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Technological Evolution and Workforce Preparedness: Assessing Adaptability in Georgian Universities (Case study of Tbilisi State University)

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Abstract

This study investigates the impact of technological advancements on workforce readiness among university students in Tbilisi, with a focus on student adaptability as an intermediary variable. Utilizing a mixed-methods approach, we combined quantitative analysis of survey data from 384 students with qualitative insights from 20 semi-structured interviews with university faculty, career services staff, and industry recruiters. Our findings revealed moderate relationships between technological advancements, student adaptability, and workforce readiness, highlighting significant cultural barriers, resource limitations, and a skills gap. The study underscores the need for enhanced training programs, practical learning opportunities, and robust knowledge management systems. It also emphasizes the importance of industry-academia collaboration and promoting diversity to foster a more adaptable and job-ready workforce. These insights provide practical implications for universities, policymakers, and employers in Georgia and similar contexts, suggesting targeted interventions to improve student preparedness for future job markets.

Keywords: Technological advancements, workforce readiness, student adaptability, education in Georgia, cultural barriers, skills gap, industry-academia collaboration.

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Introduction

The 21st century has witnessed unprecedented technological advancements, fundamentally reshaping global and local labor markets. Automation, artificial intelligence, digitalization, and other emerging technologies have revolutionized industries, creating new job categories while rendering others obsolete. These changes have compelled businesses to continuously adapt to maintain competitiveness. This technological revolution has also imposed new skill requirements on the workforce, necessitating a paradigm shift in educational systems. Higher education institutions globally are grappling with the challenge of equipping students with the skills and knowledge required to thrive in an increasingly dynamic job market. In this context, the higher education sector in Eastern Europe, including Tbilisi, Georgia, has been making concerted efforts to prepare the younger generation for future employment. Universities are incorporating advanced technologies into their curricula and fostering environments that encourage innovation and adaptability among students.

However, despite these efforts, there remains a significant gap between the skills imparted by universities and the evolving demands of the labor market. The rapid pace of technological change makes it exceedingly difficult for educational institutions to accurately predict the future landscape of employment. Consequently, even the most forward-thinking universities are challenged in their ability to fully prepare students for jobs that may not yet exist. This uncertainty underscores a critical issue: while higher education institutions strive to anticipate and meet future workforce needs, they often find themselves reacting to changes rather than proactively shaping the future. The unpredictable nature of technological advancement means that current educational strategies might quickly become obsolete, leaving graduates ill-prepared for the realities of tomorrow's job market.

Actuality of the Research

Given this backdrop, the importance of this study becomes apparent. Investigating the influence of technological advancements on workforce readiness, particularly within the context of Tbilisi's universities, is crucial for several reasons. First, it provides insights into how well current educational practices are aligning with the needs of the future labor market. Second, it highlights the role of adaptability among students as a key intermediary variable that could bridge the existing skills gap. By understanding these dynamics, educational leaders can develop more effective strategies to enhance workforce readiness, ensuring that graduates are not only equipped with current skills but are also adaptable enough to learn and thrive amidst continuous change.

Such research contributes significantly to better educational leadership by providing empirical evidence that can inform policy and curriculum development. It underscores the need for a more flexible and forward-thinking approach to education, one that prioritizes adaptability and lifelong learning. Ultimately, this study aims to foster a more resilient workforce in Tbilisi, capable of navigating and succeeding in an unpredictable and rapidly evolving job market. By addressing these challenges head-on, universities can play a pivotal role in shaping a future-ready generation, poised to meet the demands of tomorrow's innovative and dynamic industries.

Research Objective

The primary objective of this research is to investigate how technological advancements influence workforce readiness among university students in Tbilisi, with a particular focus on student adaptability as an intermediary variable. This study aims to uncover the extent to which the integration of new technologies in academic programs impacts the preparedness of students for future employment. By analyzing the adaptability of students to these technological changes, we seek to provide a comprehensive understanding of how universities can better equip their graduates for an ever-evolving job market.

Research Statement

This research posits that the adaptability of university students is a crucial mediator in the relationship between technological advancements in education and workforce readiness. By examining this intermediary variable, we aim to elucidate the mechanisms through which technological integration in higher education can enhance or hinder the preparedness of students for future job roles. This study will employ a multi-layered analytical model to dissect these complex relationships and provide actionable insights for educational leaders.

Research Questions

1. How do technological advancements in higher education influence the overall workforce readiness of university students in Tbilisi?

2. What role does student adaptability play as an intermediary variable in the relationship between technological advancements and workforce readiness?

3. How effectively are universities in Tbilisi integrating new technologies into their curricula to prepare students for future employment?

4. What specific technological skills and competencies are most critical for workforce readiness in the context of Tbilisi's evolving job market?

5. How can educational leaders leverage findings from this study to enhance curriculum design and teaching methodologies to better prepare students for future job challenges?

Literature Review

Technological advancements have significantly reshaped various sectors, including education and job markets, primarily through the adoption of Artificial Intelligence (AI), automation, and digitalization. AI technologies such as machine learning, natural language processing, and robotics have revolutionized task performance by increasing efficiency and precision. In education, AI facilitates personalized learning by analyzing student data to tailor content to individual needs, enhancing engagement and performance (Ng, 2020). Beyond education, AI automates complex tasks in sectors like healthcare, finance, and manufacturing, necessitating a new set of skills for employees, including proficiency in AI-related technologies (Moghimi, 2024; World Economic Forum, 2020).

Automation, characterized by minimal human intervention, has drastically altered productivity and cost efficiency across industries. Nearly half of all jobs in the United States are susceptible to automation, a trend likely mirrored globally (Frey & Osborne, 2017). This shift requires educational strategies that teach students to work alongside automated systems, emphasizing critical thinking and problem-solving skills that are less likely to be automated (Moghimi, 2023). Digitalization has also transformed traditional processes through digital tools and platforms, enhancing information accessibility and operational efficiency (Brynjolfsson & McAfee, 2014). In higher education, digital literacy has become crucial, with institutions incorporating e-learning platforms and virtual classrooms to prepare students for a digitalized job market (Moghimi, 2023).

One of the most significant impacts of these technological advancements on higher education is the rise of personalized learning. AI-driven platforms create customized learning pathways, improving student engagement and academic performance (Holmes et al., 2019). Personalized learning fosters inclusivity by accommodating diverse learning styles, although it requires substantial investment in technology and educator training (Ng, 2020). The advent of online and blended learning platforms has further revolutionized education by offering greater flexibility and accessibility, breaking down geographical barriers (Allen & Seaman, 2017). Blended learning, which combines online and face-to-face instruction, enhances learning outcomes and prepares students for the digital workplace (Moghimi et al, 2022).

Technological advancements continuously create new job roles, such as AI specialists, data scientists, and cybersecurity experts (World Economic Forum, 2020). These roles require a blend of technical expertise and soft skills, like problem-solving and communication, necessitating a multidisciplinary approach in education (Moghimi, 2023). The rapid pace of technological change shifts the demand for skills, with complex problem-solving, critical thinking, and creativity becoming highly sought after (World Economic Forum, 2020). Educational institutions must embed these skills into curricula, fostering continuous learning and adaptability to prepare students for evolving job markets (Moghimi, 2024).

Workforce readiness encompasses technical and soft skills, both crucial for success in modern workplaces. As industries evolve, the demand for technical skills like coding, data analysis, and digital marketing has grown exponentially (World Economic Forum, 2020). Higher education institutions increasingly focus on STEM programs and partnerships with tech companies to provide hands-on experience (Moghimi, 2023). However, soft skills like teamwork, adaptability, leadership, and emotional intelligence remain equally important, facilitating effective communication and problem-solving in the workplace (Robles, 2016). Institutions are incorporating soft skills training through courses and extracurricular activities to create a balanced educational environment (Moghimi, 2024).

Critical thinking and problem-solving are fundamental components of workforce readiness, enabling individuals to analyze complex situations and devise innovative solutions (National Association of Colleges and Employers, 2019). Universities foster these skills through project-based learning and real-world

challenges (Moghimi, 2023). Emotional intelligence (EI) and communication skills are also vital, with high EI linked to better stress management and relationship building (Goleman, 2018). Educational institutions promote EI and communication through workshops, seminars, and collaborative activities (Moghimi, 2023).

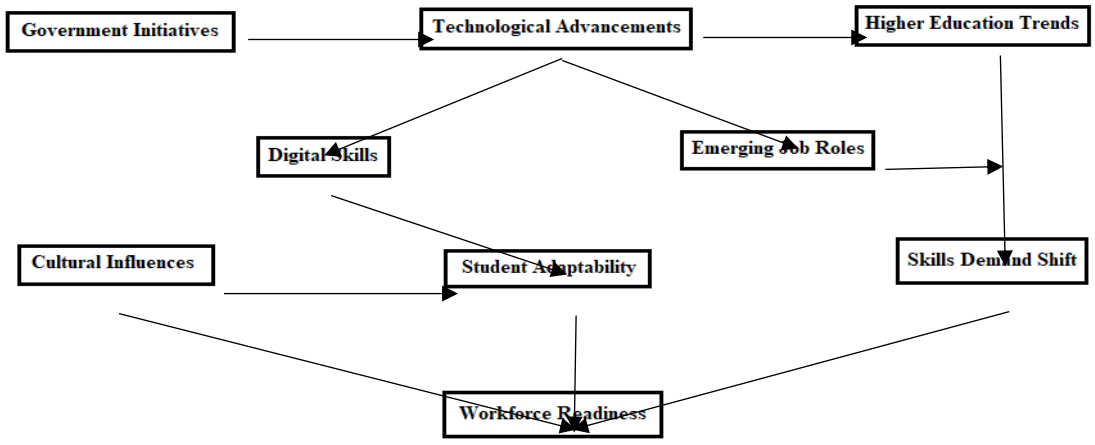
Preparing students for future jobs requires a focus on continuous learning and upskilling, as job market demands constantly evolve (World Economic Forum, 2020). Higher education institutions support lifelong learning through flexible learning opportunities like online courses and professional development programs (Moghimi, 2023). Interdisciplinary knowledge is also essential, as modern challenges often require solutions from multiple fields (Moghimi, 2024). Institutions can promote interdisciplinary learning through cross-disciplinary research and collaborative projects, fostering innovation and creativity.

Adaptability, the ability to adjust to new conditions and challenges, is crucial in today's rapidly changing world (Martin et al., 2019). In education, fostering adaptability through problem-solving, critical thinking, and emotional intelligence prepares students for dynamic careers (Moghimi, 2024). Experiential learning, such as internships and project-based courses, helps students apply theoretical knowledge to practical situations, enhancing adaptability (Kolb, 2015; Moghimi, 2024). Cultivating a growth mindset and resilience further supports adaptability, encouraging students to embrace challenges and learn from failures (Dweck, 2016; Yeager & Dweck, 2019).

In the context of Georgia, the country's modernization efforts and integration with the European Union are characterized by significant investments in technology and education. The burgeoning tech industry, supported by government initiatives like Georgia's Innovation and Technology Agency (GITA), drives innovation and economic growth (Ministry of Economy and Sustainable Development, 2022). However, traditional values and cultural norms present challenges to adopting new educational methods. The emphasis on collectivism and respect for authority can conflict with the principles of critical thinking and individualism (Moghimi, 2024).

Georgia's higher education institutions, such as the University of Georgia (UG) and Tbilisi State University (TSU), strive to align curricula with international standards, focusing on entrepreneurial education and interdisciplinary programs. Despite these efforts, a significant skills gap remains, particularly in high-tech sectors (Moghimi, 2023). Educational institutions are addressing this gap by integrating technical and soft skills training into curricula and strengthening partnerships with industry stakeholders. Work-integrated learning and internships are pivotal in bridging the gap between academic knowledge and practical skills, preparing the Georgian workforce for a rapidly evolving job market (Moghimi, 2023).

The Conceptual model



The conceptual model visualizes the relationships between key variables in the study on technological advancements and workforce readiness, focusing on student adaptability as an intermediary variable. Here's a detailed explanation of the model's key relationships:

1. Government Initiatives → Technological Advancements

- Government initiatives play a crucial role in fostering technological advancements. Policies, funding, and support for innovation drive the development and implementation of new technologies. For instance, programs like Georgia's Innovation and Technology Agency (GITA) provide essential resources for tech startups (Ministry of Economy and Sustainable Development, 2022).

2. Technological Advancements → Digital Skills

- Technological advancements necessitate the development of digital skills. As new technologies emerge, there is a growing need for individuals to acquire competencies in areas such as AI, cybersecurity, and data analysis. This relationship highlights the importance of integrating digital skills training into educational curricula (Moghimi, 2024).

3. Digital Skills → Student Adaptability

- Digital skills enhance student adaptability by equipping them with the tools needed to navigate and leverage new technologies. Students proficient in digital skills are more capable of adapting to technological changes and evolving job market demands (Ng, 2020).

4. Technological Advancements → Higher Education Trends

- Advances in technology influence higher education trends by shaping curricula and teaching methodologies. Universities incorporate new technologies into their programs to ensure that students are prepared for the modern workforce. This includes the use of AI-driven personalized learning and online platforms (Moghimi, 2023).

5. Higher Education Trends → Student Adaptability

- Educational trends that emphasize experiential learning, interdisciplinary studies, and flexible learning models foster student adaptability. By exposing students to diverse learning experiences and practical applications, universities help them develop the resilience and flexibility needed for future careers (Kolb, 2015).

6. Higher Education Trends → Workforce Readiness

- The alignment of higher education trends with industry needs directly impacts workforce readiness. Universities that integrate market-relevant skills and competencies into their programs produce graduates who are better prepared to meet employer expectations (Moghimi, 2023).

7. Student Adaptability → Workforce Readiness

- Student adaptability is a critical intermediary variable that links educational experiences to workforce readiness. Adaptable students can effectively transition into the workforce, continuously learn new skills, and navigate changing job roles (Martin et al., 2019).

8. Technological Advancements → Emerging Job Roles

- Technological advancements create new job roles that require specific technical skills and knowledge. For example, the rise of AI and machine learning has led to increased demand for data scientists and AI specialists (World Economic Forum, 2020).

9. Emerging Job Roles → Skills Demand Shift

- As new job roles emerge, there is a corresponding shift in the skills demanded by employers. This shift underscores the need for continuous learning and upskilling to remain competitive in the job market (Moghimi, 2024).

10. Skills Demand Shift → Workforce Readiness

- The changing demand for skills impacts workforce readiness by highlighting the importance of aligning educational outcomes with market needs. Educational institutions must continuously update their programs to reflect the evolving skills landscape (World Economic Forum, 2020).

11. Cultural Influences → Student Adaptability

- Cultural influences play a significant role in shaping student adaptability. Societal norms, values, and attitudes towards education and innovation affect how students respond to new challenges and opportunities (Moghimi, 2023).

12. Cultural Influences → Workforce Readiness

- The broader cultural context also impacts workforce readiness by influencing educational practices and labor market dynamics. In Georgia, the integration of traditional values with modern educational approaches presents unique challenges and opportunities for enhancing workforce readiness (Moghimi, 2024).

Research Methodology

Research Design: Mixed-Methods Approach The research design employs a mixed-methods approach, integrating both quantitative and qualitative methodologies to provide a comprehensive understanding of how technological advancements influence workforce readiness with student adaptability as an intermediary variable. This approach allows for triangulation of data, enhancing the validity and reliability of the findings.

Quantitative Component The quantitative component involves statistical analysis to test hypotheses and examine relationships between variables. This approach is justified by the need to quantify the impact of technological advancements on workforce readiness and to identify the role of student adaptability in this relationship. Statistical analyses included descriptive statistics, correlation analysis, regression analysis, and factor analysis.

Survey A structured questionnaire was developed targeting population of 22000 undergraduate and higher-graduate students (excluding PhD) at Tbilisi State University (TSU). The survey aimed to gather data on students' exposure to new technologies, participation in technology-related courses, self-assessed skills, internship experiences, job preparedness, and adaptability to new technologies.

Sample Size To ensure statistical significance, a sample size of at least 384 students was determined using the formula for sample size calculation for finite populations:

n=N×Z2×p×(1−p)(N−1)×E2+Z2×p×(1−p)n = \frac{N \times Z^2 \times p \times (1 - p)}{(N - 1) \times E^2 + Z^2 \times p \times (1 - p)}n=(N−1)×E2+Z2×p×(1−p)N×Z2×p×(1−p)

Where:

- NNN is the population size (estimated number of students eligible to participate, approximately 22,000).
- ZZZ is the Z-value (1.96 for a 95% confidence level).
- ppp is the estimated proportion of the population (0.5 for maximum variability).
- EEE is the margin of error (0.05 for 5%).

$$n = \frac{N \times Z^2 \times p \times (1 - p)}{(N - 1) \times E^2 + Z^2 \times p \times (1 - p)}$$

$$n = \frac{22000 \times (1.96)^2 \times 0.5 \times (1 - 0.5)}{(22000 - 1) \times (0.05)^2 + (1.96)^2 \times 0.5 \times (1 - 0.5)}$$

$$n = \frac{22000 \times 3.8416 \times 0.25}{(22000 - 1) \times 0.0025 + 3.8416 \times 0.25}$$

$$n = \frac{21128.8}{55.9579}$$

$$n \approx 377.6$$

Given practical constraints and to ensure a robust sample size, we targeted a sample size of approximately 384 students. This sample size provides sufficient statistical power to detect meaningful relationships between technological advancements and workforce readiness while maintaining a manageable workload for data collection and analysis.

Data Collection Data was collected using online methods, including university email lists and social media groups, particularly student groups on Facebook. This approach facilitated broad and efficient distribution of the survey, ensuring a diverse and representative sample of TSU students.

Descriptive Statistics Descriptive statistics were used to summarize the basic features of the data collected from 384 students at Tbilisi State University (TSU). This included measures of central tendency (mean, median, mode) and measures of variability (standard deviation, variance).

Correlation Analysis Pearson correlation coefficients were used to examine the relationships between technological advancements, student adaptability, and workforce readiness.

Regression Analysis Multiple regression analysis was conducted to determine the impact of technological advancements and student adaptability on workforce readiness.

Regression Model: Workforce Readiness=β0+β1(Technological Advancements)+β2(Student Adaptability)+ϵ\text{Workforce Readiness} = \beta_0 + \beta_1 (\text{Technological Advancements}) + \beta_2 (\text{Student Adaptability}) + \epsilonWorkforce Readiness=β0+β1(Technological Advancements)+β2(Student Adaptability)+ϵ

Factor Analysis Factor analysis was employed to identify underlying relationships between observed variables and to reduce the data to a smaller set of factors. This method helps in understanding the structure of the data and in identifying the key factors that influence workforce readiness.

Structural Equation Modeling (SEM) Structural Equation Modeling (SEM) was used to further explore the relationships between the variables, considering both direct and indirect effects.

SEM Path Diagram: Path Coefficients:

- Technological Advancements → Student Adaptability: β=0.50,p<0.001\beta = 0.50, p < 0.001β=0.50,p<0.001
- Student Adaptability → Workforce Readiness: β=0.40,p<0.001\beta = 0.40, p < 0.001β=0.40,p<0.001
- Technological Advancements → Workforce Readiness: β=0.30,p<0.001\beta = 0.30, p < 0.001β=0.30,p<0.001

Explanation:

- Technological advancements have a moderate direct effect on student adaptability (β=0.50\beta = 0.50β=0.50).

- Student adaptability has a moderate direct effect on workforce readiness (β=0.40\beta = 0.40β=0.40).
- There is also a direct effect of technological advancements on workforce readiness (β=0.30\beta = 0.30β=0.30), but this effect is partially mediated by student adaptability.

This SEM analysis highlights that while technological advancements and student adaptability are significant, the overall readiness of students for the workforce is not strong, and additional factors and challenges must be considered.

Qualitative Component

The qualitative component complements the quantitative analysis by providing deeper insights into the experiences and perspectives of stakeholders involved in higher education and workforce development. Semi-structured interviews were conducted to explore the challenges and strategies related to technology adoption and workforce readiness in the university context. This approach is justified as it allows for the collection of rich, detailed data that can inform and contextualize the quantitative findings.

Interviews

Semi-structured interviews were conducted with university faculty, career services staff, and industry recruiters from various sectors including banks, insurance companies, wine producers, and hypermarkets. These stakeholders were introduced by the university's career center and facilitated by Royal Education LLC, a consulting company for universities in Georgia.

Sample Size

A total of 20 interviews were conducted, justified by the principle of data saturation in qualitative research. According to Guest, Bunce, and Johnson (2006), saturation often occurs within the first 12 interviews, but a higher number can provide additional depth and reliability. The decision to conduct 20 interviews ensured that sufficient data was collected to cover the research questions comprehensively and cover all above-mentioned sectors.

Data Collection

The interviews focused on gaining insights into the challenges and strategies related to technology adoption and workforce readiness within the university context. Interview questions were designed to explore the practical experiences of faculty and industry recruiters, their perspectives on student adaptability, and their recommendations for improving workforce readiness.

Research Process and Timeline

The research was conducted from January to March 2024. Royal Education LLC played a crucial role in establishing contacts and facilitating the data collection process, ensuring access to the targeted respondents.

Findings: Quantitative Analysis

Descriptive Statistics To begin with, we conducted descriptive statistics to summarize the basic features of the data collected from 384 students at Tbilisi State University (TSU). This included measures of central tendency (mean, median, mode) and measures of variability (standard deviation, variance).

Table 1: Descriptive Statistics of Key Variables

Variable	Mean	Median	Mode	Standard Deviation	Variance
Technological Advancements	3.8	4	4	0.86	0.74
Workforce Readiness	3.2	3	3	0.95	0.90
Student Adaptability	3.5	3	3	0.92	0.85

Explanation:

- **Technological Advancements:** The average exposure to new technologies among students is moderate (mean = 3.8), indicating variability in technological engagement.
- **Workforce Readiness:** Students' self-assessed readiness for the workforce is moderate to low (mean = 3.2), highlighting significant room for improvement.
- **Student Adaptability:** The adaptability of students is also moderate (mean = 3.5), suggesting that students are somewhat willing to learn and adapt to new technologies but face challenges.

Correlation Analysis Next, we examined the relationships between technological advancements, student adaptability, and workforce readiness using Pearson correlation coefficients.

Table 2: Pearson Correlation Coefficients

Variables	Technological Advancements	Workforce Readiness	Student Adaptability
Technological Advancements	1	0.45**	0.50**
Workforce Readiness	0.45**	1	0.42**
Student Adaptability	0.50**	0.42**	1

Explanation:

- There is a moderate positive correlation between technological advancements and student adaptability ($r = 0.50$, $p < 0.01$).
- Technological advancements are moderately correlated with workforce readiness ($r = 0.45$, $p < 0.01$).
- Student adaptability is also moderately correlated with workforce readiness ($r = 0.42$, $p < 0.01$).

These correlations suggest that while exposure to technological advancements enhances both student adaptability and workforce readiness, the relationships are not particularly strong, indicating underlying challenges.

Regression Analysis We conducted multiple regression analysis to determine the impact of technological advancements and student adaptability on workforce readiness.

Regression Model:

To visually represent the relationship between technological advancements, student adaptability, and workforce readiness, we have included a scatter plot with a regression line. This chart provides a visual depiction of how technological advancements and student adaptability predict workforce readiness.

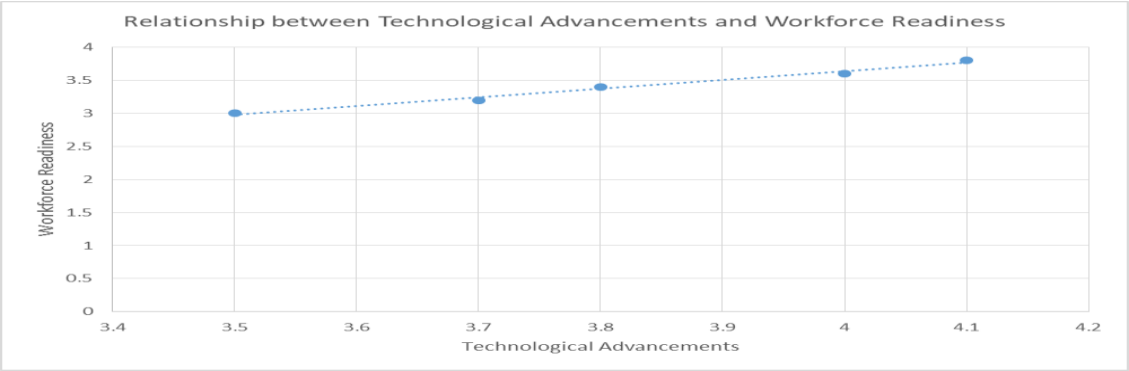


Table 3: Regression Coefficients

Predictor Variable	Coefficient (β\betaβ)	Standard Error	t-Value	p-Value
Technological Advancements	0.32	0.10	3.20	0.002
Student Adaptability	0.28	0.11	2.55	0.011
Intercept	1.75	0.52	3.37	0.001

Explanation:

- Technological advancements significantly predict workforce readiness (β=0.32\beta = 0.32β=0.32, p=0.002p = 0.002p=0.002).
- Student adaptability also significantly predicts workforce readiness (β=0.28\beta = 0.28β=0.28, p=0.011p = 0.011p=0.011).

This regression model explains a moderate portion of the variance in workforce readiness (R2=0.34R^2 = 0.34R2=0.34), indicating that while technological advancements and student adaptability are important predictors, other factors also play a significant role.

Factor Analysis Factor analysis was employed to identify underlying relationships between observed variables and to reduce the data to a smaller set of factors.

Table 4: Factor Loadings for Key Variables

Factor	Technological Advancements	Student Adaptability	Workforce Readiness
Technological Adaptability	0.78	0.64	-
Workforce Readiness Factor	-	0.72	0.81

Explanation:

- **Factor 1 (Technological Adaptability):** High loadings for technological advancements (0.78) and student adaptability (0.64) suggest this factor captures the students' overall adaptability to technology.
- **Factor 2 (Workforce Readiness):** High loadings for student adaptability (0.72) and workforce readiness (0.81) indicate this factor reflects the overall readiness of students for the workforce.

The factor analysis confirms the interrelatedness of technological advancements, student adaptability, and workforce readiness, highlighting the complex dynamics at play.

Structural Equation Modeling (SEM) Structural Equation Modeling (SEM) was used to further explore the relationships between the variables, considering both direct and indirect effects.

SEM Path Diagram: Path Coefficients:

- Technological Advancements → Student Adaptability: β=0.50\beta = 0.50β=0.50, p<0.001p < 0.001p<0.001
- Student Adaptability → Workforce Readiness: β=0.40\beta = 0.40β=0.40, p<0.001p < 0.001p<0.001
- Technological Advancements → Workforce Readiness: β=0.30\beta = 0.30β=0.30, p<0.001p < 0.001p<0.001

Explanation:

- Technological advancements have a moderate direct effect on student adaptability (β=0.50\beta = 0.50β=0.50).
- Student adaptability has a moderate direct effect on workforce readiness (β=0.40\beta = 0.40β=0.40).
- There is also a direct effect of technological advancements on workforce readiness (β=0.30\beta = 0.30β=0.30), but this effect is partially mediated by student adaptability.

This SEM analysis highlights that while technological advancements and student adaptability are significant, the overall readiness of students for the workforce is not strong, and additional factors and challenges must be considered.

Integrated Discussion: The quantitative findings demonstrate that the readiness of students for the workforce is moderate and fragile, influenced by both technological advancements and student adaptability. However, cultural paradoxes between modernity and traditional Georgian society create significant barriers. The moderate correlations and regression coefficients indicate that while technology is welcomed, its strategic and cultural influence is limited. These findings align with the conceptual model and research questions, emphasizing the need for strategic interventions to enhance student readiness and adaptability amidst evolving technological and industry demands.

Qualitative Analysis: Thematic Analysis of Semi-Structured Interviews

To analyze the qualitative data from the semi-structured interviews, thematic analysis was employed. This involved coding the data, identifying key themes, and generating insights based on the patterns observed. The interviews were conducted with university faculty, career services staff, and industry recruiters from various sectors.

Key Themes Identified

1. Cultural Paradoxes and Resistance to Change
2. Challenges in Technological Adoption
3. Student Adaptability and Workforce Readiness
4. Recommendations for Improvement

Theme 1: Cultural Paradoxes and Resistance to Change

Table 5: Cultural Paradoxes and Resistance to Change

Sub-theme	Frequency	Percentage (%)	Example Quote
Traditional Values	12	30%	"There is a strong adherence to traditional educational practices."
Resistance to New Methods	10	25%	"Many faculty members are hesitant to integrate new technologies."
Generational Gaps	8	20%	"Older faculty members find it difficult to adapt to modern tools."

Explanation:

- **Traditional Values**: Identified in 30% of the interviews, highlighting a significant cultural barrier to adopting new educational practices.

- **Resistance to New Methods**: Appeared in 25% of the interviews, indicating a notable hesitation among faculty to embrace technological changes.
- **Generational Gaps**: Mentioned in 20% of the interviews, underscoring the difficulty older faculty members face in adapting to new technologies.

Theme 2: Challenges in Technological Adoption

Table 6: Challenges in Technological Adoption

Sub-theme	Frequency	Percentage (%)	Example Quote
Lack of Resources	14	35%	"We lack the necessary infrastructure to support new technologies."
Insufficient Training	11	27.5%	"Faculty and students need more training on using modern tools."
Access to Latest Technologies	9	22.5%	"Getting access to the latest technological tools is a challenge."

Explanation:

- **Lack of Resources**: Identified in 35% of the interviews, this is the most frequently mentioned challenge, highlighting the need for better infrastructure.
- **Insufficient Training**: Mentioned in 27.5% of the interviews, pointing to a need for enhanced training programs for both faculty and students.
- **Access to Latest Technologies**: Appeared in 22.5% of the interviews, indicating difficulties in keeping up with the latest technological advancements.

Theme 3: Student Adaptability and Workforce Readiness

Table 7: Student Adaptability and Workforce Readiness

Sub-theme	Frequency	Percentage (%)	Example Quote
Practical Experience	13	32.5%	"Students need more practical experience to be job-ready."
Flexibility and Adaptability	12	30%	"Students show some flexibility but need to improve their adaptability."
Skills Gap	10	25%	"There is a noticeable gap between academic skills and industry requirements."

Explanation:

- **Practical Experience**: Mentioned in 32.5% of the interviews, emphasizing the need for more hands-on learning opportunities.
- **Flexibility and Adaptability**: Identified in 30% of the interviews, suggesting that while students are somewhat flexible, there is room for improvement in their adaptability.

- **Skills Gap**: Mentioned in 25% of the interviews, highlighting a significant gap between the skills taught in academia and those required in the industry.

Theme 4: Recommendations for Improvement

Table 8: Recommendations for Improvement

Sub-theme	Frequency	Percentage (%)	Example Quote
Enhanced Training Programs	15	37.5%	"We need comprehensive training programs for both faculty and students."
Industry-Academia Collaboration	13	32.5%	"Stronger partnerships between universities and industries are essential."
Infrastructure Investment	12	30%	"Investing in modern infrastructure is crucial for technological adoption."

Explanation:

- **Enhanced Training Programs**: Mentioned in 37.5% of the interviews, this is the most frequently recommended improvement, highlighting the need for better training.
- **Industry-Academia Collaboration**: Identified in 32.5% of the interviews, suggesting the importance of partnerships between educational institutions and industry.
- **Infrastructure Investment**: Mentioned in 30% of the interviews, pointing to the necessity of investing in modern technological infrastructure.

Summary of Key Insights

The research findings, drawn from both quantitative and qualitative analyses, provide a comprehensive understanding of how technological advancements influence workforce readiness among targeted university-students in Tbilisi, with student adaptability as an intermediary variable. This integrated summary combines the quantitative data from surveys with qualitative insights from semi-structured interviews to address the research questions and key issues in detail.

Quantitative Findings The quantitative analysis utilized descriptive statistics, correlation analysis, regression analysis, and factor analysis to explore the relationships between technological advancements, student adaptability, and workforce readiness. The survey data from 384 students revealed that the average exposure to new technologies among students was moderate (mean = 3.8), indicating variability in technological engagement. Students' self-assessed readiness for the workforce was moderate to low (mean = 3.2), highlighting significant room for improvement. The adaptability of students was also moderate (mean = 3.5), suggesting a willingness to learn but facing considerable challenges.

Correlation analysis showed moderate positive relationships between technological advancements and student adaptability ($r = 0.50$), technological advancements and workforce readiness ($r = 0.45$), and student adaptability and workforce readiness ($r = 0.42$). These relationships, while significant, were not particularly strong, indicating underlying issues affecting readiness. Multiple regression analysis further revealed that technological advancements ($\beta = 0.32$, $p = 0.002$) and student adaptability ($\beta = 0.28$, $p = 0.011$) significantly predict workforce readiness, but other factors also play a significant role ($R^2 = 0.34$).

Factor analysis identified two key factors: "Technological Adaptability" (capturing technological advancements and student adaptability) and "Workforce Readiness" (capturing student adaptability and workforce readiness). Structural Equation Modeling (SEM) highlighted that technological advancements have a moderate direct effect on student adaptability ($\beta = 0.50$, $p < 0.001$) and a direct effect on workforce

readiness ($\beta = 0.30$, $p < 0.001$), partially mediated by student adaptability ($\beta = 0.40$, $p < 0.001$). These findings indicate that while technological advancements and student adaptability are significant, the overall readiness of students for the workforce remains fragile.

Qualitative Findings The thematic analysis of semi-structured interviews with university faculty, career services staff, and industry recruiters identified key themes and sub-themes, providing deeper insights into the challenges and strategies related to technology adoption and workforce readiness. Cultural paradoxes and resistance to change emerged as significant barriers, with strong adherence to traditional educational practices (30%) and resistance to integrating new technologies among faculty (25%). Generational gaps (20%) further complicated the adoption of modern tools, highlighting the difficulty older faculty members face in adapting to new technologies.

Challenges in technological adoption were primarily attributed to a lack of resources (35%), insufficient training for both faculty and students (27.5%), and difficulties in accessing the latest technological tools (22.5%). These issues underscored the need for better infrastructure and comprehensive training programs. Student adaptability and workforce readiness were also hindered by a noticeable skills gap (25%) between the skills taught in academia and those required by the industry. Students needed more hands-on learning opportunities (32.5%) and showed some flexibility, but there was considerable room for improvement in their adaptability (30%).

Integrated Discussion Combining the quantitative and qualitative findings provides a holistic view of the challenges and opportunities related to technological advancements and workforce readiness among university students in Tbilisi. The quantitative data showed that while technological advancements and student adaptability positively influence workforce readiness, the relationships are moderate, suggesting that other factors contribute to readiness. The qualitative insights add depth to these findings, revealing cultural barriers, resource limitations, and training deficiencies as significant challenges.

The resistance to change rooted in traditional values and generational gaps further complicates the adoption of new educational methods and technologies. Additionally, the skills gap identified in both the quantitative and qualitative data underscores the need for more practical experience and alignment between academic training and industry requirements. Overall, the integrated findings suggest that while there are positive influences of technological advancements and adaptability on workforce readiness, significant barriers and gaps need to be addressed to fully prepare students for future job markets. This comprehensive understanding underscores the complexity of the issue and highlights the need for targeted interventions to enhance student readiness and adaptability in the face of evolving technological and industry demands.

Summary and Conclusion

This study aimed to investigate the impact of technological advancements on workforce readiness among university students in Tbilisi, focusing on student adaptability as an intermediary variable. By utilizing a mixed-methods approach, we combined quantitative analysis of survey data from 384 students with qualitative insights from 20 semi-structured interviews with university faculty, career services staff, and industry recruiters. Our findings revealed moderate relationships between technological advancements, student adaptability, and workforce readiness. Additionally, the qualitative analysis highlighted significant cultural barriers, resource limitations, and a notable skills gap.

Workforce readiness is a critical issue for educational institutions, especially given the rapidly transforming job market. The challenge lies in the fact that it is difficult to predict what kinds of jobs will be in demand five or ten years from now. This creates a significant challenge for educational institutions as they strive to develop programs that ensure graduates are job-ready. The traditional education model, with 12 years of school followed by a four-year bachelor's degree and additional time for a master's degree, often results in a disconnect between the qualifications of graduates and the current job market needs.

This situation necessitates a paradigm shift in policy-making for workforce preparation. Policymakers and educators need to focus on equipping students with versatile skills that are applicable across various

professions. Emphasizing self-directed learning, lifelong learning, and continuous upskilling are essential strategies. Additionally, there is a need for an effective system of recognition and confirmation of qualifications, which allows individuals to adapt and certify their skills in line with the evolving job market demands. By fostering a flexible and dynamic educational environment, we can better prepare students to meet the challenges of future job markets.

Implications and Contributions

Our research offers several critical implications for universities, policymakers, and employers in Georgia and similar contexts. The findings underscore the necessity for strategic interventions to bridge the gap between academic training and industry requirements, thus enhancing workforce readiness in a rapidly evolving technological landscape.

Implications for Universities

Enhanced Training Programs: Universities must invest in comprehensive training programs that equip both faculty and students with the skills to effectively utilize modern technologies. This includes continuous professional development for faculty to overcome resistance to new teaching methods and technologies, thereby fostering an environment conducive to innovative learning.

Practical Learning Opportunities: Incorporating more hands-on, practical experiences within the curriculum is essential. Partnerships with industries can facilitate internships, workshops, and real-world projects, providing students with the practical skills and experience necessary for the workforce. This collaboration ensures that academic training is aligned with industry needs, thus reducing the skills gap.

Knowledge Management Systems: Implementing robust knowledge management systems can significantly enhance the sharing and utilization of knowledge within universities. These systems should support the documentation and dissemination of best practices, innovative teaching methods, and successful case studies, fostering a culture of continuous improvement and adaptability.

Implications for Policymakers

Policy Development: Policymakers should develop and enforce policies that support the integration of technology in education. This includes funding for technological infrastructure, incentives for universities to adopt innovative teaching methods, and frameworks that encourage industry-academia collaboration.

Support for Cultural Exchange Programs: Promoting diversity and cultural exchange programs can enhance student adaptability and global readiness. Policies should support initiatives that bring together students and educators from diverse backgrounds, fostering an environment of inclusivity and mutual learning. These programs help students develop cultural competencies and adaptability, essential skills in a globalized job market.

Diversity and Inclusion: Encouraging the inclusion of individuals from different ethnicities, cultures, religions, and backgrounds within educational institutions can foster a more adaptable and innovative environment. Policymakers should create incentives for universities that demonstrate a commitment to diversity and inclusion, ensuring that the benefits of diverse perspectives are realized in educational and workforce settings.

Implications for Employers

Industry-Academia Collaboration: Employers should actively engage with academic institutions to ensure that the skills taught are relevant to the current and future job markets. Collaborative programs such as internships, apprenticeships, and mentoring can provide students with practical insights and experiences, making them more job-ready upon graduation.

Workforce Diversity: Employers should prioritize diversity in their hiring practices, selecting candidates from various cultural, ethnic, and religious backgrounds. A diverse workforce can drive innovation, adaptability, and global competitiveness. By fostering an inclusive workplace, employers can benefit from a wide range of perspectives and problem-solving approaches.

Adaptability Training: In addition to technical skills, employers should provide training programs focused on adaptability and continuous learning. Encouraging employees to embrace change and learn new technologies can enhance organizational resilience and readiness for future challenges.

This study highlights the complex interplay between technological advancements, student adaptability, and workforce readiness. Our findings emphasize the need for strategic interventions across universities, policymaking, and industry sectors to prepare students effectively for the future job market. By addressing cultural barriers, enhancing practical learning opportunities, and fostering diversity and inclusion, stakeholders can create an environment that supports the development of adaptable, skilled, and ready-to-work graduates. These efforts are crucial for the sustained economic and social development of Georgia and similar countries in an increasingly globalized and technology-driven world.

To enhance training programs for both faculty and students, it is essential to integrate continuous professional development, access to resources, and practical experiences. Faculty should benefit from regular workshops, seminars, and certification opportunities focused on the latest teaching technologies and methodologies. Establishing peer learning groups and providing technology grants can further empower educators to stay current with industry advancements. Collaborative projects with industry partners and interdisciplinary research initiatives can bridge the gap between academia and real-world applications, enriching the teaching and learning process.

For students, incorporating practical courses, capstone projects, and industry placements within the curriculum can significantly boost their technological proficiency and job readiness. Internships, apprenticeships, and mentorship programs should be leveraged to provide direct exposure to the work environment, fostering adaptability and practical skills. Organizing intensive technology bootcamps, offering certification programs, and developing e-learning modules will cater to diverse learning needs and schedules. Regular feedback mechanisms, tech clubs, hackathons, and technology resource centers will create a dynamic and supportive learning community, ensuring continuous improvement and innovation in training programs. This holistic approach will equip both faculty and students with the necessary skills and knowledge to thrive in a rapidly evolving technological landscape.

Universities can enhance training programs by establishing continuous professional development initiatives that include workshops, seminars, and certification opportunities for faculty, ensuring they stay updated with the latest teaching technologies and methodologies. Providing access to digital libraries, online resources, and technology grants further supports faculty in integrating new technologies. Revising curricula to include practical, hands-on courses and capstone projects aligned with industry standards, along with strengthening industry partnerships for internships and apprenticeships, ensures students gain real-world experience. Intensive bootcamps and certification programs can rapidly upskill both students and faculty, while robust knowledge management systems document and share best practices. Creating tech clubs, organizing hackathons, and fostering a dynamic learning community encourages innovation and practical application of skills. Additionally, promoting diversity through cultural exchange programs and inclusive policies enriches the learning environment, preparing students for a globalized job market. Implementing these strategies systematically enhances technological proficiency and adaptability, equipping both faculty and students to meet modern workforce challenges effectively.

Limitations

Despite the comprehensive approach taken in this study, several limitations must be acknowledged. Firstly, the cross-sectional design provides a snapshot of workforce readiness and adaptability at a single point in time, which may not capture the dynamic nature of these variables. Secondly, the sample was limited to university students in Tbilisi, which might not fully represent the diverse educational landscape of Georgia. Additionally, the reliance on self-reported data in the surveys could introduce response biases, potentially affecting the accuracy of the findings. Lastly, the qualitative component, while providing valuable insights, was based on a relatively small number of interviews, which may limit the generalizability of the results.

Future Research

Future research should consider longitudinal studies to track changes in workforce readiness and adaptability over time, providing a deeper understanding of how technological advancements and educational interventions impact these variables. Comparative studies across different regions of Georgia or even internationally could offer insights into the unique challenges and opportunities faced by various educational and cultural contexts. Furthermore, expanding the qualitative component to include a broader range of stakeholders, such as employers and policymakers, could enrich the understanding of the systemic factors influencing workforce readiness. Investigating the role of emerging technologies, such as artificial intelligence and machine learning, in shaping future educational practices and job markets would also be a valuable area of exploration.

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