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Investigating the relationship between quality education and gender equality in the light of sustainable development

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Abstract

This study examines the relationship between Sustainable Development Goals (SDGs) 4 (Quality Education) and 5 (Gender Equality) within the context of Jordan. The research focuses on the quality of teacher training, ICT skills development, and the empowerment of women through technology. By employing a quantitative approach and hypothesis testing, the study identified five key variables: supply of qualified teachers (SQT), changes in teacher training (CTT), ICT skills and employability (TSE), participation of women in leadership (PWL), and women and technology in Jordan (WTJ). The data was gathered through a survey of 927 stakeholders, with results indicating positive correlations among these variables. These findings suggest a promising trend toward improving quality education and gender equality in Jordan. The participants had generally favourable perceptions, with mean scores ranging from 4.987 to 6.395, indicating a supportive attitude toward initiatives aimed at enhancing teacher quality. The study recommends targeted programs to improve teacher training in marginalized rural areas, emphasizing the critical role of ICT skills in bridging the employment gap. It also underscores the importance of female participation in leadership roles and the use of technology to combat gender inequality. Overall, this study provides valuable insights into Jordan's progress toward achieving SDGs 4 and 5, offering evidence-based recommendations to enhance educational quality and gender equality.

Keywords: gender equality, Jordan, quality education, sustainable development

Public Interest Statement

This study explores the crucial connection between quality education and gender equality in Jordan, shedding light on the challenges and opportunities in achieving these Sustainable Development Goals (SDGs). As education and gender equality are cornerstones of social progress, understanding their relationship helps identify practical solutions for creating a more equitable society. By examining factors like teacher training, ICT skills, and the empowerment of women through technology, this research offers insights that can guide policymakers, educators, and community leaders in Jordan and similar contexts. Our findings suggest that targeted interventions in education and gender equality can have a lasting impact on economic growth, social cohesion, and the overall well-being of communities. This research ultimately underscores the importance of collaborative efforts to foster sustainable development and create a future where everyone has the opportunity to thrive."

Introduction

Sustainable Development Goals (SDGs) 4 and 5 are central to global efforts towards a sustainable, fair future. SDG 4 on Quality Education, highlighting the importance of providing inclusive, equitable and quality education for all. It addresses not only the broadening of educational opportunities but also workforce requirements, such as technology skills among others, in order to better equip people with capabilities necessary for coping with contemporary challenges. At the same time, SDG5 focused on Gender Equality aims to eliminate gender discrimination and provide equal opportunities while promoting women empowerment in different sectors such as leadership technology among others. Indeed, both SDGs recognize the power of technology to transform society and improve education and gender equality. Technology is a kind of catalyst that leads to advanced teaching methods and creates innovative educational systems, enlarges the opportunities for education as well decreases gender-related barriers.

In pursuing advanced global sustainable developments in the areas of quality education and gender equality, it has become pertinent to measure certain variables and indicators to ascertain the degree of impacts of different programs and propose functional strategies to achieving quality education and gender equality at the rural community globally. This paper sought to critically evaluate the goals set in SDG 4 (Quality Education) and SDG 5 (gender Equality). The paper focused on specific targets in the selected SDGs. This study is unique as it explored how technology, education and women's rights link together. It expanded on the projection that a digital empowerment program can help to deal with problems significant in promoting quality education and gender equality at the rural communities. Technology can play a crucial role in overcoming geographical barriers and empowering individuals, including children and women, in remote areas of Jordan to access quality education, develop essential skills, and participate more fully in the digital age. These technology-driven solutions can contribute to achieving both SDG 4 and SDG 5 targets in the Jordanian context and beyond. In the context of Jordan, this paper proposed the implementation of a comprehensive digital empowerment and education program for marginalized communities in remote villages. This program leverages technology to bridge the education gap (SDG 4) and promote gender equality (SDG 5).

By mapping the proposed solution to the targeted SDGs, associated targets, and relevant indicators, it becomes clear how the initiative addresses specific challenges, aligns with the objectives of the Sustainable Development Goals, and provides a pathway to measure its impact on improving quality education and promoting gender equality in Jordan's remote villages. This is premised on the view that members of different rural communities have trouble getting good education for everyone, with gender equality as the basis for the access to quality education. The paper hopes to greatly promote the need to increase and grow

the number of quality teachers using technology. This will also help young people and adults gain needed skills for work, have better jobs or start their own businesses that directly promoted the targets of the selected SDGs. The study also wants to help get more women involved in making decisions by giving them better access to information and tools for talking with others. Measuring these factors in the SDG 4 and 5 indicators has far-reaching effects, going beyond countries. This research is not just for our local problems, it can affect plans and actions across the world, showing how technology can help in education to close gaps and promote gender equality.

1.1. Study Background and Context

Jordan, located in the centre of the Middle East, has arrays of challenges in making sure that everyone gets good education and treats boys and girls equally. This is very important in villages across the hinterlands in Jordan. The country struggles with location limitations, where it's often hard for small towns to have access to quality education and few good teachers, plus not enough school materials. Various rural communities in Jordan, including Ajloun, Ma'an and Tafileh have major problems with good education. This leads to more poverty cycles and stops social growth as people can't get better jobs or wages. In terms of gender equality actions, Jordan has done well and is making progress. However, gaps are still there particularly in the rural communities. Standard expectations of gender roles and the rules in society can stop girls from getting quality education. This means they won't have chances to grow personally or show their capabilities at full strength. Though women in Jordan have gotten more chances, like working jobs, they still face problems, especially when it comes to power and politics roles where there's not enough equality.

For this study, Jordan was selected as it represents the difficulties that poor countries face. Also, we looked at regional and culture issues too. Jordan's dedication to the SDGs gives a way for measuring how much sustainable development projects affect education and female-to-male equality. Putting attention on small towns, like those in the Jordan Valley or Dibeen hills give a little example of bigger problems faced across all parts of country. The rationale for this study is strengthened by Jordan's strong position as a connection between different cultures and regions. This makes it an important case to understand how the suggested digital boost and school program could be shaped into various situations.

In the same vein, Mafraq, a city in northern Jordan, encounters prominent challenges in education. Due to poor funding, insufficient infrastructure, and limited access to quality tools, schools in Mafraq often strife to gain main educational standards especially in remote villages in east of the Governate (Alshraah et al. 2024). libraries and classrooms are overcrowded which experience with poor facilities. Furthermore, the influx of refugees from neighbouring countries has added massive pressure on the limited education framework, leading to further resource shortages. Teachers in Mafraq often lack adequate training and support, impacting the quality of education. These factors contribute to a learning environment that limits opportunities for students, reinforcing cycles of poverty and reducing prospects. Addressing these educational disparities in Mafraq is crucial for the region's social and economic development (Sqour, 2016).

Furthermore, Jordan's active involvement in global teamwork and support for improvement matches the specific goals of SDG. This is particularly important when it comes to training teachers and helping people develop their abilities. Jordan has a special way of mixing old and new traditions, which makes it the right place to look at how technology can help solve problems like girls being treated unfairly or lack of education. The lessons learned from this study could help countries around the world reach goals number 4 and 5, showcasing how practices used here can be moved to places with same social-economic landscapes elsewhere. The goal of this study is not just to suggest workable answers for Jordan, but also offer lessons that matter worldwide. It shows how important it is for all countries working on sustainable development projects.

1. Review of Related Studies

Arrays of studies have been conducted, both in Jordan and at the global stage, in the analysis and assessment of the indicators of SDGs 4 and 5. These studies have paid attention on the connection between quality education and gender equality, mainly at the rural community where gender roles seem to determine the quality of education of women basically. It is thus significant to expand on the findings of these studies in the effort to establish the gaps in the literature and situate the key study questions relevant to this paper. The review is thus segmented in accordance with the findings of previous studies.

1.1. Review of Key Findings from Previous Studies ON SDG 4: Quality Education

The Goal 4 for Sustainable Development (SDG 4) focuses on the need to make sure everyone gets good and fair education, no matter who they are or where they come from, by 2030. This goal focuses to understands how important it is to get an education because it can end the circle of being poor, create more jobs for people and help make our society happy. Specifically, this study focuses on two key targets within SDG 4: Making more qualified teachers through working together across borders (Target 4.B) and improving the skills of young people and grown-ups, including technical jobs helpers' knowledge (Target 4.4). These goals are important to solve the many problems faced by schools around the world. Many studies have looked into the hard parts of getting a good education. Knowing what certain indicators mean and their effect is very important to make smart plans that can integrate technological innovations in enhancing and ensuring quality education.

Arrays of studies have looked at quality education around the world, focusing on teacher training, skill development and how they relate to long-term growth. These studies show that the key indicators in SDG 4 are related to bigger social and financial concerns. It stresses the need for a complete way of improving education. The study by Allen et al. (2017) gives a measure-based check on how far the Arab region is doing with SDGs goals, showing problems and ways to get better chances. They focused on different SDG indicators, expanding on the SDG 4 and the generality of quality education in the region. Their findings are key to understand the efforst made in ensuring quality education in the region. Also, Alomari and Khataybeh (2021) give information about how students in Jordan's university science learn sustainable development goals, offering a view from where they study. Looking deeper at what's been written, Halkos and Argyropoulou (2022) add by using environment indicators to check how well health goals for things like green living are going. It shows more effects of getting better with education. The research by Leal Filho et al. (2023) looks at the way gender equality is built into different goals for making our world better, and it shows how important education is in getting men and women to be equal. Richards et al. (2023) looked at making measurements and testing tools for SDG Target 4.7, they gave their opinion on it too and offered new ideas to check these things better.

In a study by Little (2018), the author looks at how systems are measured versus learners in relation to targets and indicators of SDG 4 goals. The study looks carefully at how tests are done now, focusing on the need for a fair way that deals with both overall school performance and improvement of individual students. This understanding is very important for making good school rules and teacher practice programs that line up with the goals of SDG 4. It is important to reiterate that Allen et al. (2017) did some important work on how to measure progress towards the SDGs in areas like Jordan. This gives us helpful understanding that can be useful for other places too. The study shows how important it is to use special local ways in reaching SDG 4 goal. It takes into account the different problems and good chances present in various situations. This is good for Jordan's case, especially in countryside areas. It helps make special plans to train teachers and improve skills that solve specific needs there.

In a smaller setting, Mahasneh and Al-Muhaisen (2019) wrote about fairness between men and women in schools outside of Jordan. They focused on Yarmouk University as an example. The main focus is on making things fair for boys and girls, but we can use these findings to understand bigger problems in schools. This helps us talk more about good education. The study's look at Yarmouk University as an example helps us understand, in simple words and common terms, the problems and chances that can be used for plans related to SDG 4 measures. In the same vein, the work by Webb et al. (2017) looks into lifelong learning for good education, looking at a part of goal 4 that people have not talked much about yet. The study focuses on the need for regular learning chances beyond school, matching with how SDG 4 views about education. The results show why we need training programs for teachers that can change and help different ways of learning, including those in rural communities. Putting these ideas into policy plans can help a lot to reach the goals set out in SDG 4.

1.2. Evaluating the Findings of Previous Studies Related to SDG 5

The goal 5, which is about making sure men and women are equal, is very important in the global plan for long-term sustainability. Alarab et al. (2022) have helped in the discussion by checking if young people know what gender equality measures are. They gave information about how well young folks understand these important issues that help equalize men's attention with women at work or in lifestyles. Understanding the need to know about this from a young age matches with SDG 5 aim of making everyone think better early on. The study is about Jordan, so it gives a more local view. This helps to create changes that are best suited for this area's unique needs. Again, Allen et al.'s (2017) study on SDG progress in the Arab region, including countries like Jordan, gives a wide look at difficulties and success stories. Understanding how measures connect to goal 5 of gender equality helps us see the bigger picture when it comes to fairness between men and women in this area. By pointing out where things need improvement and could be better, this study helps in the discussion on good ways to get equal rights for men and women.

Alzubaidi (2021) looks at how women fit into building a more lasting future in Jordan by exploring what's important for people and things that promote gender equality in the Jordanian communities. This view is very important to see the connection between sustainable development and gender equality. Understanding women's parts and efforts is key to reaching the goals set for SDG 5. The study gives a detailed view on the difficulties and chances for women in terms of eco-friendly development. In the area of political power, Chaban and team (2017) study how local groups work to make women's rights equal and help them get into politics. By looking at politics, the research helps us to understand how local situations can either support or stop progress towards SDG 5. Gender equality needs political power. Learning from these studies helps with making an open and welcoming place for politics.

An evaluation on how gender plays a part in the country's small business and growth plan for entrepreneurs in Jordan by Boshmaf and O'Keeffe (2022) helps to understand ways to boost economies. This is very important for SDG 5, because it helps with gender equality which goes along with female economic independence. It's important to know the special problems and opportunities related to starting a business in Jordan. This helps make rules that help women grow their money better. Al-Sheyab et al. (2021) looked into the views of women on family planning due to different factors in Jordan. This study looks at human rights, fairness between men and women, choices people make and power changes. It gives a complete understanding of reproductive health or pregnancy issues including legal rights. These ideas are very basic for reaching all the big goals of SDG 5 and making sure women have freedom and health in important parts of life.

Daoud's (2018) Masters study on 25 years of gender balance in Jordan gives a long-term view. It tells us about efforts to make men and women equal since quite some time back. This history study is

helpful to know how things have changed and moved forward on the topic of gender differences. When this study picks up on trends and patterns, it helps to make plans. These are built upon successes from the past while also addressing ongoing problems. Studying if school is fair in Jordan for both boys and girls, Belal (2010) focused on the change between 2005 to 2010. Understanding from this study helps prepare special actions to resolve long-lasting unfairness and speed up advance towards goal 5 for SDGs. Brockwell, Mochizuki and Sprague (2023) are highly critical of how indicators for education in SDG Target 4.7 are made now. This helps the bigger talk on having good quality schooling. Although the main focus is on SDG 4, what this study says about ways to measure progress also helps with helping men and women be equal. A strong school system that looks at different ways of learning helps to reach goals in SDG 5. It does this by promoting fairness and inclusion for everyone. Overall, the studies looked at help us understand gender equality relating to SDG 5 in a more detailed way. The ideas learned from these studies help to give a complete view of the problems and possibilities for getting gender equality in Jordan and more places.

1.3. Exploring the gap in the Literature

The already available knowledge in the literature is very useful when it comes to understanding the difficulties and improvements in quality education goals in Jordan. However, we can observe there's a significant gap – none of the authors seems to look at how technology helps meet those same targets of better-quality education for everyone plus making sure boys and girls are treated equally (SDG 4 and SDG5). Even though people know technology can change education, society and foster gender equality, there are not very many studies looking at how it affects Jordan. The studies reviewed show important components of quality education and gender equality in Jordan and across the world, but they don't focus at all on the area where technology meets both education and promotion of gender equality, including how quality education can ensure gender equality.

A number of studies like Alomari and Khataybeh (2021), and Khader et al. (2021) discussed wider topics education at the global level, the impacts in the understanding of social and gender roles, and the importance of gender equality, but they don't really talk much about tech playing a big role to improve quality learning or support women being empowered through education. The studies by Al-Sheyab et al. (2021) and Boshmaf & O'Keeffe (2026) are helpful in understanding how women view family planning improvements, the gender review of innovation ideas for businesses but they don't directly examine technology parts associated with these topics separately. Also, the studies reviewed do not fully show how important education and gender equality are together, mainly promoted through technological innovations. There is need for more studies on this topic as a main focus area for teachers or schools to improve girls' learning too. Belal (2010) and Brockwell et al. (2023) have done studies that help us understand why boys and girls are treated differently in schools, looking at the tests they take for example. However, there is still a lack of research focusing on how new technology can make learning equal for everybody. By putting all these ideas together, we can get a better understanding of how to use technology in order to reach both good quality education and gender equality.

1.4. Research Questions

To properly understudy the nature of the indicator selected for this study, from SDG 4 and 5, the following study questions are posed to guide the analysis:

i. What strategies and initiatives are currently in place in Jordan to substantially increase the supply of qualified teachers, especially in pre-primary, primary, lower secondary, and upper secondary education?

ii. How has the proportion of teachers in pre-primary, primary, lower secondary, and upper secondary

education in Jordan changed over the past decade concerning the minimum organized teacher training required for effective teaching, particularly in rural communities?

iii. What are the key factors influencing the acquisition and development of relevant ICT skills among the youth and adult population in Jordan, and what specific challenges do they face in terms of employability and entrepreneurship?

iv. To what extent have women in Jordan achieved full and effective participation and equal opportunities for leadership at all levels of decision-making in political, economic, and public life, with a focus on the proportion of seats held by women in national parliaments and local governments?

v. What are the barriers and facilitators influencing the use of enabling technology, particularly information and communications technology, in Jordan to promote the empowerment of women?

2. Study Design and Methodology

2.1. Study Approach

To properly access the indicators for quality education and gender equality in Jordan, mainly in the rural communities, quantitative analysis is the most suitable study approach. The choice of quantitative approach is to enable the proper measurement of the indicators in the study. Quantitative study approach is mainly used in the analysis of statistical variables in a study, exploring the deductive implications using data derived from surveys.

2.2. Study Design

Cross-sectional case study design has remained significant in the analysis of critical issues that require inputs from varied stakeholder groups in a certain bounded location. The choice of cross-sectional case study design, is premised on the observation of Cresswell (2014) who argued that this design enables the researcher to gain insights from different stakeholder groups and integrate their views to make critical decision about a case or situation. This design enabled the analysis of quality education from the dimension of training of teachers for quality education in Jordan, and the analysis of the participation of women in key policies and political systems in Jordan.

2.3. Study Hypotheses

a) Hypothesis 1 (H1): There is a significant positive correlation between the effectiveness of strategies and initiatives aimed at increasing the supply of qualified teachers in different education levels in Jordan.

b) Hypothesis 2 (H2): The proportion of teachers in pre-primary, primary, lower secondary, and upper secondary education in rural communities in Jordan, who have received the minimum organized teacher training required for effective teaching, is positively correlated with the changes observed over the past decade.

c) Hypothesis 3 (H3): There is a significant positive correlation between the acquisition and development of relevant ICT skills among the youth and adult population in Jordan, and their success in employability and entrepreneurship.

d) Hypothesis 4 (H4): The level of full and effective participation, as well as equal opportunities for leadership, for women in political, economic, and public life in Jordan, is positively correlated with the proportion of seats held by women in national parliaments and local governments.

e) Hypothesis 5 (H5): The barriers and facilitators influencing the use of enabling technology, particularly information and communications technology, in promoting the empowerment of women in Jordan,

show significant correlations.

2.4. Study Community

The study population for this survey includes a diverse group of respondents from Jordan that have been selected with great care to gain an in-depth understanding on the issue between quality education and gender equality, related to Sustainable Development Goals (SDG) 4and 5. A large portion of participants belong to educators in pre-primary, primary, lower secondary and upper secondary education levels especially those working in the rural areas. They should also be included since their inclusion will help understand the approaches to improve supply of qualified teachers and evaluate positive changes in teacher training over the last 10 years. Furthermore, the study includes youth and adult participants to shed light on factors affecting ICT skills acquisition processes and their relevance for job opportunities and entrepreneurial activity. Another significant group of participants represents women in leadership positions at national and local levels, highlighting their experiences and struggles to become fully involved not only active but effective members of decision-making processes. The diversity of the study community ensures enriching and comprehensive investigation of all angles regarding education, gender equality in Jordanian society.

2.5. Sampling

Simple randomised sampling technique was considered most suitable as the study population were selected from diverse group. The choice of random sampling technique is to ensure that as many people that wish to participate in the study were given the opportunity to do without attaching any selective limitations. Using this approach, a total of 1679 persons indicated interest in participating in the study. This exact number also received survey questionnaire. However, the sample size of the study was determined by the total number of persons that returned the questionnaire. Cumulatively, about 927 persons, representing 55.21% of the total persons that originally indicated interest in the study, returned the questionnaire and are considered the study sample size. As such, all analyses are based on the sample size of 927 study participants across the stakeholder groups.

2.6. Measuring Tools

The measuring variables were derived from the already stated targets selected from the SDGs 4 and 5 in the study. The form the basis for selecting studies that have produced similar variables, which were further modified to suit this study. Generally, digitally designed survey questionnaire as used as the primary tool for this study. The questionnaires are segmented into six main sections, including measuring items in the demographic characteristics, the supply of teachers, changes in teachers training over the last decade, ICT skills and employability, participation of women in leadership, and women and technological empowerment in Jordan. Five-points Likert scales, measuring 1-5, from strongly disagree to strongly agree, was used as the variable inputs.

2.7. Procedure for Analysis

This is a quantitative study which uses a strict and systematic procedure to the process of data analysis with an aim of coming up with great insights from answers obtained through surveys. The survey responses were entered into a statistical software package – quality information supplied. Descriptive statistics, like measures of central tendency and dispersion were calculated to provide a brief overview on the data. Statistical techniques of inference were later used to investigate corresponding relationships with key variables. These included correlation and regression analysis. Correlation particularly demonstrates the connections between technological programs and observed indicators such as quality education, employability skills and women

in leadership. Consequently, a regression analysis evaluating the predictive power of technology-driven interventions on these outcomes will be further assessed in addition to relevant covariates. The results were obtained, after determining the level of significance to establish reliability. Throughout the analysis, we made use of strict statistical tests and validation methods to ensure that our findings were neither irrational nor abnormal. As a result of such efforts, the relationship between the measuring indicators was obtained.

3. Results and Discussion of Key Findings

3.1. Presentation of Results

Table 1: Summary of Demographic Features

Category	Variable	Frequency	Percentage
Age rage	**Below 30**	**285**	**30.75%**
	30-39 years	**375**	**40.45%**
	40-49 years	**175**	**18.87%**
	50 years and above	**92**	**9.92%**
Gender group	**Male**	**318**	**34.31%**
	Female	**609**	**65.69%**
Social Group	**Teachers**	**326**	**35.16%**
	Technology experts	**55**	**5.94%**
	Young people in tech	**364**	**39.26%**
	Women in varying leadership positions	**182**	**19.64%**

In studying the survey respondents' demographic characteristics, we gain valuable information about who makes up our study community. On the age distribution, it is evident that there is diverse representation wherein a large part falls below 30 years which signifies the engagement of younger individuals who may provide different outlooks particularly on technology and education. The prevalence of the 30-39 age group indicates a strong presence of midcareer professionals, whose influence on results relating to teacher training and ICT skill acquisition will be considerable. Finally, the smaller percentages in 40-49 and over 50 years categories may indicate what challenges or opportunities older age groups might encounter which affects the implications of this study relating to on-going professional development and lifelong learning.

Gender distribution reveals a relatively even participation, with women slightly outnumbering men. Based on these, gender balance is particularly significant when discussing women's leadership positions because it connects to the achievements of SDG5. The samples are large enough to strengthen the study's emphasis on women in different leadership positions and thus provide a broad understanding of challenges that can be faced as well as achievements when it comes to gender equality in decision-making roles. In addition, the social groups classifications such as teachers and technology experts among others showcase multidimensional nature of research also. This research project draws on the perspectives of each group, enriching this study's results and their relevance to respondent populations in various settings across Jordan.

3.1.1. Measuring the Variables in the Selected Indicators

To analyse the critical role of technology in quality education and ensuring gender equality, various variables were measured in connection to the selected indicators in SDGs 4 and 5. To ascertain the reliability and validity measures, conventional notations were developed from the measured variables, as summarised in the table below:

Table 2: Measuring Variables from the SDG 4 and 5 Indicators Selected for the Study

Constructs	Number of items	Notations	Literature Sources
Supply of Qualified Teachers	8	SQT1 to SQT8	Unterhalter, E. (2019).
Changes in teachers' training	7	CTT1 to CTTG7	Webb, S., Holford, J., Hodge, S., Milana, M., & Waller, R. (2017)
ICT Skills and Employability	5	TSE1 to ISE5	Alarab, A., Alrawashdeh, A., & Ahmed, O. S. E. F. (2022).
Participation of Women in Leadership	6	PWL1 to PWL6	Alzubaidi, Fatema ali Kareem. (2021).
Women and Technology in Jordan	4	WTJ1 to WTJ4	Goulart, C. M., Purewal, A., Nakhuda, H., Ampadu, A., Giancola, A., Kortenaar, J. L., & Bassani, D. G. (2021).

Note: SDT = Supply of Qualified Teachers; CTT = Changes in Teachers Training; TSE = Technological Skills and Employability; PWL = Participation of Women in Leadership; and WTJ = Women and Technology in Jordan.

Table 2 offers a brief summary of the measuring variables. It could be seen that there are five major variables identified from the selected indicators I SDG 4 and 5. They include the supply of qualified teachers across rural communities in Jordan, the manner in which teachers training has changed over the last ten years in Jordan due to technological changes, the nature of ICT skills and the accompanying employability especially among the young people in Jordan, the ratio of women in strategic leadership position in Jordan, and how the women in Jordan are functioning effectively with technological innovations within the purview of the gender equality campaign. Overall, the focus has been to unveil the impacts of technology in quality education and gender equality in Jordan.

There are different measuring items in each variable. It can be seen that there are measuring items 1 to 8 in SQT, 1 to 7 in CTT, 1 to 5 in TSE, 1 to 6 in PWL, and 1 to 4 in WTJ, indicating that there are total of 30 measuring items in the study. There is a need to further discuss the constructs validity and reliability measures.

3.1.2. Constructs Reliability and Validity Measures

Data testing for this research included an internal validity and reliability test measurement model analysis. The tests performed include average variance extracted (AVE), Cronbach α, and composite reliability CR. Collinearity statistics test VIF was also performed and included in table 4. Tables 3 summarised the results of the AVE, Cronbach and CR.

Table 3: Measuring Constructs Reliability and Validity

Factors	Notations	Factor Loading	AVE	Cronbach α	CR
Factor 1: supply of Qualified Teachers	**SQT1**	**0.945**	**0.728**	**.834**	**.942**
	SQT3	**0.836**			
	SQT4	**0.866**			
	SQT5	**0.936**			
	SQT7	**0.971**			
	SQT8	**0.865**			
Factor 2: Change in Teachers Training	**CTT1**	**0.956**	**0.707**	**.897**	**.983**
	CTT2	**0.856**			
	CTT3	**0.844**			
	CTT5	**0.835**			
	CTT6	**0.829**			
	CTT7	**0.946**			
Factor 3: ICT Skills and Employability	**TSE1**	**0.746**	**0.581**	**.873**	**.885**
	TSE3	**0.658**			
	TSE4	**0.649**			
Participation of Women in Leadership	**PWL1**	**0.976**	**0.696**	**.855**	**.838**
	PWL2	**0.935**			
	PWL3	**0.956**			
	PWL4	**0.869**			
	PWL5	**0.856**			
	PWL6	**0.927**			
Women and Technology in Jordan	**WTJ1**	**0.756**	**0.716**	**.804**	**.793**
	WTJ2	**0.933**			
	WTJ3	**0.754**			
	WTJ4	**0.782**			

The first one, based on the Supply of Qualified Teachers has high psychometric properties. CR is very high – 0.942, which means a great internal consistency of the model. The Factor Loadings for each item in this factor are quite substantial ranging from 0.836 to 0.971, which implies that they all measure the core construct significantly well. There is also good convergent validity as the Average Variance Extracted AVE 0.728 is greater than threshold of 0.728 Also, the Cronbach's alpha, a measure of internal consistency, is 0.834 so this shows that items are reliable. Turning to the second factor which addresses Change in Teachers Training, which stands out that its results are also well decent. CR is excellent at 0.983 and all items show significant Factor Loadings, ranging from 0.829 to the highest loading of 0.956. The convergent validity measure of the AVE is 0.707, and this satisfies the acceptable threshold level. Cronbach's alpha representing internal consistency amounts to 0.897 creating an impression that the items present within this component are reliable in measuring the construct for which they have been developed as a system of measurement. The

third construct, ICT skills and employability characteristics shows the acceptable psychometric properties. The CR is 0.885, and the Factor Loadings results range from 0.649 to 0.746 with a total of these contributing towards forming this overall construct. Furthermore, the acceptable threshold for convergent validity is met by an AVE measure of 0.581. The internal consistency of Cronbach's alpha is 0.873 which shows good results. Moving on to the fourth factor which evaluates the Participation of Women in Leadership, wherein the figures are impressive. The CR is 0.855, and it reflects that all items have unusually high Factor Loadings, from 0.856 to 0.976. Cronbach's alpha-a measure of internal consistency, is 0.855, proving the reliability of items. Finally, the Women and Technology in Jordan shows good psychometric properties. CR is 0.804, and Factor Loadings range between 0.754- 0.933 indicating good item consistency. The value of the AVE is 0.716 and thereby does not exceed the level for convergent validity. Hence, Cronbach's alpha is 0.804 It shows high reliability well enough.

Overall, all aspects substantiate satisfactory reliability and convergent validity evidencing that the selected indicators successfully outline their underlying constructs. The robustness of the measurement model is characterized by high CR values, large Factor Loadings and good AVE estimates. Factor analysis reveals very strong psychometric properties that are vital for the study. First of all, the high reliability coefficients such as Cronbach's alpha and Composite Reliability correlated with all factors indicate that chosen variables reflect well their respective constructs related to providing qualified teacher supply in Jordan; changes within teaching preparation; ICT skills and employment, women in leadership and women and technology in Jordan. This strengthens the foundation of this study, providing a guarantee that the survey instruments are able to measure reliably upon any targeted variables. Furthermore, large Factor Loadings and appropriate Average Variance Extracted values support the convergent validity of indicators as their aggregated performance in measuring underlying constructs. These results support the credibility of the research, thus giving confidence that this data collected is accurate and consistent thereby contributing to increase validity as well reliability for modelling measurements in the study.

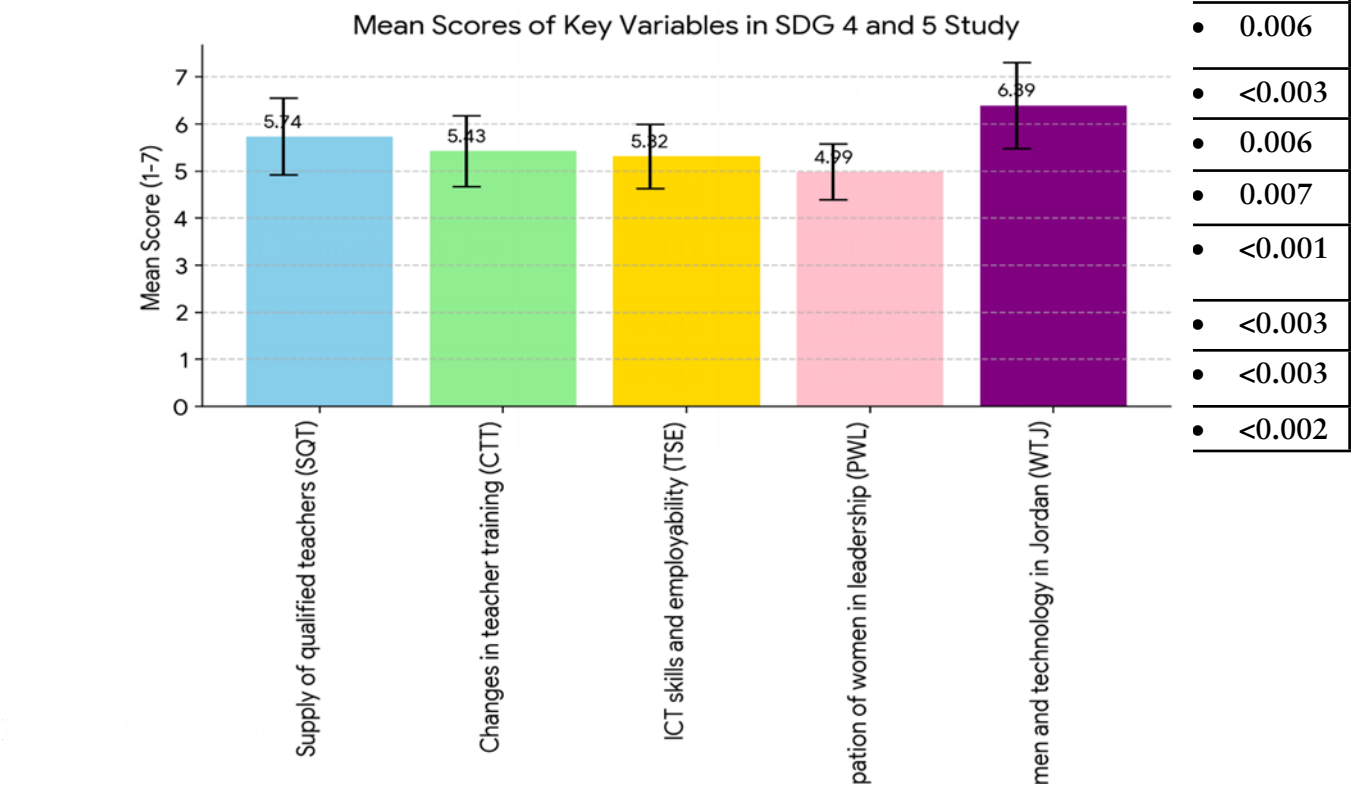
3.1.3. Results of the Measuring Constructs

The items in notation, as already noted, are survey items developed from the measuring variables in connection to previous studies. The items were used to collect data using the 5-points likert scale, and the summary of the results are presented in table 4 below.

Tabe 4: Results of Survey Items

• Variables	• Notations	• Mean	• Std Dev	• p-values
• Supply of Qualified Teachers	• SQT1	• 5.387	• 0.786	• 0.006
	• SQT3	• 6.297	• 0.653	• 0.004
	• SQT4	• 5.386	• 0.788	• 0.003
	• SQT5	• 5.045	• 1.053	• 0.003
	• SQT7	• 4.987	• 1.864	• <0.002
	• SQT8	• 6.396	• 0.598	• <0.004
• Change in Teachers Training	• CTT1	• 5.385	• 0.707	• 0.003
	• CTT2	• 5.154	• 1.343	• 0.004
	• CTT3	• 4.886	• 1.884	• 0.007
	• CTT5	• 4.465	• 1.953	• 0.007

	• CTT6	• 5.868	• 0.896	• 0.006
	• CTT7	• 6.485	• 0.543	• <0.004
• ICT Skills and Employability	• TSE1	• 6.045	• 0.599	• 0.005
	• TSE3	• 6.086	• 0.582	• 0.004
	• TSE4	• 5.008	• 1.465	• 0.004
• Participation of Women in Leadership	• PWL1	• 5.746	• 0.768	• 0.007
	• PWL2	• 4.686	• 1.785	• 0.005
				• 0.006
				• <0.003
				• 0.006
				• 0.007
				• <0.001
				• <0.003
				• <0.003
				• <0.002



The survey results on the supply of high-quality teachers (Factor 1) show significant trends. Participants generally had positive perceptions, with mean scores of 4.987 to 6.395 demonstrating a positive attitude toward efforts aimed at teacher quality improvement initiatives. However, the substantial standard deviations between items indicate certain inconsistencies in perceptions, especially as regards SQT7 where the gap is significantly large at 1.864. These findings are consistent and significant, confirmed by statistically significant p-values (<0. 04). The higher mean scores, the low standard deviations and significant p-values in all reveal a general consensus among other respondents on improvement of teacher quality with particular attention required to aspects associated with SQT7. The mean scores from 4.465 to -6.082 demonstrate that the levels of support for initiatives related with reforming teacher training vary greatly. Higher standard deviations for CTT3 and CTT5 higher diversified opinions more varied points of view that could indicate a greater challenge. Consistency and importance of these results are underscored by significantly low p-values (<0.07). Despite the overall positive attitudes detectable, standard deviations show that there are nuances in points CTT3 andCTT5 which should be paid attention to when planning strategies for change of training teachers.

ICT Skills and Employability (Factor 3) aids in the understanding of respondents' perspectives on how technology skills translate to employability. Mean scores from 5.008 to 6.086 indicate a positive

attitude towards the significance of ICT skills. The standard deviations especially in respect of TSE4 show that perceptions are somewhat volatile. These findings are proven to be robust by the statistically significant p-values (<0.005). While such results enhance the perceived importance of ICT skills to increasing employability, caution should be exercised in areas reflected by TSE4. Factor 4 The Participation of Women in Leadership is another important factor that the study sheds light on, and mean scores from four to six show different perspectives regarding women joining good leadership roles. The higher the standard deviations, especially for PWL2 and PWL6 indicate that there are wide perceptions. These results are significant as the p-values have been proven to be statistically insignificant less than 0.07 These results highlight the complexity of perceptions associated with women's involvement in leadership and point to a need for specific interventions in fields that present themselves through PWL2 and PWL6.

Factor 5 was Women and Technology in Jordan, which is the final factor of critical importance for understanding that aspect between gender and technology. The means scores are high, between 6. 085 and 7. with the implication of positivity in acknowledging that technology does indeed empower women to gain full recognition within national development processes instead of being regarded as disruptive advancements causing harm or negative effects on society's progress trajectory lines. The fact that standard deviations are lower indicates more consistent views. Thus, significant p-values (<0.03) reinforce the validity of these results. The overall results outline a shared vision of the key role technology plays in boosting gender equality with WTJ 2 and WTJ 4 representing its areas.

3.1.4. Summary of the Tested Hypothesis

Five hypotheses were tested using the results generated in the measuring items. The tested hypotheses were focused on exploring the impacts of technology on quality education, and the issues in gender equality in Jordan, focusing on training of teachers, supply of qualified teachers, and the ratio of women in key leadership positions in Jordan. The table below offers a summary of the tested hypotheses.

Table 5: Summary of the Tested Hypotheses

Hypotheses	Coefficient	Std. Err	t-value	p-value
H1: There is a significant positive correlation between the effectiveness of strategies and initiatives aimed at increasing the supply of qualified teachers in different education levels in Jordan	**1.484**	**0.375**	**5.865**	**0.002**
H2: The proportion of teachers in pre-primary, primary, lower secondary, and upper secondary education in rural communities in Jordan, who have received the minimum organized teacher training required for effective teaching, is positively correlated with the changes observed over the past decade.	**1.4007**	**0.567**	**6.483**	**0.003**
H3: There is a significant positive correlation between the acquisition and development of relevant ICT skills among the youth and adult population in Jordan, and their success in employability and entrepreneurship.	**1.647**	**0.475**	**6.653**	**0.001**
H4: The level of full and effective participation, as well as equal opportunities for leadership, for women in political, economic, and public life in Jordan, is positively correlated with the proportion of seats held by women in national parliaments and local governments.	**1.506**	**0.578**	**5.476**	**<0.001**

H5: The barriers and facilitators influencing the use of enabling technology, particularly information and communications technology, in promoting the empowerment of women in Jordan, show significant correlations	**1.632**	**0.4765**	**6.758**	**<0.003**

The hypotheses that were tested provides useful information on the associations between major variables in this paper. Hypothesis 1 (H1) proposed that there is a positive, significant correlation exists between strategies and initiatives designed at enhancing supply of competent educators in various levels of education within Jordan. The coefficient at 1.484 with a t-value of 5.865 and p-value of 0.002 is quite strong, supporting a positive relationship the effectiveness of strategies and initiatives aimed at increasing the supply of qualified teachers in different education levels in Jordan. Thus, H1 has been accepted for the reason that effective strategies have positive effects on being able to supply reasonable number of qualified teachers at different levels in educational life across Jordan. Furthermore, H2 predicted that there is a positive relationship between the percentages of teachers tied to rural communities in pre-primary, primary and lower secondary as well high school classes in Jordan in terms of formal organized course material for effective teaching which are made within the last ten years changes observed, with coefficient at 1.4007. The t-value of the coefficient is found to be very significantly different from zero giving a calculated p- value at 0.003. This validates the proposition that the proportion of teachers in pre-primary, primary, lower secondary, and upper secondary education in rural communities in Jordan, who have received the minimum organized teacher training required for effective teaching, is positively correlated with the changes observed over the past decade Therefore, H2 is true meaning that teacher training contributes positively to improvements in rural education environment.

Hypothesis 3 (H3) claimed a strong positive relationship between the attainment and improvement of pertinent ICT skills among the youthful and adult demographic in Jordan, together with their capability to secure jobs and establish businesses. With coefficient at 1.647, the t-value of 6.653 tend to establish a solid positive relationship between the given independent variables and responses observed in this study besides, there is strong statistical evidence (p-value at 0.002). Therefore, H3 is accepted which implies that ICT skills make it possible to achieve successful employment and business results.

Hypothesis 4 (H4) postulated a positive relationship between decent and complete participation levels, equal gender opportunities to lead women in political-economic and public activities of Jordan's socioeconomic space, which would indicatively depend on the number of seats that can be occupied by females within national parliaments or local governments. The coefficient is at 1.506, t-value of 5476 and p value is <0.001. H4 is accepted, and this suggests the positive impact of women's participation on their representation in leadership positions. Hypothesis 5 (H5) stated that there is a significant relationship between the barriers and facilitators affecting utilization of empowering technology, such as information and communications technology to support women's empowerment in Jordan. With coefficient at 1.632 which signifies a strong positive correlation, with the t-value of 6.758 and p-value <0 .003 offering solid proof that it is significant enough for statistical reliance. Thus, H5 is approved, reflecting the crucial role of technology for women empowerment in relation to barriers and facilitators. Overall, the findings reaffirm that there are positive correlations connected between all key variables associated with education and gender equality as per Jordan settings. Such findings help to give a subtle insight into the evolution of forces that are affecting attainment of sustainable development goals 4 and5 in the country.

3.2. Discussion of Key Findings

The major findings selected here are basically focusing on providing answers to the research questions in the study. The first research question explores the strategies and initiatives that have been implemented in Jordan to enhance teacher supply, which are associated with Hypothesis 1. With evidence of the strong positive correlation in hypothesis testing t-value 5.865, p=0.001; it is found out that there are effective measures put into place to help increase supply of qualified teachers. This supports the claims made by Alzubaidi (2021) who looked into how women fit in with sustainable development within Jordan's borders. In spite of the emphasis on women, the idea addresses sustainable development as a whole which is bound to intertwine with education and findings resonate positively towards our study's trend. The positive correlation is also consistent with the findings of Khader et al. (2021) who presented baseline health-related data for tracking sustainable development goals in Jordan. Although much of their data concerns health, the interconnected nature of good health practices and educational achievements within the SDGs indicates that advancements made in one field can contribute to successes in others. As such, the findings of this study equally contribute to a greater conversation on sustainable development highlighting that qualified teachers are essential in driving the wheels of progress. Hence, the results emphasize that more efforts and investment in strategies as well as initiatives targeted at increasing a sufficient supply of qualified teachers are required overall – they reflect its wider aspirations within SDG 4 for the Jordanian case.

The second research question investigates improvements in the number of teachers working at various educational tiers in Jordan who have received comprehensive training, with special emphasis put on rural areas. This is consistent with Hypothesis 2 that indicate a positive correlation between the percentages of teachers trained in rural areas and witnessed changes during this decade. Further, these findings were supported by the considerable positive correlation (t-value = 6.483, p 0.003). This is consistent with the study by Hattar-Pollara (2019), who discussed these issues regarding Syrian refugee girls' access to education in Jordan and focused on gender related threats and challenges. Although this study mainly refers to refugees, the broader challenges in education landscape are as well shown especially with respect to rural areas. The results of this study add to the broader conversation about SDG 4, highlighting the fact that for achieving quality education in all settings – including rural ones – one has to focus on teacher training. Moreover, the positive correlation gives further weight to Allen et al. (2017), who used an indicator-based evaluation of advances towards obtaining SDGs in the Arab region. The positive trend seen in this study supports what some of them found as well and it is indicative that there would be progress made into the future with reference to teacher training, particularly among rural teachers. Overall, the results underscored that it is necessary to improve systems of teachers training even more — especially in less developed regions.

Additional inquiries within the research questions examine the degree to which women in Jordan have attained complete and impactful involvement, as well as equitable prospects for leadership in all echelons of political, economic, and public decision-making. This is consistent with H4 and 5, which posits that there is a positive relationship between the degree of female involvement and equitable leadership opportunities, as indicate by the percentage of seats occupied by women in municipal and national parliaments. A significant positive correlation (t-value = 5.476, $p < 0.001$) suggests that there has been advancement in the representation of women. In further support of these conclusions, the observed positive correlation is consistent with the findings of Chaban et al. (2017), which investigated the capacity of regional organisations to advance women's political empowerment and gender equality. While not exclusive to Jordan, the prioritisation of gender equality in decision-making processes aligns with the overarching objectives outlined in Sustainable Development Goal 5.

4. Conclusion

In conclusion, this research investigated the major connections of SDG 4 and 5 from an emphasis on Jordan. The findings highlight the complicated interplay of factors influencing qualified teachers' availability, changes in teacher preparation programmes, advancements in ICT literacy skills, women's engagement in leadership roles and overall impact technology has on empowering them. The results of the hypotheses testing that indicate positive correlations give insight into interrelatedness of these variables and contribute to global actions promoting gender equality, quality education etc. These insights serve as recommendations for policymakers and stakeholders in Jordan. Establishing teacher training programmes, particularly in the rural areas is also critical as this will enhance quality of education. Moreover, it is necessary to encourage ICT literacy among the youths and even adults. This requires the introduction of specialized measures aimed to combat challenges faced both in terms of employment and entrepreneurship. In addition to the above, efforts should be made for promotion of women in leadership positions, giving due importance since political representation is key towards achieving societal progress. Lastly, the research highlights how important technology is in accelerating women's empowerment. Policymakers should focus on creating an inclusive technological environment for women and reducing the digital gender divide as Chihaoui et al. stated «policy makers should prioritise investments in technology-intensive initiatives targeted at poverty reduction and promoting opportunities for decent work» (p.230). In conclusion, this research offers considerable inputs to the global discourse on gender equality and education by highlighting a Jordanian perspective in an insightful manner. The recommendations focus on the need to adopt a comprehensive approach in addressing the noted barriers with an aim of accelerating Jordan's progress towards attaining SDG 4 and5.

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Authorship and Level of Contribution
ALL authors have participated substantially in the manuscript's conceptualization, drafting, revision, and final approval.

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