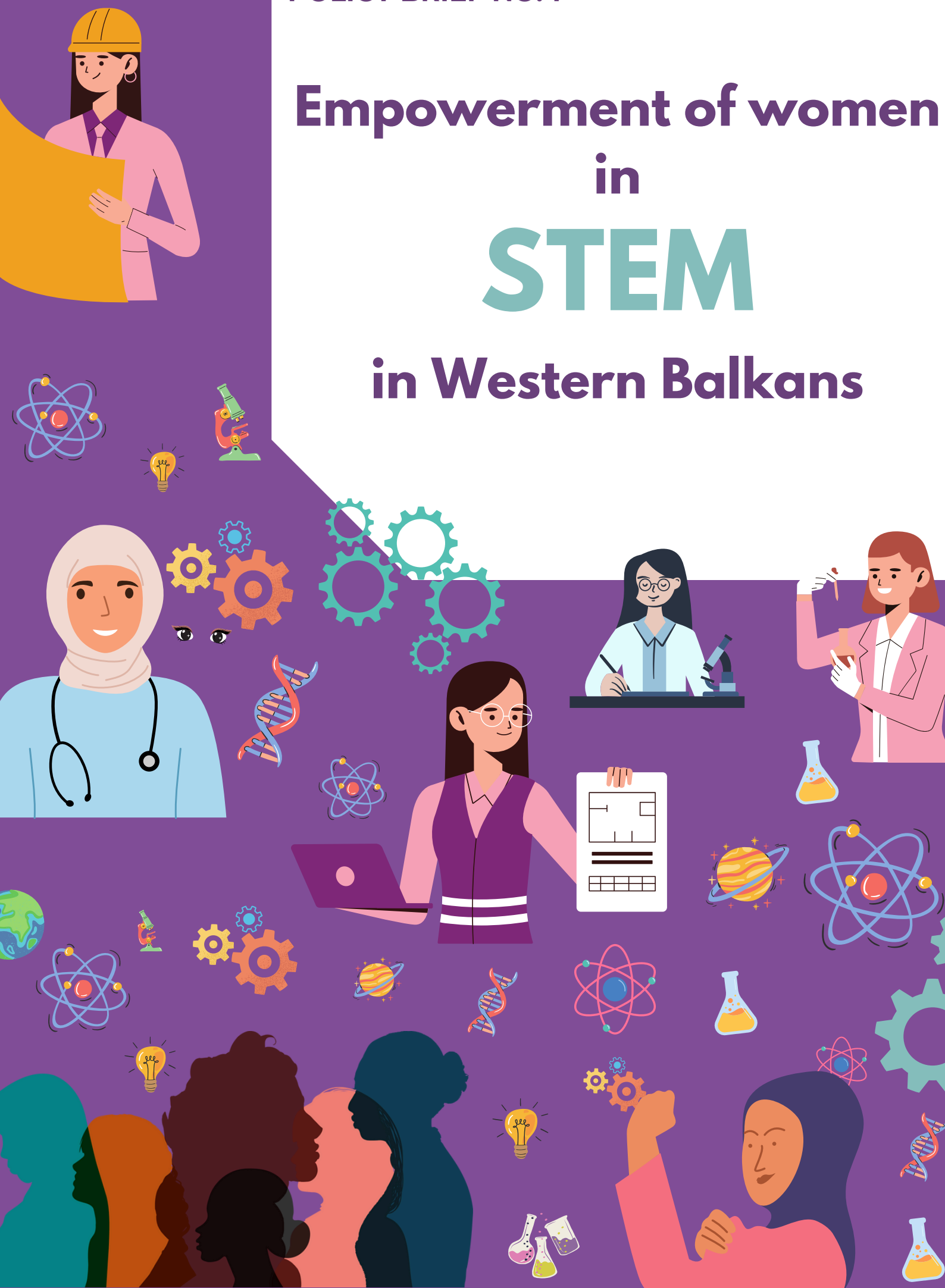
POLICY BRIEF NO. 1

Empowerment of women in STEM in Western Balkans



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INSTITUTE FOR SOCIOECONOMIC DEVELOPMENT OF WESTERN BALKANS

The first Think Tank established beyond the Western Balkans, exclusively dedicated to sustainable development in the region. Comprising experts in Pluralist Economics, we promote policies and practices that support economic stability, environmental sustainability, and social inclusion. Through rigorous research, strategic partnerships, and advocacy, we aim to influence both regional and international decision-making processes, ensuring that the Western Balkans can thrive in a global context. Our commitment to evidence-based policies, innovation, and collaboration drives our efforts to create a prosperous and sustainable future for all communities in the region.

PURPOSE OF THE DOCUMENT

The main purpose of this document is to show the current state of women in STEM in each of the Western Balkan countries, as well as the challenges, and initiatives for women in STEM. It will also provide recommendations on good practices, including approaches to close the gender gap in STEM.

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Terminology

Gender Budgeting: The practice of analyzing and allocating budgets to assess their impact on gender equality, ensuring that resources support both men and women equitably.

Gender-disaggregated data: Refers to data that is separated by gender, which is essential for understanding disparities between men and women in various sectors.

Gender Equality Plan (GEP): A framework or set of strategies designed to promote gender balance and inclusivity within organizations, often required by institutions to secure funding or meet compliance standards.

ICT: Refers to Information and Communication Technology, the use of computers and telecommunications to store, retrieve, and send information, and in some contexts includes call center employees or other roles that do not necessarily require technical education

STEM: Refers to Science, Technology, Engineering, and Mathematics, encompassing fields such as physics, engineering, and computer science.

STEM Pipeline: Refers to the pathway or progression of individuals from early STEM education through to advanced degrees and careers in STEM fields. Challenges in the pipeline often result in reduced female participation in STEM professions.

Unpaid Care Work: Refers to non-remunerated tasks, such as childcare, elder care, and household responsibilities, often disproportionately carried out by women, impacting their professional advancement.

Western Balkans: A group of countries located in the southeastern region of Europe, which are either in the process of integrating into the European Union (EU) or are considered potential candidates. The term commonly includes Albania, Bosnia and Herzegovina, Kosovo*, Montenegro, North Macedonia, and Serbia.

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Key messages

Persistent Gender Disparities in STEM

Despite progress in tertiary education, women remain underrepresented in STEM careers, particularly in leadership roles and high-demand fields like ICT and engineering, across the Western Balkans. Structural barriers, social norms, and cultural stereotypes continue to limit their participation.

Educational Attainment vs. Workforce Representation

While women achieve high graduation rates in STEM disciplines in most Western Balkan countries, these rates don't translate into equitable workforce representation. The transition from education to STEM careers is marked by significant drop-offs for women due to workplace barriers and societal expectations around caregiving.

Lack of Data and Research Gaps

There is a critical shortage of comprehensive, gender-disaggregated data on women's participation in STEM, making it challenging to measure and address gender gaps. This data limitation obstructs the creation of effective policies and targeted interventions.

Initiatives and Regional Collaboration

Current programs, driven mostly by international organizations and NGOs, have made some impact, but national governments in the region lack dedicated, actionable policies for advancing gender equality in STEM. Strengthening regional cooperation could help bridge these gaps and foster sustainable, collective growth.

Policy Recommendations for Inclusive STEM Growth

The report recommends implementing better data collection practices, enhancing STEM outreach for young girls, improving workplace inclusivity, and prioritizing policies that support work-life balance. This combined approach aims to build a supportive environment for women in STEM, essential for the region's economic growth and EU integration.

Summary

The Western Balkans —comprising Albania, Bosnia and Herzegovina, Kosovo, Montenegro, North Macedonia, and Serbia— are at various stages of European Union (EU) integration, striving to align with the 17 Sustainable Development Goals (SDGs) by 2030, which were adopted by the United Nations in 2015 as a universal call to action to end poverty, protect the planet, and ensure that by 2030 all people enjoy peace and prosperity. A critical aspect of this alignment involves addressing gender disparities in Science, Technology, Engineering, and Mathematics (STEM) fields. Despite progress in educational attainment, women remain significantly underrepresented in STEM professions, particularly in leadership roles, across the region. This policy brief identifies a research gap in the understanding of gender disparities in STEM within the Western Balkans and examines the current state of policies addressing these issues. To achieve this, a comprehensive literature review was conducted, synthesizing data from a variety of sources including World Bank, UNDP, and national statistical offices, to bridge the gaps in existing research. Our analysis reveals that while some countries have made strides in promoting gender diversity in STEM, persistent challenges—including deep-rooted gender stereotypes, cultural norms, and structural barriers—continue to hinder women's participation and advancement. A significant obstacle is the lack of comprehensive, gender-disaggregated data, which complicates efforts to develop effective, targeted policies. Additionally, critical data on other factors such as women's participation in innovation, the number of patents filed by women, the representation of women entrepreneurs, and the extent of gender budgeting remains largely unavailable. This publication presents unique cross-regional insights and recommends actionable steps to enhance gender equality in STEM and beyond. These include improving data collection, strengthening regional cooperation, fostering supportive work environments, and implementing gender-focused policies and mentorship programs. Addressing these challenges and building on regional and international partnerships will be crucial for the Western Balkans to close the gender gap in STEM, driving sustainable development and supporting their EU integration efforts.

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Introduction

Over the past few decades, extensive research has highlighted a persistent global gender gap across various sectors, particularly in STEM. The 2023 Global Gender Gap Index, with an average score of 68.4% across 146 countries, shows that 31.6% of the gender gap remains unaddressed. While this score reflects progress, it underscores that no country has achieved full gender parity; significant efforts are still needed to ensure equal opportunities and representation in education, employment, and political participation. In STEM fields, this disparity is especially pronounced, with women comprising less than 30% of the global STEM workforce (Ford et al., 2020; Piloto, MIT).

In the Western Balkans, Global Gender Gap Index scores vary, from 70.4 in North Macedonia to 77.1 in Albania, reflecting the ongoing challenges these nations face in achieving gender parity (World Economic Forum, 2023). Some countries, like Albania and Serbia, are nearing the European average of 76.3, while others, including Bosnia and Herzegovina and North Macedonia, are further behind. Similar to global trends, the Western Balkans also experiences pronounced gender disparities in STEM education and careers (Risteska et al., 2020).

The Western Balkans confront a critical challenge in achieving gender equality within STEM. Despite overall progress in educational attainment, women remain significantly underrepresented in STEM careers and leadership positions across the region. Recent data highlights this starkly: women hold only about 14% of STEM jobs, with men earning STEM degrees at approximately four times the rate of women (Balkan Innovation, 2022). This gender gap is largely driven by entrenched stereotypes, social norms, and structural barriers that dissuade women from pursuing STEM education and careers. These disparities affect not only the labor market but also the educational and technological sectors, where women are especially underrepresented in leadership roles and high-demand STEM fields.

A major obstacle in understanding and addressing these gaps is the lack of comprehensive gender-disaggregated data within the Western Balkans. Research often relies on women's participation in Information and Communication Technology (ICT) as a proxy for broader STEM engagement. In this regard, the Western Balkans present a somewhat encouraging picture, with an average of 45.9% of ICT graduates being women. However, workforce participation tells a different story, revealing disparities and paradoxes. For example, while women in Serbia represent 23.3% of the ICT sector—surpassing the EU average of 18.9%—they still face a 17% pay gap, largely because women are more likely to hold junior positions, while men occupy leadership roles (UNDP, 2024). Women are often concentrated in lower-paying positions, such as science education, and are underrepresented in high-demand roles like engineering and ICT specializations.

This policy brief examines the challenges women in STEM face across the Western Balkans, highlights initiatives promoting gender equality, and proposes actionable directions for empowering women in these fields. Addressing these issues will enable policymakers to build a more inclusive, innovative, and prosperous future for the region.

Current State of Women in STEM in the Western Balkans

Enrollment and Graduation Rates

The transition from high school to higher education is a critical juncture where many young women opt out of pursuing STEM career paths (Hill et al., 2010, 2015). By examining educational attainment data by gender, we can pinpoint where the most significant drop-offs occur for women in STEM, such as between high school and university or within specific disciplines like engineering and computer science. This analysis reveals not only the current state of gender representation but also highlights systemic barriers that affect women's progression in STEM education, such as cultural norms, socioeconomic factors, and institutional biases. Educational attainment data from Albania, Bosnia and Herzegovina, Kosovo, Montenegro, North Macedonia, and Serbia in 2023 illustrate these patterns across three education levels: Primary, Secondary, and Tertiary. Generally, gender representation at the primary and secondary levels is relatively balanced, except in Albania, where disparities are more pronounced early on, and in Kosovo, where slightly more male students enroll in primary and secondary education. However, at the tertiary level, a clear shift emerges, with women consistently achieving higher completion rates than men across the region, indicating strong potential for advancing gender equality within STEM.

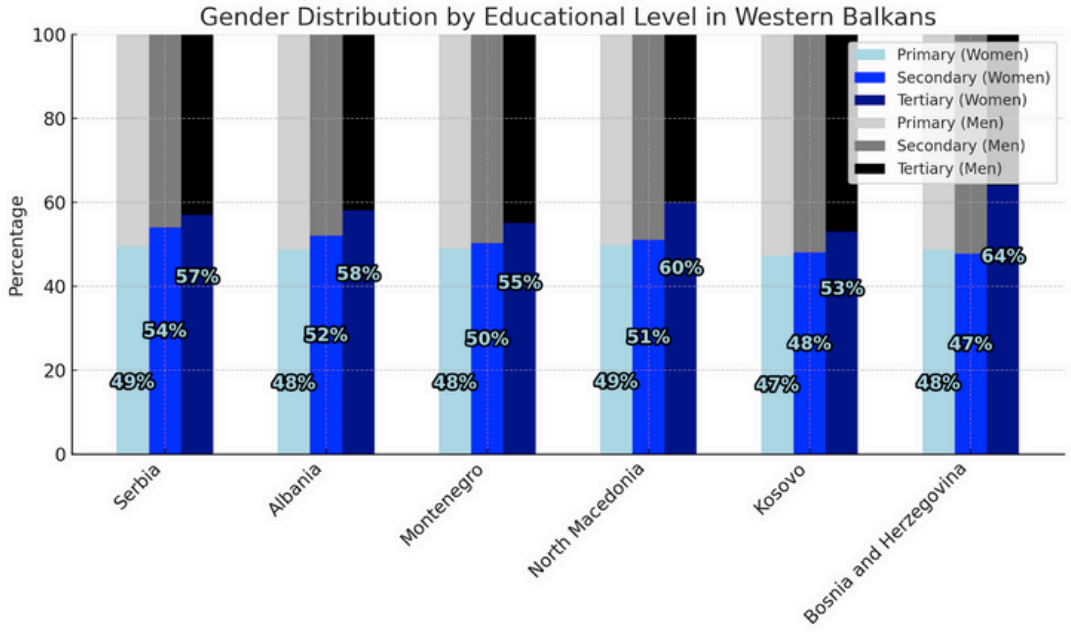

Figure 1. Education Attainment by Gender and Level in the Western Balkan

Source: Open Data Albania, 2023 Economic Reform Programmes by the European Commission, Regional Cooperation Council (RCC) Publications, INSTAT(Instituti i Statistikave). Kosovo Ministry of Education, Science, Technology, and Innovation, Note: In some cases data for 2020 was the latest available.

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However, disparities arise within STEM fields. While women in the Western Balkans make up a significant proportion of tertiary STEM students—between 66% and 70%—this representation varies widely across specific disciplines. Data from the STEM4ALL* portal reveal that women's representation in engineering, manufacturing, construction, and ICT is considerably lower: women comprise only 38-42% in engineering and 27-35% in ICT. Unfortunately, data reliability is a challenge, as different sources often report inconsistent figures, and complete data is unavailable for Kosovo, Montenegro, and some categories in North Macedonia. For example, a study conducted by the Kosovo Association of Information and Communication Technology found that, in 2018, 43.6% of ICT students in public universities were women, while in Northern Mitrovica, only 25% of ICT students were female (STIKK - Kosovo IT Barometer, 2019). ICT graduation rates tend to be slightly higher across the region compared to enrollment, though gender disparities persist. These rates are notably better than the EU average, where only one in three STEM graduates and one in five ICT specialists are women (EU Commission, Women in Digital, 2024).

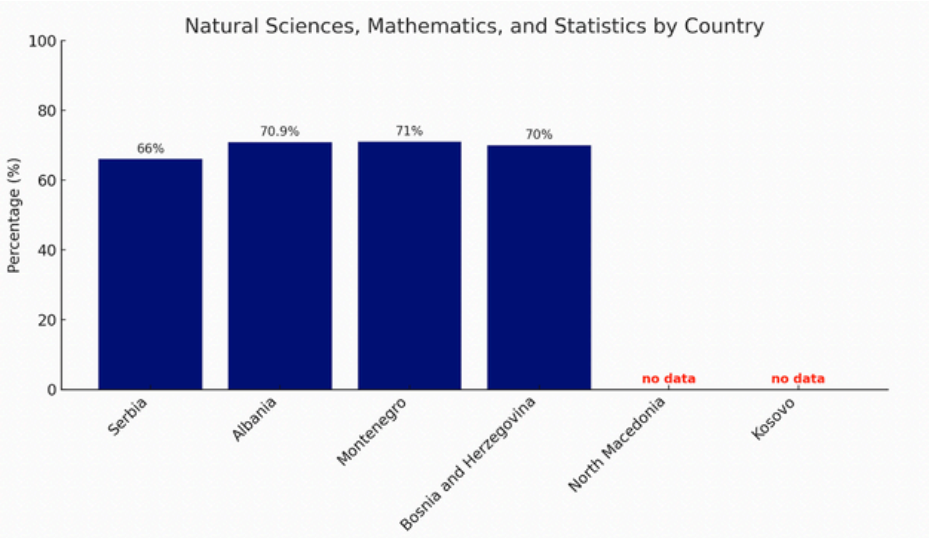

Figure 2. Share of women studying natural sciences, mathematics and statistics.
Source: STEAM4ALL, 2017 data

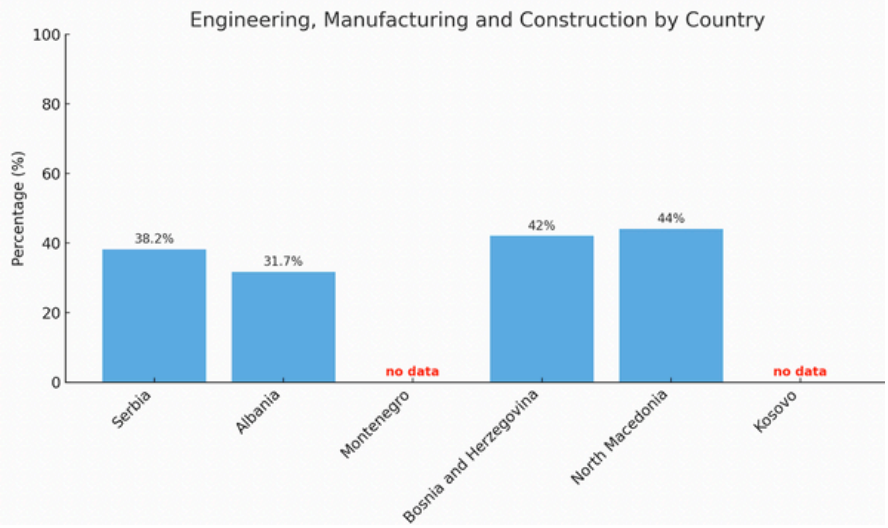

Figure 3. Share of women studying Engineering, Manufacturing and construction.
Source: STEAM4ALL, 2017 data

*a joint platform by UNDP and UNICEF Europe, Asia, and the Pacific dedicated to accelerating gender equality and the representation of women and girls in STEM to meet the demands of the future of work in the region.https://stem4alleurasia.org/about/about-stem4all

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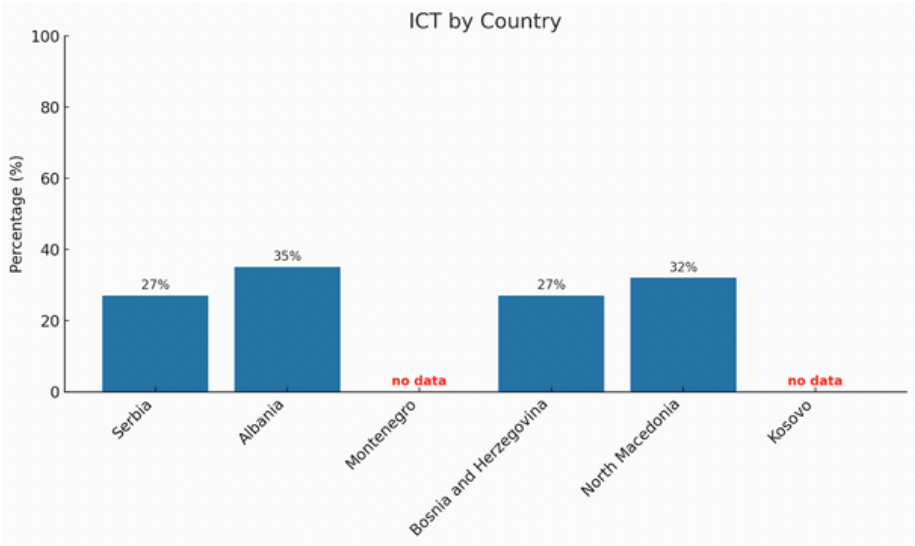

Figure 4. Share of women studying Information and Communications Technologies
Source: STEAM4ALL, 2017 data

Transition from studies to labour market

While graduation rates for women in STEM are relatively positive, these achievements do not fully translate into workforce participation. Despite educational successes, women face significant challenges when transitioning from education to employment, as evidenced by a persistent gender employment gap across the Western Balkans. According to the UNDP's 2022 Ipsos survey, women comprise approximately 40% of the total employed population in the region, yet 23% are in insecure jobs. Kosovo, for example, reports one of the widest gender employment gaps, highlighting substantial barriers for women entering the workforce.

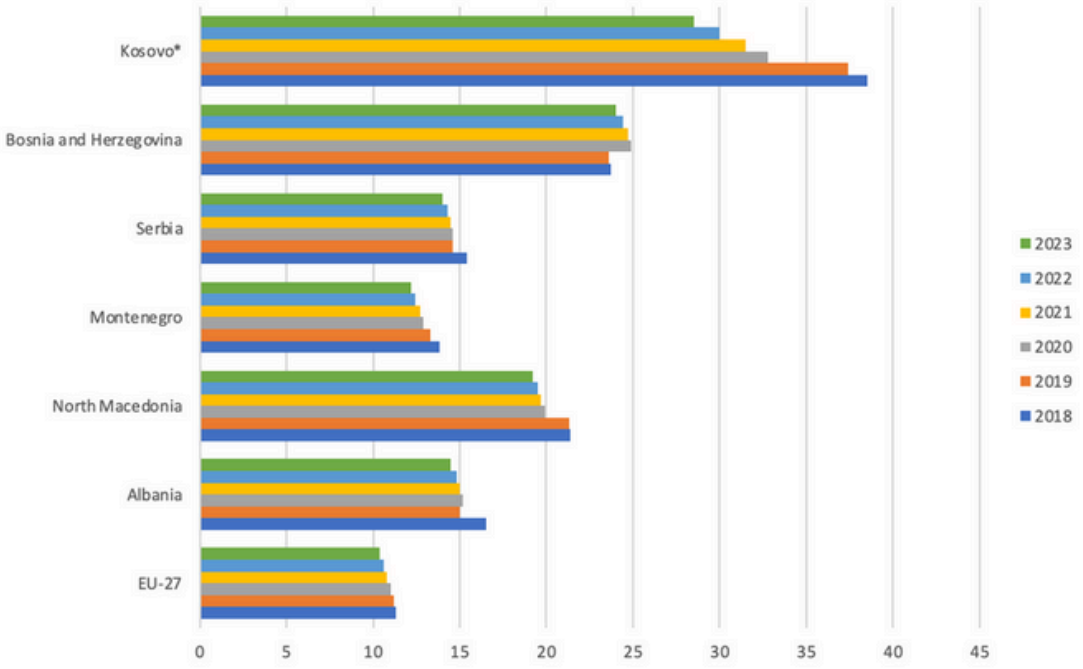

Figure 5. Gender employment gap in percentage points, 2018 - 2023
Source: Eurostat, National Statistical Offices, World Economic Forum`s Global Gender Gap Report, Kosovo Labour survey

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Current State of Women in STEM in the Western Balkans

In the EU, just 1.9% of ICT specialists in 2022 were women compared to 7% for men, and among STEM graduates, the ratio stands at 28 men to 14 women per 1,000 individuals (DESI, 2022). Within the Western Balkans, research careers serve as a proxy for STEM employment: Serbia, Montenegro, and North Macedonia have around 50% female researchers, with Bosnia and Herzegovina showing 44% female representation as of 2014. However, substantial differences remain across fields; women are far less represented in engineering, with just 35-42% in Montenegro, North Macedonia, and Bosnia. ICT employment also varies, with only 20% female participation in Kosovo compared to 53% in Montenegro. Though some data indicate progress in particular areas, these figures largely reflect research roles without capturing broader STEM occupations, leaving a gap in understanding women's specific positions and job levels

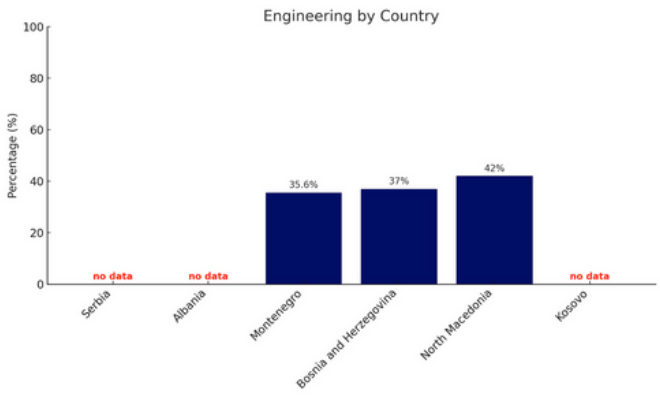

Figure 6. Women working in Engineering field
Source: STEAM4ALL, UIS Studies based on data no older then 2017. Note: Research careers are used as proxy indicators of STEM careers

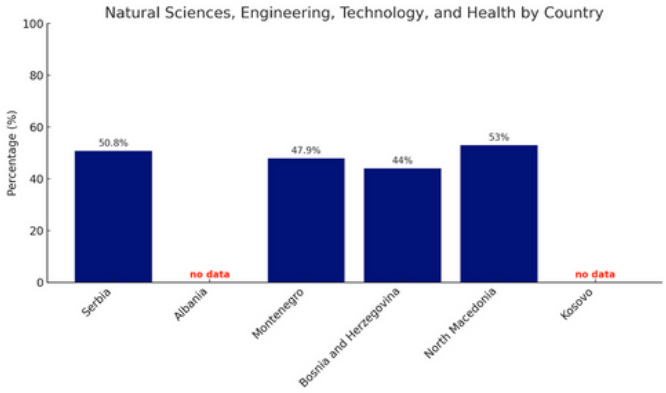

Figure 7. Women working in STEM
Source: STEAM4ALL, UIS Studies based on data no older then 2017. Note: Research careers are used as proxy indicators of STEM careers

A major limitation in assessing these disparities is the lack of comprehensive, gender-disaggregated employment data across all STEM sectors. Additionally, regional factors like high youth unemployment, informal economies, and joblessness further obscure true employment statistics. Informal employment is prevalent, with Albania reporting the highest informal workforce (56.7%), followed by Montenegro (26-31%), Bosnia and Herzegovina (19.9%), and Serbia (18.7%), while North Macedonia reports only 10.1% (ILOSTAT, n.d.; European Commission, 2021). Barriers to entrepreneurship further restrict opportunities for women, who own only 27.5% of businesses and generally operate in smaller, less capital-intensive sectors with limited income potential. Access to credit and networks remains a challenge; for instance, in Montenegro, women accounted for less than 24% of entrepreneurs in 2021 (Tax and Custom Administration, 2020). In Serbia, only 12% of startup founders are women, and the rate of female technical founders is even lower: only one out of 175 chief technical officers who reached Series A or B funding is female. Bosnia and Herzegovina reports similar figures, with only 10% of startups founded by women (ITU, 2021). Despite some signs of progress, such as a slight reduction in the gender employment gap, the need for targeted initiatives remains clear. Supporting women's entry and retention in the labour market, particularly in STEM, is essential to bridge these persistent disparities and foster more inclusive economic growth.

Current State of Women in STEM in the Western Balkans

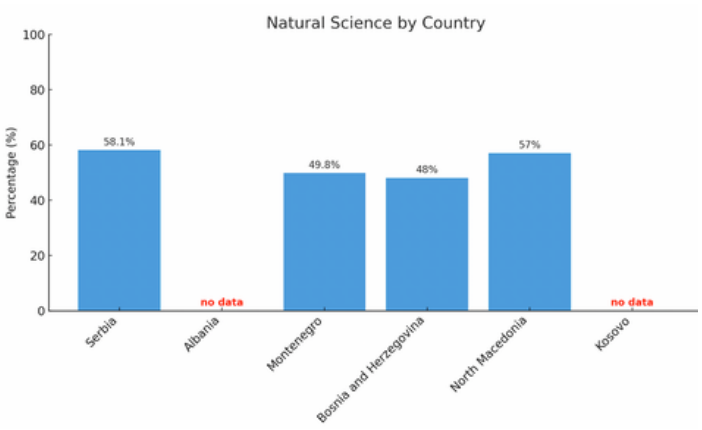

Figure 8. Women working in Natural Sciences
Source: STEAM4ALL, UIS Studies based on data no older then 2017. Note: Research careers are used as proxy indicators of STEM careers

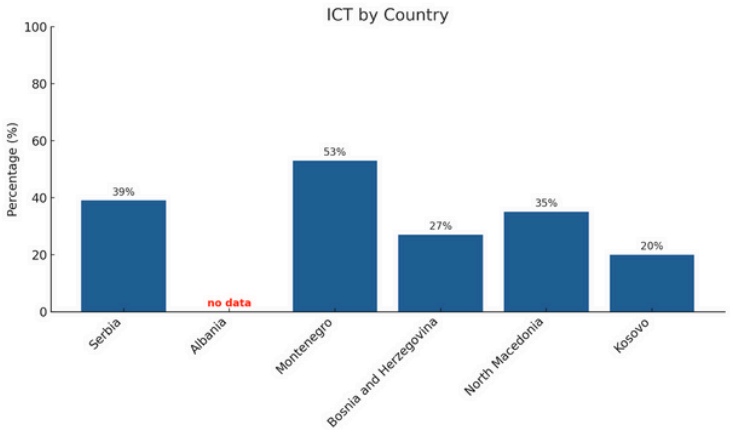

Figure 9. Women working in ICT
Source: STEAM4ALL, UIS Studies based on data no older then 2017. Note: It is unclear in the survey what exactly ICT worker is

Leadership Positions

Women in the Western Balkans are significantly underrepresented in leadership roles within STEM fields, though concrete, representative data remain sparse. For example, a 2022 UNDP report on Serbia's ICT sector highlights a substantial gap, with only 34% of executive roles held by women. Although Serbian women are twice as likely as men to hold doctoral degrees in computer programming, they are noticeably absent from top managerial positions in ICT companies (ITU, 2021). Additionally, only 10% of the highest-paid employees in Serbia are women, a trend mirrored across neighboring countries.
In Montenegro, the National Body of Science and Research is a striking example of this imbalance: women hold no decision-making roles, with 14 men and just one woman in its Department of Natural Sciences. This scenario underscores systemic barriers that stymie gender equity in STEM leadership. Similarly, only 10% of companies in Bosnia and Herzegovina and 12% in North Macedonia have women in managerial positions (ITU, 2021). In Kosovo, a study of 27 ICT companies revealed that only 22% of women respondents occupied leadership roles (STIKK, 2021). However, comprehensive data for each country and STEM category remain unavailable, limiting insight into women's leadership across STEM fields.

To address these disparities, the RCC and UNDP have identified priority areas for joint action, including "Women's leadership in economies and decent work for women" and "Closing gender gaps in digitalization and STEM." These priorities seek to foster gender equity by promoting legislation with affirmative measures, introducing mandatory gender-responsive budgeting, and expanding women's access to education and STEM career opportunities. By targeting these areas, the Western Balkans aim to create a more inclusive environment for women's leadership in STEM, supporting broader regional goals for inclusive growth and gender equality.

Transition from studies to labour market

Main Challenges in Closing the Gender Gap in STEM

STEM fields benefit from the contributions of both women and men, yet in many countries, environments present barriers that hinder women's pursuit of careers in science, technology, engineering, and mathematics. While women in the Western Balkans surpass men in enrollment in mathematics and science education, they remain underrepresented in fields like engineering and technology. As a result, many women are concentrated in lower-paying jobs, such as science teaching, and hold fewer high-profile positions in roles like engineering or ICT specializations (Ferati et al., 2023; Risteska et al., 2020). In examining the causes behind this gender gap, we highlight a range of factors: a disproportionate burden of unpaid family care, gender-based violence, discrimination based on disability, underinvestment in STEM education, spousal approval requirements for employment or entrepreneurship, and various systemic barriers that restrict career growth. We explore these challenges in the following sections, categorized as personal, cultural, discrimination-related, and work-life balance barriers.

Personal and Cultural Barriers - Gender Stereotypes, Social Norms and Bias

Numerous studies have examined the factors influencing the gender gap in STEM education and professions, highlighting the role of gender stereotypes and their impact on the number of women in STEM (Carli et al., 2016; Chatzi & Murphy, 2022; Ferati et al., 2023; Miller et al., 2018). Gender-based stereotypes create barriers for women and contribute to persistent discrimination and underrepresentation in STEM careers (Carli et al., 2016). Research shows that when asked to draw a scientist, girls are more likely to depict a male figure, reinforcing the notion that science is not for them (Miller et al., 2018). Even artificial intelligence, when prompted to display a scientist, often shows a white male in a lab coat, underscoring the deep-rooted bias in society. From an early age, girls are frequently subjected to societal beliefs suggesting they are less competent in math and science than boys. Studies indicate that even preschool educators may underestimate girls' math abilities, which reduces encouragement for girls to pursue STEM subjects (Kowalski et al., 2018).

This global trend of gender stereotyping is reflected in research from the Western Balkans. Ferati et al. (2023) confirm that high school and college students in the region hold stereotypical perceptions about STEM subjects. Most students in these studies view technical fields, such as physics and informatics, as better suited to men, believing that men have a natural aptitude for technical subjects. This perception extends beyond regular classes into extracurricular activities, where boys are often overrepresented in science competitions.

A noteworthy finding in the studies by Ferati et al. (2023) is the disparity in how boys and girls perceive their own abilities and those of the opposite gender in technical fields. Boys often see themselves, and males in general, as more skilled in STEM subjects such as natural sciences and technology, a view consistent with global findings where men frequently associate scientific and mathematical success with their own gender (Passolunghi, 2014). Negative stereotypes about girls' and women's abilities in science and mathematics can increase stress and anxiety for girls in STEM subjects. Research shows that girls report higher levels of anxiety in math classes than boys, a finding consistent with studies from outside the Western Balkans, which also indicate that greater math anxiety among girls can negatively impact their performance (Van Mier, Schleepen & Van Der Ber, 2019).

Transition from studies to labour market

Consequently, many women expect lower performance on advanced math tests, which may lead them to avoid math-intensive fields of study (Marx & Roman, 2002). These stereotypes are thus seen as significant factors influencing women's choice of profession and major.
Further literature highlights how the attitudes and career aspirations of students in the Western Balkans reflect the existing gender-based occupational segregation in the labor market. Women predominantly work in traditionally female-dominated, people-oriented professions, while men are more commonly employed in things-oriented roles (Su, Rounds & Armstrong, 2009). These occupational patterns are influenced by social norms and values (Demukaj, Maloku & Beqa, 2018) and contribute to the gender pay gap, as women are often concentrated in lower-paying professions (Chamberlain, 2016; Banerjee, 2014). Despite improvements in women's educational outcomes, they remain underrepresented in high-paying jobs and face weaker labor market outcomes across the Western Balkans. It is estimated that gender gaps in the labor market reduce GDP by approximately 18%, with one-third of this gap linked to the occupations chosen by women (World Bank, 2018).
Social norms further complicate women's experiences in STEM. A study by the Regional Cooperation Council (RCC) on the gender gap in the Western Balkans indicates that STEM is often seen as a male-dominated field conflicting with traditional domestic responsibilities assigned to women. Deep-rooted social norms and attitudes lead to lower participation of women in STEM education and careers, with girls making educational and career choices heavily influenced by prevailing societal expectations (Risteska et al., 2020). Many STEM workplaces maintain a male-dominated culture, often characterized by exclusionary practices, limited mentorship opportunities, and inadequate support for balancing work and family responsibilities, particularly in policies around parental leave.

Implicit bias and discrimination also contribute to the underrepresentation of women in STEM. Studies show that women in STEM frequently encounter subtle biases that affect hiring, performance evaluations, and day-to-day workplace interactions. Such discrimination can discourage women from entering or remaining in STEM fields, as they may feel undervalued or unsupported. Another concern is the confidence gap, which reflects the difference in self-assurance between genders. Research demonstrates that, by the third grade, girls often begin to lose confidence in their math abilities, while boys are more likely to assert their competence. This confidence gap affects academic performance and influences career choices and persistence in STEM fields

Main Challenges in Closing the Gender Gap in STEM

Personal and Cultural Barriers - Lack of Role Models and Mentorship

Many women make significant contributions to society through their professional achievements and by inspiring other girls and women in STEM and ICT fields. However, these talents and accomplishments often go unnoticed by the broader public. This lack of visibility can lead to a reduced sense of belonging among women, potentially discouraging them from pursuing studies or careers in STEM (Buhnova, 2021; EIT RawMaterials, 2022). For instance, a study by the Regional Cooperation Council (RCC) revealed that only 20% of women in STEM within the region had access to a female mentor during their career, in contrast to 50% of men who had male mentors (RCC, 2022). This disparity in mentorship opportunities and visibility may deter young women from entering or remaining in STEM careers. Initiatives like the "Women in STEM" network in Serbia aim to bridge this gap by connecting young women with experienced professionals; however, the impact remains limited by the scale of the problem (UNDP, 2023).

Personal and Cultural Barriers - Discrimination and Exclusionary Cultures

Women frequently encounter biases in hiring processes, where their qualifications are undervalued relative to those of men (European Commission, 2020). These biases extend into performance evaluations, often resulting in feelings of isolation and undervaluation (Ross et al., 2022). The male-dominated culture in STEM fields further exacerbates these issues, creating environments where support for women is limited and turnover rates are consequently higher (EIGE, 2018). Addressing these challenges requires the implementation of gender-sensitive practices and the fostering of inclusive work environments (Hunt et al., 2020). According to a survey by the European Institute for Gender Equality (EIGE), women across the region report that their qualifications are frequently undervalued during hiring, leading to lower initial salaries and fewer opportunities for advancement compared to male colleagues (EIGE, 2021). In Serbia, for example, women constitute only 28% of the STEM workforce and are often concentrated in lower-paying roles, such as teaching, rather than in higher-paying engineering positions (UN Women, 2022). The male-dominated culture in many STEM workplaces exacerbates these issues, contributing to the higher turnover rates among women who often leave due to insufficient support and limited career advancement prospects. Efforts to cultivate more inclusive work environments, such as the introduction of gender sensitivity training within Montenegro's tech companies, represent initial steps in addressing these concerns, though progress remains gradual (RCC, 2023).

Main Challenges in Closing the Gender Gap in STEM

Personal and Cultural Barriers - Work-Life Balance Challenges

Balancing career and family responsibilities poses a significant challenge for women, especially in the STEM workforce. Women often bear the primary caregiving role in their households, which limits their availability for the rigorous demands of STEM fields, known for requiring extended hours, intense focus, and constant skill updates (FRA, 2021). Unlike some other professions, careers in science, technology, engineering, and mathematics often operate in highly competitive environments where flexible working arrangements, which would enable better work-life balance, are uncommon. Additionally, the need to be available for project deadlines or collaborate across international time zones further complicates work-life balance, placing disproportionate strain on women who are expected to manage family care alongside their careers. This challenge is exacerbated by the limited availability of supportive policies, such as flexible working hours, comprehensive parental leave, and childcare services, which hinders career advancement for many women (ILO, 2020). Cultural expectations within the Western Balkans often reinforce the notion that caregiving responsibilities fall primarily on women, leading them to struggle with the demands of STEM careers. For example, a 2021 report by the Balkan Investigative Reporting Network (BIRN) found that in Bosnia and Herzegovina, 60% of women in STEM identified family responsibilities as a major barrier to career advancement, compared to only 15% of men (BIRN, 2021). Additionally, the scarcity of flexible work options is notable. In North Macedonia, for instance, only 20% of tech companies offer flexible working arrangements, making it difficult for women to effectively balance their professional and personal lives (ILO, 2022). According to a UNDP survey in Serbia, many women report that support for childcare is crucial for their career development, with some mothers returning early from maternity leave or hiring external childcare support to keep their careers on track. Implementing more comprehensive family-friendly policies could significantly boost female participation in STEM fields across the Western Balkans, as shown by other regions with more progressive policies (OECD, 2021).

Existing Programs and Initiatives

Global initiatives

In the United States, **Title IX** has been a cornerstone for advancing women's participation in higher education, including STEM. Enacted in 1972, Title IX prohibits gender discrimination in federally funded educational programs, paving the way for more women to enter male-dominated fields like engineering and computer science.

Similarly, the European Union's **Horizon Europe** program, one of the largest EU research and innovation initiatives, mandates that organizations applying for research funding have a Gender Equality Plan (GEP) in place. This requirement promotes active efforts to achieve gender equity, incentivizing institutions to prioritize gender diversity.

Canada Research Chairs Program sets explicit diversity targets to increase the representation of women and underrepresented groups in research roles. The program allocates a portion of federal research funding specifically for institutions that support diversity initiatives, creating an environment where women and marginalized groups are better represented in research and academia.

Australia's **Athena SWAN Charter** focuses on promoting cultural and structural changes in academia to reduce gender disparities. Modeled after the UK's Athena SWAN initiative, this program encourages academic institutions to identify and address gender inequities within their organizations, from recruitment to career progression. The program's impact is enhanced through accreditation levels, which motivate institutions to continuously improve.

The **UK's mandatory gender pay gap reporting**, introduced in 2017, has been a strong driver for transparency and accountability. Companies with over 250 employees are required to publish their gender pay gaps, pushing organizations to adopt proactive policies to close these gaps, particularly in sectors like STEM, where disparities are often more pronounced. n

In Japan, the Act on Promotion of Women's Participation and Advancement in the Workplace mandates targets for women's advancement, including in traditionally male-dominated sectors. Since its implementation, the Act has encouraged a gradual cultural shift, emphasizing the importance of female representation and promoting an inclusive work culture. Companies and government organizations are required to report on their progress, fostering accountability.

South Korea's WISET Program (Women in Science, Engineering, and Technology) offers scholarships, internships, and mentoring for women in STEM. This initiative has significantly increased female representation in STEM fields by removing financial and professional barriers, especially for early-career professionals. WISET has created a pathway for women to participate more fully in the workforce, contributing to South Korea's growing innovation economy.

The Nordic countries exemplify how comprehensive gender equality policies can be combined with work-life balance support to allow women to pursue STEM careers without sacrificing family responsibilities. These countries provide extensive parental leave, subsidized childcare, and policies promoting flexible working hours.

Existing Programs and Initiatives

National and International Initiatives

While various Western Balkan countries have published government documents addressing gender equality, specific initiatives targeting women's participation in STEM remain limited and are often driven by NGOs and international organizations. However, there are notable national policies, strategies, and programs that contribute to the broader goal of gender equality, which indirectly influence women's participation in STEM. Below is a closer look at the national efforts across the region.

Albania has introduced the National Strategy for Science, Technology, and Innovation 2017-2022 alongside the National Strategy for Gender Equality 2021-2030. Although these policies highlight the importance of gender equality in various sectors, specific targets for women in STEM are absent. The focus remains on promoting innovation and technology development, with some emphasis on women's roles in these fields. The SCiDEV grassroots program, funded by international organizations, aims to bridge the gap by supporting women's engagement in science. Additionally, the UNESCO Network of Albanian Women in Science fosters collaboration and mentorship, although there are no clearly defined funding amounts or concrete STEM-related outcomes attached to these initiatives. The focus has been on capacity building and increasing awareness, but the impact on STEM employment remains under-evaluated.

In **Bosnia and Herzegovina**, government programs focus on encouraging women to participate in engineering and IT, led by the Ministry of Civil Affairs. These initiatives have been supplemented by the efforts of NGOs like the *CURE Foundation* and the *BH Futures Foundation*, which provide mentorship and career development opportunities for women in STEM. These programs have been active since around 2018 and continue to promote gender equality, although there is no detailed budgetary breakdown for their activities. International initiatives, such as *STEMwave* supported by UNDP, also play a pivotal role by providing technical skills training to young women and girls. The overall impact of these programs is visible in increased awareness and participation in workshops and internships, but a lack of comprehensive evaluation limits our understanding of their long-term outcomes.

Kosovo stands out for its legal framework, having implemented the *Law on Gender Equality* since 2015, which establishes a foundation for gender equality in all sectors, including STEM. However, specific policies that directly target women in STEM remain underdeveloped. The NGO *Girls Coding Kosova* plays a significant role in promoting women's involvement in the tech sector, providing training and mentorship. Additionally, the *Girls in ICT Initiative* contributes to raising awareness, although both initiatives rely heavily on external funding and partnerships rather than sustained government investment.

In **Montenegro**, the *Strategy for Gender Equality 2021-2025* outlines broad goals for reducing gender disparities across sectors. However, specific actions targeting women in STEM are largely absent from government agendas. Projects led by the Ministry of Science, often funded through international partnerships with UNESCO and UN Women, offer some support for women in technology and science fields. For example, the *Digitalizuj.Me* initiative promotes women's digital skills, but again, specific data on the allocation of financial resources or direct outcomes are scarce. These projects typically focus on short-term training and awareness-raising, with little data available on their effectiveness.

Existing Programs and Initiatives

North Macedonia introduced the *National Strategy for Gender Equality 2021-2026*, which aims to reduce gender disparities in education and employment, though there are no specific action points for STEM. The Ministry of Education and Science has been involved in several reforms aimed at improving STEM education for girls, but these remain under general gender equality goals. NGO initiatives such as *Girls in Tech* and *Tech4Girls*, supported by international organizations, have been essential in promoting digital literacy and technology careers for women. However, the lack of sustained government-led efforts in STEM policy hinders large-scale impact.

Serbia has made some progress in gender equality through the *Gender Equality Strategy* and its *Innovation Fund*, which includes provisions for supporting women-led innovation projects. Although these initiatives are significant, they are not solely focused on STEM, and no dedicated national policy exists to address the gender gap in these fields. Serbia also participates in regional collaborations such as the *Regional Network of Women in STEM*, which aims to connect women professionals across the Balkans. International support, such as UNESCO's partnership with L'Oréal for national awards recognizing women in science, provides visibility but does not address the broader structural challenges women face.

Impact and Future Directions

While the presence of national strategies and NGO initiatives shows a growing awareness of gender inequality in STEM, the Western Balkans still lacks comprehensive, long-term national policies specifically addressing women in STEM. The efforts made by NGOs and international organizations play a crucial role, yet their reliance on external funding creates sustainability issues. Furthermore, a lack of systematic monitoring and evaluation makes it difficult to measure the real impact of these initiatives on women's participation and success in STEM fields. Moving forward, governments in the Western Balkans should consider adopting more robust, dedicated policies that target women's participation in STEM. These could include setting national targets for female enrollment in STEM disciplines, creating scholarship opportunities for women in technical fields, and implementing workplace policies that support women's career progression in STEM industries. By learning from successful global initiatives, such as Horizon Europe's gender equality requirements and South Korea's WISET program, the region could make significant strides toward closing the gender gap in STEM.

Country	Government Initiatives	NGO Initiatives	International Initiatives
Albania	National Strategy for Science, Technology, and Innovation; National Strategy for Gender Equality	SCiDEV grassroots programs	UNESCO Network of Albanian Women in Science; EU4Schools
Bosnia and Herzegovina	Programs supporting women in engineering and IT; Ministry of Civil Affairs	CURE Foundation; BH Futures Foundation	STEMwave (UNDP); IT Girls Initiative
Kosovo	Law on Gender Equality	Girls Coding Kosova	Girls in ICT Initiative
Montenegro	Strategy for Gender Equality; Ministry of Science projects	Digitalizuj.Me	UNESCO International Day of Women in Science
North Macedonia	National Strategy for Gender Equality; Ministry of Education and Science reforms	Girls in Tech; Tech4Girls	UN Women Scholarships and Training Programs
Serbia	Gender Equality Strategy and Innovation Fund	Regional Network of Women in STEM	UNESCO & L'Oréal Foundation National Awards

Figure 10. Overview of national and international initiatives

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Limitations of the study and research methods

One of the primary limitations of this study is the absence of official, accurate, and particularly gender-disaggregated data from public institutions. Much of the available data is derived from reports produced by the NGO sector or international organizations, which were collected using varying methodologies and for different purposes. In many cases, the data concerning "women working in ICT" does not distinguish between those with technical education and those without. This presents a challenge, as several roles within technology companies—such as human resources, accounting, and marketing, which are often dominated by women—do not require technical skills. Additionally, country-specific definitions of ICT vary, complicating data interpretation. For instance, in Albania, the ICT sector includes call center employees, typically women in low-paid, low-skilled positions. Another limitation is the lack of standardization in defining STEM fields. Different interpretations of STEM may encompass not only core technical areas but also social and behavioral sciences, such as psychology, economics, sociology, and political science. This broader definition of STEM can lead to inconsistencies in data collection and analysis across regions. Despite these challenges, considerable efforts were made to acquire and analyze relevant data, although the limitations should be considered when interpreting the findings of this study.

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Recommendations

Diversity in STEM is widely recognized as a key driver of innovation and economic growth (Herring, 2009; Page, 2007). Therefore, the underutilization of female talent in these fields represents a significant loss of potential (Ross & Glennon, 2022). Studies by Anđelković, Šapić, and Skočajić (2019), as well as Pesole et al. (2018), show that women remain dominant in traditionally "female" sectors with lower pay, such as writing and translation in ICT, and that gender-based task segregation persists. Additionally, the "human capital" dimension, which measures the skills required to thrive in a digital society, remains underdeveloped. According to the 2022 Digital Economy and Society Index (DESI), the Western Balkans lags behind the EU average in terms of digital skills. Only 18.1% of the population in the Western Balkans possesses advanced digital skills, compared to the EU average of 20.4% (RCC, 2022). Women contribute to scientific advancements at rates comparable to men, yet their work often receives less visibility and recognition. This disparity is not just numerical but also qualitative, reflecting how women's research is often undervalued and overlooked. Promoting and utilizing women's talent in STEM is critical for advancing science, technology, and innovation (STI), which are essential for sustainable economic growth. With the high-tech industry anticipating a growing workforce shortage, empowering women in STEM becomes increasingly crucial in an era where securing talent in science and technology provides a competitive edge (Moon et al., 2024). To address these issues and empower women in STEM across the Western Balkans, the following recommendations are proposed, considering the region's shared challenges and opportunities:

Strengthen Data Collection and Monitoring

Data on women in STEM in the Western Balkans is limited, often scattered across local sources and insufficiently detailed. Moreover, there is no unified data set for the region, and existing reports typically cover only individual countries or provide incomplete information. Official statistical agencies in the region do not provide sufficient, consistent data, and the reports that are available—mainly produced by NGOs and international organizations—use varying methodologies, making cross-comparisons difficult. For instance, the World Bank's gender data score focuses on the existence of legal frameworks rather than their implementation or impact. Improving data collection is critical, with an emphasis on gathering comprehensive, gender-disaggregated data on education, workforce participation, and leadership roles. A centralized data repository aligned with EU standards would enhance regional comparisons and support evidence-based policymaking. Collaboration with international organizations could further refine data collection methods, ensuring greater consistency and accuracy.

Use better criteria for measuring gender disparities and women in STEM

Using ICT as the sole indicator of women's participation in STEM can be misleading. Many reports, including World Bank data, grade the region based on the existence of legal frameworks, but fail to assess whether these frameworks are implemented effectively or if there are action plans in place. It is essential to broaden the criteria used for measuring gender disparities in STEM to include a wider range of fields and evaluate not just policy existence but its actual impact and outcomes.

Recommendations

Enhance Regional and International Collaboration

Given the shared challenges faced by Western Balkan countries, enhancing regional cooperation is essential. Current efforts are often sporadic and driven primarily by international organizations. Strengthening regional networks could help amplify local initiatives. Cross-border mentorship programs, joint training sessions, and collaborative policy development can foster a more unified and effective approach. Supporting local NGOs and think tanks with resources and platforms for advocacy will encourage sustained change and innovation.

Improve National Policies and Legal Frameworks

Governments across the Western Balkans should prioritize the development and implementation of clear, gender-focused policies aimed at increasing women's participation in STEM. While some reports and government statements suggest improvements, there is often a lack of clear, dedicated policies specifically targeting women in STEM. In countries where frameworks do exist, the extent of their implementation remains unclear. Governments should set specific targets, apply gender budgeting to STEM initiatives, and allocate funds for women-led research and startups. Montenegro is a regional leader in this respect, having already initiated gender budgeting in STEM, but other countries in the region should follow suit.

Education and Outreach

Early education is key to fostering girls' interest in STEM. Outreach programs aimed at young women should be integrated into school curricula to promote STEM as a viable and rewarding career path. Establishing mentorship programs that connect students with experienced women in STEM fields will provide guidance and role models for future generations. Social education campaigns aimed at challenging gender stereotypes are also critical to fostering a more inclusive cultural mindset. The region should look to successful international initiatives like Tech4Girls, which seeks to inspire underserved young women and girls (aged 10 to 25) to pursue STEM careers, as a model.

Address Structural Barriers and Cultural Stereotypes

Cultural stereotypes and structural barriers continue to limit women's participation in STEM. Programs that expose girls to STEM education early on, combined with initiatives aimed at dismantling gender stereotypes, can help create a more inclusive environment. These initiatives should target a wide audience, including educators, students, and the general public. Policy interventions should focus on breaking down these barriers and promoting equal opportunities for women from an early age.

Foster Inclusive Work Environments

To support women's career progression in STEM, governments and companies must address the challenges of balancing work and family life. Policies that promote flexible working conditions, parental leave for both parents, job security, and accessible childcare are essential for enabling women to sustain long-term careers in STEM. Additionally, creating clear career progression paths and offering leadership training specifically for women in STEM will help more women advance to senior and decision-making roles. Building inclusive workplaces where women can thrive professionally without sacrificing personal responsibilities will be key to closing the gender gap in STEM.

Conclusions

The Western Balkans faces significant challenges in bridging the gender gap in STEM fields. Despite strides in women's educational attainment, especially at the tertiary level, women remain underrepresented in critical STEM professions, particularly in leadership roles. This underrepresentation is compounded by deep-seated cultural stereotypes, structural barriers, and a lack of targeted policies across the region. The analysis reveals that the region's approach to women in STEM is fragmented, with initiatives often led by international organizations rather than being embedded in cohesive national policy frameworks.

While there are pockets of progress—such as higher-than-average female participation in ICT in some countries—these successes are overshadowed by persistent issues, including gender pay gaps, underrepresentation in leadership, and limited access to entrepreneurial opportunities. One of the most pressing challenges identified is the lack of comprehensive, gender-disaggregated data. This scarcity hampers the ability of policymakers to craft effective interventions and monitor progress. Improved data collection, aligned with EU standards, is essential for understanding the nuances of women's participation in STEM and for developing targeted strategies to address existing gaps

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Regional cooperation offers a significant, yet underutilized, opportunity to amplify the impact of local initiatives. Cross-border mentorship programs, shared educational resources, and collaborative research efforts could create a more supportive environment for women in STEM. However, such cooperation must be backed by strong national policies that set clear targets for gender equity in STEM, supported by adequate funding and accountability mechanisms.

Education and outreach are critical to fostering early interest in STEM among girls, but these efforts must also address the broader societal context in which women make their career choices. Importantly, focusing solely on policies in education and labor market domains will not fully resolve the challenges women face, as the unbalanced distribution of caregiving responsibilities continues to shape women's labor market participation. Women in the Western Balkans often bear a disproportionate burden of unpaid care work, which limits their ability to pursue and advance in demanding STEM careers. Without addressing this imbalance through supportive family policies, such as accessible childcare, flexible working arrangements, and equitable parental leave for both parents, the full potential of women in STEM cannot be realized.

In conclusion, while there are commendable efforts underway, the Western Balkans must adopt a more cohesive, data-driven, and comprehensive approach to closing the gender gap in STEM. This approach must extend beyond education and labor market policies to address the social reproduction needs that heavily influence female labor choices. By strengthening regional collaboration, improving national policies, and tackling cultural and structural barriers, the region can unlock the full potential of its human capital. This, in turn, will drive sustainable development and support the Western Balkans' aspirations for deeper integration into the European Union. The journey toward gender equality in STEM is not only a regional necessity but a critical step toward achieving broader economic and social goals.

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