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UNDERSTANDING STEM EMPLOYMENT CHALLENGES IN GEORGIA: A QUALITATIVE ANALYSIS OF EMPLOYER PERSPECTIVES

A. VASHAKMADZE, N. MIKAVA, T. ZHGHENTI, D. SIKHARULIDZE

Ani Vashakmadze[1], Nino Mikava[2], Tsotne Zhghenti[3], Davit Sikharulidze[4]
[1] [2] [3] Business and Technology University, Georgia
[1] orcid.org/0000-0002-2072-6904, E-mail: ani.vashakmadze@btu.edu.ge
[2] orcid.org/0000-0002-9567-3958, E-mail: nino.mikava@btu.edu.ge
[3] orcid.org/0000-0002-6779-172X, E-mail: tsotne.zhghenti@btu.edu.ge
[4] Ivane Javakhishvili Tbilisi State University, Georgia
orcid.org/0000-0003-1738-9828, E-mail: davit.sikharulidze@tsu.ge

Abstract: *This paper explores the challenges and opportunities within Georgia's STEM (Science, Technology, Engineering, and Mathematics) labor market from the perspective of employers. Drawing on qualitative data from in-depth interviews and focus group discussions with representatives from key sectors—including ICT, healthcare, engineering, and research—the study examines structural issues hindering STEM workforce development. The analysis identifies six major challenges: talent drain, low salaries and limited career growth, mismatch between education and labor market demands, limited STEM awareness, gender disparities, and regional inequalities. Findings show that employers face persistent difficulty in attracting and retaining qualified professionals, largely due to inadequate training systems, underfunded research infrastructure, and limited career incentives. The study concludes that improved collaboration between academia, industry, and government is essential for enhancing workforce preparedness and promoting sustainable economic growth. Policy recommendations include aligning academic programs with labor market needs, investing in regional infrastructure and promoting inclusive STEM participation through early engagement and targeted reforms.*

Keywords: *STEM, labor market, skills mismatch, talent drain.*

1. INTRODUCTION

Science, Technology, Engineering, and Mathematics (STEM) fields are fundamental to economic growth, technological advancement, and national competitiveness. Countries that successfully develop and sustain a skilled STEM workforce benefit from increased productivity, innovation, and long-term economic resilience. In Georgia, as in many other countries, STEM employment plays a crucial role in shaping industrial and technological progress. However, despite the growing demand for STEM professionals, various structural and systemic challenges hinder workforce development and retention. Following the collapse of the Soviet Union, many post-Soviet states, including Georgia experienced the dismantling of their once-robust research and development (R&D) sectors. During the Soviet era, R&D institutions were heavily funded and integrated into industrial and technological development strategies. However, the transition to a market economy led to severe funding cuts, brain drain, and the fragmentation of research infrastructure, leaving STEM fields struggling to recover.

Currently, approximately 10.5% of employees in Georgia work in STEM-related professions (source: authors' calculation based on Labour Force Survey). However, STEM employment is highly gender-segregated, with men dominating ICT and engineering fields, while women are more represented in healthcare and certain science disciplines.

Through qualitative data from in-depth interviews and focus group discussions with employers and industry representatives, the research will evaluate challenges based on the employer's perspective regarding STEM employment. By analyzing them, the research aims to identify structural gaps and propose policy recommendations to enhance STEM workforce retention, strengthen R&D capabilities, and foster innovation-driven economic growth in Georgia and other developing nations facing similar obstacles.

2. Literature Review

The growing discourse around the mismatch between STEM (Science, Technology, Engineering, and Mathematics) education and industry demand highlights challenges in workforce development. While STEM education is promoted as a pathway to innovation and economic growth, the actual employment landscape presents discrepancies between the skills students acquire and those employers seek. This literature review aims to identify the main challenges, and their extent related to STEM employment which will be discussed in the practical research from the employers' perspective.

One of the main challenges on a labor market with regard to STEM professions is **talent drain**. The exodus of skilled professionals in STEM fields, commonly referred to as "brain drain," poses a significant threat to economic development, technological advancement, and workforce stability. Various factors contribute to the migration of STEM experts, including financial incentives, restricted career growth, and suboptimal work environments. Salary differences play a crucial role in this mobility, with higher-paying sectors like finance drawing STEM graduates away from traditional scientific and technical roles (Marin & Vona, 2017). Moreover, the scarcity of career progression opportunities and inadequate research funding compel professionals to seek better prospects in other countries (Schwager & Gates, 2024). Inferior working conditions, especially in less developed areas, further amplify this trend by pushing talent towards nations with superior research facilities (Yu, Piew, & Fai, 2014). Political unrest and administrative inefficiencies also contribute to the outflow of skilled workers (Zwetsloot, 2021). The effects of this talent drain are debatable, with some researchers suggesting that global redistribution of talent can enhance labor market efficiency (Horton et al., 2017), while others emphasize the detrimental impact on economic productivity and innovation in the countries of origin (Auriol, 2010). To counter this trend, governments can bolster STEM education, enhance workplace conditions, and implement programs that incentivize expatriates to return (Chen & Tan, 2024; Duran & Lopez, 2019). Fostering stronger ties between industry and academia can also play a crucial role in retaining skilled professionals by promoting domestic career advancement (Schwager & Gates, 2024).

The STEM workforce plays a crucial role in driving economic growth and innovation, but professionals in this field encounter persistent challenges related to **insufficient pay and limited career growth opportunities**. Career stagnation in STEM fields is exacerbated by the lack of structured promotion pathways, particularly in academia and research, where professionals often struggle to advance due to unclear career trajectories and limited leadership opportunities (Saras, 2024; Xue & Larson, 2015). Additionally, public sector STEM wages remain uncompetitive compared to private sector opportunities, making it difficult to attract and retain skilled professionals in government-funded research and technical roles (Edwards, McCollester, & Phillips, 2021). Rapid technological advancements also contribute to career instability, as evolving industry demands frequently render certain skills obsolete, requiring continuous retraining to remain relevant (Deming & Noray, 2018). Compounding these challenges, market saturation in STEM fields has led to wage stagnation, particularly in

academia and research, where an oversupply of highly educated professionals has outpaced the availability of well-paying jobs (Delavallade et al., 2024; Salzman, 2013; Xue & Larson, 2015).

Furthermore, the **mismatch between STEM education and industry demand** has been widely discussed in the literature (Biagi & Castaño Muñoz, 2020; Smith & White, 2022; Pater et al., 2022; Ghaffarzadegan et al., 2017; Ngo et al., 2025; Srivastava, 2025; Ali & Bangalore, 2025). The disconnect between STEM education and industry needs leads to underemployment, as employers seek practical skills often absent from traditional STEM degree programs (Delavallade et al., 2024; Rodríguez et al., 2025), especially STEM curricula lag behind emerging technologies (Tajudeen et al. 2025, Zhou et al., 2025, Gao, et al., 2025; Wu & Zhou, 2025). Researchers also highlight the lack of industry-specific skills among STEM graduates (Kersanszki & Nadai, 2020; Teshome & Oumer, 2024; Morris et al., 2024).

The growing skills gap in the labor market, especially among women and minorities, is largely attributed to **insufficient STEM awareness and engagement**. Research indicates that the absence of early STEM exposure and traditional teaching methods that lack interdisciplinary integration contribute to this issue (Owens et al., 2012). Moreover, employers report that graduates often fall short in both technical proficiency and crucial problem-solving and communication abilities needed for contemporary STEM positions (Karimi & Pina, 2021, Hora et al. 2016; Jiang et al., 2024). While programs to boost STEM participation exist, many are found to be temporary and fail to provide lasting solutions to workforce deficits (Hodgson et al., 2024). Introducing STEM education in early years increases interest and career aspirations in STEM fields. Without structured interventions, disengagement occurs (Siregar et al. 2023).

Current research indicates ongoing **gender inequalities in STEM education and careers**, despite initiatives to enhance diversity. Reviewed literature demonstrates that gender disparities in STEM emerge early, influenced by societal expectations, unconscious biases, and a scarcity of female exemplars (Martínez-Gómez et al., 2024; Jimenez, Santiago, & Couvertier, 2024; Burgos-Lopez et al., 2024). Female professionals in STEM often encounter pay inequities and obstacles to professional growth, compounded by job segregation and workplace bias (Ruiz, Ganuza, & García, 2024; Dolgikh & Potanin, 2025). Sector-specific inequalities are particularly evident in aerospace, AI, and green technology industries, where systemic obstacles further restrict women's involvement (Costa et.al, 2024; Conde-Ruiz et al., 2024; Moso-Diez & Mondaca-Soto, 2025). Policy measures have shown varied outcomes, with certain studies recommending more equitable recruitment practices, mentoring initiatives, and educational reforms to tackle ingrained biases (El Khawand, 2025; Lucietto & Peters, 2024).

Still another challenge with regard to STEM professions is the **uneven distribution of STEM careers across regions**. This is influenced by a combination of economic, educational, and demographic elements that result in unequal access to opportunities in different geographical areas. Studies show that urban centers with robust STEM industries provide enhanced job prospects and salary levels, while rural and economically challenged areas struggle with ongoing issues due to scarce educational resources and industrial concentration (Wright, Ellis, & Townley, 2017; Lysenko & Wang, 2020). These regional imbalances are further intensified by gender and racial disparities, as women and minority groups are often underrepresented in lucrative STEM positions due to systemic and cultural obstacles (White & Smith, 2024). Economic strategies and workforce development initiatives are instrumental in shaping these disparities, with regions that actively invest in STEM education and innovation centers typically demonstrating stronger labor market results (Gregory, 2015; López-Bazo, Monastiriotis, & Motellón, 2017).

Table 1. *Predefined STEM Employment Broad Challenges based on Literature Review*

Challenge	Academic Literature
Talent Drain	Auriol, 2010; Horton et al., 2017; Marin & Vona, 2017; Yu, Piew, & Fai, 2014; Zwetsloot, 2021; Schwager & Gates, 2024; Chen & Tan, 2024; Duran & Lopez, 2019
Low Salaries and Limited Career Growth	Salzman, 2013; Xue & Larson, 2015; Deming & Noray, 2018; Edwards, McCollester, & Phillips, 2021; Saras, 2024; Delavallade et al., 2024
Mismatch Between Industry Demand and Workforce Skills	Ghaffarzadegan et al., 2017; Smith & White, 2022; Biagi & Castaño Muñoz, 2020; Kersanszki & Nadai, 2020; Pater et al., 2022; Teshome & Oumer, 2024; Morris et al., 2024; Delavallade et al., 2024; Ngo et al., 2025; Srivastava, 2025; Tajudeen et al., 2025; Zhou et al., 2025; Gao, et al., 2025; Rodríguez et al., 2025; Wu & Zhou, 2025
Limited STEM Awareness and Engagement	Owens et al., 2012, Hora et al., 2016; Karimi & Pina, 2021; Siregar et al., 2023; Hodgson et al., 2024, Jiang et al., 2024; Ali & Bangalore (2025)
Gender Disparities in STEM	Jimenez, Santiago, & Couvertier, 2024; Lucietto & Peters, 2024; Martínez-Gómez et al., 2024; Ruiz, Ganuza, & García, 2024; White & Smith, 2024; Dolgikh & Potanin, 2025; Costa et. al, 2024; Conde-Ruiz et al., 2024; Burgos-Lopez et al., 2024; El Khawand, 2025; Moso-Diez & Mondaca-Soto, 2025
Regional Disparities in STEM	Gregory, 2015; Wright, Ellis, & Townley, 2017; López-Bazo, Monastiriotis, & Motellón, 2017; Lysenko & Wang, 2020

Source: Developed by authors.

3. Methodology

3.1 Research Materials

This academic research is based on transcripts and qualitative data from the 2024 practical research project- "STEM OPPORTUNITIES AND CHALLENGES IN GEORGIA: Analysis of the Education System, Labor Market, and Legislative Framework" which examined the challenges, needs, and opportunities faced by employers in STEM fields within Georgia's labor market. The transcripts include interviews and focus group discussions conducted as part of the mentioned research project, providing a rich dataset for analysis. Rather than collecting new primary data, this study utilizes those existing transcripts to examine key labor market trends, skill shortages, and employer perspectives in greater depth.

The research respondents represent major sectors and organizations that employ STEM professionals, ensuring a comprehensive understanding of workforce challenges and opportunities. STEM professionals in this research are defined based on the ILO 2024 classification, which categorizes occupations relevant to science, technology, engineering, and mathematics. According to this classification, STEM professions include engineering and science specialists (ISCO-08: 21, 31), IT professionals (ISCO-08: 25, 35), and healthcare specialists (ISCO-08: 22, 32) involved in scientific and technological work. Additionally, business and administrative roles (ISCO-08: 12, 13, 24) are included only when employees work in specific industries. ISCO-08: 12 (Administrative and commercial managers) is considered STEM if employed in NACE 72 (scientific research and development). ISCO-08: 13 (Production and specialized services managers) qualifies if employed in NACE 62 (computer programming, consultancy, and related activities). ISCO-08: 24 (Business and

administration professionals) is included if working in NACE 62, 63 (information service activities), or 72.

In total, transcripts are available for thirteen in-depth interviews and six focus group discussions, involving 43 participants. These transcripts form the foundation of this study, allowing for an in-depth examination of employer challenges and expectations. The list of respondents is displayed in Table 2.

Table 2. *Overview of Interview and Focus Group Participants*

In-depth Interview	Focus Group Discussion
Research Institutes ▪ R. Agladze Institute of Inorganic Chemistry and Electrochemistry ▪ Ilia Vekua Sukhumi Institute of Physics and Technology ▪ Institute of Earth Sciences and National Seismic Monitoring Center ▪ G. Eliava Institute of Bacteriophages, Microbiology, and Virology ▪ A. Razmadze Mathematical Institute Government & Innovation Agencies ▪ Agency "Produce in Georgia" ▪ Georgia's Innovation and Technology Agency Industry Associations & NGOs ▪ ICT Association of Georgia ▪ Georgian Association of Artificial Intelligence ▪ Georgian Renewable Energy Development Association ▪ Georgian Farmers' Association ▪ N(N)LE "Healthcare Association" ▪ StrategEast	▪ Managers of Clinics and Hospitals ▪ Representatives of Sectoral Skills Organizations ▪ Board Members of the Georgian Laboratory Association ▪ Representatives of ICT Companies ▪ Managers of Energy Sector Companies ▪ Representatives of Technology Startup Companies

Source: Developed by authors.

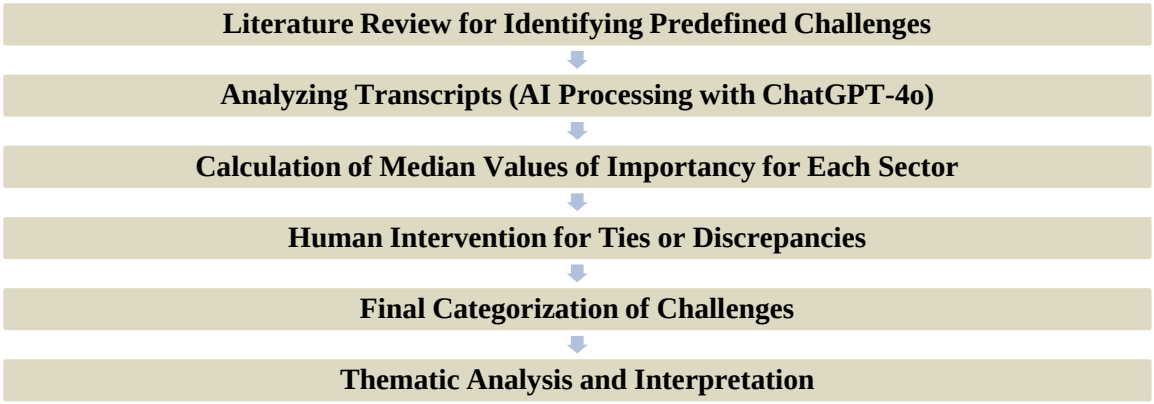
3.2 Data Analysis Process

The qualitative data analysis in this study was used to identify the importance and context of key challenges based on findings from the literature review. The predefined challenge categories were collected based on academic literature review and included following factors: Talent Drain, Low Salaries and Limited Career Growth, Mismatch Between Industry Demand and Workforce Skills, Limited STEM Awareness and Engagement, Gender Disparities in STEM, and Regional Disparities in STEM (see the Table 1 in previous chapter).

To systematically analyze the transcripts, we applied a structured classification approach using AI-assisted content analysis. Each transcript was assessed based on how prominently each challenge was discussed and the sentiment expressed by the respondents. The classification system used four categories**: Important** (discussed in-depth with strong negative sentiment), **Somewhat Important** (mentioned but without strong emphasis), **Not Important** (rarely mentioned or explicitly dismissed), and **Not Mentioned** (not referenced at all).

The analysis was conducted in several steps. First, AI tools (ChatGPT-4o) processed the transcripts, categorized discussions, and assessed sentiment based on the predefined classification criteria. After this initial analysis, we reviewed the results and calculated **combined values for each sector** by determining the **median value of the transcript analysis for each respondent within that sector**. If the responses were tied or varied significantly, **human intervention was used to determine the final category** based on contextual interpretation and industry-specific insights.

Figure 1. *Qualitative Data Analysis Process*



Source: Developed by authors.

During the sectoral analysis, we manually grouped the findings into **four broad categories**: ICT, Science, Engineering, and Health. These categories align with common international classifications used in STEM workforce analysis, particularly those based on ISCO-08 and NACE Rev.2 standards, ensuring consistency with global research frameworks. Additionally, they were identified as broad and easily understandable sectoral divisions that best represent the distribution of STEM employment and challenges across industries.

3.3 Research Limitations

This study examines STEM employment challenges exclusively from the perspective of employers.

This approach was chosen for two main reasons. First, the dataset consists solely of qualitative data from employers, making it the primary lens through which challenges are assessed. Second, the challenges faced by employees represent a distinct research question requiring different research methods. Employee perspectives tend to focus on more specific, personal-level concerns, whereas employers provide insight into systemic labor market issues. As a result, a separate study would be needed to properly capture the challenges from the employee's viewpoint.

Additionally, this study **does not compare employer perceptions of challenges to general labor market data**. There are two reasons for this. First, reliable statistics on STEM employment in Georgia remain limited, making direct comparisons difficult. Second, the study seeks to understand employer perceptions rather than objective market trends. Employer sentiment does not always align with statistical realities; for example, while salaries in certain STEM sectors may be high compared to other fields, employers may still perceive them as insufficient to attract or retain talent. Understanding these perceptions is critical, as they influence hiring decisions and workforce strategies.

Furthermore, **the dataset is limited to transcripts from STEM-related organizations and companies,** excluding non-STEM industries that may also employ STEM professionals. While this study captures insights from core STEM sectors, it does not account for the demand for STEM professionals in industries such as finance, consulting, and public administration, where technical expertise is increasingly valuable. Future research could expand the scope to include perspectives from non-STEM sectors to provide a more comprehensive picture of STEM employment opportunities and challenges.

4. Results and Discussion

4.1 General Overview of Findings

The analysis is systematically structured, beginning with an examination of each challenge identified through the literature review. This approach ensures a comprehensive assessment of the predefined issues, grounding the findings in established academic discourse. Subsequently, each challenge is analyzed within the context of the studied sectors, providing a sector-specific perspective on the identified challenges. The main results for each sector are presented in Table 3, indicating the significance of each challenge as follows: **Important** (discussed in-depth with strong negative sentiment), **Somewhat Important** (mentioned but without strong emphasis), and **Not Important** (rarely mentioned or explicitly dismissed).

Challenge	ICT	Health Sector	Science	Engineering
Talent Drain	Important	Important	Important	Somewhat Important
Low Salaries and Limited Career Growth	Important	Important	Important	Important
Mismatch Between Industry Demand and Workforce Skills	Important	Important	Important	Somewhat Important
Limited STEM Awareness and Engagement	Not Important	Somewhat Important	Somewhat Important	Important
Gender Disparities in STEM	Important	Somewhat Important	Not Important	Important
Regional Disparities in STEM	Somewhat Important	Somewhat Important	Important	Important

Table 3. *Sector-Specific Importance of Identified STEM Challenges in Georgia*
Source: Developed by authors.

4.2 Discussion of Key Challenges in STEM Employment

Talent Drain - Talent drain remains a critical challenge across STEM fields in Georgia, with many professionals choosing to work abroad or remotely for international companies. Respondents highlight that this issue is particularly severe in healthcare, IT, and research, where skilled professionals have access to significantly higher salaries and better working conditions outside Georgia. For some fields, such as nursing, the migration trend is largely due to structured pathways leading to European jobs, where wages can be three to four times higher than in Georgia. In other sectors, such as IT and AI, the trend is different: while professionals remain in Georgia physically, they work exclusively for foreign employers, bypassing the local job market and contributing to a shortage of senior professionals in Georgian companies.

The lack of career progression and research funding further fuels the brain drain. Many researchers and engineers leave the country for doctoral programs and specialized training, often choosing to remain abroad due to better infrastructure, access to modern technology, and financial incentives. Respondents also highlight the failure to retain international specialists who arrived in Georgia during geopolitical shifts, particularly after the Russia-Ukraine war. Bureaucratic hurdles and lack of targeted policies meant that many skilled foreign professionals ultimately moved on to European countries instead of staying in Georgia. Without long-term investment in local career opportunities, salaries, and research infrastructure, talent drain will likely continue to be a major obstacle for Georgia's STEM workforce.

Low Salaries and Limited Career Growth - Respondents overwhelmingly agree that low wages and a lack of structured career growth are among the biggest obstacles to talent retention in STEM fields. In many cases, salaries are not only non-competitive internationally

but also insufficient for professionals to remain in their fields domestically. The problem is most pronounced in healthcare, research, and engineering, where wages often do not match the skills, education, or workload required for the roles.

For example, young researchers in physics, microbiology, and chemistry frequently leave academia because entry-level salaries are so low that continuing research is financially unsustainable. Healthcare professionals, particularly nurses and therapeutic specialists, also cite salary stagnation as a key reason for leaving their fields or switching to higher-paying specialties like plastic surgery. In IT and AI, while salaries are relatively higher, they still cannot compete with international companies, leading to a steady outflow of mid-to-senior level professionals.

Respondents also emphasize the lack of structured career progression pathways in many industries. Young professionals often see few opportunities for promotions, professional training, or leadership roles, making long-term career growth in Georgia unattractive. Engineering and energy sector professionals specifically mention that public sector jobs fail to attract young talent, as salaries remain unchanged for years, and career development programs are either nonexistent or poorly implemented. Without policy interventions that increase salaries and create clear career advancement structures, Georgia risks continued workforce attrition in critical STEM sectors.

Mismatch Between Industry Demand and Workforce Skills - Respondents identify a serious gap between STEM education and actual industry needs, with many graduates entering the job market without the necessary practical skills. Across multiple sectors, employers report having to invest heavily in additional training, as many university graduates lack real-world experience and technical expertise required for their roles.

In IT, this issue is particularly visible in AI, data science, and cybersecurity, where university curricula have not kept pace with technological advancements. Many graduates struggle with hands-on problem-solving, forcing companies to spend significant resources on internal training programs. Similarly, engineering and energy sector respondents highlight that technical education is outdated, and many professionals graduate without exposure to modern industrial equipment, hydropower infrastructure, or automation technologies.

Healthcare professionals note that the medical specialization system does not align with sector demands, leading to shortages in therapeutic medicine and general practitioners, while oversaturation exists in certain high-paying specialties. Laboratory professionals also emphasize that many graduates lack fundamental laboratory skills, requiring additional in-house training. Without curriculum modernization, better industry-university collaboration, and improved certification processes, Georgia's STEM graduates will continue to face challenges in meeting labor market demands.

Limited STEM Awareness and Engagement - While awareness of STEM careers has improved, respondents indicate that many young people still lack proper career guidance, leading to imbalances in sector growth. Certain fields, such as IT, have benefited from strong marketing and educational programs, leading to an influx of students. However, other critical STEM fields—such as renewable energy, microbiology, and industrial engineering—struggle to attract young talent due to a lack of visibility and outreach efforts.

Respondents stress that many students choose quick certification programs instead of building a strong foundation in STEM education, often entering the workforce with insufficient skills for long-term career success. This creates an oversupply of junior professionals in some areas while leaving critical gaps in others. Some professionals argue that early engagement programs in schools, industry partnerships, and better career guidance could help direct students toward sustainable career paths in underrepresented STEM fields.

Gender Disparities in STEM - It manifest differently across industries, but respondents agree that structural barriers still limit gender equality in leadership roles. In some fields, such as healthcare and laboratory sciences, women make up the majority of entry-level positions, but men dominate leadership roles, creating barriers to career progression. Respondents in laboratory sciences emphasize that despite women being well-represented in technical roles, decision-making positions in research institutions remain largely male-dominated.

In IT and engineering, the underrepresentation of women in technical roles is more pronounced. Despite ongoing efforts to increase female participation in software development, AI, and hydropower engineering, respondents state that cultural perceptions and a lack of mentorship opportunities still discourage many women from pursuing STEM careers. The healthcare sector presents an interesting contrast: while nursing is a female-dominated field, men are significantly underrepresented due to social stigma and traditional gender roles. Addressing these disparities requires structural policy changes, mentorship programs, and targeted initiatives to promote greater gender diversity in STEM careers.

Regional Disparities in STEM - Access to STEM education and career opportunities remains highly concentrated in urban centers, with respondents highlighting severe workforce shortages in rural areas. Schools outside major cities often lack high-speed internet, laboratory facilities, and trained educators, making it difficult for students to pursue STEM careers outside of Tbilisi and major regional hubs.

In the energy and engineering sectors, respondents stress that the absence of regional training centers has created critical skill shortages, making it difficult to implement infrastructure projects in rural areas. IT professionals note that rural students lack access to proper digital education, limiting their ability to enter high-demand fields like software engineering and cybersecurity. Additionally, healthcare respondents point out that regional hospitals struggle to attract and retain skilled medical professionals, worsening the gap between urban and rural healthcare services.

Without targeted investment in regional education programs, workforce incentives, and infrastructure development, these disparities will continue to hinder economic growth and STEM sector expansion outside major cities.

Table 4. *Key Research Findings for Each Challenge*

Talent Drain	- IT and AI professionals remain in Georgia but work remotely for international companies, bypassing local employers. - Healthcare and nursing professionals migrate to Europe due to significantly higher salaries. - Research talent leaves due to lack of funding and career opportunities. - Georgia failed to retain international specialists who arrived during geopolitical shifts.
Low Salaries and Limited Career Growth	- Salaries are not competitive with international markets, leading to workforce attrition. - Career progression pathways are unclear in engineering, healthcare, and research. - Public sector jobs fail to attract young professionals due to stagnant wages.
Mismatch Between Industry Demand and Workforce Skills	- Graduates often lack hands-on experience and require additional training. - University curricula in IT, AI, and engineering are outdated. - Specialization choices in healthcare do not align with labor market needs.

Limited STEM Awareness and Engagement	- Certain STEM fields, like renewable energy and microbiology, struggle to attract students. - Quick certification programs are leading to skill imbalances in the workforce. - Early engagement initiatives could improve career planning.
Gender Disparities in STEM	- Women dominate lower-level laboratory and healthcare roles but are underrepresented in leadership. - IT and engineering have a significant gender gap, particularly in technical positions. - Nursing remains female-dominated, with few men entering the field due to societal perceptions.
Regional Disparities in STEM	- Rural areas lack access to STEM education, limiting career opportunities. - Engineering and healthcare sectors struggle to retain professionals outside major cities. - Limited digital infrastructure prevents rural students from entering IT careers.

Source: Developed by authors.

4.3 Discussion of Sector-Specific Trends and Insights

We also analyzed sector-specific findings to better understand the challenges and opportunities within different industries:

ICT Sector - According to IT sector respondents, the industry faces a unique form of talent drain, where professionals remain in Georgia but work exclusively for foreign companies, bypassing local employers. While there is a steady influx of new entrants into the field, mid-to-senior level professionals are in short supply. Many respondents highlight that university graduates often lack practical experience, forcing companies to invest heavily in training. Additionally, salary disparities between local and international employers make retention difficult. The gender gap in IT remains another issue raised by respondents, with women being underrepresented in software development and technical roles, despite growing awareness initiatives.

Engineering & Energy - Respondents in the engineering and energy sectors highlight that workforce shortages are one of the biggest challenges, primarily due to the lack of technical training programs and weak career incentives. While the demand for specialists continues to grow, many professionals either seek opportunities abroad or transition to better-paying fields. Hydropower and infrastructure projects, in particular, face a shortage of skilled workers, especially in rural areas where training facilities are limited. Public sector engineering jobs, according to respondents, fail to attract young professionals due to low wages and limited career development pathways. The gender gap remains particularly wide in this sector, with few women pursuing technical engineering roles.

Healthcare & Life Sciences - Respondents highlight severe talent shortages in the healthcare sector, particularly in nursing, where many professionals migrate to Europe due to significantly higher salaries. While medical careers remain attractive, specialization choices do not always align with industry needs, leading to shortages in critical areas such as therapeutic medicine. Some respondents note that financial considerations often dictate career paths, with professionals transitioning into more lucrative fields such as plastic surgery rather than remaining in essential medical specialties. Additionally, urban-rural disparities in healthcare are a major concern, as regional hospitals and clinics struggle to retain qualified personnel due to low wages and limited access to professional development. From a gender perspective, nursing remains a female-dominated profession, with very few men entering the field.

Respondents suggest that societal perceptions and stereotypes discourage men from pursuing careers in nursing, despite increasing demand for professionals in the sector. Conversely, leadership roles in healthcare institutions remain male-dominated, with fewer women advancing into senior decision-making positions.

Science & Research - The science and research sector, including microbiology, physics, and laboratory sciences, faces major workforce challenges due to underfunding, outdated equipment, and low salaries. Respondents emphasize that talented researchers in physics, microbiology, and industrial laboratory work frequently leave Georgia due to a lack of career growth opportunities and poor research infrastructure. The disconnect between university curricula and practical industry needs is another key issue, as new graduates often require extensive additional training before becoming job-ready. Laboratories, in particular, face a shortage of well-trained specialists, and employers note that many graduates lack hands-on experience with modern laboratory equipment. Women are well-represented in laboratory roles at the entry level, but leadership positions are still dominated by men. Respondents also highlight that rural areas lack access to modern research and laboratory facilities, limiting opportunities outside major cities.

5. Conclusions and Recommendations

The study reveals several structural challenges in the STEM labor market in Georgia:

- Due to low income levels and limited prospects for career advancement, STEM professionals show low engagement in scientific and research activities, particularly in natural and exact sciences. This creates a significant barrier to retaining qualified STEM talent within the academic sector, which in turn hinders knowledge generation and the potential for research commercialization.
- Brain drain remains a persistent issue across multiple sectors, including ICT, medicine, and engineering. Notably, tech startups, which already face difficulties in attracting qualified personnel due to relatively low salaries, are further challenged by the high turnover of re-trained staff, resulting in resource losses after initial investments in skill development.
- Employers across all STEM sectors report that the knowledge and competencies of job seekers often fail to meet market demands. This mismatch is particularly evident in the lack of practical skills and the limited applicability of theoretical knowledge. Although the issue is widespread, IT employers perceive it as a comparatively less critical concern.
- There is a lack of sufficient efforts to promote STEM education and career pathways across all STEM fields, which undermines labor market readiness and long-term workforce planning.
- Gender stereotypes negatively influence hiring practices and educational choices. For example, women remain underrepresented in engineering and ICT sectors, while men are underrepresented in nursing professions. These stereotypes, embedded in societal attitudes, discourage individuals from pursuing education and careers in certain STEM fields, exacerbating existing labor shortages.
- STEM education and career opportunities are heavily concentrated in urban areas, especially Tbilisi, leading to severe workforce shortages in rural regions. Limited infrastructure and training centers outside cities create critical skill gaps and deepen regional inequalities.

The recommendations are based solely on the perspectives of employers and are intended for key stakeholders in higher education, government, and the private sector. Insights

from students, educators, or policymakers may lead to different or additional recommendations.

- Universities are encouraged to strengthen cooperation with employers to enhance students' practical training and improve their transition into the workforce. This includes aligning academic programs more closely with current labor market demands.
- To foster innovation, it is recommended to promote the commercialization of research through the establishment and integration of R&D centers within universities.
- At the policy level, setting a progressively increasing national target for R&D expenditure as a share of GDP, along with regular monitoring, would help support sustainable scientific and technological development.
- A STEM employer working group, composed of private sector stakeholders, could regularly inform universities about evolving labor market needs and collaborate with public institutions to attract further investment into the STEM sector.

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