful in their career and get a higher salary, they don’t obey their husbands.” (Gyumri, Non-STEM University, male student)

“I will be disappointed if my wife has higher income than I do. She is a woman, has a lot to do in the household. It will be unfair if she gets paid more than I do. If she gets more then she is a decision-maker, which is unacceptable. The man has to be the head of the family. And income is a key factor.” (Yerevan, Non-STEM VET institution, male student)

“If girls marry early it is hard to get involved in a career. If the girl is already working and then gets married, it will be easier to persuade the husband and the in-laws.” (Yerevan, STEM VET Institution, female student)

“My friend was a good student. She was very beautiful and had a boyfriend. One day she was kidnapped by him. He became her husband and didn’t let her work. After long negotiations, her father persuaded the husband to let her finish her education. Now she is very successful and her husband helped her find a job at a hospital.” (Yerevan, non-STEM VET Institution, female student)

High incomes motivate both boys and girls to choose their education and career paths. But male respondents mentioned income as a key reason more often than women. Men’s roles in society are unambiguous: they see themselves and are seen as breadwinners. However women’s roles are in constant conflict and negotiation while they oscillate between professional and caregiver.

“Children get messages on their future career in the family. Boys are told that they will grow up, get married and will have to provide for their families. Today it is possible within STEM education. IT is the future.” (Yerevan, STEM Employer, Key Informant, female).

VI.3.2.2 STEM fields and the “hungry engineer”

After the collapse of the Soviet Union, the notion of the “hungry engineer” appeared. Engineers who were educated during the Soviet era when STEM education was highly valued saw once-positive job prospects collapse after the fall of the Soviet Union. In Armenia, the whole industry was destroyed and jobs for engineers suddenly disappeared. Those who could

keep or find some employment were forced to work for a very low income. This situation impacted the profession's image, and the number of students in STEM education decreased significantly. During the same timeframe, linguistics, economics, and law became the most prestigious education and career paths.

This stereotype is changing with the latest developments in ICT and mining employment. But the “hungry engineer” stereotype still persists. Jobs within the new ICT and mining enterprises are paid much better than those in state scientific institutions (National Academy of Sciences, universities, etc.), which were established in Soviet times, and developed little since then. Lack of employment opportunities, an insecure work environment, and low income expectations make a scientific career unattractive to both sexes.

“The number of applicants to the faculty of physics is very low: Our dean calls us ‘white crows. We are not going to study physics to any great extent. We have enough knowledge in mathematics and can use it and develop.” (Yerevan, STEM University, male student)

Jobs in STEM are equally available to men and women—job descriptions never express a preferred sex. However, most female applicants drop out at the interview stage, when travel requirements to distant regions, workload, business trips, and work hours are discussed. Men are usually more self-confident and ready to work overtime. Overtime jobs are not seen as appropriate for women, but overtime is a common occurrence in the industry.

“We had only one case when a woman accepted our job offer and moved to work from Nagorno-Karabakh to Teghut. She is an unmarried woman of 40. She has to work and live in a men’s group. Some women agree for 2-3-day business trips, but work should be preferably based in Yerevan.” (Yerevan, STEM Employer HR, female)

Women employed in STEM feel that they have to go above and beyond to prove their position and competency to meet the male-defined expectations. This is also true for women holding managerial positions in other employment fields. For women who want to work in STEM, options cited were for them to marry later or to simply put their careers first.

“Those women who are limited or even forbidden by their parents or husbands to choose a STEM profession and work don’t even enter our organization.” (Yerevan, STEM Employer HR, female)

“A woman has to justify her opinion very properly to be heard and accepted in our patriarchal society. Men don’t need to argue that much to insist on their position. To be able to justify her opinion a woman needs to be more intelligent and trustworthy. Coquetry and femininity can be shown only in the family.” (Gavar, STEM University Key Informant, female)

“I am a developer at an IT company. People are often joking, ‘you are a girl, you can’t develop a good code.’ Or people are surprised to see a female developer. It’s harder for women to work in STEM. You always have to prove that you can.” (Yerevan, STEM Employee Developer, female)

VI.3.2.3 Workplace practices

Even women who graduate with STEM-oriented degrees tend to hold mid-level positions focused on less-skilled technical programming. Men tend to hold managerial positions and conduct skilled STEM tasks. The following STEM employers were sampled for this study: an ICT company, a mining company, an electric company, a state scientific research institute, and a design and construction company. Of the female workers employed by these companies, most were in fact engaged in non-STEM-related areas such as accounting, human resources, public relations, and administration.

“When employers ask the educational institutions to send a student for part-time employment, they sometimes mention if they need a male or female employee. For work in regions and installations they prefer men, women are preferable for office work. Sometimes we can anticipate if they need male or female employee, purely based on the information about the job.” (Yerevan, STEM VET Institution, male administrative staff representative)

Women’s career progression is curtailed due to restrictions and stereotypes. Women tend to avoid going on business trips with male colleagues, and do not want to work at offices where all employees are men; doing so can cause professional alienation and even stagnation.

“I am sorry that I am not a man, because in my business, trips are very important and frequent. We travel to the mining camps. My male colleagues travel very often, but I cannot travel with them that often. Traveling to regions with male colleagues is difficult for me, and for them. Nobody minds, but it is not that convenient. I traveled a couple of times with them to Teghut, but they are male, they have their plans and activities. I may disturb their plans. If I go on business trips I will learn much more and will become highly qualified in my profession. During 5 years on this job, I have been on business trips 4 or 5 times. At first I traveled frequently, now it is a rare occurrence.” (Yerevan, STEM female Employee).

“Women in STEM are also needed. They work on the computers, but don’t repair computers. A woman can’t go to anybody’s home to fix something.” (Gavar, STEM University, Key Informant, female)

VI.3.2.4 The glass ceiling

Women can progress in STEM fields to a certain point, but rarely make it above the glass ceiling. Men remain in executive positions and are the key decision makers. Female and male employees get the same salary in the same position, but in most cases, women have a lower position within a company, and consequently, a lower income.

“My female colleague is more experienced and responsible. I trust her. But her male supervisor gets paid about 10% more. Due to this position and wage, he feels confident within his family and in front of his wife.” (Yerevan, STEM Employer, male)

“In the family women leave the leading roles to men: father, husband, brother, son. The same attitude is applied within employment: women leave the leading positions for the men. The woman has to be a covert leader.” (Yerevan, STEM Employer, female)

VII. Conclusions: What Can Be Done to Improve Equality of Opportunity and Outcomes in STEM?

This report demonstrates that Armenia can improve women’s participation in STEM careers by influencing academic choices at school and university and helping women gain employment in higher-paying fields while taking advantage of career advancement opportunities at work.

To date, equality between girls and boys has not been identified in Armenia as an explicit principle in the drafts of the *State Program on Educational Development for 2016–2025*. An awareness of practical actions and the value for Armenia that would result should therefore be mainstreamed into the broader system of education and school culture.

Policies are needed to reduce bias at school and to ensure that girls are aware of the connections between certain fields of study and job opportunities—particularly in the high-growth technology sector. While cultural stereotypes take time to change—such as that of the “hungry engineer” or the notion that certain jobs should be off-limits to women—the government can build on the principles that underpin TUMO’s existing STEM programs and outreach to create an environment in which women and girls choose these fields of study.

At work, the increased flexibility in STEM fields should enable women to feel less pressure when choosing between remunerated work in the market and unpaid work at home. High-profile television campaigns, such as those deployed to address sex ratios at birth, could be used to promote positive role models for women in STEM. Table 3 summarizes the policy options that can be deployed by the Armenian government in the short and medium term to increase the number of women training in STEM fields and progressing into high-potential STEM jobs. The policy actions listed below are based on evidence emerging on good practice based on a global literature review, as well as nascent findings emerging from Armenia. The options reflect a range of approaches, some of which are feasible to implement in the short term within two to three years, albeit with sufficient level of political will and aligned incentives.

Table 3: Policy options to improve equality of opportunity and outcomes in STEM in Armenia

<p>AT SCHOOL</p> <p>Primary and secondary level</p> <p>Start as early as possible to ensure positive stereotypes are ingrained</p> <p>Tertiary level</p>	<p><i>Short-term priority actions:</i></p> <ul style="list-style-type: none"> • Engaging teachers and students in discussions about the benefits of STEM fields of study and careers • Encouraging girls to embrace their interest in math and science, and providing positive role models of women who work in STEM careers <p><i>Change systems:</i></p> <ul style="list-style-type: none"> • Setting goals to create equal opportunities for boys and girls to succeed in STEM subjects • Integrating a gender perspective in the primary/secondary STEM school curricula by developing gender-neutral/sensitive class materials • Creating opportunities within the curricula to discuss gender bias and how it affects opportunities at work and within the home <p><i>Information:</i></p> <ul style="list-style-type: none"> • Providing gender-neutral career advice that reflects labor market needs <p><i>Overcome stereotype threat:</i></p> <ul style="list-style-type: none"> • Monitoring and coaching teachers to help them remain gender-neutral <p><i>Change systems:</i></p> <ul style="list-style-type: none"> • Building on the principles of TUMO’s existing STEM programs and outreach to inform government policy and VET institutions • Using financial incentives (tuition fees and scholarships) to encourage women, especially from rural areas, to STEM fields of study
<p>SCHOOL-TO-WORK TRANSITION</p>	<p><i>Short-term priority actions:</i></p> <ul style="list-style-type: none"> • Pairing women working in the STEM industry as mentors to female college and university students • Rewarding companies that develop and monitor progress on gender action plans • Encouraging companies to contract with higher education institutions to organize field visits, apprenticeships, and other networking opportunities that target female students <p><i>Information:</i></p> <ul style="list-style-type: none"> • Raising awareness of STEM professions as career opportunities that provide flexibility for women <p><i>Access:</i></p> <ul style="list-style-type: none"> • Helping employers provide women-friendly environments and conditions at the workplace, and then actively promoting successful programs to change public opinion about women in STEM careers

	<ul style="list-style-type: none"> Facilitating STEM employers to develop daycare solutions at work, flexible schedules, telework options, and job-sharing for women, while encouraging men to take paternity leave <p><i>Market/institutional failures:</i></p> <ul style="list-style-type: none"> Mainstreaming considerations of equality across human resource functions at STEM companies, possibly starting with having a target number of women on the Board of Directors and in top management positions, and then ensuring gender neutrality throughout the pipeline Evaluating the “Edge Certification” process for wider use across Armenia
GOVERNMENT	<p><i>Short-term priority actions:</i></p> <ul style="list-style-type: none"> Participating in public information campaigns to promote positive aspects of STEM careers to students in middle school and above, such as greater income, flexibility, and status Launching media campaign to promote and celebrate positive female role models in STEM Reducing any gender distortions in education funding (such as unintended consequences resulting from financial aid packages) <p><i>Information:</i></p> <ul style="list-style-type: none"> Evaluating the use of edutainment to change perceptions of the traditional roles of women and men (e.g., through Armenian sitcoms or other media) <p><i>Access:</i></p> <ul style="list-style-type: none"> Following up on recommendations from the World Bank study of Armenian textbooks Considering a quota system to address women’s overrepresentation in lower faculty positions and underrepresentation in senior positions of research staff in STEM fields Evaluating the admissions requirements for STEM-oriented specialties, which are lower compared to other fields of study <p><i>Change systems:</i></p> <ul style="list-style-type: none"> Supporting the <i>Gender Policy Concept Paper (2010)</i> recommendations and committing to an action plan with a timeline to meet specific goals Translating principles of equal opportunities for women and men into the <i>State Program on Education Development for 2016-2025</i> (currently under development), including the process of ensuring gender neutrality in education standards, curricula, and textbooks in

	<p>all subjects and levels of the educational system</p> <ul style="list-style-type: none">• Filling the “legislative gap” in two areas where the absence of a legal provision may impede the hiring of women in formal firms: prohibition of prospective employers to ask about family status and mandate for nondiscrimination based on gender in hiring
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ANNEX 1: Explaining Inequality between Men and Women in Education and at Work

Women have made major advances in labor markets over the past century. During this time, there has been a clear convergence in women’s levels of human capital investment and their employment prospects and outcomes relative to those of men. However, even in rich countries where the gender gap in education has closed, considerable gender differences remain in pay, employment levels and opportunities. This section builds on the World Bank’s World Development Report on Gender (2012), and reviews the literature on factors that prohibit gender parity at school and at work.

Explaining Inequality in Education

Access

Some women never make it to school. As of 2010, over 790 million adults lacked reading and writing skills, of whom about 64 percent were women. The majority are located in Sub-Saharan Africa, South Asia, and West Asia (UIS 2011).²⁷ In many parts of the Global South, many girls do not complete school because of early marriage and pregnancy (Eldis 2007).

Even when women make it to school, inequality persists. Although the education gap is closing, men and women still acquire different skills as part of formal education, and that determines differences in employment and remuneration (World Bank 2012). Women also derive different messages at school regarding what is possible in terms of goals and future careers: schools are not value-free, neutral environments that prepare all students equally (Stromquist 2002). In fact, three general reasons explain gender inequality at school: information asymmetries, institutional bias, and stereotype threat.

Information factors

Assessing the type and level of information that men and women receive at school is important to understanding their subsequent career choices. In particular, poorer individuals and those who live in rural areas may be less well-informed about labor market prospects and returns to education (Jensen 2012). Stereotype threat—the notion that men and women should choose gender-defined career paths—could then impact the type of information women seek

²⁷ Note that The United Nations Industrial Organization includes Azerbaijan, Iran, Armenia, Oman, Yemen, Lebanon, Syria, Israel, Iraq, United Arab Emirates, Qatar, Bahrain, Kuwait, Saudi Arabia, and Jordan when listing the nations of the West Asia region, and leaves out Turkey and Georgia.

out or are given by teachers and educational institutions (Avitabile and de Hoyos 2015). Gendered information asymmetries might also carry over into other areas of life beyond future job prospects, with women “burdened” with information regarding the physical condition/location of employment, or how a certain job will affect their potential marriage and family formation (Attanasio and Kaufmann 2008).

Educational failure: Systems

A pedagogical environment that imbues societal gender bias can lead to suboptimal outcomes for women. This is not only manifested in stereotype threat messages from teachers to students, but lies in the very foundations of the system itself and the principles upon which it operates. Systemic bias is perhaps the most difficult to detect or even define; it can include the types of teaching materials that are deployed, the ways in which teachers are trained, or simply the culture of a certain school. The section below on STEM looks more closely at the ways in which educational systems fail to give equal opportunities in these subject areas to girls and boys. Another way in which schools perpetuate gender inequality is through the stereotypical portrayal of male and female roles in textbooks, curricula, and learning materials (Longwe 1998). Women tend to be greatly underrepresented in school textbooks, and both men and women are often depicted in gender-stereotyped roles (Blumberg 2007; Magno and Silova 2007). Gender bias in textbooks and school curricula remains “one of the best camouflaged – and hardest to budge – rocks in the road to gender equality in education” (Blumberg 2007, p. 4).

Stereotype threat

Education systems subtly reproduce invisible, internalized gender stereotypes prevalent in society as a whole. Negative stereotypes held by women and men typically play an active role in the academic underperformance of students who identify with them (Steele and Aronson 1995). Across countries and cultures, expectations are molded by social norms and perceptions of what is possible: what kinds of professions women and men can aspire to. Factors such as self-perception, self-confidence, and the availability of female role models are internalized by girls and women and develop over their lifetime. Teachers, too, can communicate certain stereotypes through curricula, methods of instruction, and the messages they give to students, all of which can negatively affect equality between women and men and may discourage women from pursuing high-paying, male-dominated careers (Levanon, England, and Allison 2009; UNESCO 2009). Teachers’ biases can be manifested in a number of ways, either explicitly or more insidiously (DeJaeghere and Pellowski Wiger 2013).

Explaining Inequality at Work

In developed countries women have overcome gendered educational obstacles. They are now better educated than men, have nearly as much work experience, and are equally as likely to pursue high-paying careers (Levanon, England, and Allison 2009). However, women's annual earnings still lag behind men's, even when homogeneous groups are compared (Goldin and Katz 2008; Weinberger 1998; Wood, Corcoran, and Courant 1993). The notorious "glass ceiling" also persists, whereby women fail to make it into management positions.

Discrimination has merely shifted to gender differences and discrimination in occupation and industry (Blau and Kahn 2016). A review of tertiary graduates in 14 OECD countries showed that more women fill clerical roles than men, and women are half as likely to be managers (Flabbi 2011). Inequality in employment between women and men is caused by structural factors rooted in economic and institutional systems, both formal and informal. Often, these factors work in concert, trapping women in a vicious cycle of low productivity.

Three broad factors explain the gender pay gap in labor markets:

- Time differences in household responsibilities
- Access to productive inputs such as land and finance
- Failures in markets and institutions

Time

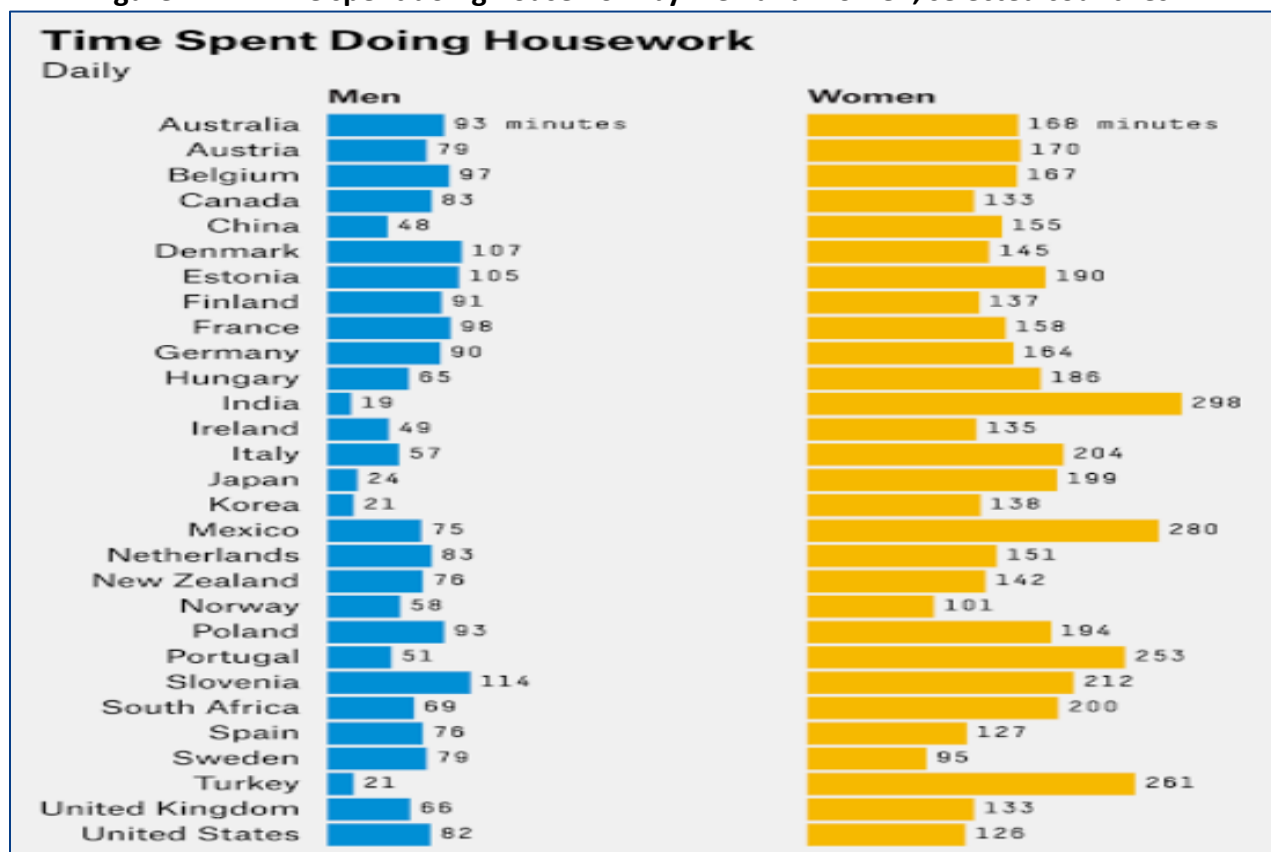
Social norms demand different time commitments of women, and women's unpaid work in the home impacts their ability to dedicate equal effort at work. The key to understanding this dimension of equality requires looking beyond the pay gap, to what happens outside the workplace and inside the home. Every household sets aside a certain amount of time for housework, which denotes a range of essential "survival-related" activities such as cooking, fetching water, and sleeping as well as caring for dependents (Goodin et al. 2008). When the entirety of time-consuming activities is taken into account, women work more than men: globally women do most housework and care (of children and elderly parents/relatives), while men are mostly responsible for market work (Berniell and Sanchez-Paramo 2011).²⁸ Marriage significantly increases time devoted to housework for women but not for men; and children

Women work more than men. In the end, gender trumps money...allocating more time to market work generally comes at the price of higher total workloads for women

²⁸ The research cited focused on heterosexual households only.

increase the time spent on care by both men and women, but more for women—and this remains the case at higher income levels (World Bank 2012).

Figure A1.1: Time spent doing housework by men and women, selected countries



Source: OECD-STAT, accessed 2016, data from 2015.

The time choices made by women result in significant and systematic differences between men’s and women’s jobs across sectors, types of jobs, and firms. Women’s jobs pay less, and women are overrepresented among unpaid and informal sector workers. Women account for 58 percent of unpaid work and 50 percent of informal employment globally (World Bank data). In other words, greater gender parity in working hours is not just about increasing the number of women in full-time employment, but also convincing more men to reduce their long hours in paid work and to contribute equally to unpaid work.

Over the last 50 years, women decreased their hours of unpaid work as they increased hours of paid work. Yet although men are doing more housework and childcare, gender inequalities in the use of time are still large in all countries (OECD 2016). Burdened with a disproportionate share of household work and career interruptions to care for children or other dependents, more women than men opt for flexible time schedules (Gorlich and de Grip 2009). These

choices act to undermine women’s career opportunities through what has been dubbed the “mother trap” (Bertrand, Goldin, and Katz 2010; Goldin and Katz 2008).²⁹ Once women are out of full-time employment, they find it hard to use part-time work as a bridge back. Career interruptions also result in less actual experience, and lead to lower wages and wage growth as women are channeled into lower-quality jobs even after they resume paid work (OECD 2007).

Access

Women have less access than men to productive inputs such as land and credit. The most important productive inputs are defined as land and credit, which in turn determine access to other inputs and the scale and mode of production, be it in agriculture or business. Women are as efficient as men in production when given the same inputs, but female farmers and entrepreneurs have less access to land and credit than men (World Bank 2012).

Access to land

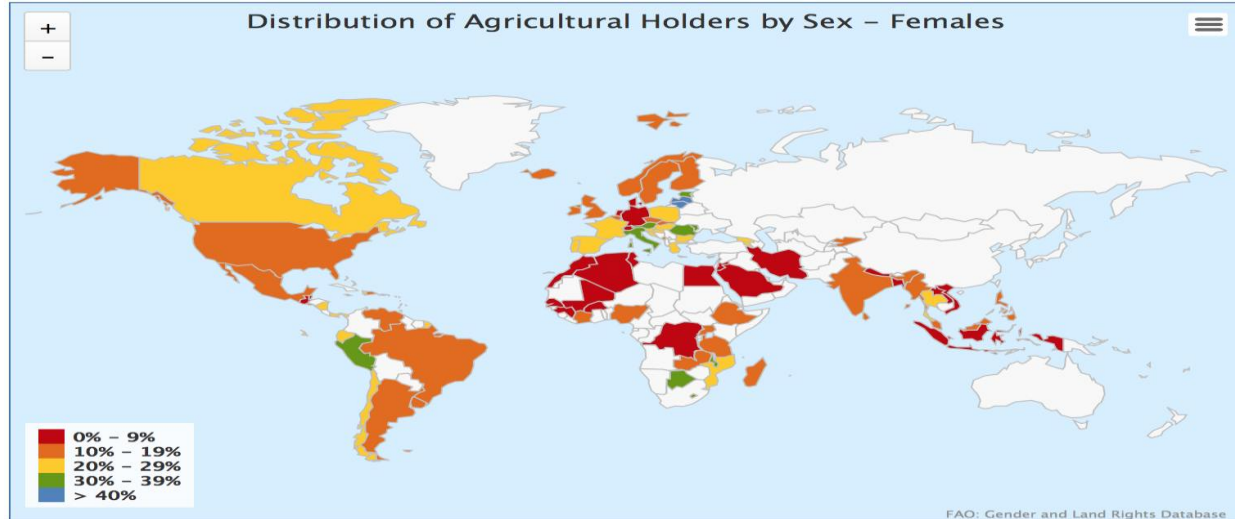
Women are chronically disadvantaged in terms of land access. Policies and practices in 50 percent of countries around the world actively hinder women’s ownership, control, or access to land (IFC 2016). Although over 40 percent of agriculturists in the developing world are women, most do not have land titles or power over their household's economic decision-making (SOFA Team and Doss 2011). Even when countries mandate equality of men and women before the law in principle, the procedures used by land administration institutions often discriminate against women, either explicitly or implicitly. Empirical evidence suggests that even where legal provisions are adequate, their effectiveness may be limited if they clash with traditional norms.³⁰ The absence of land rights has many negative ramifications, both direct and indirect, including a loss of productivity, loss of land by widows, and even a higher propensity for women to suffer physical violence (Agarwal 1994; Deere and Leon 2001; Deininger 2003).

Irrespective of whether women engage in agriculture, independent asset ownership will considerably enhance their livelihood opportunities. Land ownership is often the key to access to finance and nonfarm remunerative activities that help not only women but their families and communities, too. Asset ownership by women has been shown to affect family spending dynamics, for instance on girls' education and food (de la Briere 1996; Doss 1996; Fafchamps and Qisumbing 1999 and 2002; Haddad 1997).

29 Data from the United States show that a woman in the early stages of her career currently makes 90 cents on the dollar—however, women in the middle of their careers face a bigger pay gap of 88 cents, and the gap only widens as they age: 77 cents for 45- to 54-year-olds, and 76 cents for 55- to 64-year-olds (Liner 2016).

³⁰ In the Caucasus for example, most constitutions mandate equality of men and women before the law, but in practice land is often only registered in the name of the male head of household, and women are reticent to challenge this patriarchal norm (Brearley 2015).

Figure A1.2: Global distribution of female agricultural holders



Source: FAO Gender and Land Rights Data Base, accessed 2016.

Access to finance

Women lag far behind men when it comes to financial access. Globally this gender gap is 7 percentage points, while in developing countries, it is 9 percentage points, with large regional disparities— South Asia has an 18 percent gap in ownership of bank accounts, and the Middle East has a 10 percent gap. The gap also exists for access to formal savings and credit (Findex 2014). Cultural norms or legal barriers are often at the root of women’s limited financial access, while inheritance laws often favor men over women, reducing women’s access to family assets and in turn the need for financial services.

Institutional and market failures

Market and institutional failures refer to the ways in which these structures treat men and women differently based purely on gender. When combined with time constraints and lack of access to inputs, these failures can affect employment outcomes and contribute to employment inequality and clustering by gender (England et al. 2007). Market and institutional failures can occur for three principal reasons:

Information gaps

Information is often simply lacking for women, or men in the labor market have more or better-quality information. For example, if there are not enough women in a certain career field, employers will not know they are worth hiring. Low female participation in some

professional fields can affect those trying to enter the market, and even those already in them (World Bank 2012).

Structures

Failures can occur due to the inherent structures or rules of markets and institutions. For example, labor legislation on parental leave and retirement, hiring, and personnel management can all harm women. Legal gender differences are widespread: in half of the countries in the world, at least one law impedes women's economic opportunities. According to a recent report on gender and the law (IFC 2016), the total number of legal gender differences across 173 countries is 943, categorized as: job restrictions in 100 countries; lack of gender-based violence laws in 46 countries; and laws that allow husbands to legally prevent their wives from working in 18 countries. Legal discrimination tends to have a ripple effect; it is associated with fewer girls attending secondary school relative to boys, fewer women working or running businesses, and a wider gender wage gap. Tragically, where laws do not provide protection from domestic violence, women are likely to have shorter life spans, and even in countries with gender-equal laws, high gender inequality can still exist due to poor implementation (IFC 2016).

Bias

Discrimination accounts for as much as 38 percent of the gender pay gap (Levanon, England, and Allison 2009), and outright gender bias and stereotypes result in “statistical discrimination” at work and at home. Even though much of the pay gap is attributable to differences in hours worked, the effects of family formation, and occupational choice, a gap remains that cannot be attributed to observable factors. In other words, women still make less than men even after accounting for differences in job type, job level, experience, education, hours worked, and location—which indicates that bias in the workplace also contributes to the gender pay gap (Liner 2016).

- *At home...*

When families begin to form, cultural expectations still dictate that women step back at work, while men continue to work hard (Linden 2016). A recent poll in the United States found that 51 percent of Americans believed that children are better off with a mother who stays at home, while only 34 percent said they are just as well off if a mother works. For men, those expectations are drastically different—only 8 percent said children are better off with a father who stays at home (Livingston 2015). Further, women who return to the labor force after having children face a wage penalty of 4 percent per child that cannot be explained by factors other than the perception that they are less efficient workers. By contrast, working men with

children experience a “fatherhood bonus” of 6 percent, regardless of the size of their family (Budig 2015).

- *At work...*

According to World Bank focus groups conducted for the 2012 World Development Report, inequality due to statistical discrimination is significant across all countries—about 50 percent of jobs are considered to be “men’s jobs” or “women’s jobs.” Men’s jobs are often technical, and involve a high level of skill. Women’s jobs include retail, personnel work, and domestic service.

Box A1.1: What is bias?

*It is only women, not men, for whom a unique propensity toward dislike is created by success in nontraditional work**

No one is immune from biases. Stereotypes serve as heuristics—rules of thumb—that allow us to process information from the myriad data points the world throws at us. In some instances these are useful as we do not always have the time to carefully analyze every single person or instance; but they can also be a double-edged sword: stereotypes can be inaccurate, and worse, when we do not question our assumptions stereotypes can turn into prescriptions of how we think the world should be. This process of “sorting” happens automatically, and so when we learn the sex of a person, gender biases are automatically activated, leading to unintentional and implicit discrimination.

Gender stereotypes appear to generalize to some degree across cultures. For example, many societies differentiate warmth from competence when judging social groups; high-status groups are stereotypically perceived as competent but lacking warmth, and the male stereotype is associated with the cultural ideal. Because of our biases, we tend to react to successful women much like we react to dishonest men: we do not like them or want to work with them.

When evaluators know nothing except a candidate’s gender, men are about twice as likely to be hired as women. Even when more information is provided about qualifications, this bias holds. Men also tend to oversell their qualifications, whereas women undersell themselves (Bohnet 2016). Recent studies in the field of behavioral economics give a clearer understanding of the implicit and myriad ways in which gender bias—displayed by both men and women—acts against women in the workforce during the hiring process, when negotiating promotions, and accessing career advancement opportunities.

- *Discriminating in hiring based purely on gender:* One experiment recorded a 50 percent increase in female-hires when gender-blind auditions were conducted for symphony orchestras (Goldin and Rouse 2000).³¹ Another experiment found a “motherhood penalty,” and that childless women received 2.1 times more calls for job interviews than equally qualified mothers (Correll, Benard, and Paik 2007). When emails from a phantom student requesting a 10-minute meeting were sent out to professors, regardless of the professors’ own demographic characteristics, across the board they were less likely to respond to a student who was not a white male (Milkman, Akinola, and Chugh 2015).
- *Negotiating promotions:* Women are less likely than men to ask for promotions, and even when they do, they are less likely to get one. Women who negotiate are perceived as more demanding and difficult to work with—by both their male and female colleagues (Riley Bowles, Babcock, and Lai 2015).
- *Accessing opportunities:* Women tend to receive less challenging assignments than men, and to be harder on themselves in self-evaluations (Silva, Carter, and Beninger 2013).

In contrast to the situation for entry level positions, no closure of the gender gap at the top is in sight. Evidence exists of significant discrimination against women in high-status or male-dominated jobs, suggesting that women indeed have to be even more qualified or competent than their male competitors (Azmat and Petrongolo 2014). Successful female executives receive 10 percent less in remuneration compared to male executives, and they are penalized more than men when their firms perform poorly (Albanesi, Olivetti, and José Prados 2015). In their book *Through the Labyrinth*, Eagly and Carli (2007) discuss how gender stereotypes constrain women’s access to leadership roles. In particular, biases affect evaluations of women vying for the very top positions, commonly known as the “glass ceiling effect.”

Summarizing the Relative Importance of These Factors in Combination

Employers devalue work done by women (Levanon, England, and Allison 2009). Men and women are paid differently not just when they do different jobs but also when they do the same work, and the gender pay gap persists within occupations (Goldin 2015). For example, female physicians earn 71 percent of that earned by their male counterparts, and female lawyers 82 percent. When women move into certain sectors in large numbers, those jobs begin

³¹ As late as 1970, only 5 percent of musicians performing in the top five orchestras in the United States were women. Today, women compose around 35 percent of the most accomplished orchestras; this required the introduction of blind auditions. The share of female musicians in the 10 highest-budgeted orchestras in the United States has increased at a modest rate from 2004–2013 (Goldin and Rouse 2000).

to pay less—even after controlling for education, work experience, skills, race, and geography (Levanon, England, and Allison 2009).³²

³² For example, the median earnings of information technology managers (mostly men) are 27 percent higher than those of human resources managers (mostly women), while janitors (usually men) earn 22 percent more than maids and housecleaners (usually women). In computer programming, a field that used to be dominated by women, the job began paying more and gained prestige when male programmers began to outnumber female ones.

ANNEX 2: Overview of Qualitative Research Methods

The qualitative research conducted for this report looked at factors that prevent women in Armenia from translating academic success into jobs in STEM fields. This study was conducted by a team of local researchers from Yerevan State University from November 2015 – January 2017.

The research covered: 4 out of 23 STEM-focused VET institutions; 4 out of 29 STEM-focused universities; 5 out of 25 leading STEM employers in Armenia; 4 non-STEM VET institutions and universities; and the TUMO Center for Creative Technologies in Yerevan (the capital) and Shirak and Gegharkunik *marzes* (provinces). Shirak and Gegharkunik *marzes* are considered to be the most problematic regions in terms of gender stereotypes and access to educational opportunities.

Methodological Approach

Data collection targeted women and men attending university or post-secondary VET institutions focusing on STEM and non-STEM fields of study, as well as those who are working in STEM occupations.

Table A2.1: Overview of data collection methods and sample by respondent type

Respondent type	Data collection method	# of female respondents	# of male respondents	Total # of respondents
STEM-focused VET institution teachers/principals	Key informant interview	1	3	4
STEM-focused university department professors/deans/rectors	Key informant interview	1	3	4
STEM employers human resources managers	Key informant interview	3	2	5
TUMO representative	Key informant interview	1	-	1
Non-STEM VET institution teachers/principals	Key informant interview	2	-	2
Non-STEM university department professors/deans/rectors	Key informant interview	2	-	2
STEM-occupied employees	In-depth interview	5	5	10
Total # of Interviewees				22
STEM-focused VET	Focus group	31	30	61

Respondent type	Data collection method	# of female respondents	# of male respondents	Total # of respondents
institution students				
STEM-focused university students	Focus group	29	27	56
Non-STEM VET institution students	Focus group	15	16	31
Non-STEM university departments	Focus group	15	15	30
Total # of focus group respondents		90	88	178
Total number of all respondents				200

Research Participants

Research participants fell into five categories:

1. Four post-secondary VET institutions that have the most students covered the STEM field of study : Yerevan (Yerevan State IT College; Yerevan State Technological College), Shirak (Gyumri State Technical College) and Gegharkunik (Gegharkunik Regional State College).
2. Four universities were selected based on having the deepest focus on STEM-related departments, the level of resources provided (libraries, professors, degrees granted), and number of attending students. Universities were also selected from Yerevan (Yerevan State University and National Polytechnic University of Armenia), Shirak (Gyumri branch of National Polytechnic University of Armenia), and Gegharkunik (Gavar State University) *marzes*.
3. Five STEM employer organizations were selected to cover an equal involvement of employers and employees specialized in science, technology, engineering, and mathematics. The five leading organizations in the STEM field (Synopsis, Vallex Group Mining Company, Electric Network of Armenia, Horizon 95 Construction Company, and Institute of Radiophysics and Electronics of National Academy of Science RA) were selected (considering number of employees, organizational structure, and corporate hierarchy). Interviewing these employers provided the opportunity to review the institutional factors, such as labor regulation and gender policy, that affect women’s participation in STEM.
4. Two non-STEM VET institutions (Yerevan Pedagogical High School and Yerevan State Base Medical College) and two universities (Yerevan State Linguistic University and Gyumri State Pedagogical University) were selected to examine patterns in reasons for rejection of STEM-related education and careers.

5. The TUMO Center for Creative Technologies³³ was selected to represent a non-formal STEM-oriented education unit.

Key Informant Interviews

Key Informant Interviews were conducted with non-STEM and STEM-focused VET institution teachers/principals and university department professors/deans/rectors. These covered their observations regarding: the differences between women and men and how they respond to information and incentives to pursue non-STEM and STEM-related career paths; how information and messages used for students differ by gender; and the extent to which social norms, reproduced via stereotypes, hinder women's entry into STEM fields of education. The comparison of information gained through interviews in STEM and non-STEM educational units provided a deeper understanding of the issue.

Interviews were also conducted with STEM employers/human resources management personnel. These focused on: differences in how women and men apply for jobs; differences in the level of proficiency between men and women applying for the same position; and career aspirations and development by gender.

TUMO representatives were interviewed to examine non-formal approaches to working with teenagers in STEM-focused fields; e.g., recruitment methods, behavioral trends, and preferences of male and female participants.

In-depth Interviews with Employees

Male and female employees at five selected STEM employers were interviewed to collect individual STEM career success stories and gender-related differences. This information was cross-checked with the information gained through the key informant interviews with employees of the same organizations.

Focus Groups

Focus groups were conducted with male and female students at STEM and non-STEM universities and VET institutions. In total, 24 focus groups were conducted, segregated equally by gender. The minimum number of participants in each focus group was 6, with some reaching 12 persons.

Focus groups were conducted with VET institutions' students in the following STEM departments: programming, computer engineering, network operator, mechatronics, auto

³³ <https://www.tumo.org/>

mechanics,³⁴ accounting, audit, banking machinery operations, railway engineering, telecommunications, cooking, hairdresser, and modeling. Non-STEM departments included: humanities, journalism, nursery, pharmacology, obstetrics,³⁵ cosmetology,³⁶ and dental technics.³⁷

Focus groups at universities were conducted with students in the following STEM departments: mathematics, applied physics, mechanics, radio physics, radiotechnics, atomic physics, physics of atomic reactors, cybernetics, applied mathematics, computer engineering, informatics, economics of light industry, building and construction, computer design, economics, and accounting. Non-STEM departments included: public relations, journalism, international relations, foreign languages (Spanish, Russian, Italian, English, Chinese), social work, psychology, philology, law, pedagogical methodic, translation and English, military and physical trainer, pedagogy, translator, history, and education organization.

³⁴ Only male students study auto mechanics.

³⁵ Only female students study obstetrics.

³⁶ Only female students study cosmetology.

³⁷ Only male students study dental technics.

ANNEX 3: Equity in Education and at Work: Global Best Practice

Policies for Equity between Women and Men at School and Work	
<p>AT SCHOOL</p> <p>Primary & Secondary Level</p> <p><i>Start as early as possible to ensure positive stereotypes are ingrained...</i></p>	<p>Access</p> <ul style="list-style-type: none"> • Ensure women have equal access to quality education <p>Change Systems</p> <ul style="list-style-type: none"> • Mainstream gender-sensitive policies: curricula, textbooks, teacher training, and culture • Use gender-neutral/sensitive class materials and curricula, work groups, grading systems and software <p>Overcome Stereotype Threat</p> <ul style="list-style-type: none"> • Talk about stereotype threat: give information and discuss gender inequality and bias • Talk about the likeability versus academic achievement bias • Explain standards <p>STEM-Specific</p> <ul style="list-style-type: none"> • Integrate STEM into school curricula from Grade 7 or earlier • Orient STEM curricula around relatable problems rather than abstract concepts • Infuse STEM subjects across the curriculum and in ways to promote critical, life-long learning and respect multiple ‘entry points’ • Reject ‘math’ brain: use a ‘growth mindset’ (anyone can learn with the right methods): teach students to embrace learning through ‘failure’ / experimentation: especially in math • Prepare tech-savvy teachers • Educate students about technology and the future of work • Reclaim Science from the domain of men and give girls and women a boost into the pipeline
<p>Tertiary Level</p>	<ul style="list-style-type: none"> • Avoid professor bias: provide in-class observation and stenographers, grading software • Hire more female professors and offer them coaching to project confidence <i>and</i> warmth • Coach female students on participation • Experiment with grading schemes other than class participation, including group work • Talk about respect and civility; sexual harassment, gender bias <p>STEM-Specific</p> <ul style="list-style-type: none"> • Counsel female students on career choices within STEM as they relate to earning power, how to stay in the work force after marriage, what to expect in male-dominated fields
AT WORK	
<p>TIME</p>	<ul style="list-style-type: none"> • Introduce flexible work schedules for everyone: family-friendly policies: (equal maternity/paternity), affordable child/elderly care: note that STEM

	fields offer women time flexibility
ACCESS	<ul style="list-style-type: none"> • Improve women’s access to productive resources: by ensuring gender neutral laws and implementation • Public policies to ensure equal digital access
MARKET + INSTITUTIONAL FAILURES	<ul style="list-style-type: none"> • Mainstream gender across human resources: keep tabs on gender hiring, retention and promotion: <i>Edge</i> certification is one way to do this • Affirmative action, quotas, structured mentoring • Use behavioral design to transform HR departments: the hiring, promotion, and mentoring of women • Given retention issues in STEM companies: firms should first follow the example of Google and use data to understand how women are hired, promoted, and mentored • Companies should experiment in ways to changed ‘systems’ and environments so they are more female friendly: Who gets to speak? Set goals and priorities? Whose vision is counted?

This section provides an in-depth look at global best practices to increase equality for men and women in STEM at school and at work. Equality entails men and women enjoying the same rights, resources, opportunities, and protections, but it does not require that they be treated exactly alike (UNICEF 2014). Breaking out of the low-productivity trap requires policies that lift time constraints, increase access to productive inputs, and correct market and institutional failures.

The table below lists the key barriers to equality for men and women discussed in this report, with examples of policies and approaches to improve women’s opportunities at school and at work. Each policy is then discussed in more detail below.

EQUALITY FOR MEN AND WOMEN AT SCHOOL

○ Access

Numerous international agreements—including the Sustainable Development Goals (SDGs), Millennium Development Goals (MDGs), and the Education for All (EFA) initiative—have emphasized the importance of achieving gender parity in education. To date, these goals have primarily focused on achieving gender parity in access and enrollment and increasing education quality for all learners.

○ Changing Systems

Mainstreaming gender: A UNESCO (2009) report on equality in schools suggests that girls and boys should enjoy “teaching methods, curricula, and academic orientation unaffected by gender bias.” Gender mainstreaming in schools requires implementation of gender-sensitive policies, curricula, textbooks, teacher training, and the overhaul of school culture with the goal of transforming social norms and values that perpetuate discrimination. Such an approach

takes time, a systemic effort, and financial investment to adopt and institutionalize (Eurydice 2010). Although policies and practices cannot be changed overnight, evidence suggests that gradual introduction of gender mainstreaming into the education system has the potential to transform the national culture – including the discourses, policies, procedures, and participants.

Gender parity appears as an overarching principle of the school curriculum in Austria, Liechtenstein, Malta, Norway, and Sweden. In these countries, the gender perspective permeates the whole curriculum and is taken into consideration throughout all subjects and areas across all grades (Eurydice 2010). Austria, Germany, Iceland, Ireland, and Latvia have official guidelines on gender issues for authors of educational texts and teaching materials. Finland's teachers have access to a guidebook that highlights the importance of developing teaching methods and creating learning environments that benefit both genders at the high school, but not primary, level. In the Czech Republic, the NGO Open Society published a handbook for teachers and students of pedagogical universities, describing the risks of gender stereotyping in various areas of school life. In Ireland, the resource packs prepared for schools include lesson plans that demonstrate how all subject areas can be inclusive of the perspectives, interests, and experiences of both boys and girls across all grades.

Experiments in social change to affect tertiary level educational environments: An experiment at Harvard Business School in 2013 attempted to change the “environment” at the school, where women who on paper were as highly educated as men soon lagged behind in their grades and class participation—the latter a key component of student evaluations. A number of steps were taken. Professors lectured on respect and civility; gave “hand-raising” coaching, and added stenographers to every class so professors would no longer rely on possibly biased memories of who said what. A new course called “Field” was introduced, whereby students were grouped into problem-solving teams, reducing potential professor-bias from the traditional cold-calling approach. New grading software tools allowed professors to instantly check their calling and marking patterns by gender. Mandatory discussions were instituted on sexual harassment and the “heavy drinking” scene and its consequences. Female professors were observed by faculty and coached on how to project confidence, avoid boosting their credibility with soliloquies about their own research, and project warmth and high expectations. By graduation, the teaching scores of female professors had doubled in some cases. The school became a markedly better place for female students, according to interviews with more than 70 professors, administrators, and students. More women participated in class, record numbers of women won academic awards, the “grades gap” disappeared, and the “environment” became more accepting of women. Participants also realized that more

counseling was needed for female students on career choice, earning power, or staying in the work force after marriage (Kantor 2013).³⁸

- **Overcoming Stereotype Threat**

The stereotype threat literature should lead teachers to create classrooms in which students do not feel defined or limited by their demographic group membership. Teachers can take proactive steps to show that students from all groups have the potential for academic excellence, and can talk about gender bias while giving women real-life role models to look up to. Finally, teachers can strive early on to minimize the likeability versus intelligence bias facing girls, and prevent them from having to choose between high academic achievement and peer acceptance.

Explain standards and “learn through failure”: Extensive research suggests that stereotype threat can be reduced by changing students’ beliefs about intelligence as a given attribute, to an understanding of the malleability of intelligence through effort (Aronson, Fried, and Good 2002; Good, Aronson, and Inzlicht 2003). Viewing intelligence as changeable according to one’s efforts is associated more generally with high academic achievement (Stipek and Galinski 1996). In one study seventh grade students were mentored by college students who encouraged them to either view intelligence as malleable or to attribute academic difficulties in the seventh grade to the novelty of the educational setting. Results showed that girls earned significantly higher math standardized test scores than girls in the control condition (Inzlicht 2003). Teachers can also ensure that female students do not perceive poor grades to be due to their status as members of a group with a negative stigma concerning achievement. Teachers should explain their grading criteria as explicitly as possible. Letting students know that challenging but attainable standards are present is perhaps most crucial in the lower grades (from seventh grade or below), before students have enough metacognitive awareness to judge their own competencies accurately (Cohen, Steele, and Ross 1999).

Talk about gender bias: With older students, a frank discussion of stereotype threat may help to ameliorate possible stereotype threat effects (Johns, Schmader, and Martens 2005). Talking about the likeability versus academic achievement paradigm that girls and women face at school and in the workplace can help sensitize

To be “technologically literate” requires a set of critical skills, concepts, and problem-solving abilities that permit full citizenship in contemporary e-culture. It is our job as a society to ensure that girls are just as competent as their male peers in meeting these standards.

Source: AAUW 2000

³⁸ Note that the faculty could not determine the causal factors for these outcomes: had professors rid themselves of subconscious biases? Were women performing better because of the improved environment? Or was the faculty easing up on grading women because they knew this was the desired outcome?

boys and girls to its existence, and help them to start to overcome this bias within themselves (Bohnet 2016).

Give counterfactuals: Raising awareness of counter-stereotypical examples of real-world achievement by women can boost the performance expectations of girls and women in high-stakes assessment situations, where students may view the assessment as predictive of future life outcomes (Jordan and Lovett 2007). Exposure to female role models whose positions of leadership or power contradict stereotypes of women’s roles can reduce the intergenerational transmission of gender norms (World Bank 2012).³⁹

- **STEM-Specific Policies**

In Education

According to existing research, much of the work to increase women in STEM must take place at school, starting at a young age (primary). Decisions made early on can drastically affect the pipeline of women studying STEM fields at the tertiary level and choosing STEM as a career field.

Integrate STEM into school curricula from grade 7 or earlier: Governments should modernize primary and secondary school curricula, and schools should integrate analytical thinking, digital technologies, and coding into their curricula, starting in primary school. Integrating ICT studies as part of the core curriculum will also have the benefit of ensuring a critical mass of girls in classes, rather than relying on students to self-select (Powell and Chang 2016). Early exposure has shown to be of particular benefit to building confidence and overcoming cultural stereotypes for girls (Fisher and Margolis 2003).

Orient STEM curricula around relatable problems rather than abstract concepts: Many women and girls see ICT as a tool for solving problems, rather than as an end in itself. Thus introductory courses focused on abstract concepts such as algorithms and programming syntax can feel dry and irrelevant. Tools that enable students to write interesting and useful programs quickly, and provide hands-on research experiences will encourage students to enjoy STEM, and see how it applies to different areas of their lives. Different children will encounter different entry points into STEM subjects: some through art, for example, some through design, some through

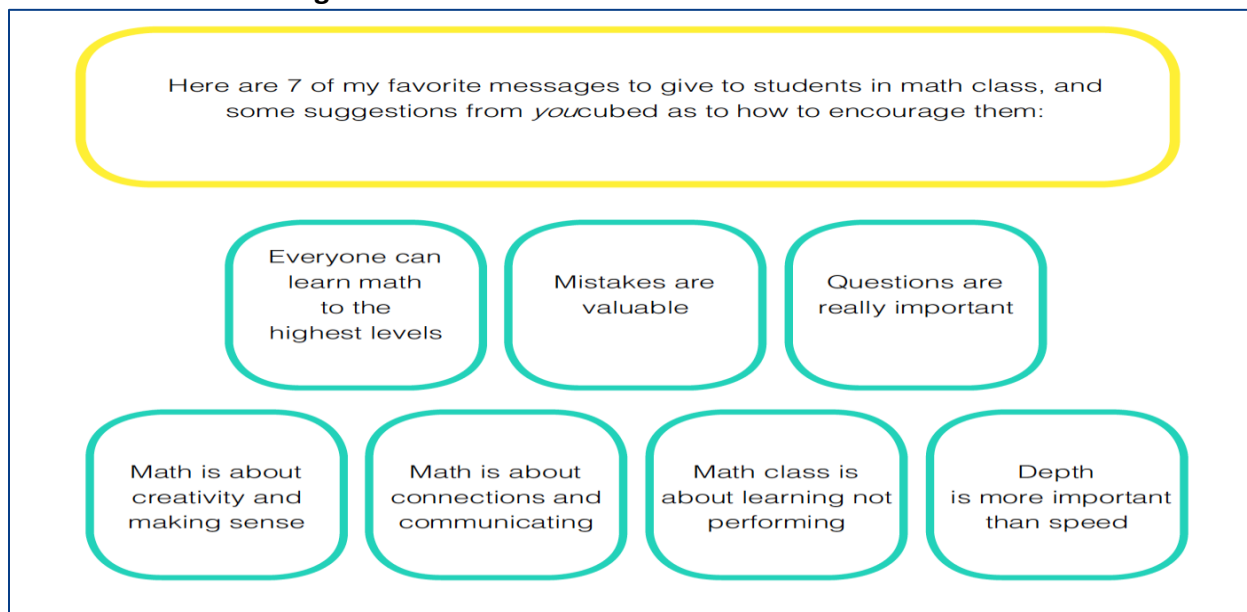
³⁹ An experiment in India showed that positive stereotypes can have a huge impact on girls and their parents. Three years of recruitment services were provided to women in randomly selected rural villages. As a result of the service, employment among women increased significantly (without affecting men). In addition, in the villages chosen to receive recruitment services, girls aged 5–15 experienced a substantial improvement in health and were significantly more likely to go to school. Seeing women work in call centers allowed parents to imagine a different future than early marriage for their daughters (Jensen 2012).

mathematics. These multiple entry points need to be respected and encouraged, while remaining sensitive to activities and perspectives that are appealing to girls and young women.

Reject the notion of math brains: Research has shown that small interventions to change attitudes about learning can have an outsized effect on performance (Chen 2014). Carol Dweck has become the closest thing to an education celebrity because of her work on the “growth mindset”—her research shows that children who have a growth mindset welcome challenges as opportunities to improve, believing that their abilities can change with focused effort. Kids with fixed mindsets, on the other hand, believe they have a finite amount of talent that cannot be altered and shy away from challenges that might reveal their inabilities (Dweck 2016).

Use “growth mindset” teaching methodologies: Jo Boaler runs the *YouCubed* initiative at Stanford University; this neuroscience research shows a strong connection between the attitudes and beliefs students hold about themselves and their academic performance. Boaler promotes the growth mindset through teaching approaches—shared on the website for teachers, parents, and students—that use methods like visualizing math, discussing problems, and writing about math. According to Boaler, different brain pathways light up when one thinks “visually” rather than “numerically.” The more brain pathways a student engages on the same problem, the stronger the learning (Boaler 2015).

Figure A3.1: YouCubed initiative recommendations



Source: YouCubed at Stanford University: <https://www.youcubed.org/category/teaching-ideas/growing-mindset/>

Educate students about technology and the future of work. Schools have a message to communicate about the future of work: all jobs, including those in the arts, medicine, law, design, literature, and the helping professions, will involve more and more technology. Conversely, technological careers will increasingly draw on the humanities, social science, and people skills. It is especially important that girls understand their career options in STEM and the impact of new technologies on more traditional fields.

Reclaim science from the domain of men and give girls and women a boost into the pipeline. It is important to make the public face of women in STEM correspond to the reality rather than the stereotype. Girls tend to imagine that STEM professionals live in a solitary, antisocial, and sedentary world. This is an alienating—and incorrect—perception of careers that will rely heavily on computer technology and expertise in this century. Thus it is important to create and support computing, coding, and math clubs and summer school classes for girls, mentoring programs, science fairs, and programs that encourage girls to see themselves as capable of careers in technology.

Box A3.1: When did STEM become the domain of boys?

Modern computer science is dominated by men, but it was not always this way. A lot of computing pioneers—the people who programmed the first digital computers – were women. And for decades, the number of women studying computer science grew faster than the number of men. But in 1984, something changed. The percentage of women in computer science flattened, and then plunged, even as the share of women in other technical and professional fields kept rising. The share of women in computer science started falling at roughly the same moment when personal computers started appearing in US homes in significant numbers. These early personal computers were not much more than toys—and were marketed almost entirely to men and boys.

This idea that computers are for boys became a narrative. It became the story we told ourselves about the computing revolution. It helped define who geeks were, and it created techie culture. In the 1990s, researcher Jane Margolis interviewed hundreds of computer science students at Carnegie Mellon University, which had one of the top programs in the country. She found that families were much more likely to buy computers for boys than for girls — even when their girls were really interested in computers (Henn 2014).

Infuse computing into the curriculum, and subject areas that teachers care about in ways that promote critical thinking and lifelong learning: The American Association of University Women (AAUW) makes the following suggestions to ensure that girls have the same opportunities as boys to exploit their full potential in computer science:

- *Compute across the curriculum.* Computers can no longer be treated as a “set-aside,” lab-based activity. Computation should be integrated across the curriculum, into such subject areas and disciplines such as art, music, and literature as well as engineering and science. This integration supports better learning for all, while it invites more girls into technology through a range of subjects that already interest them.
- *Redefine computer literacy.* Computer literacy needs to be redefined to include the lifelong application of relevant concepts, skills, and problem-solving abilities. What does this mean? Students must be trained to be literate citizens in a culture increasingly dependent on computers. Students—especially girls, who predominate in clerical and service occupations—must be educated to move beyond word processing and presentation software to solve real-life problems with technology. While a tally of girls in computer science classes is a convenient benchmark, empowering girls and other nontraditional users to mine computer technology for sophisticated, innovative uses requires a mastery of these literacies and abilities, not quickly outdated programming skills alone.
- *Rethink educational software and computer games.* Educational software and games have too often shown significant gender bias. Girls need to recognize themselves in the culture of computing. Software should speak to their interests and girls should be treated as early as possible as designers of software and games, rather than as mere end users.
- *Prepare tech-savvy teachers.* Schools have a special responsibility: they need to develop teachers who are able to design curricula that incorporate technology in a way that is inclusive of all students. Schools of Education also must be able to assess “success” for students and teachers in a tech-rich classroom. The focus for professional development needs to shift from mastery of the hardware to the design of classroom materials, curricula, and teaching styles that complement computer technology.

EQUALITY FOR MEN AND WOMEN AT WORK

○ *Mainstreaming gender*

Sweden is currently one of the most gender-egalitarian societies in the world, and has consistently addressed equality between women and men in national policies since the 1970s. Since 1994, gender mainstreaming has been the main feature and is currently the principle strategy for achieving Sweden's national

"We now know what must be in the last metaphoric chapter...It must involve considerable economic change, not a Band-Aid with firms offering flexible hours and schedules to workers in return for lower compensation. To get from here to there, temporal flexibility must become less expensive for firms."

Claudia Goldin 2015

policy objectives for equality between women and men. According to the Swedish government, *"gender mainstreaming means that decisions in all policy areas are to be permeated by a gender equality perspective,"* including the allocation of resources and the establishment of standards.

○ *Time*

Absolute equality between the sexes in terms of time might be an unobtainable goal given childbirth. Will we ever live in a world where men and women have the same time constraints, the same care and household obligations, and therefore the same amount of time to spend on paid work? Goldin (2015) suggests that it would be easier in the short term to change the nature of jobs, rather than people, and that what is needed are *"changes in how jobs are structured and remunerated, enhancing the flexibility of work schedules."* To succeed, these changes would have to decrease employers' costs in substituting the hours of one worker for another. The gender pay gap would vanish if long, inflexible work days and weeks were no longer seen by employers as the optimal route to profitability—that is, if firms did not have a financial incentive to pay employees working 80 hours a week more than twice what they would receive for 40-hour weeks. An experiment in Holland showed that when a few men in high-paid positions started experimenting with part-time work, acceptance of the practice gradually increased, and that the changes were faster in companies where men were in managerial positions (Bennhold 2010).

The ability to change the patriarchal structure of capitalism might seem a long way off, but in fact the costs of temporal flexibility have begun to fall in some sectors—notably, technology, science, and health. Pushing competitive labor markets to generate more linearity of earnings with respect to the number of hours worked, and when they were logged, will remove the time penalty placed on women. Many of the technology and science occupations have built-in flexibility because work projects are often conducted independently and are highly specific,

requiring less oversight. The spread of information systems has led to change in other sectors, enhancing substitutability across workers.

- **Access**

Reducing gender-based legal restrictions and promoting the use of women's talent in the labor force allows women to choose the opportunities that are best for them, their families, and their communities. Better rule of law is associated with having more gender-equal laws on the books. Empowering women legally may have similar effects to empowering them politically, allowing them to better reflect their preferences in decision making (IFC 2016). Moreover, evidence suggests that after women were granted the right to vote, legislative decisions differed in such areas as child welfare and spending on public health. This may be because elected officials better incorporated women's preferences within their legislative agendas once women became a significant part of the electorate. For example, a study examining state voting rights for women in the United States found that within a year of voting rights being granted to women, voting patterns shifted to incorporate greater local public health spending by about 35 percent. This allowed for greater emphasis on local public health campaigns for issues such as hygiene, leading to a decrease in infectious childhood diseases and a decline in childhood mortality of about 8–15 percent.

Access to land

Although efforts to secure women's land rights must include the passage of gender-equal laws, this is just a first step to realizing equality. Even in those countries where constitutions mandate the equality of men and women before the law, failure to implement, or the procedures used by land administration institutions often discriminate against women, either explicitly or implicitly. To overcome this tendency, a more proactive stance in favor of awarding land rights to women by governments, together with more rigorous evaluation of innovative approaches aiming to accomplish greater equality between women and men in control of conjugal land on the ground, would be warranted (Deininger 2003). Advocacy and awareness campaigns to draw attention to the importance of gender issues in land policy, as well as measures to make women aware of their rights and to provide them with legal aid, are required (Gopal and Salim 1998).

Technology can also be deployed strategically to address structural exclusions such as the denial of land rights to women. In Togo, property rights education was delivered through

mobile phones, and used to build dispersed learning networks (Gurumurthy and Chami 2014).⁴⁰ And e-registration of services can bring gains for women’s strategic interests: by making co-ownership of land or co-stewardship of leased natural resources between husband and wife a compulsory requirement in the digitization of records, public systems can tacitly promote equitable ownership of resources even it is only “on paper” (Ibid).

Access to Finance

The progress made in digital financial services has been heralded as one of the most important means to accelerate access to financial services for women. Since the mid-2000s, mobile money transfers have emerged as a pathway to financial inclusion, evoking considerable interest from international funding organizations. In the past decade, mobile phone money transfer services that use text messaging and a network of retail outlets as cash-in/cash-out points have proliferated. At present, over 150 such mobile money deployment services are in existence, many of which are still expanding the reach of the financial sector to hitherto unbanked pockets in developing country contexts (GSMA Association 2015). One of the more obvious places to improve women’s access to finance is to target salaried workers who receive salaries in cash. The other is to leverage the existing payments from governments to poor people—such as conditional cash transfers or pensions. Findex estimates that 80 million women are recipients of social benefits or wages in cash. Working with governments and the private sector to transfer these payments to bank accounts would be a significant step in expanding financial services (Findex 2014).⁴¹

- **Overcoming Market and Institutional Bias**

The promise of behavioral design

“Big data” improves our understanding of what is broken and needs fixing; shielded from potentially-biased evaluation procedures, data can help companies hire the best candidates and avoid bias. Building on what works, behavioral design creates better and fairer organizations—often at low cost and high speed (Bohnet 2016). It is necessary to create learning environments where people, especially hiring managers, are encouraged to try something new, possibly fail, and learn from it. Behavioral design works, and since individuals

⁴⁰ The Togo Union des Groupements des Femmes initially started an Internet platform that would address SMS-based queries about price information for various crops, but also ventured into mobile phone-based education of women on their property rights, thus adopting a comprehensive strategy to empower women farmers.

⁴¹ In Kenya, the M-PESA mobile money network increased women’s access to finance from 39 percent in 2011 to 51 percent in 2014. In fact, Kenya is one of the few countries where women are more likely than men to have a mobile account. A connectivity ecosystem to guarantee women’s rights to technology would require policies to provide public broadband networks and community-owned wireless systems (Gurumurthy and Chami 2014).

do not always do what is best for themselves, for organizations, or for the world, these approaches offer a little “nudge” in the right direction (Thaler and Sunstein 2009).

Behavioral design can help harvest low-hanging fruit. Key to this endeavor is the collection and use of “big data”—companies must look into the often opaque world of human resources: how are people hired, promoted, and coached? What kinds of behaviors are rewarded at work, and do these reflect a broad spectrum of ideas and backgrounds? Such an approach allows the replacement of intuition, informal networks, and traditional rules of thumb with quantifiable data and rigorous analysis. Successful for-profit firms such as Credit Suisse, Goldman Sachs, Google, LinkedIn, and Microsoft are increasingly running their human resources departments based on evidence. Some now refer to them as “people analytics departments” (Bohnet 2016).

Oftentimes companies are not aware of gender inequality until they actually look into how women are hired, paid, retained, and promoted compared to men. One way to gauge progress and keep tabs on policies and procedures is the “Edge Certification” process, recently initiated by the World Bank and the Inter-American Development Bank, among others. Edge is a global business certification for equality between women and men; its objective is to capture an organization’s most important opportunities to attract, develop, motivate, and retain a gender-balanced pool of talent, giving businesses a competitive advantage. Edge’s assessment methodology and certification standard is built around four pillars that define success in equality between women and men. Two are quantitative and outcome-driven and two are qualitative and process-oriented:

- -Strong gender balance at all levels of the organization
- -Proactive management of pay equity in the organization
- -A solid framework of effective equality between women and men in policies and practices
- An inclusive culture, as reflected in employees’ high ratings in terms of equality between women and men

Once companies know the areas in which they are failing women, they can combat gender inequality in many ways – from affirmative action and quotas— shown to successfully redistribute employment from white men to women and minority groups at no significant efficiency costs (Holzer and Neumark 2000) – to mentoring programs to coach women to reach upper management positions, to the overhaul of traditional human resources departments, often reliant on subjective and biased decisions, to those that use up-to-date and impartial analysis for hiring and promotion.

STEM-Specific Policies

Technology companies should release gender diversity numbers: Fouad (2014) recommends that engineering companies looking to retain female employees first need to recognize the problem and then commit to change at the leadership level. That way change can be transmitted throughout the system.

STEM mentorship and support networks for women in education and employment programs should be integrated: As seen across the globe, the lack of role models and the isolation inherent in pursuing male-dominated professions contributes to women’s high attrition rates. Mentor and peer networks can provide support and combat isolation. For example, the US Department of State’s TechWomen program empowers, connects, and supports the next generation of women leaders in science, technology, engineering, and mathematics from Africa, Central Asia, and the Middle East through a US exchange program and mentorship network.

Human resources departments should be transformed using “what works”: Perhaps one of the most advanced companies in this regard is a tech company. Google realized that 7 out of 10 of its employees are men—the status quo for major Silicon Valley technology companies. Yet there is a business imperative to have women brainstorming and building tech products, not just using them. Google is in the process of transforming its traditional human resources department into a “people management” operation that uses real-time data and experiments based on the latest behavioral economics research to hire, retain, and promote more women (Bohnet 2016). The company recently created a US\$50 million coding project that uses the film *Hidden Figures* to challenge popular perceptions of what computer scientists look like (USA Today 2017). Google admits that gender and racial stereotypes often deter women and people of color from studying computer science and from pursuing careers in the tech industry. Google has also funded research into the structural and social barriers that keep underrepresented students from studying computer science.

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