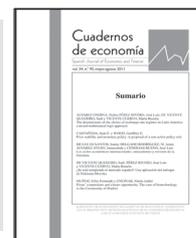




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The Impact of Knowledge-based Economy on the Economic Growth of Middle Eastern Countries

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Abstract: Due to environmental unsustainability and a lack of research and development (R&D) and training and education expenditures, countries' economic growth (EG) has recently encountered several obstacles. These difficulties require the attention of researchers. This study evaluates the impact of the knowledge-based economy (R&D expenditures, government education expenditures, and highly educated workforce) on the EG of Middle Eastern nations. The impact of control variables such as population increase and industrialisation on EG was also analyzed. From 2006 through 2020, the article extracts secondary data from World Development Indicators (WDI). The relationship between variables was examined using the fixed effect model (FEM) and the robust standard error approach. Results demonstrated that R&D spending, government education expenditures, labor force with advanced education, population growth, and industrialization have a favorable and significant effect on the economic growth of Middle Eastern nations. The article assists policymakers in formulating policies for enhancing EG by increasing the government's budget for R&D, training, and education.

1. Introduction

Over the past few decades, the global financial situation has transformed. These financial imbalances have an impact on both developed and developing nations. Due to a lack of income-generating resources, developing nations are becoming poorer. The literature demonstrates that the global financial crisis is causing governments to cease EG. Natural resources are one of the country's most important economic resources. However, countries with abundant natural resources suffer from the current economic crisis. The causes of the financial crisis include globalization, population growth, industrialization, the energy crisis, a lack of a trained workforce, and political instability (Pradhan, Arvin, Nair, Hall, & Bennett, 2021; R. Wang, Tan, & Yao, 2021). In addition, globalization has boosted international rivalry. Globalization has affected all facets of the nation's economy. In addition, the nations are exerting their greatest efforts to stabilize their economies. The EG of the countries is the guarantee for the improvement of people's living standards. Therefore, the purpose of this study was to investigate EG.

The Middle East is a crucial region in the global context. The region is the world's largest oil producer. The entire region's economy is dependent on oil. The IMF anticipated the Middle East's real gross domestic product (GDP) would expand by 4.6% in 2022. In addition, an "upward revision" of 0.9 percentage points from October 2021 is anticipated for the Middle East's GDP growth, which is projected to decrease to 5% in 2022 from 5.8% in 2021. This demonstrates that Egypt's growth during the first half of the fiscal year 2021-2022 has increased, as have oil exporters' prospects. In light of this, Egypt's GDP growth is anticipated to accelerate from 3.3% in 2020-2021 to 5.9% in 2021-2022. In addition, the survey projected that the real GDP would expand by 5 percent in 2022-2023. From 2016 to 2022, the GDP growth of GCC nations would increase from 2.7% to 6.4%. (Abou-Moghli & Dandis, 2021; Otman, 2021). The rate has increased by 2.2 percentage points since October 2022. This indicates that the GCC states' inflation is projected to reach 3.1% in 2022, up from 2.2% in 2021. Regarding the worldwide outlook, food prices are expected to rise by approximately 14.5% in 2022 and 5.7% in 2023. Figure 1 depicts the Middle Eastern countries' GDP per capita.

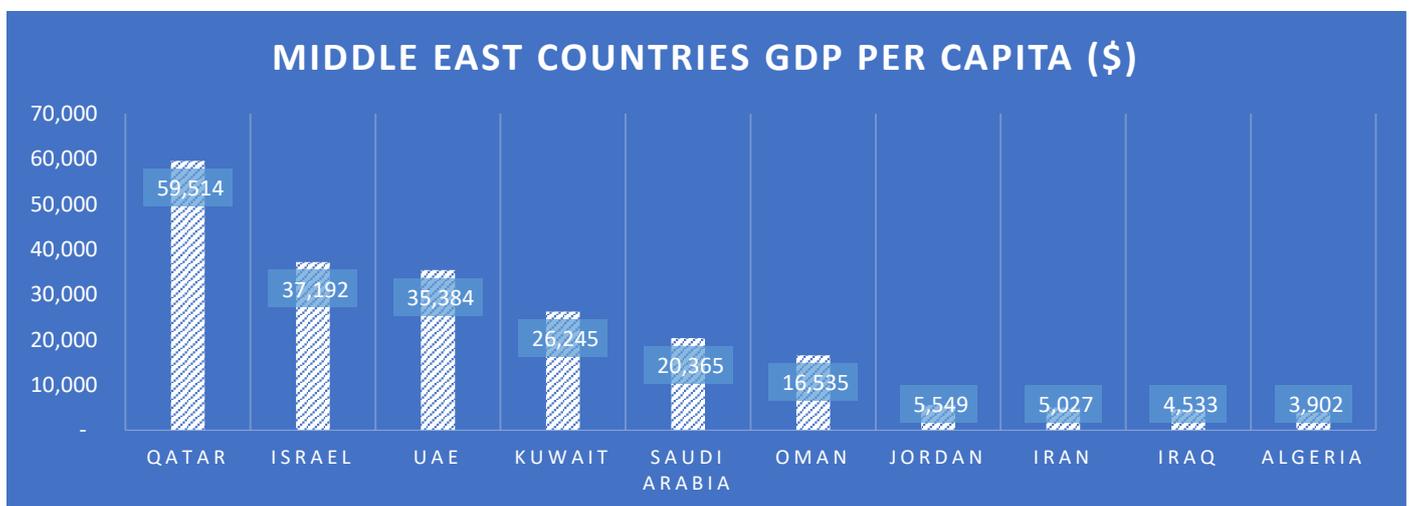


Figure 1: GDP per capita in the Middle East countries

Similar to earlier studies, the present study will address gaps in the prior literature, such as 1) governments worldwide ensuring maximal efforts to improve their citizens' level of life. The countries invest more and more in education and R&D to educate and train their citizens. Education is the key to the nation's improvement since the educated and skilled generation contributes to the nation's economy. In the case of Middle Eastern nations, although EG, education, and R&D have been studied, they have not yet reached their zenith because many of its components remain to be investigated. 2) Choi and Yi (2018); Olaoye, Ayinde, Ajewole, and Adebisi (2021) examined whether R&D has any effect on the EG. Still, the current study will additionally examine the effect of education expenditures, population growth, and industrialization in Middle East countries using a new data set. 3) The equation of EG, R&D spending, government education on expenditure, labor force with advanced education, population growth, and industrialization in Middle Eastern nations has not been tested with contemporary data sets. 4) Jorgenson and Fraumeni (2020); Liao, Du, Wang, and Yu (2019) examined the influence of government spending on education on EG. In contrast, using a new data set, the current study will examine the effects of R&D, population growth, and industrialization. 5) Kumari (2018); Wijaya, Kasuma, Tasenęe, and Darma (2021) investigated the effect of an educated labor force on EG. In contrast, the current study will also focus on the educated labor force in addition to R&D and government expenditures on education and examine the relationship in Middle East countries using a new data set. 6) Kuhe (2019); Mujtaba and Jena (2022)

examined the impact of population increase and industrialization on EG, whereas the present study would use both variables as controlled variables. The present study is also significant from a theoretical and practical standpoint because 1) it will highlight the importance of R&D, education spending, and an educated workforce for the EG of Middle East countries, and 2) it will help government and private sector economy-related professionals review and upgrade their policies to improve the economy, and 3) it will help researchers explore more facets of education.

The study's framework is broken into distinct phases. The first chapter of the study will provide an introduction to the overall study, focusing on EG, as well as the investigation's significance. The second chapter presents the literature on EG, R&D spending, government education on expenditure, highly educated workforce, population growth, and industrialization. The third chapter of the paper describes the methodology, including the gathering of data regarding EG, R&D spending, government education on expenditures, labor force with advanced education, population growth, and industrialization, followed by an analysis of the data's validity. The data analysis results will be presented in the fourth chapter of the study. The fifth chapter will give the conclusion, consequences, and recommendations for the future.

2. Literature Review

There are a variety of elements that influence a nation's economy. R&D is among the most crucial. Countries and

businesses worldwide are confronted with a high level of competitiveness. The firms use their utmost efforts to maintain a competitive advantage over their rivals, which helps them compete with their rivals. R&D is one of the components that contribute to the competitive edge. Research and development helped the nation and businesses introduce a product or service lacking in the marketplace. In addition to maximizing their efforts and investments in research and development (R&D) to overcome the economy's weak elements and discover new opportunities, nations worldwide also prioritize overcoming economic weaknesses and discovering new opportunities. Thus, there is a strong relationship between a nation's economy and R&D. (Kaneva & Untura, 2019). There are several ways to advance knowledge, goods, and technology, but research and development are the most effective. According to economic theory, governments generally finance R&D through direct funding, indirect funding, and their own R&D. Each strategy has advantages and disadvantages.

In reaction to the financial crisis, several governments adopted severe budget-cutting policies, giving other issues precedence over R&D. (Lupu, Petrisor, Bercu, & Tofan, 2018). In response to the crisis, policymakers in numerous nations increased the public R&D budget to deter firms from decreasing R&D expenditures and to maintain national R&D capability. In light of this, (Zafar, Shahbaz, Hou, & Sinha, 2019) researched the relationship between EG and R&D in Asian Pacific corporations and proposed that R&D has a beneficial relationship with the economy. In addition, the report recommended that governments increase their investment in R&D to boost the economy. Similarly, (Nair, Pradhan, and Arvin (2020) examined the R&D and ICT effects on OECD economies and proposed a favorable correlation between them. Consequently, Baneliene and Melnikas (2020) also investigated the relationship, and their findings demonstrated a connection between R&D and EG. Thus, sustainable economic development, globalization, and R&D investment have a positive effect on EG, with the advantage being substantially bigger in more developed EU members.

The countries' governments take several steps to improve the living conditions of their citizens. The primary objective of government activities is to improve the lives of the country's citizens. Possessing a contemporary education system is a fundamental entitlement of the citizens of every nation. Therefore, (Trabelsi (2018) analyzed the relationship between government education expenditures and EG. According to the findings, government expenditures on education reflect the significance of education to the government. Education leads to the preparation of an educated and skilled generation, which then contributes to the economy and places the nation on the path to prosperity. It has been established that governments are essential for resource distribution, social organization, regulation, law enforcement, and political stability. They provide various services, such as defense, health care, and education, that the private sector finds difficult to provide despite their substantial impact on economic performance. Numerous academics are interested in the size dimension of governments because they are convinced of the importance of their involvement in encouraging economic expansion. They focus on the linear relationship between public expenditure, which represents the size of the public sector, and economic growth.

Using the ARDL methodology, (Lupu et al. (2018) examined the relationship between public education spending and EG in 11 former communist Eastern European nations that are now EU members. There was no evidence of a relationship in five nations, whereas, in six countries, both long-term and short-term relationships were seen. In addition, the study suggested that educators adjust their policies about investment in the education sector to improve its performance. As a result, the

level of people's general well-being grows, and EG becomes healthier as their level of acquired abilities increases. Consequently, (Shinta and Solikin (2022) examined the impact of education expenditures on EG. The findings suggested that education spending levels highly influence EG. The economies of nations that invest more in education are prosperous.

In the literature on development economics, human capital is regarded as a crucial element of economic development. Human capital is the knowledge, skills, competencies, and abilities individuals have acquired through time through education, training, work, healthcare, and migration. Consequently, human capital can be divided into three primary categories: health, education, and experience/training. The stock of human capital can increase if health, education, and learning are enhanced. Therefore, (Pomi, Sarkar, and Dhar (2021) examined if education expenditures affect Bangladesh's EG. The 19-year data collection from 2000 to 2019. The results suggest that human capital improves the Bangladeshi economy in various ways and at various times. In addition, the research recommended that the government devote greater resources to human capital development. In addition, (Ogundari and Awokuse (2018) examined the relationship between human capital and EG.

The data indicate that both measures of human capital contribute favorably to EG, with health contributing much more than education. This result demonstrates the importance of education and health as human capital indicators. It supports the claim stated in the literature that neither education nor health is an ideal substitute for the other. Considering the significance of measuring human capital, the World Bank created a human capital index. Multiple pertinent theories have highlighted the significance of human capital to economic development. Government investments in social services such as health care, education, and other support systems boost the growth of human capital in rising nations (Börner et al., 2018; Malik, 2018). A skilled and educated labor force is essential to economic development. The formal education of the workforce influences their potential for output; hence, higher formal education is related to greater productivity. Several alternative growth theories, like the endogenous hypothesis, emphasize the relative importance of endogenous and exogenous sources for EG. In addition to physical capital, countries worldwide see human capital as an autonomous factor of production vital for reaching high rates of long-term EG, even in the event of a pandemic (Amna Intisar, Yaseen, Kousar, Usman, & Makhdum, 2020).

The country's government implements various policies to improve its citizens' lives. One of the most important components in sustaining a nation is generating revenue, which is closely tied to job creation. The private sector is typically regarded as the country's primary revenue generator. The more the private sector, especially manufacturing, grows, the more it generates income and contributes to expanding the nation's economy. Thus, there is a correlation between industrialization and observed EGs (Ahmad & Zhao, 2018). (Opoku and Yan (2019) investigated the relationship between industrialization and EG via energy. The 25-year data set from 1990 to 2015 was evaluated using the GC test. According to the study's findings, there is a correlation between industrialization and EG.

The greater the level of industrialization, the greater the level of manufacturing, increasing exports and bolstering the economy. In addition, (Q. Wang and Su (2019) examined the relationship between industrialization and EG in China and India. The data indicate that, whereas India's decoupling status was erratic, China's decoupling of economic growth from carbon emissions was typically low between 1980 and 2014. Decoupling is primarily driven in China by industrialization, per capita GDP, urbanization, and carbon emission intensity. In India, the

intensity of carbon emissions is the most important element in decoupling, followed by urbanization, industrialization, and GDP per capita. Therefore, increasing energy efficiency is the optimal option for economic expansion in China and India without increasing emissions.

The world has experienced various problems, particularly in the last several decades. One of them is rapid population expansion. Population expansion harms the country, even though human capital is crucial for the nation. The country's income and expenditures become unbalanced due to excessive growth. The greater the required population, the greater the government's expenditures will necessitate a higher tax revenue. Thus, there is a substantial correlation between population growth and EG (Alemu, 2020; Rehman, Ma, Ozturk, & Ulucak, 2022). Population refers to the total number of persons that can interbreed and inhabit a particular geographical area or region. A region or nation experiencing population expansion is said to be experiencing population growth. Population growth is only possible when a nation's total fertility or birth rate exceeds its total mortality or death rate. This means more births than deaths, resulting in a population increase. This population growth impacts the country's economy. Therefore, Kuhe (2019) examined Nigeria's relationship between population and EG. The data set spanning the 55 years from 1960 to 2015 were collected and evaluated using the VARG test. According to the study, population growth is inversely connected with EG, notably in Nigeria. The research also recommended Nigeria reduce its population expansion and enhance its alternatives for income generating.

Similarly, Rehman and Deyuan (2018) explored if population expansion affected the country's EG and hypothesized that an increase in population increases the country's resource needs. This increase in demand results in the cessation of EG. Thus, a negative correlation exists between population increase and EG.

Table 1: Measurements of Variables

S#	Variables	Measurement	Sources
01	Economic Growth	GDP growth (annual percentage)	WDI
02	Knowledge-based Economy	R&D expenditures (% of GDP)	WDI
		Government expenditure on education (% of GDP)	WDI
		Labor force with advanced education (% of the total working population)	WDI
03	Population Growth	Population growth (annual percentage)	WDI
04	Industrialization	Industry value added (% of GDP)	WDI

The article has run the descriptive statistics that exposed the details of the variables. In addition, the article has also run the correlation matrix that provides the association between the variables. Moreover, the study has also run the variance inflation factor (VIF) that exposed the multicollinearity among the variables. The equations for the test are given below:

$$R^2_Y \rightarrow Y_{it} = \alpha_0 + \beta_2 X_{2it} + \beta_3 X_{3it} + \beta_4 X_{4it} + \beta_5 X_{5it} + e_{it} \quad (2)$$

$$j = R^2_{\bar{Y}}, R^2_{X_1}, R^2_{X_2}, R^2_{X_3}, R^2_{X_4}, R^2_{X_5} \quad (3)$$

$$Tolrance = 1 - R_j^2 \quad VIF = \frac{1}{Tolrance} \quad (4)$$

Moreover, the study has also run the Hausman test to check the appropriateness of the model. If the probability value of the test is larger than 0.05, then the random model is suitable. In contrast, if the probability value of the test is lower than 0.05, then FEM is suitable. In addition, the study has run the FEM to examine the linkage among the variables. FEM allows controlling for all time-invariant omitted variables. FEM is also suitable when difficult to observe constructs (Abe, Taniguchi, Kawachi, Watanabe, & Tamiya, 2021). The FEM equation is mentioned below:

$$Y_{it} = \beta_{1i} + \beta_2 X_{2it} + \beta_3 X_{3it} + \beta_4 X_{4it} + \beta_5 X_{5it} + u_{it} \quad (5)$$

3. Research Methods

The study examines the R&D expenditures, government education expenditures, labor force with advanced education, population growth, and industrialization on the EG of ten Middle Eastern countries named Algeria, Iran, Iraq, Israel, Jordan, Kuwait, Oman, Qatar, and Saudi Arabia, United Arab Emirates. The article has extracted the data from WDI from 2006 to 2020. In addition, the study has established the equation with the help of variables used in the study given below:

$$EG_{it} = \alpha_0 + \beta_1 RDE_{it} + \beta_2 GEE_{it} + \beta_3 LFAE_{it} + \beta_4 PG_{it} + \beta_5 IND_{it} + e_{it} \quad (1)$$

Where;

- EG = Economic Growth
- t = Time Period
- i = Countries
- RDE = Research and Development Expenditures
- GEE = Government Expenditures on Education
- LFAE = Labor Force with Advance Education
- PG = Population Growth
- IND = Industrialization

The study has taken the EG as the main variable and measured GDP growth (annual percentage). In addition, the study used the knowledge-based economy as the predictor. It measured the R&D expenditures (% of GDP), government expenditure on education (% of GDP), and labor force with advanced education (% of the total working population). Finally, the study has taken two control variables: population growth, measured as the population growth (annual percentage), and industrialization, measured as the industry value added (% of GDP). These constructs with measurements and sources are given in Table 1.

Where subscript (i) in equation (5) highlighted the individual country and made the different countries concerning their characteristics, in addition, FEM denotes a regression model in which the "group means are fixed." The FEM equation using understudy variables is given below:

$$EG_{it} = \beta_{1i} + \beta_2 RDE_{it} + \beta_3 GEE_{it} + \beta_4 LFAE_{it} + \beta_5 PG_{it} + \beta_6 IND_{it} + u_{it} \quad (6)$$

Finally, the article has also applied the robust standard error method to examine the association among the variables. The equation for robust standard error using the understudy constructs is mentioned below:

$$EG_{it} = \beta_1 RDE_{it} + \beta_2 GEE_{it} + \beta_3 LFAE_{it} + \beta_4 PG_{it} + \beta_5 IND_{it} + \varepsilon_{it} \quad (7)$$

4. Research Findings

The article has run the descriptive statistics that exposed the details of the variable. The results exposed the 150 (10 countries x 15 years) observations used in the study. The results exposed that the EG mean value is 0.410 percent, while the RDE average value is 3.037 percent and GEE mean value is 3.337 percent. In addition, the results also exposed that the LFAE mean value is 4.119 percent, while the PG average value is

2.091 percent and IND mean value is 3.918 percent. These values are given in [Table 2](#).

In addition, the article has also run the correlation matrix that provides the association between the variables. The results indicated that the R&D expenditures, government education expenditures, labor force with advanced education, population growth, and industrialization positively and significantly impact the EG of Middle Eastern countries. These associations are given in [Table 3](#).

Table 2: Descriptive Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
EG	150	0.410	1.202	0.192	9.088
RDE	150	3.037	1.363	1.075	7.102
GEE	150	3.337	0.910	1.928	4.930
LFAE	150	4.119	1.288	1.375	9.028
PG	150	2.091	0.102	0.902	4.927
IND	150	3.918	0.716	0.872	7.019

Table 3: Matrix of Correlations

Variables	EG	RDE	GEE	LFAE	PG	IND
EG	1.000					
RDE	0.546	1.000				
GEE	0.269	0.645	1.000			
LFAE	0.377	-0.223	0.332	1.000		
PG	0.573	0.262	-0.372	0.488	1.000	
IND	0.221	0.271	0.287	0.390	0.573	1.000

Moreover, the study has also run the VIF that exposed the multicollinearity among the variables. The results exposed that

Table 6: Fixed Effect Model

EG	Beta	SD.	t-value	p-value	LL.	UL.	Sig
RDE	1.302	0.402	3.24	0.012	0.342	1.448	***
GEE	0.873	0.281	3.11	0.018	0.122	1.444	***
LFAE	0.290	0.027	10.74	0.000	0.541	1.011	*
PG	1.093	0.411	2.66	0.021	0.023	1.155	***
IND	2.287	1.001	2.28	0.032	1.902	2.109	**
Constant	3.625	0.586	6.19	0.000	2.431	4.128	***
R-squared	0.538		Number of obs		150		
F-test	31.142		Prob > F		0.000		

*** p<.01, ** p<.05, * p<.1

The robust standard error results indicated that the R&D expenditures, government education expenditures, labor force with advanced education, population growth, and

Table 7: Robust Standard Error

EG	Beta	S.D.	t	P>t	L.L.	U.L.
RDE	1.540	0.745	2.067	0.032	0.659	1.643
GEE	0.922	0.287	3.213	0.007	0.830	1.426
LFAE	1.964	0.738	2.661	0.021	0.541	1.009
PG	2.154	1.002	2.149	0.029	0.547	1.170
IND	1.554	0.654	2.376	0.027	1.092	2.827
cons	3.636	1.022	3.558	0.000	2.751	5.298

5. Discussions

The results demonstrated a favorable correlation between R&D expenditures and EG. These findings are supported by [Phale, Li, Adjei Mensah, Omari-Sasu, and Musah \(2021\)](#), which indicate that when individuals are engaged in research and development activities in an economy, they have a comprehensive understanding of economic conditions, the challenges to which the economy is exposed, and the opportunities that can be utilized to ascend the economic rungs. These findings are also consistent with [Amirat and Zaidi \(2020\)](#) assertion that business organizations' research and development programs provide organizational personnel with the opportunity to learn more about novel technologies, improved production techniques, and

the VIF values are less than five, the reciprocal is bigger than 0.20, and there is no multicollinearity. These values are given in [Table 4](#).

Table 4: Variance Inflation Factor

	VIF	1/VIF
RDE	3.392	0.294
GEE	3.103	0.322
LFAE	2.901	0.345
PG	2.428	0.412
IND	1.902	0.526
Mean VIF	2.745	.

Moreover, the study has also run the Hausman test to check the appropriateness of the model. The results exposed that the probability value is lower than 0.05, and exposed FEM is appropriate for the study. These values are given in [Table 5](#).

Table 5: Hausman Test

	Coef.
Chi-square test value	52.543
P-value	0.001

The FEM results indicated that the R&D expenditures, government education expenditures, labor force with advanced education, population growth, and industrialization have a positive and significant impact on the EG of Middle Eastern countries. In addition, the R square value of 0.538 indicated that 53.8 percent of changes in EG are due to all the predictors used in the study. These associations are given in [Table 6](#).

industrialization have a positive and significant impact on the EG of Middle Eastern countries. These associations are given in [Table 7](#).

high-quality production resources. Thus, economic growth can increase. The results demonstrated a positive correlation between government education spending and EG. These findings are backed by [Yeo and Lee \(2020\)](#) finding that the government occasionally spends at a different level on the education of individuals in the interest of a country's sustainable development. Due to these expenditures, human capital formation occurs. The knowledgeable and trained human resources increase a company's ability to produce more with the same number of resources. Therefore, the EG is high. These results concur with [Ivaldi, Penco, Isola, and Musso \(2020\)](#) findings regarding education and EG spending. When the government invests heavily in the education of its citizens, the

education sector generates skilled scientists, managers, and laborers who, with their knowledge, lead the nation to greater economic growth (EG).

The results demonstrated a favorable correlation between the labor force with advanced education and EG. These findings are consistent with [Sagiyeva, Zhuparova, Ruzanov, Doszhan, and Askerov \(2018\)](#) findings, which indicate that many companies have the policy to provide advanced training and education for their personnel. These pupils understand advanced technology, resource allocation, and industrial procedures. They can contribute to the GDP growth of the nation. These outcomes also correspond to [Liyanage and Netswera \(2021\)](#). This study sheds light on the role of the education of the labor force in EG. When the workforce possesses sophisticated knowledge, they can implement current technology for various company objectives, resulting in sustainable EG. The results demonstrated a favorable correlation between population growth and EG. These findings are reinforced by [Sinha \(2018\)](#), which demonstrates that when a country's population grows, its labor force and human capital also expand. This increases national production and adds to the growth of EG. These results are also consistent with [Tchamyou, Asongu, and Odhiambo \(2019\)](#) findings, which indicate that economic activity and productivity increase across all sectors as population growth grows.

Consequently, EG is rising. The industrialization has been found to have a positive correlation with EG. These findings are corroborated by [Haini \(2019\)](#), who argues that the industrialization of a larger portion of the nation boosts economic activities, resulting in higher total productivity and a higher EG. These findings are further corroborated by [Hysa, Kruja, Rehman, and Laurenti \(2020\)](#). They assert that increasing industrialization improves resource exploitation and boosts total production, increasing the country's EG.

6. Implications

This study instructs the writers to enhance their EG research since it provides numerous contributions to the economics literature. This study investigates the effects of R&D spending, government expenditures on education, the labor force with advanced education, population increase, and industrialization on EG. Before this, few studies investigated R&D spending, government expenditures on education, labor force with advanced education, population growth, and industrialization for EG in middle-eastern nations. Therefore, the present study, which analyzes these characteristics in Middle Eastern nations, contributes to the existing body of knowledge.

The article assists policymakers in formulating policies for enhancing the EG by increasing the government's budget for R&D, training, and education. The study has tremendous empirical implications for emerging economies, such as the Middle East, because it concerns how to boost EG, which is universal. According to the study, a knowledge-based economy must be built to accelerate EG. The report provides a framework for the government and economists to formulate policies that encourage R&D spending, increase education spending, and provide advanced education to the working force to regulate the country's EG. Similarly, there should be appropriate management of population increase and industrialization through policy formulation so that EG may be enhanced.

7. Conclusion

The study aimed to investigate the effects of knowledge-based economic factors such as R&D expenditures, government expenditures on education, labor force with advanced education, population growth, and industrialization on EG. Middle Eastern nations provided the quantifiable statistics for R&D expenditures, government expenditures on education, labor force with advanced education, population growth, industrialization, and EG. The results demonstrated that when research and development activities are conducted in an economy, persons comprehensively understand how they must live intellectually in an economy and lead the nation to attain higher growth. According to the findings, as government expenditures on education increase, education contributes to human capital development and EG. When the workforce is armed with enhanced knowledge, they can apply modern technologies for various commercial purposes, which ultimately fosters continuous economic growth. As a result of population growth, the economy becomes more active, and all sectors demonstrate higher productivity levels. Consequently, EG is accelerating. The country's economy expands due to enhanced resource exploitation and greater productivity resulting from increased industrialization.

8. Limitations

In addition to its shortcomings, the current study has numerous practical consequences. In future EG research, these constraints are anticipated to be eliminated. Only knowledge-based economic indicators such as R&D expenditures, government expenditures on education, and labor force with advanced education are analyzed in this study. Future authors of EG will also be asked to consider additional aspects that influence EG. The authors of this paper gathered data from middle-eastern nations for their research. The study's applicability is limited to this part of the globe. Therefore, it is suggested that the authors increase the scope of their analysis.

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