

The Nexus Between Demographic Factors and Economic Development in the Kingdom of Saudi Arabia

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ABSTRACT

Demographic factors significantly shape economic development, especially in rapidly transitioning nations like Saudi Arabia. This research explores how demographic dynamics such as population growth, education, health, and employment impact Saudi Arabia's economic development. This analysis of the demographic factors and economic growth model for Saudi Arabia using annual time series observations from 2000 to 2023 utilizes new methods such as the ARDL and co-integration techniques; the study brings new perspectives on the dynamic causal connections between measures of population growth, education and health, and workforce development that are paramount for Vision 2030 economic planning. Also, this research uniquely examines the impact of gender workforce participation and access to new technologies on Saudi Arabia's demographic characteristics and economic development. It aims to uncover how modern societal and technological trends influence economic evolution and support Vision 2030's diversification and sustainable development goals. Results reveal that the Human Development Index HDI, Female participation in the total labour force FPTL, and Internet penetration rate IPR which is a proxy variable of technological advancement, significantly and positively influence economic growth and development, underscoring the importance of human development, gender inclusion, and digital connectivity. Conversely, the unemployment rate shows a marginally significant relationship with GDP. Policymakers should understand the role of demographics as vital for economic development planning and enhancing human development, promoting gender equity, and improving digital infrastructure for sustainable economic growth.

Keywords: Demographic Factors, Economic Development, Human Development Index, Unemployment, Gender Workforce Participation, Digital Connectivity, Vision 2030, Economic Planning

INTRODUCTION

The nexus between demographic factors and economic growth is pivotal to studying Saudi Arabia, as demographic shifts, economic reforms, and the evolving labor market significantly influence its economic development. (Salam, 2022).

Socio-demographic factors such as population growth, age structure, and urbanization level affect economic development (Hrybinenko, Bulatova, & Zakharova, 2020). The Kingdom of Saudi Arabia is experiencing demographic changes (R. Al-Khraif, Abdul Salam, & Abdul Rashid, 2020). Understanding these dynamics is essential for crafting policies that harness population potential to drive economic prosperity. The link between population change and the economy is a rather complex one. Three key sectors are education, health, and workforce investment, pivotal in the interaction. Education improves the skills of the working population by equipping them with more knowledge, hence providing the nation with a smarter workforce. Health improvement increases productivity because many illness-related absences are due to health issues, and workers are more

effective when healthy (Deming, 2022). Maintaining a strong and healthy population is important because the workers' force supports sustainable economic development, especially amid global economic changes. Studying these elements within the Saudi context is particularly relevant given the nation's ambitious Vision 2030 plan, which aims to diversify the economy and reduce dependency on oil revenues (Al Naimi, 2022). This research will explore how demographic factors drive economic growth in Saudi Arabia, focusing on education, health, and workforce investment.

Research Objectives

Analyzing the role of demographic factors in Saudi Arabia's economic development is the aim of this research, for this, the following are the primary objectives of this research.

- To examine the role of demographic factors in economic development
- To analyze the mutual relationship between population development and economic growth
- To explore the basis of this relationship through investments in human capital

This study investigates the influence of demographic factors using GDP as a proxy variable for economic growth and observes the long-term association between Human Development Index (HDI), Unemployment Rate (UR), Female Participation Rate in the Labor Force (FPTL), and Internet Penetration Rate (IPR). The youthful demographic profile and expanding population influence workforce dynamics, consumption patterns, and infrastructure needs. Education is critical for economic progress, with investments to equip Saudi youth with essential skills (Salam, 2022). Health improvements enhance productivity and extend working lives, contributing positively to economic output. Influenced by demographic shifts and economic reforms, the evolving Saudi labour market highlights the importance of developing policies for promoting workforce participation and skill development to harness demographic dividends and ultimately lead to economic development (Al-Khraif, 2022).

The current study's limitations include data availability and the complexity of isolating specific demographic impacts (Pandey, Madhusudhan, & Singh, 2023). However, the findings will be useful in utilizing knowledge of Saudi demographic patterns to formulate and apply accelerated and long-term economic development policies.

LITERATURE REVIEW

Demographic Factors and Economic Growth

Demographic characteristics greatly impact the economy and development, defining countries' future globally (Yumashev, Ślusarczyk, Kondrashev, & Mikhaylov, 2020). In the case of the Kingdom of Saudi Arabia (KSA), the dynamics in question are particularly pertinent at this phase of the country as it strives to drive through a comprehensive economic transformation under Vision 2030 to reduce the nation's reliance on oil exports (Rostan & Rostan, 2021). In the past, changes in demography have been associated with changes in the economic facet of humanity. The rate of growth, age distribution, and the level of urbanization are the core demographic features affecting economic factors (Hrybinenko et al., 2020). KSA, a nation growing so fast and with a highly youthful population, makes it ideal to analyze these relationships. The natural population in Saudi Arabia has been rapidly increasing in the past few decades due to high fertility rates and enhanced health facilities, resulting in low mortality rates (Thompson, 2021). The demographic factor has implications on the availability of people in the workforce, consumption, and investment necessary for infrastructure and social facilities (Gerasimova, Oblova, & Golovina, 2021).

Education, Health, and Economic Development

Education increases Human Capital, promotes innovation, and increases economic productivity. The expansion of universities and technical training institutes provides skills to the growing young generation for a diverse economy. Programs to update the curriculum and STEM projects improve the technical and vocational training corresponding to developing a capable human capital to spur innovation and diversification in other sectors besides dependency on oil (Arif & Al-Zahrani, 2022). Rather, in Saudi Arabia, investments in healthcare facilities and services have drastically improved health and expectations. This has favourable prospects for workforce efficiency, a vital element for a nation's GDP. To accumulate these gains and address the possible demographic issues resulting from a decreasing birth rate continuing efforts to fight lifestyle diseases and increase insurance for healthcare facilities in rural areas (Alkhamis & Miraj, 2021).

Workforce and Economic Development

The Saudi labor market is transforming, influenced by demographic shifts and economic reforms. Efforts to increase workforce participation, particularly among women and youth, are essential for leveraging demographic dividends (Folasade, 2019). Policies promoting private sector growth, entrepreneurship, and skill development are

pivotal in absorbing the expanding labour force and reducing unemployment rates (R. M. Al-Khraif, Salam, & Rashid, 2022). Empirical studies on demographic factors and economic growth often employ quantitative methods such as regression analysis, time series modelling, and econometric techniques. These methodologies become a tool for researchers to analyze the impact of demographic variables on economic indicators such as GDP growth, labour market dynamics, and sectoral contributions over time (Ziberi, Rexha, Ibraimi, & Avdiaj, 2022). Demographic characteristics are at the core of Saudi Arabia's economic development trajectory. In pursuit of Vision 2030 for economic diversification and sustainable development, the country optimizes its demographic through the development of education and health, among other critical stakeholders in the labour market (Al-Khraif, 2020). Demographic characteristics are closely connected with trends in economic policies and results, which is why these factors must be considered while planning economic development.

GDP (Gross Domestic Product)

Gross Domestic Product (GDP) is one of the starting measures to assess the country's economic condition (Fraumeni, 2022). It assesses the total price of all the items manufactured and provided in a state over a given period. The GDP indicator is necessary for analyzing economic growth because it provides a broad picture of the activity. A higher value of GDP normally correlates with economic development, and when the values are low, the economy may stagnate or be in a recession period. Due to the significance of economic growth, GDP assists policymakers, economists, and investors in decision-making concerning economic policies, investment plans, and resource distribution (Shrotryia & Singh, 2020).

HDI (Human Development Index)

HDI, also known as the Human Development Index, comprises three statistical dimensions representing a country's level of human development. It encompasses three key dimensions: health, life expectancy at birth, education, mean years of schooling and years expected to be in school, and standard of living per capita (Sajith & Malathi, 2020). HDI is vital for evaluating a given population's development and health status. HDI offers a different approach to development than GDP in that it incorporates human factors. That is why HDI can be considered an effective instrument for comparing the development indicators between the countries and the regions (Conceição, Kovacevic, & Mukhopadhyay, 2021).

Unemployment

The Unemployment Rate (RU), therefore, refers to the proportion of the total working force who are unemployed but are willing and able to take up employment opportunities. Hence, there is only one better way of assessing the state of the labor market and economic health than through the unemployment rate (Hjazeen, Seraj, & Ozdeser, 2021). So, high unemployment rates can, in turn, signal poor economic prosperity, less consumer spending, and slow economic development. On the other hand, low unemployment instances are often seen as a healthy state or economy with existing work openings. The unemployment rate is a major indicator that officials and economists use for determining policies regulating employment, evaluating the performance of an economy, and putting in place strategies that can fuel employment opportunities and economic activity (Aliyev, 2021).

Gender Workforce Participation

The Female Participation Rate in the Total Labor Force (FPTL) is calculated as the female part of the economically active population to the total economically active population. This measure is crucial for gender issues in employment and improving gender equality in the labor market (Folasade, 2019). This is evidenced by increased FPTL figures, implying an expansion of women's engagement in the economic sphere, thus boosting overall financial progress. Female participation in the labour force is a critical aspect of economic and social development in Saudi Arabia. Over the past few years, the country has undertaken significant reforms to enhance women's roles in various sectors, aligned with the broader goals of Vision 2030. By analyzing FPTL's comparative information, the government can define obstacles to women's employment and apply necessary measures for gender equality, including education, child care, and workplace policies (Jaapar, Chukari, & Hisham, 2022).

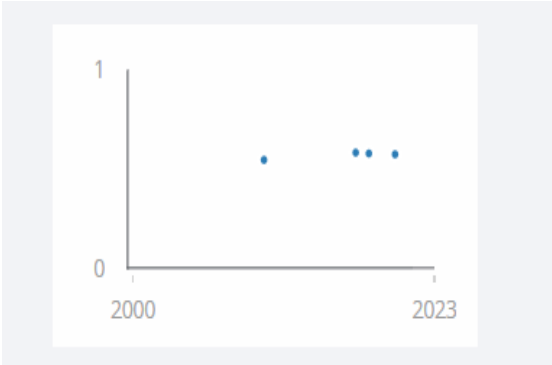
Technological Advancement

Technological advancement is an important socioeconomic factor to consider while studying the influence of demographic factors. Population with access to the internet and advanced technology is closely linked to economic growth since it improves production, efficiency, and product improvement (Zhang, Zhao, Wan, & Yao, 2021). A high internet penetration rate (IPR) enhances the flow of information and knowledge, digital products, and international markets, propelling economic activity. The Internet Penetration Rate (IPR) defines a percentage of the population using Internet services, indicating Internet accessibility. It is one of the most essential signs of a country's connectivity to the digital world and technological status. Thus, high internet density entails better information, communication, and economic prospects (Fernández-Portillo, Almodóvar-González, & Hernández-

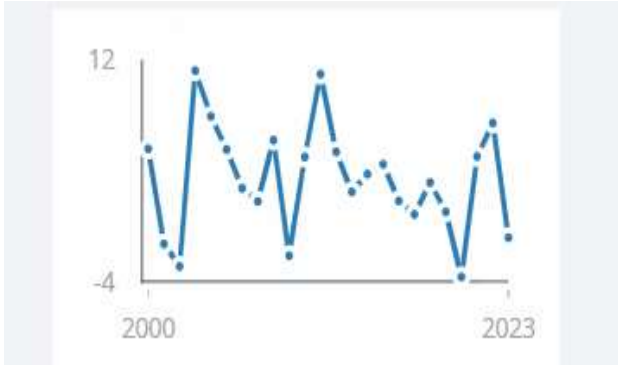
Mogollón, 2020). IPR also plays a central role in creating innovation, electronic business and utilization of electronic information services. The policymakers and the firms employ this measure to determine the Digital Divide to formulate and implement strategies, policies, and infrastructure for raising the level of Digital Inclusion and economic growth in the Digital Economy (Appiah-Otoo & Song, 2021).

Population Growth Rate

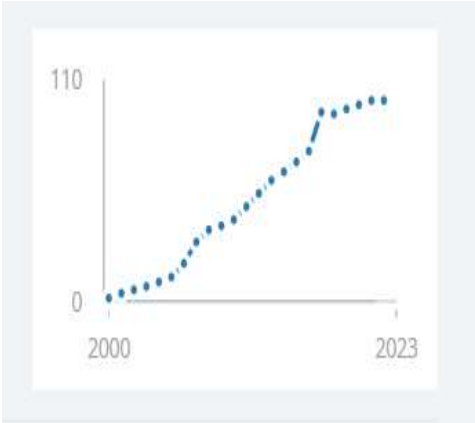
The Population Growth Rate (PGR) is the rate at which a given country’s population grows within a particular period. High population growth can lead to increased demand for resources, education, healthcare, and employment opportunities, while low or negative growth may pose challenges related to aging populations and workforce shortages (Gu, Andreev, & Dupre, 2021). Understanding PGR helps policymakers plan sustainable development, resource allocation, and long-term economic strategies (Todaro & Smith, 2020).



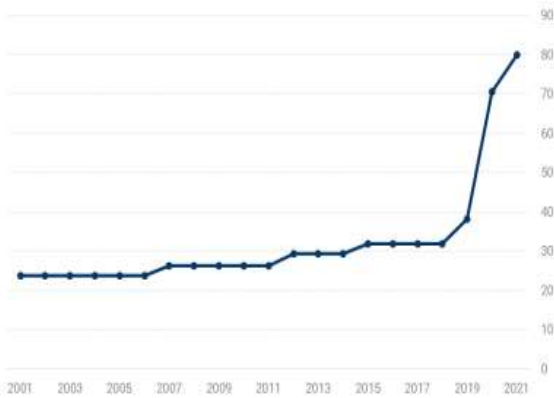
Human Development Index



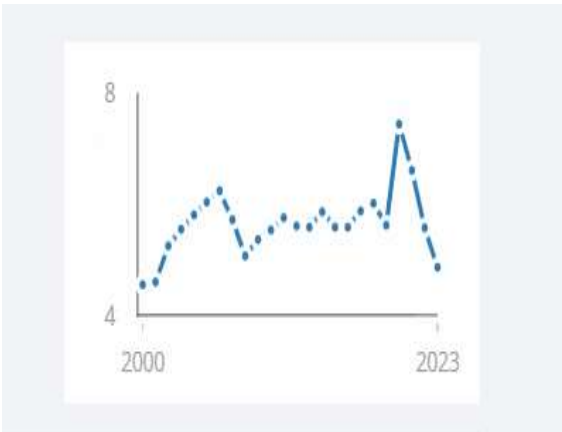
Gross Domestic Products



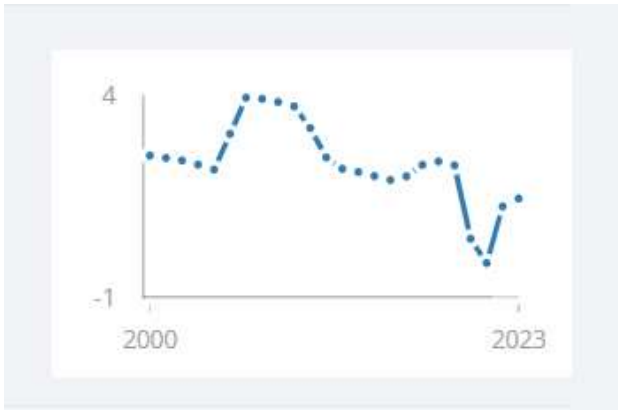
Internet Penetration Rate



Female Labour Force participation



Unemployment Rate



Population Growth Rate

Source: World Bank Data, 2024.

METHODOLOGY

Research Design

Various demographic factors have been selected from the empirical literature to examine their relationship with economic development planning. Quantitative methods were employed to analyze the relationship between demographic characteristics and economic growth in Saudi Arabia. This approach allowed statistical data analysis to identify long-term associations among selected dependent and independent variables (Barth & Blasius, 2021).

Data Collection

Data has been collected and sourced from different platforms, including government reports, academic journals, case studies, and the World Bank's website. Secondary data analysis focused on variables derived from empirical literature, ensuring comprehensive coverage of relevant economic and demographic indicators.

Modelling of Equation

This analysis has examined how various demographic factors influence economic growth over time to highlight its importance in the economic development process. The Autoregressive Distributive Lag model has been applied to analyze the long-term association of demographic factors with economic growth. The equation can be specified as follows:

Gross Domestic Product = Human Development Index + Unemployment Rate + Female Participation Rate in Total Labor Force + Internet Penetration Rate + Population Growth Rate.

Mathematically, the equation has been written as:

$$GDP = f(HDI + RU + FRTL + IPR + PGR) \text{ ----- (1)}$$

By taking the log and converting the above equation according to econometrical modeling, the equation is now written as

$$\text{LogGDP}_t = X + \beta_1 \text{LogHDI}_t + \beta_2 \text{LogRU}_t + \beta_3 \text{LogFRTL}_t + \beta_4 \text{LogIPR}_t + \beta_5 \text{LogPGR}_t \text{ ----- (2)}$$

ARDL Model

$$\Delta GDP_t = X + \beta_1 \sum \Delta GDP_{t-1} + \beta_2 \sum \Delta HDI_{t-1} + \beta_3 \sum \Delta RU_{t-1} + \beta_4 \sum \Delta FRTL_{t-1} + \beta_5 \sum \Delta IPR_{t-1} + \beta_6 \sum \Delta PGR_{t-1} \text{ ----- (3)}$$

Where

GDP= Gross Domestic Products as a proxy variable for Economic Growth

HDI = Human Development Index

UR= Unemployment Rate

FRTL= Female participation rate in the Total Labour Force

IPR = Internet Penetration Rate

PGR =Population Growth Rate

Data Analysis

Table 1: Description of Variables

The description of variables with their sources has been described in table 1.

Variable	Symbols for study	Definitions	Source	A prior anticipation
Gross Domestic Products	GDP	Gross Domestic Products means the production of all the goods and services in a year of a country.	World Bank website	Positive Relationship with Economic Development
Human Development Index	HDI	HDI measures the quality of the population in terms of health, education, and	World Bank metadata	Positively connected with Economic Development
Rate of Unemployment	RU	The unemployment rate means the percentage of unemployed people in the total labor force.	World bank	Positive Association with Economic Development

Female Participation in the total labor Force	FPTL	It means the percentage of working women in the total labor force.	World bank website	Positive relationship with economic growth in the country.
Internet Penetration Rate	IPR	The portion of the population with internet access is calculated in percentage.	World bank data	Positively connected
Population Growth Rate	PGR	The population growth rate is when the number of individuals increases in a population in a given period.	World bank data	Positive association with economic development

Source: Author's Estimation

Table 2: Test for Unit Root

Variables	ADF with Constant & Trend		Philips Perron with constant and trend	
	Test Statistics		Test Statistics	
	At level	At first difference	At level	At first difference
GDP	1.223	0.008	1.335	0.005
HDI	2.346	0.015	2.457	0.009
UR	0.789	0.007	0.901	0.021
FPTL	2.012	0.056	1.123	0.004
IPR	1.568	0.005	1.679	0.006
PGR	2.789	0.013	2.890	0.007

Source: Author's Estimation

Two of the above variables were stationary at a level while others were at level one; this suggests that ARDL would be best appropriate for analyzing the long-term association between dependent and independent variables.

Table 3: Short Run Analysis ARDL

Variable	Coefficient	t-Statistic	Prob.
GDP	0.940	19.080	0.000
Δ HDI	0.360	3.091	0.002
Δ HDI(-1)	0.153	1.906	0.066
Δ UR	0.275	3.412	0.054
Δ UR(-1)	0.092	2.468	0.036
Δ FPTL	1.516	2.500	0.014
Δ FPTL(-1)	1.440	2.038	0.048
Δ FPTL(-2)	1.081	2.115	0.038
Δ IPR	0.019	2.002	0.038
Δ IPR(-1)	0.179	2.003	0.003
PGR	-	-	-
PGR(-1)	0.274	4.542	0.000
Adjusted R-squared	0.723		
Durbin-Watson statistic	1.980		0.002

Source: Author's Estimation

The short-run analysis indicates that demographic factors such as changes in the Human Development Index, Internet Penetration Rate, and Population Growth significantly influence GDP growth in Saudi Arabia. Still, Female labor force Participation and Unemployment rate have a less significant impact on economic growth. Both current and lagged values of these variables are important. The model explains 72.3% of the variability in GDP growth, with no autocorrelation in the residuals, highlighting the robustness of the findings.

Table 4: Long Run Analysis through ARDL

Variable	Coefficient	t-Statistic	Prob.
C	0.599	0.589	0.556

GDP	4.760	19.080	0.000
HDI	0.360	2.091	0.038
HDI(-1)	0.153	1.906	0.066
UR	0.275	3.412	0.021
UR(-1)	0.092	1.468	0.146
FPTL	1.516	2.500	0.014
FPTL(-1)	1.618	1.195	0.048
IPR(-2)	1.056	2.005	0.038
IPR	0.073	1.092	0.276
PGR	0.188	2.906	0.003
PGR(-1)	-	-	-
Adj. R ²	0.798	-	-
F-Statistics	-	123.56	0.000
DW	2.109	-	-

Source: Author's Estimation

The model shows that GDP, HDI, unemployment, and population growth rates significantly impact Saudi Arabia's GDP growth in the long run. Positive relationships are observed with GDP, HDI, current unemployment rate, and population growth rate, while negative effects are noted for lagged female labor force participation rate. The adjusted R² of 0.798 indicates that these variables explain nearly 80% of GDP growth variability.

Table 5: Bound Test for ARDL Co-integration

F-statistic = 87.071		
Significance Level	Lower Bound Value	Upper Bound Value
10%	1.96	2.36
5%	2.44	3.42
1%	2.67	4.11

Source: Author's Estimation

Given that the F-statistic (87.071) is significantly higher than the upper bound values at all listed significance levels (10%, 5%, and 1%), it can be concluded that the regression model is highly statistically significant. This suggests that the independent variables collectively have a strong and statistically significant impact on the dependent variable. The high value of the F-statistic indicates that the model explains a substantial portion of the variance in the dependent variable.

Table 6: Granger Causality Test

Null Hypothesis	Obs.	F. Stats	Prob.
Human Development Index does not granger cause Economic Development	24	8.93	0.01
Unemployment rate does not cause granger cause Economic development.	24	9.64	0.00
Population Growth Rate does not granger cause Economic Development	24	13.21	0.01

Source: Author's Estimation

The Granger causality tests in Table 6 show that changes in the Human Development Index, unemployment rate, and population growth rate significantly predict economic development in Saudi Arabia. The null hypotheses for each variable are rejected at the 1% significance level, indicating their strong influence on future economic trends.

RESULTS & DISCUSSION

The results of data analysis indicate that GDP, a proxy variable of economic growth, is significantly influenced by the selected demographic factors: HDI, the female employment rate in the labor force, and the internet connection rate; meanwhile, its relationship with the unemployment rate is less significant.

The constant term is also significant, depicting the basic GDP level. As expected, HDI positively influences GDP; thus, improving human development increases economic growth.

Women's Employment ratio also positively influences GDP, and Internet usage confirms this relation, stressing the role of gender equality and digital accessibility.

Analyzing the Human development index identifies the need to understand internal and external migration patterns, which helps ensure that cities are equipped to handle population influxes and provide adequate services and opportunities.

Addressing income distribution and poverty levels is critical for formulating social policies to reduce poverty and improve income equality. Understanding economic disparities within the population helps allocate resources efficiently to areas and groups most in need.

Population Growth requires expansion in infrastructure, with an increased number of institutions in the health, education, transportation, and communication sectors needed to support growing productive workforce requirements.

Significant investment in the education sector is required to attain sustainable economic growth as these institutions prepare the workforce for emerging industries and firms.

The HDI indicates improved health outcomes, which include a more productive workforce and ultimately have a relationship with the economic development process.

Increased gender workforce participation positively impacts economic growth by driving better economic outcomes.

As internet penetration rates indicate, improved technological access significantly boosts economic growth, aligning with Vision 2030's goals for innovation and modernization.

The data analysis results emphasized integrating demographic data into development planning to enhance human development, promote gender equity, and improve digital infrastructure. This approach aligns with Saudi Arabia's Vision 2030, providing fresh policy solutions to support economic diversification and sustainable development goals. Demographic Factors are vital in development planning, informing resource allocation, economic policies, and infrastructure needs based on population size, growth, and age structure. They guide urban planning, healthcare, education, and labor market strategies, ensuring sustainable and inclusive development. Understanding migration, health indicators, and consumption patterns aids in designing effective social services and environmental management. Integrating demographic data ensures that development efforts meet current and future population needs.

CONCLUSION

Based on the findings from this research, it is evident that demographic factors play a crucial role in shaping economic development strategies. The analysis underlines the positive effects of the Human Development Index on economic growth, stressing the importance of the social and educational progress of the population. Furthermore, it has also cleared the factor that women's capability and participation in the productivity level, so gender inequality plays an important role in economic policy. In addition, the analysis shows that technological advancement enhances economic growth through the availability of information and technology. On the other hand, unemployment has been observed to positively correlate with GDP though its effect seems smaller than other variables under discussion. Altogether, these findings underscore the complex nature of economic development; this calls for policies that address demography efficiently. Therefore, it emerges that planning for economic development has to factor development of Human capital and women's employment in the Economy with easy access to technology. Attending to these demographic factors makes economic growth steady and development policies that are friendly to society.

FUTURE RESEARCH RECOMMENDATIONS

Following are the recommendations for future research

- Future research can be done to examine how GDP and factors influencing it, such as education quality and healthcare facilities' availability, evolve and interact with socio-economic and environmental factors.
- Expanding specific data on the female labour force rate, particularly through sectoral analysis, can be valuable for further policy reforms.
- Another area to expand this research is to increase focus on the impact of technology and related digital assets on the country's development is essential.
- Cross-sectional research could highlight regional differences and aspects of economic growth.
- Using multiple qualitative methods alongside quantitative approaches can enrich the understanding of factors influencing economic growth.

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