JESCAE

Journal of Environmental Science and Economics

ISSN: 2832-6032

Global Scientific Research

www.jescae.com

Journal of Environmental Science and Economics

Vol.1, No.2

June 2022

Chief Editor	Dr. Hayat Khan
Edited by	Global Scientific Research
Published by	Global Scientific Research
Email	thejesae@gmail.com
Website	www.jescae.com
Journal Link:	https://www.jescae.com/index.php/jescae/about

Contents

Journal of Environmental Science and Economics ISSN: 2832-6032
https://doi.org/10.56556/jescae.v1i2.11

RESEARCH ARTICLE

Critical Analysis of Energy Consumption and Its Impact on Countries Economic Growth: An empirical analysis base on Countries income level

Muhammad Naveed Jamil[1*]

[1]Department of Management Sciences, (KFUEIT) Rahim Yar Khan, Pakistan

Corresponding Author: Muhammad Naveed Jamil, mnaveedknp@gmail.com
Received: 22 January, 2022, Accepted: 13 March, 2022, Published: 16 March, 2022

Abstract
Energy is a very important and key factor for developing countries like China, India, and Pakistan have a growth rate of population is very high. In today's changing world scenario of Petroleum price high, that increasing the gap between demand and supply of energy in the World. Energy shortage is a test case for governments due to the high demand for energy due to rising commercial need, consumption, and industrialization. Current economic and energy crisis scenarios force me to work on those issues. An objective of the study is to test the long-run connection between energy consumption and economic progress from 1971 to 2021. This study adopts the Unit Root Test for stationary, Cointegrating equation and Vector Error Correction used for short-run/long-run relationship; Granger Causality test used for find-out the causal association, and Ordinary least square to examine the impact between energy sources and economic progress. The study result shows Oil, Gas and Electricity are equally important short run/long run, while the Coal log-run is more than in the short-run. The energy consumption to economic growth has a unidirectional causality, indicating energy is a factor that affects country growth. Regression results also confirm that energy significance on top for economic growth, Energy Sources; Gas and Electricity were useful but energy source Oil getting more attention in past decades. Currently, high-cost sources of energy, i.e. up Oil prices, this study suggest the alternate energy source nuclear, wind and solar to ensure low-cost energy generation to economic growth.

Keywords: Economic Growth, Resource of Energy, Energy Consumption, Causal Relationship.

Introduction

Research Background

Energy is a key element for a country and the main factor for the economy; the Energy field plays a critical role in Countries Growth, mostly the manufacturing sector. An optimistic long-run cointegrated association between actual Gross Domestic Product and energy consumption. There is no causality between short and long-run, unidirectional causality between energy consumption and economic growth. It shows energy utilization deduction does not affect G.D.P. in the short run but in the long run (C. C. Lee & C-P Chang, 2008). Compared to other World Pakistan has an inverse relationship in the technology sector. But in the United States, no association was found between energy utilization and gross domestic product, which effectively increased employment and economy. McKinnon and Shaw (1973) examine the relations among energy consumption and countries growth. Energy has to attain a high level of the central position of economic progress. Alam and But (2002), co-integration and unidirectional causality founded among the energy utilization and country growth.

Researchers disaggregate approaches used to establish economic growth affect energy sources, i.e. Oil, Natural Gas, Coal and Electricity. Oh, and Lee (2006) found the bidirectional causality between electricity and the gross domestic product of South Korea in the long run. Ghosh (2002), Mozumdar and Marathe (2006) described the gross domestic product causally influencing Electricity. Jamil, M. N. (2022) examined the 195 countries data to check the macro-economic stability period of 1961 to 2020 adopts new measurements under control of different income levels high, upper-middle, middle and lower-middle. Macro-economic stability examines through G.M.M. estimates per-capita G.D.P., G.D.P. growth, inflation and foreign trade. This study explores the Research further and estimates economic stability estimating through energy consumption. Yang (2000) and Fatai (2002) investigate the relationship between electricity and gross domestic product and analyze other factors like oil and coal and natural gas consumption. Currently, the World is facing the problem of energy shortfalls, and countries growth are reducing. Confusion is their energy have any impact on economies or not. It is more important to analyze the effect of energy on economic growth. This paper investigates the relations between energy consumption and economic growth

based on countries income levels, both in short/long periods of 1991 to 2021. Any associations found between energy utilization and economic growth than the government's steps to overcome those issues.

World Bank reports, national power policy announced by the Ministry support the current and future energy requirement and set a trajectory of rapid economic development. It also covers the energy sector's challenges and relieves the citizens. Following main goals have been set as policy.

- Increase the generation capacity, which is minimum to fulfil the country's energy demand.
- Ensure energy production through alternative energy sources, i.e. coal, wind, and nuclear at least units, start energy generation.
- Improve the transmission network distribution system and overcome line losses.

Energy System

Oil: The World is shifting pattern in the source of energy supply. The current scenario is mostly countries highly reliant on crude oil and natural gas, exposed to high risk and negative affect the economies. D. Mahmoudinia et al. (2013) found Unidirectional causality in the long run between oil and electricity consumption to the economy of countries; coefficient showing the negative effect on oil consumption and electricity usage on economic growth. Kamran Shafiq (2011) stated that imported fuel energy would affect the economy from the consequences of oil shocks. Oil price shocks have negatively impacted the growth of countries. Odhiambo (2010) Price rise led to falling in demand and causes of reducing the aggregate output and inversely affecting when price level decrease. The price of oil increased continuously1995 to onward. Ten dollars was per barrel (1995) and 110 dollars per barrel in 2014. During this time, low-income countries, i.e., Pakistan and the Indian economy, were seriously damaged and performed at a low level. Energy production estimates cost through oil I.P.P. thermal units Rs.18 and Rs.24 when produced through diesel. Pakistan economy declined in (2014) and grew in (2016) because the oil price is fast going down. January 2015 price of oil was at Rs.45 Dollars per barrel, helping Pakistan's economy, and it was performing well. The stock exchange crossed 34000 points in January 2015.

Gas: Pakistan domestic reserves of Natural Gas were 55.6 trillion cubic feet (June 30, 2013) and 30.9 trillion cubic feet of production. Investment (December 2013) was Rs.0.264 billion has made for L.P.G. Infrastructure and the total investment of this fiscal year near about 17.464 billion. Chinese investment (Road initiative) of this sector helped overcome the energy shortfalls.

Coal: Rohin Anhal (2013) has evidence in the association of unidirectional causality working from Coal consumption to economy. Coal share in energy generation was 6 per cent (1995). The government of Pakistan was working on coal units at Thor (Sindh) for energy and installing new units financed by China and World Bank. Thor Coal (Sindh) is the World most extensive resource of Coal. Pakistan and China were jointly working at Coal units of 6600 megawatts at Gaddani Power Park (Baluchistan).

Electricity: Oh and Lee (2006) find about bidirectional causality among Electricity and gross domestic product of South Korea in the long run. Yo and Choi (1985) found the cost of energy and electricity usage was a small proportion of the gross domestic product. In the World, energy generation through electricity is considered the secondary source. In contrast, primary generation energy by Coal, oil, gas, nuclear and other alternative natural resources is trending in most countries. Energy generation through electricity share in energy was 15.5 per cent (1995) and 13 per cent (2013). Imran and Siddiqui (2010) stated that Granger causality found Electricity to gross domestic product. In the short run, no causality relations were found from gross domestic product to Electricity or Electricity to gross domestic product. Still, in the long run, Electricity to economic progress causality exists, and high electricity usage tends to come with high gross domestic product. The previous study does not investigate the effect of energy on economic development. In this Research, we examine the following topics;

"Analysis of the total performance of the energy sector economically.

Analysis of the energy has an impact on economic growth or not. If yes, then what steps can take to increase the generation of energy and overcome the fallback on economic growth.

Suggest some points to plan, organize, lead, control, and get maximum Growth of Economies.

The World is energy lacking country, and the energy field works as bare capability. Gas distribution and transmission networks are the World biggest. If planning is not done, line losses increase, it may negatively affect economic development. It is the core issue, and my motivation is too high lights the issue and participate with good ideas to overcome the fallback on economies. The energy is significance profound. It works as blood for every country economic growth. The generation of

power is less than the demand. Causes of this; export of a country decreases due to Industry not meeting the production order timely and economy of countries go falls. All the time world needs to monitor progress, and the country continuously traces to energy to overcome the shortfalls of energy requirement. Early 90 Pakistan conducted strenuous efforts to reduce the rising demand and limited energy supply gap. The energy field (2000) get special attention because of its fast growth rate and energy demand. During 2011-12, Pakistan faces severe energy and gas shortages and study as a primary cause of unusual production activities in several manufacturing and industries. Pakistan energy industry saved off from 2019 to 2020, 0.2 % points of real gross domestic product growth. The power crisis cost to the economy is 380 billion rupees per year. It is near an estimation of 2% of gross domestic product. Govt. of Pakistan still subsides last four years, which round about 2.5 % of the gross domestic product of Pakistan.

The country needs to best plan, organize, and direct investment in infrastructure development. Current Govt. focusing on alternative energy sources produces natural gas, solar panel and wind. Countries determination is positive and govt. Received billions of rupees direct investment. The current year also progresses in economy and energy activities because of less loss of transformation line and energy distribution than last year. The gross domestic product and energy consumption of underdeveloping countries like Pakistanis are increasing exponentially. The main problem and solution will investigate; “There is a relationship between energy consumption and countries economic growth. It is cointegrated and overcomes the energy shortfall to enhance economic growth."

H1: Have a significant relationship with energy consumption to countries' economic growth.

Source of Energy: Net purchase of crude Oil in Pakistan in 2012 is near about 31% of the overall energy supply. S.D.P.I. report shows that crude oil and liquids manufacture in Pakistan has varied among 55000 to 70000 barrels per day since the 1990s. Pakistan produced 64000 barrels, refined oil capacity186000, and averaged near to 437000 barrels. Resource assessed Coal in Pakistan is over 185 billion tones and 175 billion find at Thar Pakistan Sindh area. Chinese power companies signed an agreement to install a 2400mw capacity coal project with the government of Pakistan, and work started on it. Pakistan production of Coal from 2008 to 2009 decreased by 17% and 10 % increase during 2009 and 10. Due to the import of Coal products being reduced, imported coal's share was around 62.2% in 2008 and 2009.

Current year its 67.9% count. Brick kilns industry usages were 39.6% in 2009 and 2010. Decline the coal share in energy and brick kilns sector in 2009 and 2010 2.4% and 35.8% respectively. The cement industry shifted oil to Coal because oil prices are higher than coal prices. Coal share decreased from 2007 to 2008 and 2009 mines production 15% and 4.12 million tones respectively. In 2012 natural gas Pakistan had a primary energy supply of 49 per cent, and dry natural gas production has grown by more than 80 per cent the last ten year by 809 and 1462 billion cubic feet in 2002 and 2012, respectively. Pakistan is facing shortfalls of natural Gas by the report of the Pakistan government near 912 Billion cubic feet in 2013. Pakistan does not have the proper infrastructure to import more Gas, and also domestic products also reduce time by time. E.I.A. reported the gas reserves of Pakistan to have 105 trillion cubic feet, and govt. It needs serious effort to avail that resource (Economic Survey of Pakistan).

Alternative energy source: Many alternate sources for energy and these purpose countries develop a responsible authority in the shape of an alternative energy development board. It deals with planning, constriction and facilitating services for the public and private sector. **Wind power projects:** The committee is working on four projects, three for 50 M.W. and one for 2.4 M.W. The Energy board provides technical support on 20 projects it’s a capacity of 50 M.W. each, which work in different places and participate in industrial development. A.E.D.B. signed an agreement with an international turbine manufacturer for technical support and equipment. One other company worked on 6 M.W. at the first stage, and then it installed 50 M.W.in the next phase. Paperwork is complete of 14 wind projects, and it was soon established. **Bio Diesel:** Alternative energy development board is working on biodiesel and has found many resources. Lab and experimental work started, and cultivation has risen from 2 and 650 acres in 2005 and 2009, respectively. Currently, in Karachi, a commercial biodiesel facility has been created, and its capacity of production is 18000 tons per year. **Bio-mass**: Alternative energy development board is working with the external organization for paperwork on the Biomass project in Karachi. Its first unit is a capacity of 10 M.W. and extends farther.

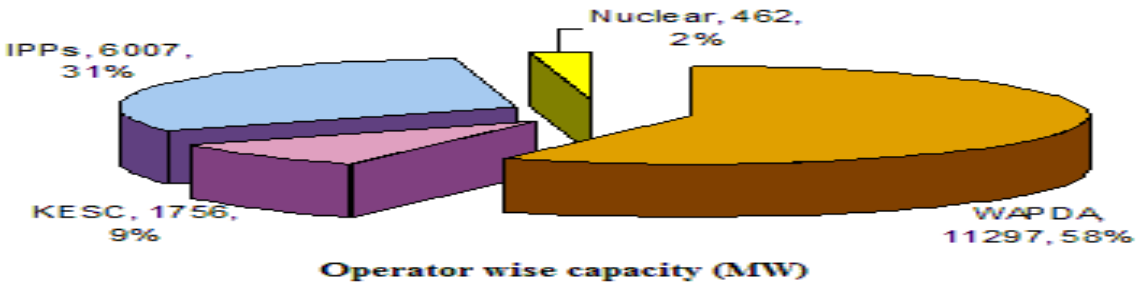
Canadian high-mark bio Gas Company signed an agreement with Punjab govt. For 22 M.W. capacity project construct at Punjab. **Hydro energy:** Govt. of Pakistan is taking with the Asian development bank on Diamer Basha Dam, and it is going positively. Chinese companies are working on the Neelam Jhelum hydropower project, and it started generation, and now company go for increasing capacity up to 969 MW and working started on it. A.E.D.B. is working on 103 micro-hydro projects, and it will complete in Chitral and Gilgit Baltistan areas. Govt. is working with the Asian

development bank on eight hydro projects for renewal. **Solar:** Chines firm ends a 100 MW solar park project at the Bahawalpur area of Punjab and further extends to 1000 MW.

The Punjab government facilitates water resorts, and tube wells will convert into solar panels.

Nuclear energy: P.A.E.C. is an autonomous body of energy production in Pakistan, and it is the main producer of nuclear energy. P.A.E.C.'s main responsibilities have to plan, establish the units, lead and control the atomic installation. The government of Pakistan has approved four projects of 3511 MW nuclear energy project will complete under the assistant of china govt. Currently, Pakistan has two nuclear installations in Karachi, which is at Chashma. One more plan installation is under construction at Chashma, a water pressure type reactor installed in 2000, and its generation capacity is 325 and 2063.94 in 2009 and 10. It operates commercially. The name of the energy unit is c-1. Pakistan also installed a c-2 nuclear energy plan in 2011 and now working on c-3 and c-4 plants. P.A.E. sign task for installation of 8800 MW nuclear power before 2030. That's why systematic services and resources have been arranged and working on it. K-1 project is working on 1100 MW, and k-2 also has the same capacity.

Figure 1. Operator wise capacity (MW)



Literature Review

Assessments of Relatives' Studies:

Granger and Engle (1987) measure the causality relationship between energy consumption and the economic progress of a country. It also works on fuel and electricity issues. Empirical studies applied different techniques in different conditions. Results also show different country by country, condition of the environment, the requirement of energy and sources of energy production. Kraft (1978) stated that Electricity has significance for economic progress. Integration found among energy utilization and G.D.P. for economy result by unidirectional relations. Yu & Choi (1984) examine the standard causality test period of 1954 to 1981 relationship among gross national product and different sources of energy usage with panel group of countries. Unidirectional causality ran among energy utilization and gross domestic product of Korea Philippines; no causality exists in the U.S.A., U.K. and Poland. Masih (1996) was found the causality working energy usage to gross domestic product. Unidirectional causality exists in Pakistan, India, and Indonesia, but non-co-integration in Malaysia, Singapore, and the Philippines. The same data applied the vector error correction model and found bidirectional causality between energy utilization and Pakistan growth. Unidirectional causality was found in India and Indonesia. This study was also applied by non-co-integrated countries (including Malaysia, Philippines and Singapore), but no Granger causality was found. Pachauri and Filippini (2004) examine the variables, and the result shows if population and industrialization increase, the main reason for the increase of energy utilization. Lee (2005) was analysis the co-integration and causality relationship among energy utilization and gross domestic product in eighteen developing countries by using data period of 1975 to 2001. It also compares data through Unit root test, heterogeneous panel co-integration and panel E.C.M. model. There was evidence of the short-run/long-run causality relationship between energy consumption and gross domestic product. These results propose energy conservation policies capacity, to which extent, and damage economic growth in developing countries. Francis (2007) examines the causality between energy and gross domestic product by multivariate Bayesian V.A.R. Bayesian techniques. Jamil, M. N. (2022) use data of seven world countries period of 1955 to 2021 and estimates the impact of exchange rate and prices on countries policy. This study will further explore and examine the energy impact on

countries growth. Qureshi and Sahir (2007) define; energy as a lifeline of a country's economy. It is an important resource of socio-economic progress and deliberate commodities. Later on, Riaz and Adnan (2008) studied estimated and found unidirectional relationships in the long period and bidirectional in the short period. Both persons study conduct and conclude that energy affects the whole growth of countries and go other jobless environment and social issues rise (2011). Li et al. (2011) analyzed data from china 30 provinces from 1985 to 2007. Examine the causality relations between CO2 emissions, energy usage, and China's economy. The final result of their paper was unidirectional causality relations among gross domestic product and energy consumption. It has positive long-run cointegrated relations; if per capita gross domestic product increase by 1 per cent, energy usage will increase by 0.50 per cent approximately. Rejeb and Farhani (2012) stated that no causality was found in short-run energy consumption to the economic growth of 15 MENA countries. As well as, unidirectional causality was working energy usage to the economy of 15 MENA countries. A.Y. Javid et al. (2013) conducted a study and Analysis; Pakistan is working at bare competency in the energy sector, planning and direct investment required for this sector; if Pakistan goes the other way, it harms the economy of Pakistan. Finding to Muhammad et al. (2013), the relationship between energy usage and the country's economy is empirical. The study analyzed the data from 1980 to 2009. It concluded that developing country like Pakistan has less economic growth due to the shortfall of energy, and the distribution structure was very poor. Fulfilling demand and constant supply of energy are important for the healthy Industry and growth of a country. Arslan et al. (2013) was Analysis the heterogeneous panel data from 47 U.S. states and examined the relations between energy consumption to an economic period of 1997 to 2009. Bidirectional causality relations found among energy consumption and economic progress. Many studies had completed on energy utilization and the economy of countries. Different researchers applied different techniques for investigating energy and economic relations, but unfortunately, no consensus developed. Every country has a different scenario and results also differ Fatai (, 2010). Ozturk (2010) stated that different countries different studies have done on energy utilization and gross domestic product relations. However, still mixed evidence were empirical researches and controversial direction in terms of causality. The intensity of the effect on energy policy is important. A study on energy consumption and economic growth conducted by A. Salman et al. (2013) are Analysis the data from 1978 to 2012. This study concluded that energy consumption significantly affects the gross domestic product in the short run, and unidirectional causality is found in the long run. Energy is a harmful factor for the economy, and it increases production, which leads to more investment and more jobs for people. Different income level countries have different environments and scenarios in word. It was a gap in the direction of causality between energy consumption and economic growth. A. Salman et al. (2013) study also did not tackle that issue. So I overcame the Gap through my Research by using different countries' income levels.

Research Methodology

Data collection and Model: Study analysis relationship of energy usage and countries economic development for 1971 to 2021. This paper uses time series secondary data Gross Domestic Product (G.D.P.) four-level of income; High income, upper middle income, middle income, lower middle income and energy consumption of Oil, Gas, Electricity and Coal. Data collected by World Bank and I.M.F. For defining each variable in all four High income, upper middle income, middle income, lower-middle-income sample units were selected. Two variables were used (1) Gross domestic product (four income levels of countries) as a dependent variable which presents as country economic growth. (2) Energy consumption of Oil, Gas, Electricity and Coal as an independent variable. Last two decades, different methods were used to analyze the long-run co-integration between time series variables and were mostly used in empirical research. An example of Engle and Granger (1987) was univariate co-integration recommended. For Integration, the variable requirement augmented Dickey-Fuller unit root test applied. Commonly, the variable is known as integrated of order d and written by *I*(d). The integrated order of variable was more significant than or equal to 1 is non-stationary. Asteriou and Hall (2007) state that economic variables cointegrated in order 1. After that stage, if I find evidence of co-integration among variables, I need the Granger test for Analysis. (X) Time series is said to Granger cause and on the other hand time serious (Y). The prediction error of Y was a decline by using the past values of X in addition to past values of Y. Inversely, Y to X was defined as the same. The empirical result will be found in granger causality in at least one direction (X to Y), (Y to X).

Regression equation (X on Y) is

$$(X - X^{-}) = r.\ \frac{\sigma x}{\sigma y}\ (Y - Y^{-})$$

Regression equation (X on Y)

$$(Y - Y^{-}) = r.\ \sigma x\ (X - X^{-})$$

σy

The Gross Domestic Product (G.D.P.) has been taken as dependent variables which present the Economic Growth of Countries and energy consumption, i.e. Oil, Gas, Electricity, and Coal is taken as the independent variable. The time-series data have the unit root problem and mostly presents the non-stationary tendency. So Augmented Dickey-Fuller test is used to make the data stationary. The causality test is used to determine the causal relationship between energy and G.D.P. Gross domestic Growth and The Energy Consumption Annual Growth. Finally, the Ordinary least squares model was applied to examine the impact of energy consumption i. e. Coal, Gas, Electricity and Oil impact income level countries groups, i.e. High income, upper middle income, middle income, and lower middle income.

Data Analysis and Finding

Table 1. Descriptive Statistic

Variable	Mean	Median	Maximum	Minimum	Std. Dev.
COAL	5593.36	3364.00	25300.00	1065.00	5508.26
GAS	712852.3	590333.5	1454697.0	11514.0	452776.70
ELECTRICITY	456951.12	424190.00	1120700.00	53332.00	316607.23
OIL_PETROLEUM	1267045.0	1426707.0	2556125.0	278246.0	667502.0

The above table shows the descriptive statistic comparison of Coal, Electricity, Gas and Oil for 1991 to 2021. Results show Oil Petroleum mean 12671045 and standard deviation 6675020 are highest compared to other energy source variables, which means it's a more critical and high volume of impacting of the energy source of share. Energy source Gas on 2nd place important according to the volume of the impact of the energy source of share. Electricity shares in energy generation on 3rd and Coal shares in energy generation on fourth place. Oil is getting more attraction and leading energy sources than other energy sources.

Table 2. Unit Root Test

Unit Root Test		**Coal**	**ELECTRICITY**	**GAS**	**Oil**
Augmented Dickey Fuller test statistic (Level)		t-Statistic 3.6769	t-Statistic 0.6456	t-Statistic -1.8465	t-Statistic -1.6004
Test critical values:	1% level	-3.6105	-3.5885	-3.5744	-3.5744
	5% level	-2.9390	-2.9297	-2.9238	-2.9238
	10% level	-2.6079	-2.6031	-2.5999	-2.5999
Augmented Dickey Fuller test statistic (First Diff.)		-5.5701***	-4.0361***	-0.6348*	-4.2745***
Test critical values:	1% level	-3.5925	-3.588509	-3.574446	-3.5744
	5% level	-2.9314	-2.929734	-2.923780	-2.9238
	10% level	-2.6039	-2.603064	-2.599925	-2.5999

The above table shows the trend and stationary level according to 01%***, 05%**, 10%*; Level, 1st difference level. Coal 3.6769 at the level and first difference at -5.5701*** showing 1% stationary. Electricity 0.6456 at the level and first difference at -4.0361*** assigning 1% stationary. Gas -1.8465 at the level and first level at -0.6348* showing 10% on stationery, Oil -1.6004 at the level and -4.2745*** first difference 1% on stationary found. So, data is the perfect stationary use for further analysis of data.

Table3 . Cointegrating equation

Dependent	tau-statistic	Prob.*	z-statistic	Prob*	Rho - 1	Rho S.E.	Residual variance	Long-run residual variance
COAL	-4.27	0.84	-27.17	0.84	-0.55	0.13	977465.40	977465.40
ELECTRICITY	-4.89	0.61	-32.73	0.60	-0.67	0.14	3933533.00	3933533.00
GAS	-6.36	0.12	-90.69	0.00	-1.11	0.17	1760000000.00	5090000000.00
Oil Petroleum	-4.59	0.74	-30.02	0.73	-0.61	0.13	1130000000000.0	1130000000000.0

Automatic lags specification based on Schwarz criterion (max lag=10)* Co integrating equation deterministic: C MacKinnon (1996) p-values. The above table shows the Johansen Co-integration test results; Residual variance showing the short-run relationship, and Long-run residual variance showing the long-run relationship. Oil at 1130000000000 short-run and long-run residual variance of oil are 1130000000000 at same level mean oil is the equal impact on an economical short run as well as long run. Gas 1760000000 short run and 5090000000 for a long run almost 1:3 ratio impacts economies but as compared to oil is minor impact source of energy on the economic growth of countries. Electricity is at 3933533 in the short-run and 3933533 in the long run. This means electricity also has the same impact as oil; the short-run equally impact the long-run ratio but less Oil and Gas. Coal is at 977465 for both short-run and long-run effects on economies from 1971 to 2021.

Table 4. Vector Error Correction Estimates

Co integrating Eq:	CointEq1
COAL(-1)	1.000000
GAS(-1)	0.002136
	(0.00200)
	[1.06885]
OIL(-1)	0.000393
	(8.2E-05)
	[4.80676]
ELECTRICITY(-1)	-0.226915
	(0.04771)
	[-4.75596]
C	-1577.864

Table 5. Error Correction

Error Correction:	D(COAL)	D(GAS)	D(OIL)	D(ELECTRICITY)
CointEq1	-0.412593	-24.88258	-435.4846	-2.585899
	(0.33878)	(10.1968)	(217.174)	(0.73028)
	[-1.21786]	[-2.44023]	[-2.00524]	[-3.54095]
D(COAL(-1))	0.288043	14.65094	-511.2334	1.712774
	(0.44831)	(13.4935)	(287.386)	(0.96639)
	[0.64250]	[1.08578]	[-1.77891]	[1.77235]
D(COAL(-2))	0.474045	-8.983501	499.2669	1.369295
	(0.33694)	(10.1413)	(215.992)	(0.72631)
	[1.40691]	[-0.88583]	[2.31151]	[1.88528]
D(GAS(-1))	0.003361	0.466280	3.210511	0.020504
	(0.00575)	(0.17317)	(3.68817)	(0.01240)
	[0.58425]	[2.69265]	[0.87049]	[1.65329]
D(GAS(-2))	0.004882	0.346989	-5.993066	0.045461
	(0.00653)	(0.19646)	(4.18420)	(0.01407)
	[0.74788]	[1.76622]	[-1.43231]	[3.23104]
D(OIL(-1))	4.78E-05	-0.000976	0.246846	0.000310
	(0.00022)	(0.00654)	(0.13927)	(0.00047)
	[0.22000]	[-0.14927]	[1.77239]	[0.66234]
D(OIL(-2))	0.000316	0.008052	-0.036788	0.001366
	(0.00018)	(0.00547)	(0.11653)	(0.00039)
	[1.74002]	[1.47171]	[-0.31570]	[3.48686]
D(ELECTRICITY(-1))	0.203423	-4.631021	-40.63814	-0.423038
	(0.13114)	(3.94707)	(84.0656)	(0.28268)
	[1.55119]	[-1.17328]	[-0.48341]	[-1.49650]
D(ELECTRICITY(-2))	0.034975	2.037462	126.6926	-0.211360
	(0.13537)	(4.07430)	(86.7752)	(0.29180)

	[0.25837]	[0.50008]	[1.46001]	[-0.72434]
C	-817.9280	-2743.056	128513.1	-767.2301
	(332.325)	(10002.4)	(213033.)	(716.359)
	[-2.46123]	[-0.27424]	[0.60325]	[-1.07101]
R-squared	0.501926	0.746871	0.732920	0.769056
Adj. R-squared	0.380773	0.685299	0.667954	0.712880
Sum sq. resids	54747946	4.96E+10	2.25E+13	2.54E+08
S.E. equation	1216.419	36612.02	779770.3	2622.110
F-statistic	4.142902	12.13005	11.28168	13.69022
Log-likelihood	-394.9405	-554.9504	-698.7057	-431.0397
Akaike AIC	17.23151	24.04044	30.15769	18.76765
Schwarz SC	17.62516	24.43409	30.55134	19.16130
Mean dependent	419.8936	19146.38	247172.1	1666.894
S.D. dependent	1545.817	65264.13	1353218.	4893.500
Determinant resid covariance (of adj.)		2.64E+33		
Determinant resid covariance		1.02E+33		
Log-likelihood		-2052.776		
Akaike information criterion		89.22451		
Schwarz criterion		90.95656		

The above table shows Vector Error Correction Estimates of Coal, Electricity, Gas and Oil, which show the short-run and long-run behavior for the economy, energy behavior for countries growth; Co integrating Eq; Coal (-1) at 1.000000, Gas (-1) at 0.002136, Oil (-1) at 0.000393 and electricity (-1) at -0.226915 showing the long run behavior of energy consumption for economic growth of countries. Coal, Gas and Oil are the positive behavior and electricity showing negative behavior for countries' economic growth. As d(coal(-1)), d(gas(-1)), d(oil(-1)), d(electricity(-1)) and d(coal(-2)), d(gas(-2)), d(oil(-2)), d(electricity(-2)) are showing short run energy impact on countries growth.

Table 6. Granger Causality Test

Pairwise Granger Causality Tests (Lags: 2)

Null Hypothesis:	Obs	F-Statistic	Prob.
high income does not granger cause Coal	48	0.24640	0.7827
coal does not granger cause high income		11.9124	8.E-05
upper middle income does not granger cause Coal	48	0.09245	0.9119
coal does not granger cause upper middle income		0.72230	0.4914
middle income does not granger cause Coal	48	0.08478	0.9189
coal does not granger cause middle income		1.52036	0.2302
low, middle income does not granger cause Coal	48	0.67534	0.5143
coal does not granger cause low middle income		1.64604	0.2047
high income does not granger cause Gas	48	2.28579	0.1139
Gas does not granger cause high income		10.3377	0.0002
upper middle income does not granger cause Gas	48	0.45125	0.6398
Gas does not granger cause upper middle income		3.22867	0.0494
middle income does not granger cause Gas	48	0.54659	0.5829
Gas does not granger cause middle income		4.77533	0.0134
low middle income does not granger cause Gas	48	0.22268	0.8013
Gas does not granger cause low middle income		3.79877	0.0303
high income does not granger cause Oil	48	0.00954	0.9905
Oil does not granger cause high income		2.67406	0.0804
upper middle income does not granger cause Oil	48	0.62910	0.5379
Oil does not granger cause upper middle income		0.29675	0.7447
middle income does not granger cause Oil	48	0.59166	0.5578
Oil does not granger cause middle income		0.55671	0.5772
low middle income does not granger cause Oil	48	0.00800	0.9920
Oil does not granger cause low middle income		0.82507	0.4450

high income does not granger cause Electricity	48	0.13992	0.8698
electricity does not granger cause high income		9.29554	0.0004
upper middle income does not granger cause Electricity	48	0.05133	0.9500
electricity does not granger cause upper middle income		2.05115	0.1410
middle income does not granger cause Electricity	48	0.08507	0.9186
electricity does not granger cause middle income		2.52215	0.0921
low middle income does not granger cause Electricity	48	0.40355	0.6704
electricity does not granger cause low middle income		0.32347	0.7254

The above table shows the Causal relationship structure between Countries economic growth and energy consumption through the Granger Causality approach. The Granger causality approach is used to test whether the above variables are useful for forecasting another. Where the probability value is less than any significance level, we cannot reject the hypothesis and accept it at that level. That value is above the significant level; we can reject the hypothesis. Gas does not granger cause high income at 0.0002; Gas does not granger cause upper middle income at 0.0494; Gas does not granger cause middle income at 0.0134; Gas does not granger cause low middle income at 0.0303; Oil does not granger cause high income at 0.0804; Electricity does not granger cause high income at 0.0004 and Electricity does not granger cause middle income at 0.0921; we can accept hypothesis because p-value under the significant level 1%, 5% and 10%; accept at his own level of significant. All other variables can reject; their p values are above the considerable level. The unidirectional causality found among energy consumptions to countries growth economies.

Table 7. Regression

variable	High Income	Upper Middle Income	Middle Income	Lower Middle Income
GDP				
COAL	0.04** 2.11	0.06*** 3.12	0.05*** 2.85	0.01 1.81
ELECTRICITY	-0.02*** -3.03	-0.04*** -4.88	-0.04*** -4.76	-0.01*** -2.79
GAS	5.80* 1.68	2.08*** 5.36	1.82*** 5.35	0.01*** 3.36
OIL	6.31*** 4.37	6.36*** 3.91	5.69*** 3.99	0.01*** 2.92
R-squared	-0.26	-0.18	-0.17	-0.04
Adjusted R-sq.	-0.34	-0.26	-0.25	-0.11
S.E.S.E.S.E. of regression	2.20	2.48	2.17	2.29
S.D.S.D.S.D. Dep. var	1.90	2.21	1.94	2.17
Log -likelihood	-108.28	-114.17	-107.53	-110.23
D -W stat	1.26	1.04	0.98	1.04

0.01***, 0.05**, 0.10*** at the level of significan**ce,** the above table shows the impact of energy on countries' economic growth. Coal has less impact on lower-income growth than other income groups of countries. Electricity is an essential variable for all four levels of income group showing a highly significant impact on the growth of countries. Gas is less critical for high-income level countries than other levels of income group, which shows high significance. Oil is equally crucial for all levels of income countries, and his signature is on the top level.

Conclusion

The paper identifies the relationship between energy consumption and economic development between 1991 toward 2021 by applying causality tests and the ordinary least square model. Oil Petroleum's mean of 12671045 and standard deviation 6675020 is highest compared to other energy source variables, which means it's a more critical and high volume of impacting the energy source of share. Energy source Gas on 2nd, Electricity on 3rd and Coal shares in energy generation on fourth place. Oil is getting more attraction and leading energy sources than other energy sources. The trend and stationary at level, 1st difference level; Coal is 3.6769 at the level and

first difference at -5.5701***; Electricity 0.6456 at the level and first difference at -4.0361***, Oil -1.6004 at the level and -4.2745*** first difference 1% on stationary found and Gas -1.8465 at the level and first level at -0.6348* showing 10% on stationery, so, data is the perfect stationary use for time series analysis. Johansen Co-integration test Residual variance used to measure the relationship in the short run/long run. Oil at 1130000000000, Electricity at 3933533, and Coal is at 977465 are equally significant for short-run/long run.
While Gas 1760000000 short run and 5090000000 for a long run, almost 1:3 ratio impacts economies, but as compared to oil is less impact source of energy on the economic growth of countries. Vector Error Correction Estimates of Coal, Electricity, Gas and Oil, which show the short-run and long-run behavior for the economy, energy behavior for countries growth; Co integrating Eq; Coal (-1) at 1.000000, Gas (-1) at 0.002136, Oil (-1) at 0.000393, electricity (-1) at -0.226915 showing the long-run behavior and d(coal(-1)), d(gas(-1)), d(oil(-1)), d(electricity(-1)) and d(coal(-2)), d(gas(-2)), d(oil(-2)), d(electricity(-2)) values are showing short-run energy impact on countries growth. The probability value used for estimation is less than any significance level; we accept it at that level, the value is above the significant level, and we can reject the hypothesis. Gas-high income at 0.0002; Gas-upper middle income at 0.0494; Gas-middle income at 0.0134; Gas-low middle income at 0.0303; Oil-high income at 0.0804; electricity-high income at 0.0004 and Electricity does not granger cause middle income at 0.0921; we can accept hypothesis because p-value under the significant level 1%, 5% and 10% and all others variable can reject; its p values are above the significant level. A unidirectional causality is found among energy consumptions to countries growth economies. The impact of energy sources used on the economic growth of countries. Oil and Electricity is the essential variable for all four levels of income group showing a highly significant impact on the growth of countries. Coal has less impact on lower-income and Gas is less important for high-income level countries than other levels of income group, which shows high significance. The above scenario shows energy consumption is the most important factor for economic progress. Consumption of energy enhances the production level in the economy, and when production increases, it generates employment opportunities in the country. Inversely, when a country faces an energy shortage that time manufacturing unit is badly affected, and production is reduced, the Industry stops working and does not meet orders. Investors do not invest in new projects. People go for unemployment and living standard dropdown. So governments need to avoid that situation and plan for energy, install new projects, direct investment national or foreign, and extend energy capacity. Here I mention some main problems that lead to energy shortage, and government policymakers try to overcome that issue and increase energy capacity in a short and long time.

Reasons

The main reason for the shortage of energy identified as under.

Shortage of Gas for the energy sector: Pakistan is producing largely energy through natural gas, but in winter, Pakistan face the problem of Gas shortfalls, so it also affects energy generation and big share cut off.

Electricity robbery and bills recoveries: Every year's energy losses through robbery are Rs.260 billion, which creates debt on govt. Theft in the energy sector discourages investors from investing in this sector. Pakistan lost 10 billion and 63 billion in the energy sector in 2008 and 2012, respectively.

Hydro energy generation reduction and cost effect: Hydro capacity of Pakistan is 6600 MW but not proper maintenances and renewable the system. Currently, generation is 3600 MW.

Transmission lines losses: Open energy networks and old transmission lines cause line losses. Pakistan every year bears losses of 18793000000 in 2020, according to the report of the World Bank.

Circular of Debt: Pakistan is facing problems of circular debt rapidly. In 2020-21 govt. clear all circular debt and timely increase energy production, but circular debts again create. The financial budget of 2020 and 15 mentions Rs.350 billion for subsidies, but actual subsidies are extended near about Rs.600 billion that condition go to more and more shortfalls of energy.

Important Recommendations

- Natural Gas resources provide for energy Production.
- Coal resource use for energy generation is cheaper compared to Oil sources.
- Alternative sources used for energy production like wind, solar, and bio- mass-generated energy are cheaper.
- Energy produces through Coal and hydro is cheaper rather than other sources.
- Monitoring body establishes for theft and line losses matters.
- Govt. must invest more in the energy sector and convince a foreign investor to invest in the energy sector.

- Improve bill recoveries, clear circular debt and up the cash flow in the energy sector. It leads to an increase in the generation of energy.

Funding:
No funding was received for conducting this study (Self-finance).

Data availability: The data sets generated and analyzed during the current study are available from the corresponding author on reasonable request.

Declarations:

Conflict of interest: Authors declare no conflict of interest

Reference

Aneel Salman, Nadia Asghar, Tahir-ul-Mulk Kahlon and Muhammad Waqas Chughtai (2013). Energy Consumption and Economic Growth Nexus: Evidence from Pakistan, A.U.D.O.E., Vol 9, no 3, pp. 132-139.

Ashraf, Z., Javid, A. Y., & Javid, M. (2013). Electricity consumption and economic growth: evidence from Pakistan. Economics and Business Letters, 2(1), 21-32.

Aslan, A., Kum, H., Ocal, O., Gozbas, O. (2013). Energy Consumption and Economic Growth: Evidence from Micro Data, A.S.B.B.S. Annual Conference: Las Vegas 10(1), 280-288.

Alam, S., & Butt, M. S. (2002). Causality between energy and economic growth in Pakistan: An application of co-integration and error correction modeling techniques. Pacific and Asia Journal of Energy, 12(2), 151-165.

Akasha, Arif. Tariq, M. Salman. & M. Nasir. (2009). Residential Demand for Electricity in Pakistan. Pakistan Development Review, No. 4, pp. 457-467.

Chiado Dritsaki Melina Dritsaki, International Journal of Energy Economics and Policy, Vol. 4, No. 2, 2014,

Lee, C. C., & Chang, C. P. (2008). Energy consumption and economic growth in Asian economies: a more comprehensive analysis using panel data. Resource and energy Economics, 30(1), 50-65.

Filippini, M., & Pachauri, S. (2004). Elasticities of electricity demand in urban Indian households. Energy policy, 32(3), 429-436. https://doi.org/10.1016/S0301-4215(02)00314-2

Fatai. K, Oxley L, and Scrimgeour F (2010) "Modeling the Causal Relationship between Energy Consumption and G.D.P. in New Zealand, Australia, India, Indonesia, the Philippines and Thailand.

Hwang, D. & Gum, B. (1992). The Causal Relationship between Energy and G.N.P.: the Case of Taiwan. Journal of Energy and Development, Vol.12, pp.219-226. https://www.jstor.org/stable/24807960

Haider, Sabb. & Alter, Noel (2011). An Empirical Analysis of Electricity Demand in Pakistan. international Journal of Energy Economics and Policy, Vol. 1, No. 4, pp.116139.

Jamil, M. N. (2022). "Impact the Choice of Exchange Rate Regime on Country Economic Growth: Which anchor Currency leading the 21st Century" Journal of Environmental Science and Economics, https://doi.org/10.5281/ZENODO.6165201

Jamil, M. N. (2022). "Monetary Policy Performance under Control of exchange rate and consumer price index." Journal of Environmental Science and Economics 1((1)): 35–45. https://doi.org/10.5281/zenodo.6177519

Jamil, Faisal. & Eatzaz, Ahmad (2010). The Relationship between Electricity

Consumption, Electricity Prices, and G.D.P. in Pakistan. Energy Policy, No. 38, pp. 60166025.

K.Y. Awan, A. Rashid (2012) Overview of Pakistan's Electricity Crisis, Generation-Mix

and Renewable energy scenarios. International Journal of Engineering and Technology, 1 (4) (2012) 321-334.

Khandakar Akhter Hossain 2012, Global Energy Consumption Pattern and G.D.P. International Journal of Renewable Energy Technology Research Vol. 1, No. 1, P.P.P.P.P.P.: 23 – 29, December 2012, ISSN: 2325-3924 (Online)

Kamran Shafiq (2011) Oil Price Shocks: A Comparative Study on the Impacts in Purchasing Power in Pakistan, Vol. 5, No. 2; April 2011 (www.ccsenet.org/mas).

Mario J.S Brito and Tania Sousa (2014).Development of a "Current Energy Mix Scenario" and "Electricity as Main Energy Source Scenario" for electricity demand up to2100. International Journal of Sustainable Energy Planning and Management Vol. 02,2014.

Muhammad Ramzan, Azeem and Moazam Rashid, (2013), Impact of Energy Consumption on Pakistan's Economic Growth. International Journal of Humanities and Social Science Invention, Volume 2 Issue 6, June. 2013, PP.51-60.

McKinnon R. (1973), Money and Capital in economic development. Washington, DC:

Brooking Institute.

Noel Alter and Shabib Haider Syed, (2011). An Empirical Analysis of Electricity Demand in Pakistan. International Journal of Energy Economics and Policy, Vol. 1, No. 4, 2011, pp.116-139.

Samuel, O. D., & Onaifo, F. (2012). Integrating and Forecasting Power output in Renewable Energy power Plants via Computer Networking. International Journal of Emerging Sciences, 2(4), 611.

Hye, Q. M. A., & Riaz, S. (2008). Causality between energy consumption and economic growth: the case of Pakistan. The Lahore Journal of Economics, 13(2), 45-58.

Qayyum, Abdul. & Khan, M. Arshad (2008). The Demand for Electricity in Pakistan. OPEC Energy Review, pp. 70-96.

Qazi, Muhammad. Adnan. Hye. & Sana, Riaz (2008). Causality between Energy Consumption and Economic Growth: The Case of Pakistan. The Lahore Journal of Economics, Vol. 2, No. 13, pp. 4558. 22.

Anhal, R. (2013). Causality between GDP, Energy and Coal Consumption in India, 1970-2011: A Non-parametric Bootstrap Approach. International Journal of Energy Economics and Policy, 3(4), 434-446.

Causality between G.D.P., Energy and Coal Consumption in India, 1970-2011: A Non-parametric Bootstrap Approach (www.econjournals.com).

Stern, D.I., 2000. A multivariate co-integration analysis of the role of energy in the U.S. Macroeconomy. Energy Economics 22, 267–283.

Shaw E. (1973). Financial deepening in economic development. Oxford University Press. New York.

The World Bank. (2004). the Oil & Gas sector in the Republic of Yemen. World Bank Oil & Gas Policy Division.

Wing, I. S., & Eckaus, R. S. (2007). The implications of the historical decline in US energy intensity for long-run CO2 emission projections. Energy Policy, 35(11), 5267-5286. https://doi.org/10.1016/j.enpol.2006.01.035

Erol, U., & Yu, E. S. (1987). On the causal relationship between energy and income for industrialized countries. The Journal of Energy and Development, 113-122. https://www.jstor.org/stable/24807616

Yu, H. S. & Errol, U. (1987). On the relationship between energy and income for

Industrial countries. Journal of energy and employment, No 13, pp 113-122.

Journal of Environmental Science and Economics ISSN:2832-6032
https://doi.org/10.56556/jescae.v1i2.13

RESEARCH ARTICLE

Transparency and Global Initiatives in the Face of Natural Resource Depletion in Sub-Saharan Africa

Seun Adebowale Adebanjo[1]*, Olugbode Morufu Adeoye[2]

[1]On point Research Institute, A subsidiary of on point all service enterprises". Nigeria
[2]Federal School of statistics, Ibadan Nigeria

Corresponding Author: Seun Adebowale Adebanjo, seunadebanjo9@gmail.com
Received: 25 January, 2022, Accepted: 18 March, 2022, Published: 22 March, 2022

Abstract

This research focuses on Natural Resource Depletion in Sub-Saharan Africa, as well as ways to overcome it, with a particular focus on the role of transparency in Sub-Saharan Africa (SSA). The transparency initiative is a global initiative aimed at eradicating corruption, ensuring accountability, and assisting participating countries in developing quality budgets that will ensure a good standard of living for their citizens now and in the future. Hausman test was applied and a fixed panel regression model was specified which reveal that there is a significant relationship between GDP per capita, inflation, the EITI dummy, and the transparency indicator is established using a panel regression model. The results show that the model fits the data well and can be used to forecast future economic growth in SSA countries that participate in the EITI scheme. The fixed effect model also shows that the Transparency indicators such as voice and accountability, and corruption have a positive significant impact on the economic growth of the 10 SSA countries under consideration, indicating that transparency is a critical factor in determining good economic performance. Meanwhile, diagnostic tests such as normality test was performed, with satisfactory results, indicating that the model is very robust and reliable. Meanwhile, inflation have positive significant impact while natural resources show a negative significant influence on the economic growth of all the 10 Sub-Saharan Africa (SSA) in the EITI scheme which can be attributed to the natural economic depletion. Then, using correlation analysis, it was discovered that there is a strong link between transparency indicators (voice and accountability, corruption as well as quality of budget, and fiscal management) and economic growth. This suggests that the greater the transparency, the more natural resource constraints will be overcome, and SSA countries participating in the EITI scheme will achieve greater economic performance.

Keywords: Hausman test, Fixed effect Panel regression model, EITI, GDP Per Capita, Transparency, Correlation analysis, SSA

Background of the study

As a result of having abundant natural resources, countries' economic, political, and socioeconomic conditions deteriorate (Siegle 2008). Renewable, nonrenewable, depletable, and nondepletable resources such as hydrocarbons, natural gas, coal, minerals, and oil are also discussed in this study (all are natural resources focus of this study). The Dutch Disease was an economic phenomenon that occurred in the Netherlands during the 1960s. The discovery of natural gas in the Netherlands harmed other industries' competitiveness. The real exchange rate increased as resource revenues increased. They are unable to learn about such assets or improve their balance of payments due to the exchange rate's consistency with oil and gas revenue (Korhonen and Juurikkala 2007). The case of the Netherlands is not exceptional, as many countries with lower endowments perform far worse (Auty 2001). However, some countries have experienced growth and development. Nigeria and the Democratic Republic of Congo are at the bottom of the list, with little being done; however, several other countries, such as Botswana, Norway, and Malaysia, perform admirably. Financial resources should play a major role in both growth and escaping the development trap, while resources should provide the funding needed to succeed in moving out of the development trap (Collier 2007). Malaysia, Indonesia, and Thailand have demonstrated that economic growth and development can be achieved even in countries with abundant natural resources. The success of these countries shows that reversing or preventing the resource curse is possible. Institutional quality, according to Rodrik (1999) and Pritchett (2000), is critical for long-term growth. This is most likely due to the fact that the majority of people in resource-rich countries do not have access to such high-quality institutions? Instead, these countries are rife with corruption, increasing social inequity. Moreover, resource-rich countries share characteristics that contribute to successful economic growth and development. According to Sala and Subramanian, low development is not caused by the lack of natural resources. When institutions are taken into

account, it appears that natural resources have little impact on economic growth, according to these researchers.
Institutions play a critical role in reversing the resource curse in African countries. The resource curse literature is vast, revealing numerous avenues for investigation. Only a fewresource-rich countries have managed to overcome it. The effects of the "Dutch disease," as well as extractive capital utilization, market capital flight, and capital overaccumulation, are all part of the resource-curse complex (Auty 2001). In resource-rich countries, the following three reasons apply: Bribery is more likely to affect businesses and longer-term financial resources because it is easier for business owners to invest in money-making rather than money-affecting industries and projects (Barbier 2005). Diamond-rich countries such as Sierra Leone, Liberia, and the Democratic Republic of the Congo are particularly vulnerable (Mehlum, Moene, and Torvik 2005). Mineral revenues have been used to extract rents by these governments and foreign extractive companies. Second, due to price fluctuations in natural resources, borrowing money is difficult. Because of extractive industries and commodities, non-extractive countries are at a disadvantage due to fluctuating prices. Growth has been hampered, according to Poelhe and van der Ploeg (2009), by unstable resource revenues caused by fluctuations in primary commodity prices. Besides, natural resources crowd out other economic sectors, such as human and social capital. diverting investment and innovation away from other export-oriented industries Because natural capital is one of the three major types of capital, there is a negative relationship between this type of capital and human capital (Birdsall, Pinckney, and Sabot 2000). Natural resources obstruct the allocation of education resources. Countries underinvest in education due to their wealth and abundance of resources. All of these factors contribute to the development of a dependency economy, necessitating the implementation of more domestic policy changes and policies. The domestic economy's well-being While the "resource curse" appears to be affecting a number of countries, there are also potential solutions. Barb is a wonderful person. Barbier (2005) suggests using a variety of economies while also combating currency depreciation. Halt the depletion of natural resources the second option allows countries to export their natural resources to the global market without having to worry about currency appreciation. When importing natural resources, resource-rich countries should not value them at the same initial cost; a rapid inflow of foreign currency lowers the value of the local currency.
Exchangeable medium Furthermore, when a country's currency appreciates, so does the country's international economic activity. an increase in the domestic currency's value Lowering the export price in the long run would be the best solution. One general recommendation for resource-rich countries seeking financial growth is to implement policies that promote transparency. The main goal of a global initiative is to ensure that extractive industries are transparent (EITI). In this regard, the Extractive Industries Transparency Initiative (EIT) was founded in 2003 to fill the market gap in resource-poor countries by enforcing openness in the extractive industries. It requires all mining and oil revenue data from participating countries. The World Bank, the International Monetary Fund, the International Bank for Reconstruction and Development, and the European Investment Bank for Reconstruction and Development are all members of the EITI, which is supported by the international community. 21 African countries announced their intention to adopt the EIT for increased transparency at the end of August 2014. Natural resource revenues are currently inefficient (World Bank and Global Witness 2008). The EITI's effectiveness has yet to be demonstrated.

Significance of the study

This study focuses on resources as a constraint in Sub-Saharan African country development and ways to overcome it, with particular regard to the role of transparency in SSA. Government transparency is frequently overlooked in economic growth literature. This research looks at EITI recognizes as being important explores the relationship between economic growth and transparency for SSA countries.
In this study, I will focus on the effects the EITI initiative could have on these countries' development paths. The following research questions are studied and stated below:

- Does transparency affect the economic growth of SSA that participated in EITI?
- Does inflation affect the economic growth of SSA Countries that participated in EITI?
- Is there a difference between the economic performance of SSA countries that participate in EITI and those not participating in EITI?

To investigate these research questions, following hypotheses were set:

Research hypothesis

H1: There is a relationship between transparency and economic growth in
SSA countries that participated in EITI.
H2: There is a difference in economic growth between EITI countries and non-
EITI participants
H3: There is a relationship between economic growth and inflation.

Literature review

The resource curse is the most influential theoretical aspect of recent evolution discussions. According to the resource curse theory, countries with abundant natural resources have low GDP. When resources are plentiful, overall economic growth suffers. According to Sachs and Warner (1995; 2001), growth slows as natural resources become scarce. Future generations must take precedence over current concerns,

which is of critical importance (World Commission on Environment and Development 1987). Resource-rich countries face a major revenue management challenge. In order to generate revenue from natural resources, all/most SSA countries must take decisive action. Resource corruption, in addition to low revenue participation, is a barrier to growth. Although corruption occurs on a national level, it is inextricably linked to international issues, such as extractive industries. How does a resource-poor country benefit from associating with corrupt politicians like those with a severe lack of resources (Kempen and Gunthers 2008)? Economic, political, and international issues are the most pressing concerns in developing and resource-rich economies. Growth occurs when an increase in goods and services occurs as a result of domestic and international policies aimed at raising the population's standard of living. One way to describe political development is that it is characterized by an increase in the number of decision-makers and policymakers. Following that, there is a detailed discussion of economic, political, and international concerns. The non-resource competitiveness of a country suffers as a result of large resource income gains. As a result, when a country's economy is almost entirely based on manufacturing, the 'Dutch disease' is said to occur.

A non-resource sector that is growing in tandem with the natural resource sector the phrase "Dutch disease" was first used in an Economist article published in 1977, and its etymology is provided in the text. Abraham Maslow first recognized the phenomenon in the 1960s, when he noticed it in humans as well.

The discovery of natural gas in 1959 resulted in the abolition of manufacturing in the Netherlands. a reversal as a result, the gas sector lost competition, worsening the global economic balance and denying previously competitive non-oil exporting countries opportunities (Dutch Disease). As a result of rising exports, the value of the Dutch currency increased against other currencies, causing rising wages in natural gas industries to outpace those in non-natural gas industries. The second sector has been squeezed by the currency increase (Barbier 2003). In another regard, the country is seeing an increase in primary resource production, which may have an impact on the country's other sectors.

Overproduction has been going on for a while, and we are now paying the price (Gylfason 2001). This is because ferroaluminum is considered a cornerstone of the global commodity market, “prices of traded goods will be relatively stable” (Corden and Neary 1982). Human and social capital have been depleted as a result of "Dutch disease." Crowding out occurs when more money is invested in monetary assets while social/human capital is diverted. Many economic theories describe human and social capital as a resource curse. The availability of alternative resources, such as education funding, can cause crowding out, as seen frequently during times of resource scarcity.

Natural resources, for example, may result in less state and private investment in education, despite all other revenue-increasing ideas being thwarted by spending cuts. In inheritance-rich societies, many people are joining the developing industries because when a person or a family member dies, they often leave behind substantial amounts of property. According to a number of authors, including Auty (1993), Gylfason (2001), and Barbier (2003), Dutch disease can also be found in countries with plenty of resources. Gelb also looks at non-resource tradable sectors and six oil exporting countries: Algeria, Ecuador, Indonesia, Nigeria, Trinidad and Tobago, and Venezuela. Furthermore, he points out that some countries have used their natural resources as collateral to finance their debt, resulting in a drop in the price of oil. International organizations, such as the World Bank, have followed and continued to implement such strategies for decades.

The International Monetary Fund and the United Nations Development Programmed have emphasized the importance of developing countries not jeopardizing their non-earning sectors. The resource curse is best described as exorbitant rents and widespread corruption (Auty 2001). When more restrictions are placed on the market, companies or individuals compete for surplus produced, which is not allowed by government regulation (Collier and Hoeffler 2005). Using his title for personal or private gain is a private misuse of his power (Kaufmann and Vicente 2011). has stifled the growth of money that could have been invested and is driving up the cost of borrowing.

In SSA countries, there were numerous resource and civil wars. In countries where the government has authoritarian control over resources, money cannot be used by citizens and must instead be given to the government. Furthermore, the year 2007 saw a spike in larcenasites (Wenar 2008). It has been established that resource-rich countries face development challenges. It is as common in resource-rich countries as it is in resource-poor countries (North 2005). for those who believe they are being overcharged A rent-seeking business is one that charges more than the general rate of return, regardless of how it is defined. Our goal in all of our markets is to achieve the highest possible return while also giving everyone an equal chance. As a result, rent-seeking is illegal in all states. The resulting service is rent-seeking when profit is sought by charging above market price, what has been gained or gained through unfair means, corruption. Patronage is also boosted by service fee revenue.

They bribe their supporters to keep their positions of power. A greater abundance of resources, he claims, will give a smaller group of elites a greater political and economic advantage (Auty 2001). Mining companies can use revenue from extractive resources to give preferential treatment to one person or group over another. It could be inefficient tariffs or the government favoring one producer over another at the expense of overall tax revenue. In addition, mineral wealth enables them to generate income independently (Neumayer and Dietz 2005).

Government and Transparency

Oil-rich countries were seen as a threat to economic development even in the 1970s, as their ability to develop natural resources grew. The role of governments in overall economic development is fascinating. One interesting aspect of the resource curse is the diversity of governments among resource-rich countries. When governments rely on mineral revenues for revenue, they have fewer incentives to improve institutions that promote public services and conflict avoidance. Natural resources in SSA countries have contributed to political instability (Karl 2007). Collier and Warner (1995) and Sachs and Sachs and Warner (1995) discovered a strong negative correlation between resource abundance and political stability, expanding on their work. Transparency is essential for good government. Transparent governments are more likely to be free of corruption. According to Méon and Sekkat (2005), "weak governance is accompanied by corruption," while the Open Society Institute of Southern Africa (2007) found that resource-rich SSA countries like the Congo and Malawi relied on being open to globalization for their success (FSOA, 2007). Tanzania and Zambia discovered that mineral-rich African countries are not getting as much benefit from mining companies because they are poorly governed. Due to political bribery, this case study also suggests that African mining companies benefit unfairly from excessive and unfairly provided tax breaks. They're in charge of the company. As a result, the government receives far less revenue than anticipated. Due to corrupt politicians diverting the reported funds, the amount of this revenue is even lower. Good governance is essential in resource-rich countries to avoid the resource curse (Mehlum etal. 2005). In 2009, the World Bank recommended increased transparency in the extractive industries for economic growth and long-term development (World Bank and Global Witness 2008). Furthermore, in the African region, there may be a direct link between government structure and economic development. The 2012 index, for example, ranks the performance of 48 African countries based on a variety of criteria, including security, human rights, economic health, and sustainability. This study contributes to the advancement of the literature on governmental accountability and good governance by demonstrating that the most developed countries have the least corrupt and best-run economies. In the context in which it was written: SSA may have the potential to expand in light of efforts to alleviate the natural resource curse, such as the adoption of an international transparency initiative. There is no conclusive evidence that any particular type of government lowers or raises the risk of experiencing the resource curse. From democratic governments, such as those in Mauritius, to autocratic governments, such as those in Zimbabwe. To address these issues, a clear understanding of how to translate natural resource abundance into economic development is required. One-party, multi-party, and military-ruled countries typically dominate resource-rich countries. Although the literature on natural resources and democracy differs, with some authors claiming that a certain level of transparency and democracy is sufficient, others, such as Ross (2001), argue that more democracy will help oil production. Establishing a resource revenue fund and distribution system is one way for resource-rich countries to overcome the natural resource curse. exemplary example of a system the system's various mechanisms transfer revenue from resources to citizens' income. In the Gulf states, there are many different types of fund transfer programs: in Indonesia, resources are distributed based on community needs, while in Alaska and Kuwait, resources are distributed unconditionally. Direct welfare benefits, such as welfare, are given directly to those who qualify. Social benefits, such as child allowances, are distributed through the taxation system (Gelb and Grasmann 2009). In many African countries, it has yet to be proven useful. Measured, quantified, and estimated for a global agreement, countries like Chad and Botswana may appear to be suitable, but more research is needed to determine what policies will be most effective in achieving it. Belarus is the smallest of the three countries. According to Gelb and Groenmann, resource funds will not be able to solve the region's resource curse (2009). The transparency and accountability mechanisms in place in Alaska have the potential to inspire others. He claims legitimacy, but adds that it isn't a substitute for transparency. Strong institutions are mentioned in the literature on the political challenges related to the natural-resource curse as a critical factor in driving increased economic prosperity. Institutions are the fundamental norms of the economy, according to North (1990). We have formal systems, such as constitutions and taxation, as well as informal norms, such as habits and ideologies, to take into account. Historical institutional factors, such as existing organizations or economic factors, are widely acknowledged to be critical in this concept of takeoff. norms that are both reasonable and useful, such as Citizens' and non-government organizations (CNGOs) are also important to the development of extractive economies, particularly in post-conflict situations where these economies are emerging. The success of these businesses is also influenced by the international political and economic arenas. The following sections provide information on the role of resource-rich countries in the domestic economy.

International Challenges

Extractive industries should be held accountable for lower overall growth and development in resource-rich countries. Governments that promote growth and have transparent payment systems have a better track record of managing resource revenues. Though it is the responsibility of resource-rich governments to ensure that their resources are properly utilized, developed countries and international extractive companies are critical to their success. In other words, developed countries can encourage extractive industries to be more accountable. Governments can also demand that

clandestine bank accounts in developed countries, as well as those in resource-rich countries, be closed. Countries can use policies that reduce the incidence of conflict and war in resource-rich countries to promote good governance. Almost all SSA countries spend money earned from natural resources on armaments purchased from countries that have advanced further in their development. The elimination of this pollution cycle will have a significant impact on these countries' economic growth potential. According to Stiglitz (2005), developed countries, resource-rich countries, and extractive companies will be viewed as a blessing or a curse, respectively.

China in Sub-Saharan Africa

As commodity prices rise, it is increasingly critical to avoid the resource curse. Resource-hungry countries such as China and India, predicted to follow economic growth, are anticipated to have a rising demand for natural resources in the future. Resource-rich SSA countries, in SSA countries are facing increasing pressure to develop a transparent resource discovery process. In recent years, more African countries have been added to the ranks of the principal mineral and oil exporter countries; however, the demand for resources has continued to rise and prices have been on the rise. Ghana, Uganda, Mauritania, South Sudan, Mozambique, Liberia, and Kenya have all started or completed drilling/exploration efforts to begin production in the last few years. A transparent system and institute of governance have become increasingly important for international extractive industries to work with China in SSA A number of actors have found employment in SSA countries due to a lack of transparency China and other emerging markets have strengthened their trade relations with SSA countries. China has recently become one of the world's largest users of natural resources. Maintaining its economic growth will become more difficult in the coming years (Brautigam 2010). While the continent of Africa is wary of international economic dealings due to colonialism, China is taking advantage of this by learning the language and providing soft loans. Without dealing with the question of transparency, it has positioned itself as the primary source of foreign imports (Michel and Beuret 2008). Assistance from China is the most apparent in the form of resources. the Chinese have received drilling rights in Angola, Nigeria, and Sudan. Countries such as Chad, Gabon, Mauritania, the Democratic Republic of Congo, and Ethiopia have signed exploration and extraction agreements with China. The People's Republic of China has also invested in mineral extractive industries in countries like Zambia, the Democratic Republic of the Congo, Cameroon, Equatorial Guinea, and Mozambique. China's trade with Africa has grown from $10.6 billion in 2000 to $75.5 billion over the last decade. The worst place you could give your young is someone is your own flesh and blood, or the worse way to give your young is to give your own flesh and blood China is somewhat known for being non-transparent in their contractual agreements, especially in the countries where they operate. This opacity helps political leaders to cash in on-in on the resources (Brautigam 2011). Because China places less value on transparency, it is somewhat able to amass wealth, and it may even encourage corruption. the country's foreign policy is that of non-interference in domestic affairs as long as African governments are riddled with corruption, the true effects of China's involvement will remain unclear. such international bodies such as the World Bank view China's growing involvement in Africa as a positive development, whereas other countries, such as the United States, fear that this will lead to long-term trouble for resource-rich countries like it those countries in Sub-Saharan Africa who don't practice sustainable natural resource management

International laws and regulations play a vital role when there is a lack of good governance. Transparency is especially common in resource-rich African countries where there is a great deal of corruption to contend with. While other countries are dealing with similar problems, the situation in SSA is far more difficult. An assumption is that if corruption and rent-seeking are eliminated, the economies of these countries will develop and grow. all agree that serious measures are required to deal with the problem of inequity in global resources (Humphreys et al. 2007). In many countries, fighting corruption at home remains a difficult task. Despite the fact that nearly all extractive firms involved in corruption are foreign and based in developed countries, international law enforcement has only received the minimum attention. Many people all over the world are outraged by the lack of legal institutions that keep watchful eye on public funds. Several initiatives have emerged to hold extractive companies and national governments more accountable. Among the more well-known international and regional initiatives is the Global Reporting Initiative's publication of Publish What You Pay, the Kimberley Process, and the OECD guidelines on Multinational Enterprises. The EITI is the most positively evaluated transparency-enhancing initiative, according to the literature on promoting transparency. More than 46 resource-rich countries are currently implementing the EITI.

Review of Extractive Industries Transparency Initiative (EITI)

The EITI was established in 2003 to fill a gap in international law regarding extractive industries operating in resource-dependent countries and to assist governments in ensuring greater transparency in these industries. Countries around the world must publish all of their mining and oil revenue figures to be eligible to participate. The World Bank, the International Monetary Fund, the International Bank for Reconstruction and Development, and the European Investment Bank for Reconstruction and Development are all members of the EITI, which is supported by the international community. The EITI aims to improve efficiency by verifying and fully disclosing payments and government

revenues made by oil and mining companies. The goal of this project is to put an end to the current financial exploitation of natural resources (World Bank and Global Witness 2008). When everything is in order, the company will keep track of two types of transparency: the first, between producers and the government, and the second, the government's accountability to its citizens (EITI 2005). The EITI adheres to the following principles:

We agree that long-term economic growth is inextricably linked to prudent natural resource management; natural resources contribute to long-term development, but mismanagement can have a negative impact on both.

We affirm that it is the responsibility of sovereign governments to manage natural resources in the interests of their citizens' well-being.

The costs of resource extraction are paid in the form of revenues over time and are price sensitive.

The public's ability to better participate in public debates about feasible long-term plans, make more informed decisions, and provide better options for financing long-term goals could all benefit from a historical record of government revenues and expenditures over time.

In the extractive industries, we emphasize the importance of governmental and corporate transparency, and we call for increased public financial monitoring and reporting.

We recognize that greater transparency must be balanced with strict adherence to contracts and laws in order to avoid fraudulent claims.

We recognize the unique advantages that increased financial transparency provides for both domestic and international investment.

We believe in the principle and practice of equitable tax/expenditure distribution to ensure that all citizens are well-served.

We're committed to promoting high levels of transparency and accountability in both the government and the private sector.

To achieve our objectives, we need a consistent and practical approach to the disclosure of key attribute information. Simple to achieve and simple to carry out the public should be informed about all extractive industries operating in a given country (EITI 2003).

For countries, this opportunity provides benefits such as increased investor confidence, a stronger commitment to good governance, and greater political stability (EITI 2005). EITs were created to address the issue of natural resource dependency, with the long-term goal of improving governance and exposing the risks involved (Kolstad and Wiig 2007). Azerbaijan, the Central African Republic, Mauritania, Mali, the Mongols, Peru, and Niger are among the fourteen countries that have made EIT compliance official. Albania, Guinea, The Republic of the Congo, Cameroon, Congo-Kinshasaassou, Indonesia, Iraq, Madagascar, and Sierra Leone have also been awarded this title (EITI 2012). Twenty countries have formally expressed their desire to participate in this initiative and have begun the EITI compliance process at various stages. Promoting initiatives like EIT, on the other hand, would be free. Tax audits promote transparency and help to prevent public funds from being misappropriated. Citizens in the vast majority of SSA countries have no idea how much money is generated from natural resources or how it is spent. Hidden bank accounts in developing countries are frequently used to fuel corruption. Although resource reserves may fluctuate, no attempt is made to calculate revenue stolen by government officials. By auditing funds and increasing transparency, it is possible to increase the flow of money towards economic development. This claim will be put to the test to see if EIT has had an impact on the economy of a resource-rich SSA country. The following are some of the economic and political factors that contribute to the natural resource curse:

Unemployment is common in resource-rich areas due to insufficient employment and high commodity price volatility (Stiglitz 2012). A resource-rich country's political and institutional resources have a significant impact on its resource wealth, and the government is usually corrupt. Resource-rich countries must strive to develop transparency and laws that redistribute resources (information) to their citizens, according to "institutional theory," which examines "the processes by which schemes, rules, norms, and practices are established as legitimate guidelines for behavior" (Scott 2001).

Methodology

Panel egression model is fitted to established relationship between dependent variable which is GDP Per Capita per each of the SSA countries in EITI scheme and independent variables used to established the fitted Panel regression model includes Inflation for each of the SSA countries supported by EITI, EITI dummy (1 for yes), natural resources (which includes renewable, non-renewable, depletable and non-depletable) and Indicators of transparency, which are defined shortly, are voice and accountability, corruption, quality of budget, and fiscal management. Each of these is used as a variable of transparency in this study. *Voice and accountability* indicates citizens' opportunities to exercise political rights, such as political rights, and the extent to which civil liberties are granted, and to their media, which is a scale developed by World Governance personal gain gained through abuse of authority calculated according to the CPI-published parameters believe that there is a correlation between corruption in the public sector and natural resource shortages in the economy (Torvik 2002; Robinson, Torvik, and Verdier 2006). The CPI (although imperfect) is more widely used as an overall measure. World Bank Worldwide Governance Indicators Ten countries are participants in the EITI, while another ten are not.

Method of data analysis

The method of data analysis used in this research work is the descriptive statistics, fixed effect model, random effect

model, Hausman technique, correlation analysis and Independent t test. In order to test the hypotheses concerning the relationship between the dependent and independent variables, STATA 16 software was used.

Model specification

The formulated hypothesis will be tested using the functional description of the model, which is:
GDP Per Capita = f (I, QB, VA, EITI, C, NR).

Econometrically, the panel regression models can be expressed as:
In panel data analysis, there is often a challenge which estimator is best suited to the model. Is that a fixed effect or a random effect? The generalized model for panel data is $Y_{it} = a_i + BX_{it} + U_{it.}$ The null hypothesis assumes that ai has no relationship with the explanatory factors. That is, ai is independent of the model's explanatory variable, as opposed to the alternative hypothesis that ai is connected with the independent variable, and this frequently generates confusion among researchers about which model or estimator to use. So, when the null hypothesis is rejected, you conduct the analysis with fixed effect, according to the Hausman test.

Decision rule: Reject the null hypothesis if P< and do not reject if otherwise. Where is the significant level (1%, 5%, 10% respectively?

$$\text{GDP Per Capita}_t = \beta_0 + \beta_1 \text{Inflation}_{it-1} + \beta_2 QB_{it} + \beta_3 VA_{it} + \beta_4 EITI_{it} + \beta_5 C_{it} + \beta_6 NR_{it} + \varepsilon_{it}$$

The dependent variable which is GDP Per Capita per each of the SSA countries in EITI scheme while the independent variables are Inflation for each of the SSA countries supported by EITI, EITI dummy (1 for yes), natural resources (which includes renewable, non-renewable, depletable and non-depletable) and Indicators of transparency, which are defined shortly, are voice and accountability, corruption, quality of budget, and fiscal management
Besides, there is need for normality test that reveal the satisfaction of the model assumptions to ensure that ordinary least square panel model applied is fit and robust.

Where, I = Inflation, QB = Quality of budget and fiscal management, VA = Voice and accountability, EITI = Of the twenty countries in the study, ten are SSA countries that are implementing EITI and another ten SSA countries that do not participate in the EITI scheme (dummy), C = Corruption and NR = Natural resources while ε_{it} is the error term (Allison and Paul, 1999)
Independent sample T test is applied to examine the difference in economic growth of SSA countries that participate in EITI and those that does not participate in EITI scheme.

Table 1: EITI Countries and Non-EITI Countries

EITI Countries	Non-EITI Countries
Burkina Faso	Angola
Ghana	Botswana
Liberia	Equatorial Guinea
Mali	Gabon
Mozambique	Guinea Bissau
Niger	Namibia
Nigeria	Sao Tome and Principe
Tanzania	South Africa
Togo	Sudan
Zambia	Zimbabwe

Source: Extractive Industries Transparency Initiative (EITI, 2016)

Correlation analysis was also carried out to measure the strength of association between the variables of interest in this study. Pearson correlation was adopted to test the significance of the correlation among GDP Per Capita per each of the SSA countries in EITI scheme, Inflation for each of the SSA countries supported by EITI, EITI dummy (1 for yes), natural resources (which includes renewable, non-renewable, depletable and non-depletable) and Indicators of transparency, which are defined shortly, are voice and accountability, corruption, quality of budget, and fiscal management.

Besides, independent t test is also adopted to examine the difference in economic growth between EITI countries and non-EITI participants. Independent t test is applied to test for difference between two independent variables on a dependent variable. The two independent variables here are EITI countries and non-EITI participants while the dependent variable is the economic growth. STATA software will also be used to do this.
Data collected is the annual data from 2001 to 2020 for each of the SSA countries in EITI scheme that participated in EITI scheme which make 200 observations being considered under this study and it is extracted from databank.worldbank.org which is the site of world development indicators.

Results and Interpretation

The data analysis was done using Stata 16.0 and results are discussed below to answer the following research questions and hypothesis.

Research questions:

- Does transparency affect the economic growth of SSA that participated in EITI?
- Does inflation affect the economic growth of SSA Countries that participated in EITI?

- Is there a difference between the economic growth of SSA countries that participate in EITI and those not participating in EITI?

Research hypothesis

H1: There is a relationship between transparency and economic growth in
SSA countries that participated in EITI.
H2: There is a difference in economic growth between EITI countries and non-
EITI participants
H3: There is a relationship between economic growth and inflation.

Table 2: Descriptive statistics

Variables	N	Mean	SD	Min	Max
Inflation	200	73.63	11.56	26	93
QB	200	53.94	10.77	14	70
Corruption	200	63.47	11.37	31	121
VA	200	12.11	4.54	3	62
GDPPERCapita	200	86.44	14.84	39	133
Natural Resources	200	11.02	2.66	5	15

Source: Author's computation using Stata software

Table 2 shows that on the average inflation is about 74% of the 200 observations, quality of budget and fiscal management is about 54% on average, corruption practices is about 63% on average, voice and accountability is about 12% on average, natural resources is about 11% on the average and GDP Per capita is about 86% on the average. However, the natural resources have the least variability due to its lowest standard deviation value of about 2.6 and GDP Per Capita has the greatest variability due to its highest standard deviation value of about 86.4.

Hausman test

The Hausman test (P<0.01) which indicate that the model is statistically significant as we can see in the appendix 2 and this indicate that the fixed effect regression model would be used to run the analysis of this work.

Table 3: Fixed effects regression

GDPPERCapita	Coefficient estimate	Test statistic	P-value
Inflation	0.397	4.64	0.000
QB	0.096	0.94	0.348
VA	0.544	3.46	0.001
EITI	-0.962	-0.10	0.918
Corruption	0.414	4.41	0.000
Natural Resources	-0.551	-1.90	0.058
Constant	25.680	3.47	0.001
Overall P-value	0.0000		

Where asterisks *** ** and * are 10%, 5% and 1% significant level respectively

Source: Author's computation using Stata software

Table 3 reveals that the overall fixed effect regression model (P<0.01) indicate that the model is statistically significant at 1% level and this follows that the model is a good fit for the data and can be used for future prediction of GDP Per capita for the 10 Sub-Saharan countries that participated in EITI scheme.
Inflation (β = 0.397, P = .000), Corruption (β = 0.414, P = .000), Voice and accountability (VA) (β = 0.544, P = .001), and Natural resources (β = -0.551, P = .058). This tells us that transparency indicator is statistically significant at 1% level for corruption and VA while Inflation is statistically significant at 1% level while the natural resources is statistically significant at 10% level. This follows that inflation, and transparency indicators have positive significant impact on economic growth of Sub-Saharan countries that participated in EITI scheme while the natural resources show a negative significant influence on the economic growth which can be attributed to the natural resource's depletion. This answer the research questions that transparency affects the economic growth of SSA that participated in EITI and inflation also affect the economic growth of SSA Countries that participated in EITI.
In order to ensure that we have a valid and robust fixed effect regression model, the normality diagnostic is very necessary.

Table 4: Normality test

Variable	N	P-value
Inflation	200	0.848
QB	200	0.815
Corruption	200	0.837
VA	200	0.525
GDPPERCapita	200	0.879
Natural Resources	200	0.114

Source: Author's computation using Stata software

The data was not satisfy but was corrected using Shapiro-Wilk log-normal as a corrective measure to the violation of the normality assumption and we can see that the data is normally distributed as the P > 0.05 for all the data observations and this satisfy the normality assumption which makes the model very robust.

Independent t test

We can see from the appendix 2 that the independent t test P > 0.05 for both one tail and two tail test which tells us that we cannot reject the null hypothesis and this follows that there is no difference in economic growth between EITI countries

and non-EITI participants. This also answer the research question that there is no significant difference in the economic growth between countries that participated in EITI and countries that does not participate in EITI scheme.

Correlation analysis

In appendix 2, the asterisk * indicate that the relationship between inflation and Economic growth of SSA countries that participated in EITI scheme is statistically significant at 1% level. In the same vain, the asterisk * indicate that the relationship between transparency indicator (QB, Corruption and VA) and Economic growth of SSA countries that participated in EITI scheme is statistically significant at 1% significant level. And this support the research hypothesis that there is sufficient evidence to conclude that there is a relationship between economic growth and inflation. It also supports that there is a relationship between transparency and economic growth in SSA (Sub-Saharan) countries that participated in EITI. The correlation coefficient also indicates a positive correlation or relationship between them.

Conclusion

The study had two goals: to look into transparency, which is one of the most commonly prescribed remedies for overcoming the natural resource curse, and to see if an international voluntary initiative has an impact on SSA participants' economic growth. Although transparency is an important feature of a good institution, it is not the only factor that transforms and ignites resource-rich countries' economies development. According to the fitted fixed effect regression, transparency has a statistically significant impact on the economic growth of the ten resource SSA countries under consideration, confirming the literature that transparent governments are more likely to be free of corruption. "Weak governance is accompanied by corruption," according to Méon and Sekkat (2005), while the Open Society Institute of Southern Africa (2007) discovered that resource-rich SSA countries like the Congo and Malawi rely on being open to globalization for their success (FSOA, 2007). Natural resources, on the other hand, have no significant impact on economic growth. This is consistent with Sachs and Warner's (1995; 2001) findings that growth slows as natural resources become scarce. The descriptive statistics also show that natural resources account for about 11% of total resources, implying that scarce natural resources lead to lower economic growth. Furthermore, there is a strong link between transparency and economic growth, which simply means that countries that participate in global transparency initiatives will have high-quality budgets, be free of corruption, have good accountability, and have a strong economic performance that will guaranteed her citizens a good standard of living both now and in the future.

Acknowledgment

I want to appreciate the almighty God for the wisdom bestowed on me to write this article and I want to thank my wife Clara Adebanjo for her profound commitment to home during this scholarly study. I must appreciate Dr. Olugbode M.A, Senior lecturer, Federal school of statistics and former state coordinator of national bureau of statistics, Nigeria who is also my co-author. I acknowledged Prof Vincent O Akinyosoye, former director general national bureau of statistics, Dr. Balogun K.O, Rector, Federal school of statistics and Dr. Obisesan K.O, senior lecturer, university of Ibadan. Thank you all and God bless.

References

Allison, Paul D. (1999). Multiple Regression: A Primer. Newbury Park, CA: Pine Forge Press.

Auty, Richard M., ed. (2001). Resource Abundance and Economic Development. Oxford:
Oxford University Press.

Barbier, Edward B. (2003). The Role of Natural Resources in Economic Development"
Australian Economic Papers 42.2 (2003): 253-272.

Barbier, Edward B. (2005). Natural Resources and Economic Development. Cambridge: Cambridge University Press.

Birdsall, Nancy, Thomas Pinckney, and Richard Sabot. (2000). "Natural Resources, Human Capital, and Growth," working paper, Carnegie Endowment for International Peace: Washington, DC.

Breusch, T. S., and A. R. Pagan. (1979). "Simple Test for Heteroscedasticity and Random Coefficient Variation." Econometrica 47 (5): 1287–94.

Collier, Paul. (2007). "Is Aid Oil? An Analysis of Whether Africa Can Absorb More Aid."
World Development 34 (9): 1482–97.

Collier, Paul, and Anke Hoeffler. (2005). "Resource Rents, Governance and Conflict."
Journal of Conflict Resolution 49: 625–33.

Corden, Max W., and Peter J. Neary. (1982). "Booming Sector and De-Industrialization in a Small Open Economy." The Economic Journal 92 (368): 825–48.

Extractive Industries Transparency Initiative. (2013). The EITI Principles. London: EITI Secretariat. Accessed October 13, 2014. https://eiti.org/eiti/principles.

Fosu, Augustin Kwasi. 2010. "The External Debt-Servicing Constraint and Public- Expenditure: Composition in Sub-Saharan Africa." African Development Review 22 (3): 378–93.

Gelb, Alan H. (1988). Oil Windfalls: Blessing or Curse? New York: Oxford University Press.

Gelb, Alan, and Sina Grasmann. (2008). "Confronting the Oil Curse." Paper presented to
AFD/EUDN Conference, Paris, November.

Gylfason. (2001). "Natural Resources, Education and Economic Development". European Economic Review. 45, (4–6): 847–859.

Humphreys, Macartan, Jeffrey D. Sachs, and Joseph E Stiglitz. (2007). Escaping the Resource Curse. New York: Columbia University Press.

Karl, Terry L. (2007). "Oil-Led Development: Social, Political, and Economic Consequences." Working paper no. 80. Center on Democracy, Development, and the Rule of Law. Stanford, CA.

Kaufmann, Daniel. And and Pedro Vicente. (2011). "Legal Corruption". Economics and Politics. 23: 195–219.

Korhonen, Iikka, and Tuuli Juurikkala. (2007). "Equilibrium Exchange Rates in Oil- Dependent Countries." BOFIT Discussion Paper No. 8/2007, Bank of Finland, Institute for Economies in Transition.

Méon, Pierre-Guillaume, and Khalid Sekkat, (2005). "Does Corruption Grease or Sand the Wheels of Growth?" Public Choice 122 (1): 69–97.

Mehlum, Halvor, Karl Moene, and Ragnar Torvik. (2005). "Cursed by Resources or

Institutions?" Working Paper Series, Department of Economics, Norwegian University of Science and Technology, Trondheim, Norway.

Michel, Serge, and Michel Beuret. (2008). China Safari: On the Trail of China's Expansion in Africa. New York: Nation Books.

Neumayer, Eric, and Simon Dietz. (2005). "What Is the Appropriate Role for Economics in Sustainable Governance?" Paper presented at the Governance of Sustainability,

An International Research Conference, University of East Anglia, Norwich, UK, June 23–24.

Open Society Institute of Southern Africa. (2009). Breaking the Curse: How Transparent Taxation and Fair Taxes Can Turn Africa's Mineral Wealth into Development.

Johannesburg, South Africa: DS Print Media. Robinson, James A., Ragnar Torvik, and Thierry Verdier. (2006). "Political Foundations of the Resource Curse." Journal of Development Economics 79: 447–68.

Rodrik, Dani. (1999). "Where Did All the Growth Go? External Shocks, Social Conflicts, and Growth Collapses." Journal of Economic Growth 4 (4): 385–412.

Ross, Michael L. (2001). "The Political Economy of the Resource Curse." World Politics 51 (2): 297–322.

Sala-i-Martin, Xavier, and Arvind Subramanian. (2003). "Addressing the Natural Resource Curse: An Illustration from Nigeria." NBER Working Paper no. 9804, The National Bureau of Economic Research, Cambridge, MA.

Scott, W. Richard. (2001). Institutions and Organizations. Thousand Oaks, CA: Sage.

Shapiro, S. S., and M. B. Wilk. (1965). "An Analysis of Variance Test for Normality

(Complete Samples)." Biometrika 52 (3–4): 591–611.

Siegle, Joseph. (2008). "Governance Strategies to Remedy the Natural Resource Curse." International Social Science Journal 57: 45–55.

Stiglitz, Joseph. (2005). "Making Natural Resources into a Blessing rather than a Curse,"

in Covering Oil, A reporter's Guide to Energy and Development, Revenue Watch, Open Society ———. 2012. "From Resource Curse to Blessing". Accessed July 25, 2014.

http://www.project syndicate.org/commentary/from-resource-curse-to-blessingby- joseph-e--stiglitz. Torvik, Ragnar. (2002). "Natural Resources, Rent Seeking and Welfare." The Journal of Development Economics 67: 455–70.

Transparency International. (2013). "Corruption Perceptions Index 2013." Accessed August 30, 2014. http://www.transparency.org/. Wenar, Leif. (2008). "Property Rights and the Resource Curse." Philosophy and Public Affairs 36 (1): 2–32.

World Bank. (2009). "World Development Indicators." Accessed November 29, 2009. http://www.worldbank.org/data/.

Appendix

Appendix 1: Stata Do files

tsset Countries Years, yearly

xtreg GDPPER Capita Inflation QB VA EITI Corruption Natural resources, fe

estimates store fixed

xtreg GDPPER Capita Inflation QB VA EITI Corruption Natural resources, re

estimates store random

Hausman fixed random

pwcorr GDPPERCapita Inflation QB Corruption VA Natural resources, star(1)

ttest GDPPERCapita, by(EITI)

Appendix 2: Table of results

Stata Commands and Output

```
. hausman fixed random
```

	Coefficients (b) fixed	(B) random	(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
Inflation	.3971914	.4186824	-.021491	.032045
QB	.09589	.2038163	-.1079263	.0571917
VA	.5441647	.6073752	-.0632106	.0508153
EITI	-.9623378	3.072648	-4.034986	9.198795
Corruption	.4144543	.44334	-.0288856	.0346184
Naturalres~s	-.5509973	-.3843049	-.1666924	.1512514

b = consistent under Ho and Ha; obtained from xtreg
B = inconsistent under Ha, efficient under Ho; obtained from xtreg

Test: Ho: difference in coefficients not systematic

chi2(6) = (b-B)'[(V_b-V_B)^(-1)](b-B)
= 17.33
Prob>chi2 = 0.0081

.

Fixed-effects (within) regression — Number of obs = 200
Group variable: Countries — Number of groups = 20

R-sq:
within = 0.5145
between = 0.8416
overall = 0.6204

Obs per group:
min = 10
avg = 10.0
max = 10

F(6,174) = 30.73
corr(u_i, Xb) = 0.3132 — Prob > F = 0.0000

GDPPERCapita	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
Inflation	.3971914	.0855334	4.64	0.000	.228375	.5660079
QB	.09589	.1018107	0.94	0.348	-.105053	.296833
VA	.5441647	.1572821	3.46	0.001	.2337384	.854591
EITI	-.9623378	9.292242	-0.10	0.918	-19.30236	17.37768
Corruption	.4144543	.0938912	4.41	0.000	.2291421	.5997666
Naturalresources	-.5509973	.2892831	-1.90	0.058	-1.121953	.0199583
_cons	25.67981	7.409314	3.47	0.001	11.05611	40.30351
sigma_u	4.3875762					
sigma_e	8.7546212					
rho	.20075063	(fraction of variance due to u_i)				

Random-effects GLS regression — Number of obs = 200
Group variable: Countries — Number of groups = 20

R-sq:
within = 0.5103
between = 0.9268
overall = 0.6477

Obs per group:
min = 10
avg = 10.0
max = 10

Wald chi2(6) = 354.84
corr(u_i, X) = 0 (assumed) — Prob > chi2 = 0.0000

GDPPERCapita	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
Inflation	.4186824	.0793037	5.28	0.000	.2632501	.5741148
QB	.2038163	.0842291	2.42	0.016	.0387303	.3689023
VA	.6073752	.1488471	4.08	0.000	.3156403	.8991102
EITI	3.072648	1.314505	2.34	0.019	.496266	5.64903
Corruption	.44334	.0872761	5.08	0.000	.2722819	.614398
Naturalresources	-.3843049	.2465923	-1.56	0.119	-.8676169	.099007
_cons	11.84371	4.827551	2.45	0.014	2.381886	21.30554
sigma_u	0					
sigma_e	8.7546212					
rho	0	(fraction of variance due to u_i)				

Two-sample t test with equal variances

Group	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf.	Interval]
0	101	85.12871	1.546421	15.54134	82.06066	88.19677
1	99	87.78788	1.411096	14.04023	84.9876	90.58815
combined	200	86.445	1.049352	14.84008	84.37572	88.51428
diff		-2.659166	2.0956		-6.791725	1.473393

diff = mean(0) - mean(1) t = -1.2689
Ho: diff = 0 degrees of freedom = 198

Ha: diff < 0 Ha: diff != 0 Ha: diff > 0
Pr(T < t) = 0.1030 Pr(|T| > |t|) = 0.2060 Pr(T > t) = 0.8970

	GDPPER~a	Inflat~n	QB	Corrup~n	VA	Natura~s
GDPPERCapita	1.0000					
Inflation	0.6906*	1.0000				
QB	0.6338*	0.6086*	1.0000			
Corruption	0.7207*	0.6850*	0.6837*	1.0000		
VA	0.4152*	0.2890*	0.2981*	0.3006*	1.0000	
Naturalres~s	0.0381	0.0809	0.0531	0.0916	0.1059	1.0000

Journal of Environmental Science and Economics
https://doi.org/10.56556/jescae.v1i2.16
ISSN: 2832-6032

RESEARCH ARTICLE

Corporate Social Responsibility impacts sustainable organizational growth (firm performance): An empirical analysis of Pakistan stock exchange-listed firms

Muhammad Naveed Jamil[1]*,Abdul Rasheed[2], Zeeshan Mukhtar[3]

[1,2,3]Department of Management Sciences, (KFUEIT) Rahim Yar Khan, Pakistan

Corresponding Author: Muhammad Naveed Jamil, mnaveedknp@gmail.com
Received: 02 February, 2022, Accepted: 25 March, 2022, Published: 28 March, 2022

Abstract

This study examines of impact on Organizational sustainable growth (firm performance) of Corporate Social responsibility, Leverage on Assets, firm age and firm. This study used sample data of 296 Pakistan stock exchange-listed firms and applied correlation, Ordinary least square regression model for estimate factor impact, and Robustness use for the result is reliable and sustainable. This study used Sustainable Corporate Social responsibility (independent variable), leverage on Assets (moderator variable), firm age and firm size (control variable) and Correlation, Ordinary least square regression model that confirmed their variables, i.e. Corporate Social responsibility, Leverage on Assets, firm age and firm size highly impacting on sustainable organizational growth (firm performance). Robustness test results also confirm the reliability, validity and sustainability of results. That shows results are highly significant reliable, and sustainable. Sustainable Corporate Social responsibility is the leading factor that enhances the firm performance. Firm size and age are significant for sustainable organizational growth (firm performance). This study implication is very significant; policymakers more focus on Sustainable Corporate Social responsibility and corporate commitments. Study recommended to firms; developed a sustainable environmental structure: Enhancing the employee's motivation (self-efficacy), performance per-motion bonuses, employee's need and Corporate Social responsibility leads to sustainable organizational growth (firm performance).

Keywords: Sustainable organizational growth (firm performance); Sustainable Corporate Social Responsibility; Leverage on Assets; Firm Age; Firm Size

Introduction

Sustainable Corporate Performance is the most recent, famous and widespread concept. Markets need and human resources participation in industries is essential; Sustainable Corporate Performance depends on environmental sustainability. Sustainable Corporate Performance is role play in ethical and efficacy of employees for goals and decision-making planning and strategies. Business motives to earn profit and low expenses general way to maximize earning. Some indirect expenses that essential for firms to bear for sustain firm environment, survival in market competition. One of those expenses is Sustainable Corporate Social responsibility. Companies for his survival do different mergers, focus research and development, and capture new markets. Achieving so much, but in between the social values and responsibility minimized. To examines the moderating and direct impact between corporate social responsibility and firm performance (Anser, M. K., et al. 2018). Firm's CSR concept was used to measure the relationship with IT-enabled innovation, and its impact on Firm's performance. CSR and IT-enabled innovation have a positive impact on Firm's performance for long term financial values (Jung, M., et al. 2022). Corporate social responsiblilty and green production innovation impact on firm performance. Researcher data was collected through distributing 259 questionnaires between firms worker and conclued that CSR and green production innovation have positive impact on firm performance (Hang, Y., et al. 2022). Corporate social responsibility and green dynamic capability (production and process innovation) concept was adopted to measure the firm performance by surveying 424 manufacturing firms of China and examines through linear Regression. Research reveals the impact of CSR on green innovation and firm performance (Yuan, B. and X. Cao 2022). In similar context examine the energy; exchange rate regimes; exchange rate and consumer price impact on grwoth (Jamil, M. N. 2022).

Emparicial study investigate the sustainability reporting on firm performance. Researcher used seven sector data and conclude that cross sectorial reporting have different results on; Return on assets, return on equaty and market performance (Al Hawaj, A. Y. and A. M. Buallay 2022). Empirical studies more focus on estimating employees' perceived corporate social responsibility with organization commitments. The researcher focuses on organizational trust, social exchange and organization identification (Farooq, Payaud et al. 2014). Innovation is a key factor for reaching sustainable growth through energy efficiency and energy intensity efficacy at the macro level. This study explains the significance of environmental sustainability (green) growth through Sustainable Corporate Performance. The fourth industrial revolution for our society changes in productive ways and provides opportunities for sustainable living. Empirical studies focus on integrating industry and corporate sustainability (Dubey, Gunasekaran et al., 2017). Sustainable Corporate Performance has no relationship between energy intensity efficacies. Across the world, Sustainable Corporate Performance is role play in ethical and efficacy of employees for goals and decision-making planning and strategies (Branco and Rodrigues 2006). Carroll stated that large organizations have perfect decision-making capacity due to the influence of the organization and employees Sustainable Corporate Performance (Carroll 1999). Sustainable Corporate Performance is highly affected by organization environmental sustainability (Kolk 2016). In recent decades, the corporate has more focused on implementing responsibility behaviors only for profit-making activity rather than environmental sustainability (Camilleri 2017). Organizational development that meets the production needs without compromising future production with help factor of stakeholder relationship management, organization focus on social and environmental stakeholders rights. (Steurer, Langer et al. 2005). Recent academic research articles overlap the concept of business ethics and corporate performance (Fassin, Van Rossem et al., 2011). The above scenario motivates me important factors missing in empirical research; environmental sustainability CSR, Leverage on Assets, Firm age and firm size may affect Sustainable Corporate Performance; therefore, the study uses those factors for estimation of Sustainable Corporate Performance.
H1: Environmentally Sustainable Corporate Social responsibility positively impacts Sustainable Corporate Performance.

Literature Review

Empirical studies examine the insight, upper echelons, and organizational perspectives that affect corporate social responsibility. Sustainable Corporate Social responsibility can influence the personal needs of employees and get attention (Petrenko, Aime et al. 2016). Macro-level technology development is leading the countries sustainability (Gouvea, Kapelianis et al. 2018) environmental sustainability among employed I.T. and organizational goals (Di Pasquale, Franciosi et al. 2022). Society unpredictable costs and his transformative nature effect estimate (Binder and Witt 2011). The researcher investigated the Sustainable Corporate Social responsibility can the organization's performance; there were six companies focused on Pakistan content, both primary and secondary data used by the researcher; estimation through regression. Results indicate that Sustainable Corporate Social responsibility is useful and better for the organization environment and organizational performance (Siddiq and Javed 2014). This paper increases the sample size by 9 to 296 stock exchange companies of Pakistan. This study gives more comprehensive results and indications on Sustainable Corporate Social responsibility and Sustainable Corporate Performance. Researches on Sustainable Corporate Social responsibility have a significant effect on corporate financial performance and behavior estimate with Sustainable Corporate Social responsibility. Focus on organization commitment and organization performance estimate with equation model SEM technique for test indications. Therefore a positive relationship is found between Sustainable Corporate Social responsibility activity and organization performance, employees commitments and organization performance. Sustainable Corporate Social responsibility enhances the employee's commitment and organization performance (Ali, Rehman et al. 2010).

Research Methodology

Data: This study analyzes the impact of Sustainable Corporate Social responsibility on Sustainable Corporate Performance. The data sample is 296 Pakistan listed in the Pakistan stock exchange for 2011 to 2020. Therefore secondary research is conducted and sample data collection on company sites and Pakistan stock exchange site. The Ordinary Least Square regression model adopts to test the impact of Sustainable Corporate Social responsibility on Sustainable Corporate Performance. A robustness test is used to check the validity and sustainability of research results. The study uses sustainable organizational growth Return on Assets, environmental sustainability CSR and Leverage on Assets moderator. Firm age and firm size may affect Sustainable Corporate Performance; therefore study use as controlling factor of CSR. The equation is bellowed:

$$firm\ performace = ß + CSR + Leverage\ (A) + firm\ age + firm\ size$$

$$firm\ performace = ß + CSR + Leverage\ (A) + CSR * Leverage(A) + firm\ age + firm\ size$$

ß is used for the estimator of variable, Firm performance measure Return on Assets, CSR denoted Sustainable Corporate Social responsibility, and S.S. used for Leverage on Assets. Firm age and firm size used as control variables may enhance Sustainable Corporate Social responsibility and sustainable organizational growth.

Comparison, Results and Discussion

Table 1. Descriptive statistics

	FIRM PERFORMANCE (ROA)	CSR	LEVA	AGE	SIZE
Mean	0.0345	80.3535	0.6282	38.1891	15.4126
Median	0.0318	31.5471	0.5652	35.0000	15.3895
Maximum	0.7578	3064.0540	6.8937	108.0000	20.5741
Minimum	-4.2207	-13.9727	0.0000	5.0000	8.7849
Std. Dev.	0.1419	177.9206	0.4936	16.0880	1.7213
Observations	2670	2670	2670	2670	2670

The above table shows the descriptive statistic, which shows the worth and potential. Sustainable Corporate Social responsibility means at 80.3535, and Standard deviation of 177.9206 demonstrates high potential and worthy variables compared to others. Sustainable Corporate Social responsibility is an 80.3535 potential to enhance sustainable organizational growth.

Table 2. Correlation

	FIRM PERFORMANCE (ROA)	CSR	LEVA	AGE	SIZE
FIRM PERFORMANCE (ROA)	1.0000	0.1216	-0.1355	0.0119	0.1320
CSR	0.1216	1.0000	-0.0822	0.2080	0.1251
LEV. (A)	-0.1355	-0.0822	1.0000	-0.0747	-0.0154
FRIM AGE	0.0119	0.2080	-0.0747	1.0000	0.0932
FIRM SIZE	0.1320	0.1251	-0.0154	0.0932	1.0000

The above table shows a correlation matrix that examines the endogenous factor between Sustainable Corporate Social responsibility and sustainable organizational growth leverage on Assets, firm age and firm size. Correlation can exist and measure between +1 and -1 when it is near a correlate and endogenous issue. CSR, firm age, firm size has positive and Leverage have negative correlation matrix Firm performance (return on Assets).

Table 3. Regression (Firm Performance)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
CSR	8.71E-05	1.55E-05	5.615125	0.0000
LEV. (A)	-0.039794	0.005413	-7.351778	0.0000
FIRM AGE	-0.000386	0.000169	-2.292371	0.0220
FIRM SIZE	0.004429	0.000502	8.823908	0.0000
R-squared	0.040436	Mean dependent var		0.034453
Adjusted R-squared	0.039356	S.D. dependent var		0.141862

S.E. of regression	0.139043	Akaike info criterion	-1.106575
Sum squared resid	51.54140	Schwarz criterion	-1.097751
Log-likelihood	1481.278	Hannan-Quinn criter.	-1.103382
Durbin-Watson stat	1.357283		

Regression analysis is used to check the impact of Sustainable Corporate Social responsibility, Leverage on Assets, firm age and firm size on sustainable organizational growth. The above table shows Sustainable Corporate Social responsibility at 8.71, and firm size at 0.004 have a positive impact and is highly significant for sustainable organizational growth (firm performance). In comparison, Leverage on Assets moderator at -0.039 and firm age (controlling) at -0.0003 negatively but highly significant for sustainable organizational growth.

Table 4. Robustness Test

Variable	Coefficient	Std. Error	z-Statistic	Prob.
CSR	7.30E-05	9.00E-06	8.112785	0.0000
LEV. (A)	-0.091426	0.003140	-29.12034	0.0000
AGE	-0.000451	9.77E-05	-4.615276	0.0000
SIZE	0.006523	0.000291	22.40778	0.0000

Robust Statistics

R-squared	0.068341	Adjusted R-squared	0.067292
Rw-squared	0.223836	Adjust Rw-squared	0.223836
Akaike info criterion	3395.141	Schwarz criterion	3419.831
Deviance	17.28305	Scale	0.071420
Rn-squared statistic	1410.351	Prob. (Rn-squared stat.)	0.000000

Non-robust Statistics

Mean dependent var	0.034453	S.D. dependent var	0.141862
S.E. of regression	0.141436	Sum squared resid	53.33075

A robustness test is used to check the validity and sustainability of research results. The above table shows whether corporate social responsibility, Leverage on Assets, firm age, and firm size impact sustainable organizational growth are valid or sustainable. Results show Corporate Social responsibility, Leverage on Assets, firm age and firm size significant level on top and bellow to 1 per cent level of significance. That shows results have very reliable and sustainable.

Conclusion and Policy Recommendations

This study examines the impact of Sustainable Corporate Social responsibility, Leverage on Assets, firm age and firm size on sustainable organizational growth. Sustainable Corporate Social responsibility is an essential factor and shows the employees and organizational behavior that affect firm performance. This study used Sustainable Corporate Social responsibility (independent variable), leverage on Assets (moderator variable), firm age and firm size (control variable) and applied Correlation, Ordinary least square regression model that confirmed their variables highly impacting on sustainable organizational growth. After estimation of results, robustness tests are used to check the reliability, validity and sustainability of results. That shows results are highly significant, reliable, and sustainable—the descriptive statistic that shows the variable's worth and potential. Sustainable Corporate Social responsibility is an 80.3535 potential to enhance sustainable organizational growth. The correlation matrix examines the endogenous factors CSR, firm age, firm size have positive and Leverage have negative correlation matrix Firm performance (return on Assets). Regression analysis is used to check the impact of Sustainable Corporate Social responsibility, Leverage on Assets, firm age and firm size on sustainable organizational growth. The above table shows Sustainable Corporate Social responsibility at 8.71, and firm size (controlling) at 0.004 have positive; Leverage on Assets moderator at -0.039 and firm age (controlling) at -0.0003 negatively but highly significant for sustainable organizational growth

(firm performance). A robustness test is used to check the reliability and sustainability of research results. Results show that corporate social responsibility, Leverage on Assets, firm age, and firm size are highly significant; that shows results are very reliable and sustainable. Sustainable Corporate Social responsibility is the leading factor that enhances the firm performance. Firm size and age matter for sustainable organizational growth (firm performance). This study implication is very significant; policymakers follow the research results and more focus on Sustainable Corporate Social responsibility and corporate commitments. Study recommended to firms; developed a sustainable environmental structure: Enhancing the employee's motivation (self-efficacy), performance per-motion bonuses, employee's need and Corporate Social responsibility leads to sustainable organizational growth (firm performance).

Reference

Ali, I., et al. (2010). "Corporate social responsibility influences employee commitment and organizational performance." African Journal of Business Management **4**(13): 2796-2801.

Al Hawaj, A. Y. and A. M. Buallay (2022). "A worldwide sectorial analysis of sustainability reporting and its impact on firm performance." Journal of Sustainable Finance & Investment **12**(1): 62-86.

Anser, M. K., et al. (2018). "Moderating effect of innovation on corporate social responsibility and firm performance in realm of sustainable development." Corporate Social Responsibility and Environmental Management **25**(5): 799-806.

Binder, M. and U. Witt (2011). As innovations drive economic growth, do they also raise well-being?, Papers on Economics and Evolution.

Branco, M. C. and L. L. Rodrigues (2006). "Corporate social responsibility and resource-based perspectives." Journal of Business Ethics **69**(2): 111-132.

Camilleri, M. A. (2017). "Corporate sustainability and responsibility: creating value for business, society and the environment." Asian Journal of Sustainability and Social Responsibility **2**(1): 59-74.

Carroll, A. B. (1999). "Corporate social responsibility: Evolution of a definitional construct." Business & Society **38**(3): 268-295.

Di Pasquale, V., et al. (2022). "Smart manufacturing for sustainability: Trends and research challenges." Journal of Industrial Engineering and Management **15**(1): 1-3.

Dubey, R., et al. (2017). "Sustainable supply chain management: framework and further research directions." Journal of cleaner production **142**: 1119-1130.

Farooq, O., et al. (2014). "The impact of corporate social responsibility on organizational commitment: Exploring multiple mediation mechanisms." Journal of Business Ethics **125**(4): 563-580.

Fassin, Y., et al. (2011). "Small-business owner-managers perceptions of business ethics and CSR-related concepts." Journal of Business Ethics **98**(3): 425-453.

Gouvea, R., et al. (2018). "Assessing the nexus of sustainability and information & communications technology." Technological Forecasting and Social Change **130**: 39-44.

Hang, Y., et al. (2022). "Does corporate social responsibility and green product innovation boost organizational performance? a moderated mediation model of competitive advantage and green trust." Economic Research-Ekonomska Istraživanja: 1-21.

Jung, M., et al. (2022). "Investigating the Interaction Effect between IT-enabled Innovation and Corporate Social Responsibility on Firm Performance." Information Systems Management: 1-20.

Jamil, M. N. (2022). "Impact the Choice of Exchange Rate Regime on Country Economic Growth: Which anchor Currency leading the 21st Century" Journal of Environmental Science and Economics, https://doi.org/10.5281/ZENODO.6165201

Jamil, M. N. (2022). "Monetary Policy Performance under Control of exchange rate and consumer price index." Journal of Environmental Science and Economics 1((1)): 35–45. https://doi.org/10.5281/zenodo.6177519

Jamil, M. N. (2022). "Critical Analysis of Energy Consumption and Its Impact on Countries Economic Growth: An empirical analysis base on Countries income level." Journal of Environmental Science and Economics **1**((2)): 1-16. https://doi.org/10.5281/zenodo.6202338

Kolk, A. (2016). "The social responsibility of international business: From ethics and the environment to CSR and sustainable development." Journal of World Business **51**(1): 23-34.

Petrenko, O. V., et al. (2016). "Corporate social responsibility or CEO narcissism? CSR motivations and organizational performance." Strategic Management Journal **37**(2): 262-279.

Siddiq, S. and S. Javed (2014). "Impact of CSR on organizational performance." European Journal of Business and Management **6**(27): 40-45.

Steurer, R., et al. (2005). "Corporations, stakeholders and sustainable development I: a theoretical exploration of business–society relations." Journal of Business Ethics **61**(3): 263-281.

Yuan, B. and X. Cao (2022). "Do corporate social responsibility practices contribute to green innovation? The mediating role of green dynamic capability." Technology in Society: 101868.

Journal of Environmental Science and Economics ISSN:2832-6032
https://doi.org/10.56556/jescae.v1i2.17

RESEARCH ARTICLE

Dynamic relationship between Air pollution and Economic growth in Jordan: An Empirical Analysis

Seun Adebowale Adebanjo[1*],Twahil Hemed Shakiru[2]

[1]Statistical training and Consultation Nigeria
[2]Jiangxi University of finance and Economics, China

Corresponding Author: Seun Adebowale Adebanjo, seunadebanjo9@gmail.com
Received: 04 February, 2022, Accepted: 30 March, 2022, Published: 01 April, 2022

Abstract
Apparently, throughout human history, pollution and the economy appear to have been inextricably linked. However, the relationship between environmental harm and economic development is complex, and disciplinary biases have splintered our understanding of it. This study applies Johansen cointegration which indicate that there exists a long-term relationship between air pollutants and economic growth. Multiple regression model indicates that there is a significant relationship between air pollution variables and the economic growth. The vector autoregressive model (Var) indicates a short run relationship between the variables. Then, Vector error correction model was fitted and the Environmental Kuznets Curve (EKC) is supported. More so, the EKC shows that economic growth has both positive and negative significant impact on air pollution. Meanwhile, Granger causality test shows that economic growth has causal effect on air pollution. This indicates that Jordan has reduced CO2 emissions along with other pollutants and thereby contributed to environmental improvement in the country.

Keywords: Air pollution, Environmental Kuznets curve (EKC), Cointegration test, Var model, VECM, Causality test, Multiple regression

Introduction

There has been a lot of discussion in natural and social sciences about how pollution and economic development interact. The Environmental Kuznets curve has begun to blur some of the less obvious interrelationships between economic development and environmental outcomes (Ozokcu S, Ozdemir O, 2017). It is critical to consider the carrying capacity of the ecological system. Furthermore, many studies are conducted in narrow contexts, which prevents us from putting an integrated framework to the test. In order to advance towards a circularity, we must look at how to take advantage of pollution as a material asset in the products. Especially in the less developed countries, where pollution levels are increasing rapidly, government regulations often face the challenge of conflicting narratives on economic growth and human development. Meanwhile, without tighter controls, air pollution emissions and concentrations are expected to rise rapidly, posing a serious threat to human health and the environment. The negative health effects of air pollution are expected to result in significant economic costs, with significant annual global welfare costs at the regional and sectoral levels (Jalil and Feridun, 2011). Furthermore, air pollution can harm trees and crop yields in a variety of ways (Rupakheti, 2015). Reduced crop and forest yields, reduced tree growth and survivability, and increased susceptibility to plant diseases, pests, and other stresses are all possible consequences of ground-level ozone (for instance, harsh weather). Jordan's government has made significant progress in its ability to reduce environmental degradation over the last decade.

This progress has been made possible by a stronger legislative framework, stronger institutions, and a number of publicly funded projects. The Ministry of Environment has accomplished the following since its inception in 2003: Initiated efforts to improve the treatment of industrial wastewater (establishing an industrial wastewater treatment plant in Irbid recently in partnership with the private sector, with plans in the works for a second plant in Zarqa); medical and hazardous wastes (a plant set to open at the end of 2009 will treat roughly 70% of the annual waste flow); and other wastes (a plant set to open at the end of 2009 will treat roughly 70% of the annual waste flow); and other wastes (a plant set to open at the end of 2009 will Updated and comprehensive regulations, soon to be adopted, have improved the inspection system; Played a key role in the formation of the environmental rangers department in 2006, which has improved the effectiveness of vehicle inspection, among other things; and Public consultations on a variety of

environmental issues were promoted in collaboration with local NGOs.

Jordan's air quality has significantly improved as a result of air quality initiatives (EEA, 2017). The three main air pollution investigated in this study are nitrogen dioxide, ozone, and carbon dioxide. Besides, CO2 emissions from gasoline use account for more than 60% of the greenhouse impact (Ozturk I, Acaravci A. 2020) and are the primary source of energy for the industry in general, and the automobile industry in particular, both of which are directly related to economic growth and development (Marjanovic V, Milovancevic M, Mladenovic I. 2016). While (Holtz-Eakin D, Selden TM. 2019) forecasted an annual growth rate of approximately 1.8 per cent in emissions until 2025, the most recent International Energy Outlook (EIA 2021) projected a 34 per cent increase in global energy-related CO2 emissions in 2040 relative to 2012, with developing non-OECD countries bearing a disproportionate share of the burden due to their continued reliance on fossil fuels to meet rising energy demand. However, oil, natural gas, and uranium resources are expected to run out within a few decades, and coal in nearly two centuries (Omer AM, 2019). As a result, the United Nations Environment Programme, through the International Resource Panel, recommended a strategic approach to achieving a low-carbon, resource-efficient Green Economy that seeks to decouple human wellbeing from resource consumption (UNEP 2018). Different from previous studies, this paper is prepared with the primary aim of investigating the dynamic relationship between Air pollution and Economic growth in Jordan using an empirical analysis approach and the following objectives are needed to achieve it:

- To study the relationship between economic growth on air pollution
- To examine a short run relationship between air pollutants and GDP Per capita
- To examine a long run relationship between air pollutants and GDP Per capita
- To fit a parsimonious VECM
- To study the causal effect between air pollution and GDP Per capita
- To examine the relationship between economic growth and air pollution.

Literature overview

Air pollution refers to a wide range of pollutants that are produced by a single or multiple agent. According to a European Commission study, approximately 82 percent of Europeans are exposed to air pollution (Gehrsitz 2017). Lower air quality is a major environmental problem that has an impact on humans due to air pollutants like nitrogen dioxide, carbon dioxide, and ozone (Collivignarelli et al. 2020). Air pollution is more concentrated in urban areas due to increased traffic and population density (Li et al. 2018; Qiu et al. 2019; Silva et al. 2018). The Cost of Environmental Degradation (COED,2006) in Jordan is calculated by considering both the immediate and long-term effects of degradation in a given year. The total COED is estimated to be in the range of JD 143–332 million, with an average of JD 237 million, or 2.35 percent of GDP in 2006, using a variety of well-established and internationally accepted methodologies. When the cost of emissions on the global environment is factored in, the total cost to Jordan and the rest of the world is JD 393 million. A substantial body of specialized work examines the relationship between national income levels and the need for improved environmental quality, referred to as the EKC hypothesis. According to (Kuznets S. 2018), income inequality increases initially with economic growth and then declines after the economy reaches a certain point. Using the same logic, the EKC hypothesis asserts that increasing economic growth will initially exacerbate environmental strain, but that at a certain point, increased economic growth will alleviate environmental pressure.

The other section of the literature investigates the causal relationship between energy use and economic growth. The pioneering work on the economic growth—energy consumption connection was conducted by (Kraft J, Kraft A. 2017), which established a unidirectional causal relationship between gross national product and energy consumption in the United States, whereas (Akarca AT, Long TV. 2019) established no causal relationship. Jordan has made significant progress in the energy and transportation sectors in adopting cleaner fuels. Natural gas's use in the power sector to replace diesel and heavy fuel oil has increased dramatically in recent years, reaching 77 percent of total fuel use in 2006. Furthermore, in 2008, Jordan began the phase-out of leaded gasoline and high-sulfur diesel in order to improve fuel quality and meet European EURO 4 emission standards. 6 In low-area, high-density hotspots of vehicular traffic and industrial activity, air quality is a problem. Vehicles, industries, and residential activities produce the most polluting emissions. Vehicles are a significant source of emissions in Jordan. The fleet of vehicles is rapidly growing, at a rate of 7 to 10% per year. 7 Despite this, the vehicle fleet is relatively old, with approximately 33% of the vehicles manufactured prior to 1990. When old cars are maintained and driven, they emit a significant amount of pollution. 8 Because Amman and South Amman are home to about 70% of all Jordanian automobiles (AFD 2006), they are a major source of pollution. Cement plants in Fuheis and Rashadeia, the industrial district of Hashimyeh in Zarqa, power plants,

and phosphate and potash industries in Aqaba, among others, all contribute to industrial emissions. Mining is the largest significant source of air pollution, accounting for approximately 62 percent of total suspended particles (TSP), 78 percent of PM10, and 39 percent of nitrogen oxides (NO) produced by industry.

Recent environmental policy changes, such as the ban on diesel vehicles in urban areas, have been justified by federal court rulings in order to avoid further climate change (Giesberts 2018; Schmitz et al. 2018). In Jordan, air quality is one of the most pressing environmental issues of the day, and efforts to address it are ongoing (Zambrano et al. 2010). However, for air pollution parameters, this trend does not exist, indicating that pollution levels in Jordan did not decrease proportionally. This could be because emissions cause transformations when they are released into the atmosphere. Weather conditions, in particular, have a significant impact on pollutant distribution. For example, weather conditions with a high exchange between air layers cause particles to spread more widely, resulting in lower pollutant concentrations, and vice versa. These and other factors contribute to the fact that pollution levels vary by region. For example, nitrogen dioxide levels are higher in cities, whereas ozone-induced burdens are often more difficult in rural areas. Three different pollution parameters are used to assess air quality in this study. Carbon dioxide (CO2), nitrogen dioxide (NO2), and ozone are the three gases (O3). They are standard variables used to regulate air quality in Jordan (EEA, 2017). Combustion processes are the primary source of the gaseous pollutants CO2 and NO2 (e.g. heating or traffic). One of the most common types of smog is O3 at ground level. It is the result of sunlight reacting with other pollutants such as nitrogen oxides. However, this literature explores the association between national income levels measured by gross domestic product per capita (GDP Per capita) and the demand for greater environmental quality, namely the EKC hypothesis (Song, 2008). According to income inequity first rises with economic progress and then drops as economy advances to a certain level. Following the same reasoning, the EKC hypothesis points out that intensification in economic growth will primarily cause environmental pressure, but after a particular stage, increase in economic growth will lessen the environmental pressure. Specifically, EKC expects an inverted U-shaped association between environmental degradation and economic growth (Ozokcu, 2017). Meanwhile, economic growth will amplify CO_2 emanations, but after a certain level (turning point) this connection will come to be the opposite. For that reason, after a certain period, upsurge in economic growth will lessen CO_2 emissions (Halicioglu, 2009), accordingly, economic growth itself being the way out for an uncontaminated setting.

Research Methodology

The data collected for this paper work is secondary data extracted from world bank publications (https://www.data.worldbank.org), Institute for health metrics and evaluation (IHME) and countryeconomy.com from the period of 2000 to 2020. The Empirical approach adopted is vector error correction model (VECM), Johansen Cointegration test (Johansen, 1991), Granger Causality test, and EKC model. The VECM is accompanied with unit root test which is also called for stationarity test using Augmented Dickey Fuller test (Dickey, 1979) and Johansen Cointegration test. However, the statistical tools applied shall be discussed. It is assumed and it is the basic assumption of econometrics model that the series should be stationary and for VEC model to be applied, the variables should be stationary and there should be cointegration among the variables. VECM which adopt vector autoregressive model focus on endogenous variables and allows the variables in the model to depend on it lag values of order p.

The Var model denoted by Var(p) is mathematically expressed in a general term below as

$y_t = c + A_1y_{t-1} + A_2y_{t-2} + \ldots\ldots + A_py_{t-p} + e_t$ (Gujarati, 2009) and the corresponding VEC model can be written as

$\Delta y_{1,t} = \alpha_1 (y_{2,t-1} - \beta y_{1,t-1}) + \varepsilon_{1,t}$ represent GDP Per capita as endogenous and its lag values

$\Delta y_{2,t} = \alpha_1 (y_{2,t-1} - \beta y_{1,t-1}) + \varepsilon_{2,t}$ represent Ozone as endogenous and its lag values

$\Delta y_{3,t} = \alpha_1 (y_{2,t-1} - \beta y_{1,t-1}) + \varepsilon_{3,t}$ represent Nitrogen Dioxide as endogenous and its lag values

$\Delta y_{4,t} = \alpha_1 (y_{2,t-1} - \beta y_{1,t-1}) + \varepsilon_{4,t}$ represent Carbon dioxide and its lag values

where A_1 to A_p are the coefficients of the lag values and Y_{t-1} to Y_{t-p} are the corresponding Lag values and e_t, $\varepsilon_{1,t}$ to $\varepsilon_{3,t}$ is the error term that takes care of all the unaccounted factor in the model (Hill, Griffiths and Lim, 2008).

Var model is the vector autoregressive model that treat all variables either as endogenous and allow it to depend on the lag value p. for your to estimate Var model, first your series have to be stationary of order(1), that is after the first difference or stationary of order (2) then you fit your Lag value and your R-square should be relatively high so as to ensure reliability of your var model.

Multiple regression model

Multiple regression model is fitted to predict Jordan economic growth (GDP Per Capita) with Air pollution variables such as nitrogen dioxide, ozone, and carbon dioxide.

The functional regression model is expressed as;

GDP Per Capita = f (nitrogen dioxide, ozone, and carbon dioxide)

GDP Per Capita = $\beta_o + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \ldots\beta_nX_n$ + error term

Where β_1 to β_3 are the coefficient estimates of the air pollution variables (X_1 to X_3 = nitrogen dioxide, ozone, and carbon dioxide).

Granger causality test

For us to investigate the causal relationship of the variables we perform the Granger causality test and mainly focus on the causal relationship among the variables of interest (Granger, 1987). It can be illustrated hypothetically as X causes Y (X→Y) or X is related to Y (X↔Y). This will study whether X causes Y or not. And it pairs each variable for the causality to be examined.

EKC model structure

The EKC hypothesis can be model mathematically as

$InCo2_{it} = Bo + B_1InGDPPercapita_{it} + B_2(InGDPPercapita_{it})^2 + \varepsilon_{it}$

$InNo2_{it} = Bo + B_1InGDPPercapita_{it} + B_2(InGDPPercapita_{it})^2 + \varepsilon_{it}$

$InO3_{it} = Bo + B_1InGDPPercapita_{it} + B_2(InGDPPercapita_{it})^2 + \varepsilon_{it}$

(Ozokcu, 2017)

And can be diagrammatically explained below

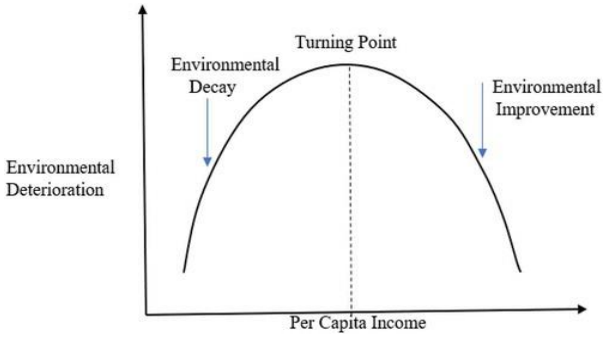


Figure 1: EKC structure

To understand the relationship between environmental quality and income, use the EKC (Song and Tong, 2008).

In the diagram above, the inverse U-shaped hypothesis would be typical. It is environmental degradation, such as carbon dioxide, nitrogen dioxide, and ozone, which is the study's focus. The independent variable is GDP Per capita income.

In the early stages of economic development, a rise in individual income also leads to an increase in individual affluence. The degree of specialization increases until a specific level is reached (the turning point). Continued economic growth brings about a lesser rate of per capita environmental deterioration. This is shown in the above typical EKC diagram a theoretical relationship between degradation per capita and wealth per capita in the shape of the EKC curve indicates whether or not the level of degradation will be maintained as long as the latter is high The EKC hypothesis is thus: In the beginning, economic activity's effect on the resource base tends to lead to a small amount of biodegradable pollution. Resource depletions and waste generation increase alongside industrialization, particularly in agriculture and other extractive and industrial processes, at an accelerating rate. at a more advanced stages of development, structural change to information-intensive industries and services, along with increasing environmental regulations and rising costs, decrease in environmental pollution, whereas low levels of development allow for its gradual pollutant discharge and acceleration and leveling off. Panayotou (1993): After confirming the location of the issue with the help of IT professionals, technicians Many economists contend that if the EKC relationship is true, economic growth is the only way to improve environmental quality. Maddison (2008) notes that, "The best – and probably the only – way to secure a decent environment is to acquire wealth. environmental factors (and income) Before we move on, we need to describe various indicators of environmental degradation. Many pollutants are created as a result of economic production and consumption. Include gases such as carbon dioxide (CO2), nitrogen dioxide (No2) and ozone (O3).

The income level value at which the indicator for environmental degradation E is at a maximum which is expressed as Y* = exp (-B1/2B2) → This is referred to as the Kuznets-Phillips curve (EKC).

Meanwhile, important diagnostic test like normality, and autocorrelation will be performed so as to be sure that the fitted model is robust, valid and reliable.

Result and Interpretation

The data used for this work is secondary data extracted from world bank (https://www.data.worldbank.org), Institute for health metrics and evaluation (IHME) and countryeconomy.com. The statistical software applied is STATA 16.0 and EViews 11.0

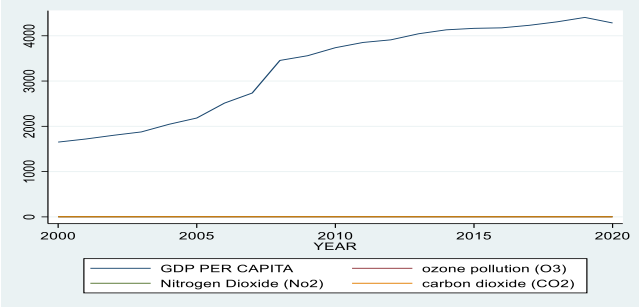


Figure 2: Graph of GDP PER capita, Nitrogen Dioxide, Ozone pollution and Carbon dioxide

Figure 2 shows that gross domestic product per capita which measure the income has the highest growth compare the air pollutants such as ozone pollution, Nitrogen Dioxide and carbon dioxide with lower growth maintaining a constant pattern. This simply means the Jordan economy has sufficiently grow to the extent of keeping environmental pollution low and thereby provide good and healthy environment to the residents of the country.

Table 1: Unit root test with Augmented Dickey fuller test (ADF)

VARIABLES	T-statistic	P-value	Order
Carbon Dioxide	-4.313	0.0037	I (1)
Nitrogen Dioxide	-4.954	0.0011	I (2)
Ozone Pollution	-4.229	0.0044	I (1)
GDP Per capita	-3.070	0.0463	I (1)

Source: Author's calculation using EViews 11.0

From the result of Table 1, we can see that P<0.05 for GDP Per capita means that GDP per capita is integrated of order 1 at 5% level of significance while carbon dioxide and Ozone (P<0.01) are also stationary after the first difference or integrated of order 1 at 1% significant level and P<0.01 for Nitrogen Dioxide means that Nitrogen dioxide is stationary after the second difference or integrated of order 2 at 1% level. This suggest that further empirical analysis can be performed since the series are stationary.

Table 2: Johansen tests for cointegration

Maximum rank	Parameters	Eigenvalues	Trace statistic	5% Critical value
0	20	-	59.65	47.21
1	27	0.845	24.19	29.68
2	32	0.582	7.60	15.41
3	35	0.318	0.32	3.76
4	36	0.017		

Source: Author's calculation using Stata 16.0

Table 3: Cointegrating equation

Equation	Parameters	Chi2 statistic	P-value
_cel	3	743.338	0.0000

Source: Author's calculation using Stata 16.0

From Table 2 and 3, the cointegration output above using Johansen shows that both the trace and max eigen value is significant at 5% level as the trace statistic (59.65) > critical value (47.21) and P<0.01 for the cointegrating equation. This indicate that there exist a cointegration between air pollution and GDP Per capita being the measure of economic growth and this suggest a long run relationship between air pollution and GDP Per capita. Since there is evidence of cointegration, it suggests fitting of both short run (VAR model) and long run (VECM).

Table 4: Vector Autoregression (short run model)

Equation	Parameters	R-squared	Chi2 statistic	P-value
GDPPERCAPITA	9	0.99	1973.17	0.0000
Ozone Pollution	9	0.78	66.86	0.0000
Nitrogen Dioxide	9	0.98	1096.37	0.0000
Carbon dioxide	9	0.89	156.08	0.0000

Source: Author's Calculation using Stata Software

From the table 4 above we can see that all the model variables (because all are treated as endogenous variable here) and their lags value are statistically significant at 1% level since P<0.01 and this indicate a short run relationship or association between air pollution and GDP Per capita. The R-square is relatively high which implies that the VAR model (vector autoregressive model) is a good fit for the data.

Long run model

Appendix part C show the equation of the vector error correction model (VECM), we can see that parsimonious VECM is achieved with GDP Per capita and Nitrogen dioxide as both are statistically significant at 1% significant level.

Table 5: Granger Causality Wald test

Equation	P-value
GDPPERCAPITA cause ALL	P<0.01
Nitrogen dioxide cause ALL	P<0.01
Carbon dioxide cause ALL	P<0.01

Source: Author's Calculation using Stata Software

Table 5 reveals a Granger causality test output and we can see that GDP Per Capita cause all at 1% level which means GDP PER CAPITA cause ozone pollution, GDP Per Capita cause Nitrogen Dioxide, and GDP Per Capita cause carbon dioxide at 0.01 significant level. This tells us that there is a causal effect of GDP per capita on the three air pollutants under this study. Besides, Nitrogen dioxide and carbon dioxide also cause all at 0.01 significant level.

Table 6: Multiple Regression analysis

Overall regression: Prob>F=0.0000, F (3,17) = 76.32, R-squared = 0.93

GDPPERCAPITA	Coefficient estimate	Test statistic	P-value
Ozone pollution	-1651.85	-1.38	0.185
Nitrogen dioxide	4861.02	8.09	0.000
Carbon dioxide	-888.75	-2.57	0.020
cons	-3816.77	-0.90	0.378

Source: Author's Calculation using Stata Software

From table 6, the regression analysis shows that the overall regression model (P<0.01, F (3,17) =76.32) implies that the model is statistically significant and this implies that there is a significant relationship between economic growth and air pollution variables. R-squared = 0.93% indicate that 93% variation in economic growth of Jordan can be explained by the three Air pollution variables under study. The regression model is significant and R-squared is relatively high which means that the model is adequate and a good fit for the data. Meanwhile, Nitrogen dioxide (P<0.01, β = 4861.02) implies that nitrogen dioxide has a positive significant impact on the Jordan economy while Carbon dioxide (P<0.05, β = -888.75) indicate that carbon dioxide has a negative significant impact on GDP Per capita (Jordan economic growth).

EKC equations

Appendix part C reveal the EKC regression in three stages, we can see from the first EKC equation table that there is a significant relationship between the economic growth and carbon dioxide emission at 1% significant level since the overall regression P <0.01. Besides, the economic growth measured by InGDPPerCapita and InGDPPerCapita^2 have significant effect on carbon dioxide since their P <0.01 and P <0.01 respectively.

From the EKC equation in second table in appendix part C, we can see that there is a significant relationship between the economic growth and Nitrogen dioxide at 1% significant level since the overall regression P = 0.0001<0.01. Besides, the economic growth measured by InGDPPerCapita and InGDPPerCapita^2 have no significant effect on Nitrogen Dioxide since their P>0.05 and P >0.05 respectively.

From the EKC equation in third table in appendix part C, we can see that the economic growth measured by InGDPPerCapita and InGDPPerCapita^2 have significant impact on ozone pollution at 1% level since their P <0.01 and P <0.01 respectively.

Diagnostic test

Lagrange Multiplier test

Lagrange Multiplier in 4.3.1 above shows that P > 0.05 as we can see in appendix part C which indicate that the fitted empirical model does not suffer from autocorrelation problem. Meanwhile, it is important to note that both Var model and VECM are very robust in treating autocorrelation problem.

Test of multicollinearity for OLS regression

We can see that the variance inflation factor (VIF) in appendix part C for all the independent variables are less than 5 which means that the fitted regression model does not suffer from the problem of multicollinearity.

Normality test For OLS regression, Var and VECM models

The above normality test using Shapiro-Wilk, Jarque-Bera, Kurtosis and Skewness test in appendix part C. The P-values are greater than 0.05 significant level (that is, P > 0.05) which implies that the variables are normally distributed which satisfy the normality condition and that makes the model more valid, reliable and robust.

Conclusion

Using the Environmental Kuznets Curve (EKC), this study examines the relationship between air pollution and the Jordan economy. Var and VECM also show that air pollution and GDP per capita have a short- and long-term relationship. The Granger causality reveals that GDP per capita has a causal effect on air pollution, indicating that Jordan has developed an optimum capacity to control air pollution, which could pose a health risk and even contribute to a high mortality rate (Hannah, 2019), due to high GDP growth. Meanwhile, urban nitrogen dioxide levels are higher, whereas ozone-induced burdens are frequently more difficult in rural areas. However, the multiple regression analysis

reveals that there is a significant relationship between air pollution and economic growth. In this study, three different pollution parameters are used to assess air quality.

The three gases are carbon dioxide (CO2), nitrogen dioxide (NO2), and ozone (O3). They are standard variables in Jordan for regulating air quality. However, the line graph shows that gross domestic product per capita, which measures income, has grown the fastest, while air pollutants like ozone pollution, nitrogen dioxide, and carbon dioxide have grown at a slower rate, maintaining a consistent pattern according to Collivignarelli MC, Abbà A, Bertanza G, Pedraza R, Ricciardi P, Miino MC (2020). This simply means that the Jordan economy has grown sufficiently to keep environmental pollution low and thus provide a good and healthy environment for the country's citizens.

Acknowledgment

I thank God for seeing me through this research work. I am fatherless early in life but I thank God I didn't suffer the pains of the fatherless. My gratitude to my late father and mother for the background that laid for me in the early stage of my life. I want to thank my friend, Twahil Hemed Shakiru for being part of this research and I also want to appreciate Professor Vincent O Akinyosoye, the former director general of the national bureau of statistics in Nigeria. I must thank my wife for her profound commitment to home during this scholarly study.Thank you all and God bless.

References

Ministry of Health. (2006). Statistical Yearbook. Amman, Jordan: Ministry of Health.

IMF. (2001). Government Finance Statistics Manual 2001. Statistics Department

JMD (Jordan Meteorological Department). 2007. Available at http://met.jometeo.gov.jo/ (accessed December 2007).

Hindiyeh M. (2007). "Assessment of Corporate Environmental Responsibility in Jordan." Prepared for UNDP project "Launching the UN Global Compact." United Nations Development Programme. Available online: www.undp-jordan.org/Portals/0/GC%20Environment%20report.doc. Accessed: July 2008.

Government of Jordan. 2005. "National Agenda. Hashemite Kingdom of Jordan." Amman, Jordan. Government of Jordan. 2006a. "Licensing and EIA Guide." Amman, Jordan.

Government of Jordan. 2006b. "National Strategy and Action Plan to Combat Desertification." Amman, Jordan

AFD (Agence Française de Developpement) 2006. "Air Pollution Monitoring in Jordan." Ministry of Environment, Air Quality Monitoring Program. September 2006.

Alawi, M. A., H. Wichmann, W. Lorenz, and M. Bahadir. 1996. "Dioxins and Furans in the Jordanian Environment—Part 2: Levels of PCDD and PCDF in Human Milk Samples from Jordan." Chemosphere 33 (12): 2469–74.

Rhedanz, K., Maddison, D. (2008). Local environmental quality and life-satisfaction in Germany. Ecological Economics 64, 787-797.

Collivignarelli MC, Abbà A, Bertanza G, Pedrazzani R, Ricciardi P, Miino MC (2020) Lockdown for CoViD-2019 in Milan: what are the effects on air quality? Sci Total Environ 732:139280.

EEA (2017) Air quality in Europe — 2017 report, EEA technical report

Gehrsitz M (2017) The effect of low emission zones on air pollution and infant health. J Environ Ecol Manag 83:121–144.

Giesberts L (2018) Diesel-Verkehrsverbote" ausnahmsweise moeglich! NEUE ZEITSCHRIFT FUER VERWALTUNGSRECHT, 37(17).

Qiu G, Song R, He (2019) The aggravation of urban air quality deterioration due to urbanization, transportation and economic development–panel models with marginal effect analyses across China. Sci Total Environ 651:1114–1125.

Zambrano AMA, Broadbent EN, Durham WH (2010) Social and environmental effects of ecotourism in the Osa Peninsula of Costa Rica: the Lapa Rios case. J Ecotour 9(1):62–83.

Rupakheti, M (2015). Air pollution impacts on Agriculture. Institute for Advanced Sustainability Studies (IASS), Potsdam, Germany. Media regional Training, ICIMOD, Kathmandu.

Jalil, Abdul and Feridun, Mete (2011). Long run relationship between income inequality and Financial Development in China: Journal of the Asia Pacific Economy, 16(2),202-214

Hannah, Ritchie and Max, Roser (2019). "State of Global Air". Death rates from Air pollution.

Gujarati, D.N; Porter, D.C (2009). Basic Econometrics (Fifth ed)

Halicioglu, F (2009). An Econometric Study of CO2 Emissions, Energy Consumption, Income and Foreign Trade in Turkey. Energy Policy 2009, 37, 1156–1164.

Johansen,Soren (1991). Estimation and Hypothesis Testing of cointegration vectors in Gaussian vector Autoregressive models. Econometrica. 59(6), 1551-1580.

Dickey, David; Fuller, Wayne. A (1979). Distribution of the estimators for autoregressive time series with a unit root: Journal of the American Statistical association 74(366),427-431.

Ozokcu S, Ozdemir O. (2017). Economic growth, energy, and environmental Kuznets curve. *Renew Sust Energ Rev*. 72:639–47.

Song, T., Zheng, T., and Tong, L. (2008). An empirical test of the environmental Kuznets curve in China: A panel cointegration approach. *China Economic Review* 19, 381–392.

Engle, R. F., and C. W. J. Granger (1987). Co-integration and error correction: representation, estimation, and testing. Econometrica 55(2): 251–276.

Hill, Griffiths and Lim. (2008). Principles of Econometrics, 3rd edition.

Gujarati and Demodar. (2009). Basic Econometrics, International edition.

Panayotou, T (1993). Empirical tests and policy analysis of environmental degradation at different stages of Economic development; working paper, Technology and Employment program; international labor office Geneva, Switzerland.

Ozturk I, Acaravci A. (2020). CO2 emissions, energy consumption and economic growth in Turkey. Renew Sust Energ Rev. 14(9):3220–5.

Marjanovic V, Milovancevic M, Mladenovic I. (2016). Prediction of GDP growth rate based on carbon dioxide (CO2) emissions. J Co2 Util. 16:212–7.

Holtz-Eakin D, Selden TM. (2019). Stoking the Fires—Co2 Emissions and Economic-Growth. J Public Econ. 57(1):85–101

EIA. (2021) International Energy Outlook 2016. Washington, DC

Omer AM. (2019). Energy, environment and sustainable development. Renew Sust Energ Rev.12(9):2265–300.

UNEP. (2018). Decoupling natural resource use and environmental impacts from economic growth.

Kuznets S. (2018). Economic growth and income inequality. The American Economic Review. 45(1):1–28.

Kraft J, Kraft A. (2017) On the Relationship Between Energy and GNP The Journal of Energy and Development. 3(2):401–3.

Akarca AT, Long TV. (2019). On the Relationship between Energy and Gnp—a Reexamination. J Energy Dev. 5(2):326–31

APPENDIX

Part A

Stata commands

```
tsset YEAR, yearly
twoway (tsline GDPPERCAPITA) (tsline ozonepollutionO3) (tsline NitrogenDioxideNo2) (tsline carbondioxideCO2)
gen lncarbondioxideCO2 = log(carbondioxideCO2)
gen lnozonepollutionO3 = log(ozonepollutionO3)
gen lnNitrogenDioxideNo2 = log(NitrogenDioxideNo2)
gen lnGDPPERCAPITA = log(GDPPERCAPITA)
gen lnGDPPERCAPITA2 = log(GDPPERCAPITA)*log(GDPPERCAPITA)
vecrank GDPPERCAPITA ozonepollutionO3 NitrogenDioxideNo2 carbondioxideCO2, trend(constant)
var GDPPERCAPITA ozonepollutionO3 NitrogenDioxideNo2 carbondioxideCO2, lags(1/2)
regress GDPPERCAPITA ozonepollutionO3 NitrogenDioxideNo2 carbondioxideCO2
regress lncarbondioxideCO2 lnGDPPERCAPITA lnGDPPERCAPITA2
regress lnNitrogenDioxideNo2 lnGDPPERCAPITA lnGDPPERCAPITA2
regress lnozonepollutionO3 lnGDPPERCAPITA lnGDPPERCAPITA2
```

Part B

Null Hypothesis: D(CARBON_DIOXIDE__CO2_) has a unit root

Exogenous: Constant

Lag Length: 0 (Automatic - based on SIC, maxlag=4)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.312512	0.0037
Test critical values:	1% level	-3.831511	
	5% level	-3.029970	
	10% level	-2.655194	

Null Hypothesis: D(GDP_PER_CAPITA) has a unit root

Exogenous: Constant

Lag Length: 0 (Automatic - based on SIC, maxlag=4)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.069789	0.0463
Test critical values:	1% level	-3.831511	
	5% level	-3.029970	
	10% level	-2.655194	

Null Hypothesis: D(NITROGEN_DIOXIDE__NO2_,2) has a unit root

Exogenous: Constant

Lag Length: 0 (Automatic - based on SIC, maxlag=4)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.954183	0.0011
Test critical values:	1% level	-3.857386	
	5% level	-3.040391	
	10% level	-2.660551	

Null Hypothesis: D(OZONE_POLLUTION__O3_) has a unit root

Exogenous: Constant

Lag Length: 0 (Automatic - based on SIC, maxlag=4)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.228957	0.0044
Test critical values:	1% level	-3.831511	
	5% level	-3.029970	
	10% level	-2.655194	

Part C

Johansen tests for cointegration

Trend: constant — Number of obs = 19
Sample: 2002 - 2020 — Lags = 2

maximum rank	parms	LL	eigenvalue	trace statistic	5% critical value
0	20	-37.674275	.	59.6503	47.21
1	27	-19.943867	0.84531	24.1895*	29.68
2	32	-11.650058	0.58232	7.6018	15.41
3	35	-8.0097644	0.31832	0.3213	3.76
4	36	-7.8491335	0.01677		

Cointegrating equations

Equation	Parms	chi2	P>chi2
_ce1	3	743.3384	0.0000

Identification: beta is exactly identified

Johansen normalization restriction imposed

beta	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
_ce1						
GDPPERCAPITA	1	.	.	.	.	.
ozonepollutionO3	2754.362	1236.859	2.23	0.026	330.163	5178.561
NitrogenDioxideNo2	-3323.727	560.9805	-5.92	0.000	-4423.228	-2224.225
carbondioxideCO2	3165.142	450.1164	7.03	0.000	2282.93	4047.354
_cons	-9110.444	.	.	.	.	.

Vector autoregression

Sample: 2002 - 2020 — Number of obs = 19
Log likelihood = -7.849134 — AIC = 4.615698
FPE = .0016503 — HQIC = 4.918547
Det(Sigma_ml) = .0000268 — SBIC = 6.405162

Equation	Parms	RMSE	R-sq	chi2	P>chi2
GDPPERCAPITA	9	121.327	0.9905	1973.168	0.0000
ozonepollutionO3	9	.051648	0.7787	66.85915	0.0000
NitrogenDioxid~2	9	.025617	0.9830	1096.367	0.0000
carbondioxideCO2	9	.164743	0.8915	156.0818	0.0000

Granger causality Wald tests

Equation	Excluded	chi2	df	Prob > chi2
GDPPERCAPITA	ozonepollutionO3	3.9213	2	0.141
GDPPERCAPITA	NitrogenDioxide~2	5.7687	2	0.056
GDPPERCAPITA	carbondioxideCO2	3.1577	2	0.206
GDPPERCAPITA	ALL	34.314	6	0.000
ozonepollutionO3	GDPPERCAPITA	3.0236	2	0.221
ozonepollutionO3	NitrogenDioxide~2	1.2393	2	0.538
ozonepollutionO3	carbondioxideCO2	1.3519	2	0.509
ozonepollutionO3	ALL	9.0346	6	0.172
NitrogenDioxide~2	GDPPERCAPITA	33.766	2	0.000
NitrogenDioxide~2	ozonepollutionO3	14.498	2	0.001
NitrogenDioxide~2	carbondioxideCO2	38.15	2	0.000
NitrogenDioxide~2	ALL	58.33	6	0.000
carbondioxideCO2	GDPPERCAPITA	.18807	2	0.910
carbondioxideCO2	ozonepollutionO3	2.7283	2	0.256
carbondioxideCO2	NitrogenDioxide~2	5.3595	2	0.069
carbondioxideCO2	ALL	17.046	6	0.009

Source	SS	df	MS		
Model	19568781.9	3	6522927.31	Prob > F	0.0000
Residual	1452959.08	17	85468.1813	R-squared	0.9309
Total	21021741	20	1051087.05	Adj R-squared	0.9187
				Root MSE	292.35

Number of obs = 21
F(3, 17) = 76.32

GDPPERCAPITA	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
ozonepollutionO3	-1651.845	1195.861	-1.38	0.185	-4174.891	871.2001
NitrogenDioxideNo2	4861.019	600.9785	8.09	0.000	3593.065	6128.972
carbondioxideCO2	-888.7543	345.3392	-2.57	0.020	-1617.356	-160.1523
_cons	-3816.771	4219.705	-0.90	0.378	-12719.57	5086.029

VECM (Long run)

Equation	Parms	RMSE	R-sq	chi2	P>chi2
D_GDPPERCAPITA	6	156.067	0.6301	22.14805	0.0011
D_ozonepolluti~3	6	.053471	0.1419	2.150597	0.9053
D_NitrogenDiox~2	6	.025842	0.7853	47.55069	0.0000
D_carbondioxid~2	6	.165201	0.4399	10.21092	0.1160

EKC equation (first table)

Source	SS	df MS Number of obs = 21
	F(2, 18) = 29.56	
Model	.263456008	2 .131728004 Prob > F = 0.0000
Residual	.080207129	18 .004455952 R-squared = 0.7666
	Adj R-squared = 0.7407	
Total	.343663137	20 .017183157 Root MSE = .06675
lncarbondioxi~2	Coef.	Std. Err. t P>t [95% Conf. Interval]
InGDPPERCAPITA	13.84759	3.280527 4.22 0.001 6.955458 20.73972
InGDPPERCAPITA2	-.8905082	.2069834 -4.30 0.000 -1.325364 -.4556522
_cons	-52.59861	12.97261 -4.05 0.001 -79.85305 -25.34417

EKC equation (second table)

Source	SS	df MS Number of obs =	21
	F(2, 18) =	88.30	
Model	.065160017	2 .032580008 Prob > F =	0.0000
Residual	.006641158	18 .000368953 R-squared =	0.9075
	Adj R-squared =	0.8972	
Total	.071801175	20 .003590059 Root MSE =	.01921
lnNitrogenDio~2	Coef.	Std. Err. t P>t [95% Conf.	Interval]
InGDPPERCAPITA	-1.417097	.9439719 -1.50 0.151 -3.400309	.5661142
InGDPPERCAPITA2	.0993777	.0595595 1.67 0.113 -.0257522	.2245075
_cons	5.969027	3.732869 1.60 0.127 -1.87344	13.81149

EKC equation (third table)

Source	SS	df MS Number of obs =	21
	F(2, 18) =	45.48	
Model	.021151552	2 .010575776 Prob > F =	0.0000
Residual	.0041858	18 .000232544 R-squared =	0.8348

	Adj R-squared =	0.8164	
Total	.025337352	20 .001266868 Root MSE =	.01525
lnozonepollut~3	Coef.	Std. Err. t P>t [95% Conf.	Interval]
InGDPPERCAPITA	-6.476181	.7494219 -8.64 0.000 -8.050658	-4.901704
InGDPPERCAPITA2	.4109985	.0472844 8.69 0.000 .3116576	.5103395
_cons	26.25646	2.963535 8.86 0.000 20.03031	32.48262

Lagrange Multiplier test

Lagrange	multiplier test	
lag chi2 df	Prob > chi2	
1 16.0392 16	0.45023	
2 12.8021 16	0.68717	
H0: no	autocorrelation at	lag order

Test of multicollinearity for OLS regression

Variable	VIF	
carbondiox~2	3.65	0.274068
NitrogenDi~2	2.27	0.440623
ozonepollu~3	2.09	0.478842
Mean VIF	2.67	

Normality test

Shapiro-Wilk	W	test for	3	parameter	Lognormal data
Variable	Obs	W	V	z	Prob>z
GDPPERCAPITA	21	0.83745	3.983	-2.038	0.97923
ozonepollu~3	21	0.94566	1.332	1.311	0.09488
NitrogenDi~2	21	0.93762	1.529	1.623	0.05231
carbondiox~2	21	0.95570	1.086	0.893	0.18598

Jarque-Bera test

Equation	chi2	df	Prob > chi2
GDPPERCAPITA	2.069	2	0.35533
ozonepollutionO3	0.446	2	0.80016
NitrogenDioxideNo2	0.730	2	0.69436
carbondioxideCO2	0.176	2	0.91562
ALL	3.421	8	0.90522

Skewness test

Equation	Skewness	chi2	df	Prob > chi2
GDPPERCAPITA	.44402	0.624	1	0.42944
ozonepollutionO3	.08875	0.025	1	0.87451
NitrogenDioxideNo2	-.16699	0.088	1	0.76635
carbondioxideCO2	-.18722	0.111	1	0.73901
ALL	0.849	4	0.93182	

Kurtosis test

Equation	Kurtosis	chi2	df	Prob > chi2
GDPPERCAPITA	4.3511	1.445	1	0.22931
ozonepollutionO3	2.2708	0.421	1	0.51647
NitrogenDioxideNo2	2.1	0.641	1	0.42327
carbondioxideCO2	2.7128	0.065	1	0.79828
ALL	2.573	4	0.63168	

Journal of Environmental Science and Economics ISSN:2832-6032
https://doi.org/10.56556/jescae.v1i2.20

RESEARCH ARTICLE

Analysis of Rainfall Variability in the Province of Quirino

Mar Heisen A. Yanos[1*]

[*1]Isabela State University, Philippines

Corresponding Author: Mar Heisen A.Yanos, marheisen.a.yanos@isu.edu.ph
Received: 25 February, 2022, Accepted: 01 April, 2022, Published: 02 April, 2022

Abstract
The temporal variability of rainfall in Quirino Province was analyzed through the use of rainfall data of seven (7) rain gauges within the neighboring provinces like Nueva Vizcaya and Aurora. The length of record analyzed from 1997 to 2016. In this study, rainfall frequency analysis and consistency of rainfall data from the different stations through the use of double mass curve analysis was performed and analyzed. The annual series was used to screen each station's annual rainfall data while the province's average Thiessen rainfall was screened using maximum period series process. It was found out that all the data of the seven (7) rainfall stations were consistent. To attain allowable error in estimation of 10%, 5% and 1% for the mean annual rainfall the number of rain gauge station needed in the province should be 18, 72 and 1799, respectively.

Keywords: Double Mass Curve; Frequency Analysis; Rainfall; Rain Gauge; Temporal Variability; Thiessen

Introduction

The Philippines has 7, 107 islands, lies on the western rim of the tropical Pacific just off the southeastern portion of the Asian continent, and is surrounded by the South China Sea and the Pacific Ocean. The high sea surface temperature rings a warm and wet climate to the Philippines (Flores and Balagot, 1969). Rainfall is the most important climatic element in the Philippines because agriculture, influenced by the annual and seasonal variation of rainfall, plays an important role in the Philippines economy (Jose, 2001; Akasaka, et. Al., 2007).
In the Province of Quirino some portuons of the province lie on the East fall under Climatic Type III, which is characterized by no pronounced seasons. Rain is evenly distributed throughout the year. Dry season is from March to the early part of October while remaining days of October to February are wet. The western portion falls under climatic Type IV which is characterized by rainfall or more or less evenly distributed throughout the year with dry season from March to August and wet from September to January (DENR-02). Rainfall variations are likely the most evident effects of the changes occurring on the earth's climate system (Ayugi et. al. 2016). An understanding to the temporal characteristics of precipitation is hence central to water resources planning and management, especially given the evidence of climate change and variability in recent years (Liu et. Al 2015). Such information is important in agricultural planning, flood frequency analysis, flood hazard mapping, hydrological modeling and water resources assessments (Gallego et. Al. 2011). Therefore, many studies on the temporal characteristics of rainfall in different part of the world have beed conducted. As a result, this study will perform and analyze the rainfall frequency and consistency of the rainfall data from the different stations.

Methods

The rainfall data used in the study were acquired from the different weather stations located within the Province of Quirino, neighboring provinces and Philippine Atmospheric, Geophysical and Astronomical Services Administration (PAGASA).

Interpretation of Rainfall Data

Before rainfall records of each station were used, they were first checked for continuity and consistency. The continuity of a record was broken with missing data due to many reasons such as damage or fault in a rain gauge during a certain period. When the condition relevant to the recording of a rain gauge station had undergone significant change during the period of record, inconsistency would arise in the rainfall data of that station. This inconsistency would be felt from the time significant changed took place.
Multiple Linear regressions has the equation of the form:

$$\mathbf{P_X = a + b_A P_A + b_B P_B + \cdots + b_N P_N}$$

Where **a** is near zero and the **b**'s approximate the coefficients of equation 1 divided by the number of index stations. The advantage of the regression approach is that it

adjusts, to some extent, for departures from the normal ratio assumption. In the mountainous regions, the Normal-Ratio and Multiple Linear Regression Analysis methods therefore yield more reliable estimates. Estimates for missing precipitation data are generally most reliable for general-type storm over flat terrain or over relatively smooth windward mountain slopes. Severe and spotty convective activity and rugged terrain lessen the reliability. Estimates for long intervals (months or years) are more reliable than those for short intervals such as day.

Test of Consistency of Record

The checking for inconsistency of a record was done by the Double-Mass Curve Analysis. This technique was based on the principle that when each recorded data came from the same parent population, they were consistent. The procedure of analysis for the testing of consistency of a rainfall record was described below.

A group of surrounding (base) stations in the neighborhood of the problem station X was selected. The annual rainfall data of the Station X and also the average rainfall of the group of base stations covering a long period were arranged in chronological order (i.e. the oldest record as the first entry and the latest record as the last entry in the list). The accumulated precipitation of the station X (i.e. $\sum P_X$) and the accumulated values of the average of the group of base stations ($\sum P_{av}$) were calculated starting from the oldest record. Values of $\sum P_X$ were plotted against $\sum P_{av}$ for various consecutive time periods. A decided break in the slope of the resulting plot indicated a change in the precipitation regime of station X. To make the record prior to the point of break in slope comparable with that of the more recent record, it was adjusted by the ratio of the slopes of the two segments of the double-mass curve. Hence, the precipitation values at station X beyond the period of change in regime were corrected through the relation:

$$\mathbf{P_{CX} = P_x\left(\frac{b}{a}\right)}$$

When the decrease in the trend of rainfall regime occurred after the point of break in slope.

$$\mathbf{P_{CX} = P_x\left(\frac{a}{b}\right)}$$

When increase in the trend of rainfall regime occurred after the point of break in slope.

where:

$\mathbf{P_{CX}}$ = corrected precipitation at any time period at any time period t, at station X

$\mathbf{P_x}$ = original recorded precipitation at time period t, at station X

a = slope of the double-mass curve for the past record

b = slope of the double-mass curve for the latest record

Considerable caution was exercised in applying the double-mass curve technique. Lindsey (1988) emphasized that the plotted points always deviate about a mean line and changes in slope are accepted only when marked or substantiated by other evidence.

Determination of the Average Depth of Rainfall

A rain gauge represents only one sampling point of the real distribution of rainfall over an area. The average depth of precipitation over a specific area, on a storm, seasonal or annual basis, is required in many types of hydrologic problems. In this study, the Thiessen Method was considered.

The Thiessen method attempts to allow for nonuniform distribution of gages by providing a weighing factor for each gage. For this study, the weighing factor for each of the stations was obtained using the Thiessen polygon tool of GIS Software. The weighted average rainfall for the whole province was computed by multiplying the precipitation at each station by its assigned percentage of area and totaling as recommended by Linsley (1988). Thus,

$$\mathbf{P_{ave} = P_A C_A + P_B C_B + \cdots + P_N C_N}$$

where:

$\mathbf{P_{ave}}$ = weighted average rainfall for the total area

$\mathbf{P_A}$, $\mathbf{P_B}$,…, $\mathbf{P_N}$ = observed rainfall values from stations A, B,…, N, respectively

$\mathbf{C_A}$, $\mathbf{C_B}$,…, $\mathbf{C_N}$ = weighting factors for stations A, B,…, N, respectively

Adequacy of Length of Rainfall

The adequacy of the length of record for a given level of significance was tested using the formula suggested by Mockus (1960) which is,

$$\mathbf{Y=\left(4.30t\ \log_{10} R\right)^2+6}$$

where:

Y = minimum acceptable years of record

t = Student's statistical value at the 90 percent level of significance with (Y – 6) degrees of freedom

R = ratio of magnitude of the 100-year of event to the 2-year event

Adequacy of Rain gauge Stations

The optimal number of stations that should exist at a desired percentage of error in the estimation of mean rainfall was obtained through statistical analysis as emphasized by Subramaya (1984).

If there are m stations in the area, each recording rainfall values $P_1, P_2, \ldots P_M$ in a known time the optimal number of stations N was calculated as

$$\mathbf{N = \left(\frac{Cv}{\varepsilon}\right)^2}$$

where:

N = optimal number of stations

$\boldsymbol{\varepsilon}$ = allowable degree of error in the estimation of the mean rainfall, usually taken as 10%

$\mathbf{Cv}$ = coefficient of variation of the rainfall values of the existing m stations (in percent)

If there are "m" stations in the catchment, each recording rainfall values P_1, P2, ...P_M in a known time, the coefficient of variation Cv was calculated as

$$\mathbf{Cv} = \frac{\mathbf{100\ x\ \sigma_{m-1}}}{\mathbf{\overline{P}}}$$

$$\boldsymbol{\sigma_{m-1}} = \sqrt{\frac{\sum_1^m (\mathbf{Pi} - \mathbf{\overline{P}})^2}{\mathbf{m-1}}}$$

where:

$\boldsymbol{\sigma_{m-1}}$ = standard deviation

Pi = precipitation magnitude in i^{th} station

$\mathbf{\overline{P}} = \sum_1^m \overline{P}_i$

$\mathbf{\overline{P}}$ = mean precipitation

Statistical parameters for Rainfall Frequency Analysis

The purpose of the frequency analysis of an annual series is to obtain a relation between that magnitude of the event and its probability of exceedance. The Log-Normal distribution method was used.

Events was ranked from the highest to the lowest with the largest event being given a rank, m= 1, the second largest event, m = 2, and so on. The variables were transformed in their corresponding logarithmic values and the mean was computed as follows:

$$\mathbf{M = Antilog}\ \frac{\sum \log \mathbf{x}}{\mathbf{N}}$$

The standard deviation (S) was computed as follows:

$$\mathbf{S = Antilog}\ \sqrt{\frac{\left[\sum (\log \mathbf{x})^2 - \frac{(\sum \log \mathbf{x})^2}{\mathbf{N}}\right]}{\mathbf{N-1}}}$$

With the use of a log-probability paper, the values were plotted at their corresponding probabilities as listed below and formed a straight line.

Mean, M = 50%

M X S = 15.9%

M / S = 84.1%

A rough estimate of the goodness of fit of the distribution to the data was determined by plotting the probability of occurrence (P) of the events through the use of the equation:

$$\mathbf{P} = \left(\frac{\mathbf{m}}{\mathbf{N+1}}\right)$$

The goodness of fit was an eyeball estimate. When found satisfactory, the resulting straight line was used in predicting the frequency of occurrence of an event of a given magnitude.

Multiple Linear Regression

This technique is applied to test the combined effects of the different independent variables on the dependent variable. In this procedure, any variable suspected to affect the dependent variable Y are included in the analysis. For k independent variable, X_1, X_2,…X_k, the functional form of the multiple linear regression is

$$\mathbf{Y = A + B_1X_1 + B_2X_2 + \cdots + B_kX_k}$$

where the B_i's were the partial regression coefficients.

Results

Interpretation of Data

Before the rainfall of all stations were analyzed, the data were checked for continuitiy and consistency. Mıssing rainfall data were estimated based on the rainfall data from neighbouring stations.

Estimation of Missing Rainfall Data

To ensure a better outcome of the study it was deemed necessary to estimate this missing record. The missing rainfall data of a station was computed from observations or rainfall at some other stations as close to and as evenly spaced around the station with the missing record as possible. The station with missing data were computed through multiple linear regression method of estimation.

Rainfall Consistency

Before rainfall records were used in the study, they were tested through the use of double-mass curve technique to verify that any trend detected were due to meteorological causes and not to changes in gage location, in exposure, or in observational methods (Searcy and Hardison, n.d.). The double mass curves depicted in Fig 1, in which all of them were virtually unbroken straight lines and no significant changes in slope, an indications that the rainfall records were consistent.

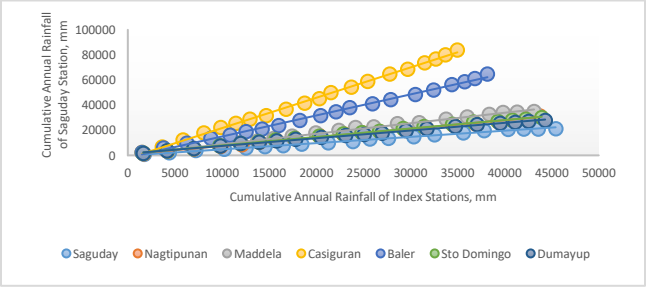


Figure 1. Double mass curve of the seven (7) stations

Mean Depth of Rainfall

To calculate the average rainfall over an area, the rainfall was calculated at a range of suitably placed raingauge stations within the province. The number of raingague stations depended on the surface area and rainfall distribution.

Thiessen polygons were constructed to create initial territorial boundaries for each of the rainfall stations. The polygons obtained involved the division of the province into a number of separate territories, each of which focused on a separate or single station. The simple Thiessen polygons shown in Fig 2 indicate the territorial distribution of mean annual rainfall.

As shown in Table 1, the Nagtipunan station covered the largest area of 43.72% of the total area of the Quirino province which was about 1393 sq. km with an average depth of rainfall distribution weightage factor of 0.44 mm. The station with least coverage was the Sto Domingo with an area of 2.26 % or 72 sq. km. of the whole study area.

Table 1. Area Coverage of Each Station

Station	Area (sq km)	Area Covered (%)	Weighting Factor	Altitude at AMSL (m)
Nagtipunan	1393	43.72	0.44	206.35
Dumayup	136	4.27	0.04	320
Sto Domingo	72	2.26	0.02	370
Casiguran	159	4.99	0.05	4
Baler	70	2.20	0.02	173
Maddela	751	23.57	0.24	160.63
Saguday	605	18.99	0.19	101.8

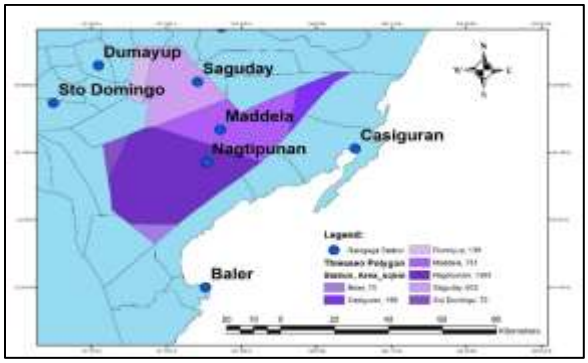


Figure 2. Thiessen Polygon

Adequacy of Rain Gauge Station in the Area

The optimal number of rain gauge stations provide more accurate rainfall estimation for Quirino province. The optimum number of stations that should exist at specified allowable errors of estimation for mean annual and monthly rainfall were listed in Table 2. Eighteen (18) stations are required to optimize rain gauge network with allowable error of about 10%. This indicated that the number of rain gauge stations of three (3) in Quirino is not adequate to estimate the mean annual rainfall of the province at 90% degree of accuracy or reliability. Additional 18 stations will be needed to attain the desired allowable error of estimate of 10%. As the allowable percentage error was reduced, a greater number of rain gauge stations will be needed.

Table2. Recommended Optimal Number of Rainfall Stations in Quirino a different Allowable Percentages of Error of Estimation.

	Percentage of Error		
	10%	5%	1%
	Number of Station		
Annual	18	72	1799
Monthly Basis			
January	103	413	10334
February	159	635	15877
March	76	303	7579
April	91	362	9052
May	58	233	5837
June	51	206	5150
July	76	304	7595
August	42	166	4162
September	42	167	4187
October	18	72	1804
November	82	328	8191
December	77	308	7706

Frequency Analysis

Rainfall events and their impact on hydrological systems and culture are important factors when planning and maintaining a large number of water management projects. Regional frequency analysis of extreme rainfall is critical in the formulation of hydrometeorological engineering procedures (Zhou, 2017).

The different annual rainfall amount of the seven stations at different probabilities of occuerence is shown in table 3 and the annual rainfall frequency curves all fitted to the log-normal distribution is shown in fig 3 to 9. The outcome indicated that extreme rainfall patterns were deteriorating (i.e., rainfall during high frequency events is declining as it increases during low frequency events). These findings support the findings of different researchers worldwide and

has been linked with climate change due to global warming (Merabtene et. al, 2016).

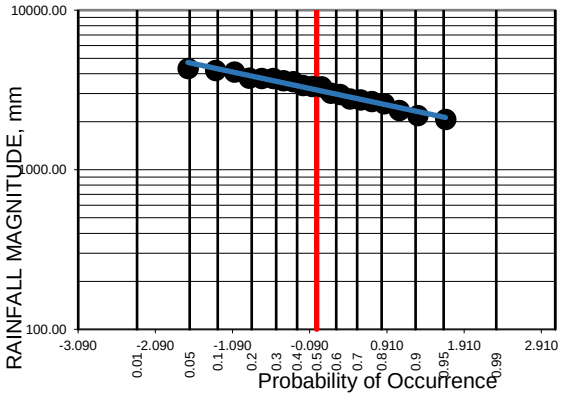


Figure 3. Annual Rainfall Frequency Curve Using Log-Normal Distribution for Baler.

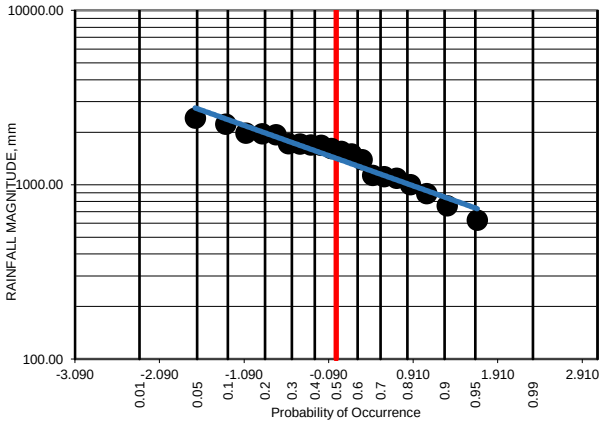


Figure 4. Annual Rainfall Frequency Curve Using Log-Normal Distribution for Sto Domingo.

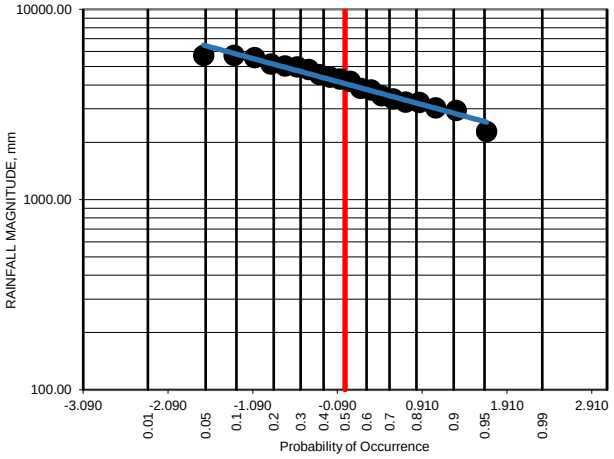


Figure 5. Annual Rainfall Frequency Curve Using Log-Normal Distribution for Casiguran.

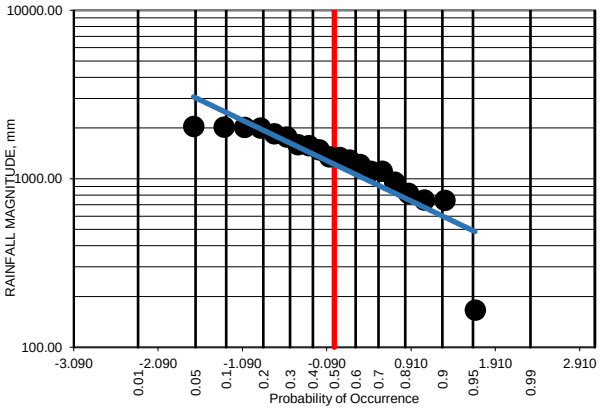


Figure 6. Annual Rainfall Frequency Curve Using Log-Normal Distribution for Dumayup.

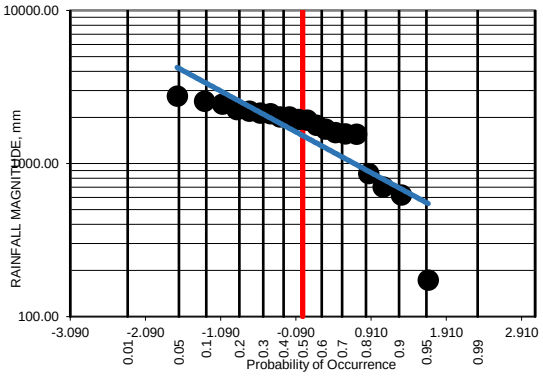


Figure 7. Annual Rainfall Frequency Curve Using Log-Normal Distribution for Maddela.

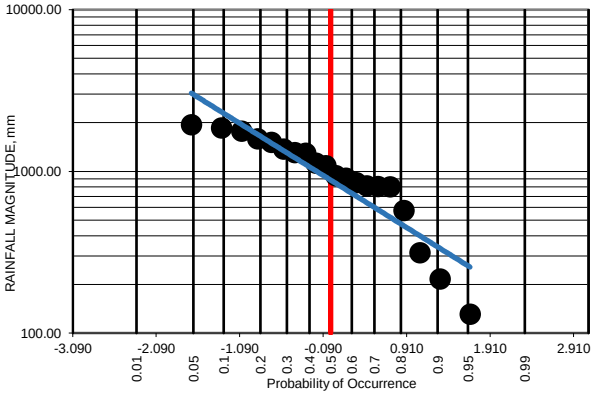


Figure 8. Annual Rainfall Frequency Curve Using Log-Normal Distribution for Saguday.

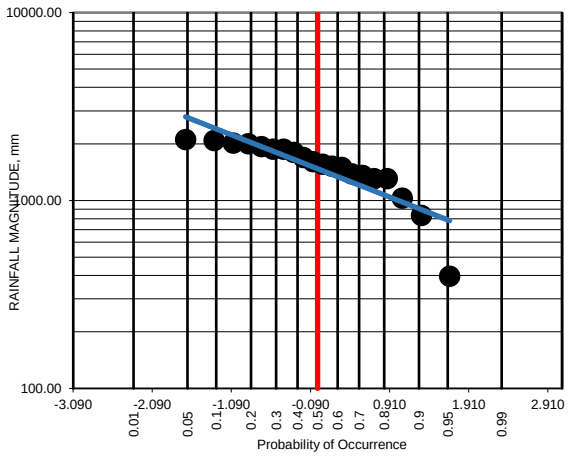


Figure 9. Annual Rainfall Frequency Curve Using Log-Normal Distribution for Nagtipunan

Table 3. Annual rainfall amounts (mm) at different probabilities of occurence for each of the seven stations.

Station	10%	20%	30%	40%	50%	60%	70%	80%	90%
Dumayup	2027.9	1976.4	1718.8	1539.8	1347.5	1248.2	1110.553	849	747.2
Sto Domingo	2250.8	1955.8	1722.2	1692.6	1586	1438.8	1121.764	1018.6	771.3
Baler	4216.76	3755.86	3708.59	3501.82	3331	2999.62	2765.27	2621.31	2211.80
Casiguran	5756.52	5138.5	4931.64	4491.124	4241.25	3808.02	3424.96	3240.92	2955.98
Maddela	2564.391	2243.651	2135.365	2019.152	1934.895	1724.469	1572.917	999.6656	631.7698
Nagtipunan	2092.542	1993.167	1880.225	1761.26	1588.452	1511.422	1371.47	1307.921	854.92
Saguday	1864.824	1573.64	1351.815	1224.777	1011.227	873.6406	806.8442	618.2302	225.2003
Quirino Province	2388.78	2164.68	2020.59	1882.30	1719.73	1573.99	1427.66	1201.67	807.93

Conclusion and Future Works

There are a total of seven (7) stations that were used in this study namely: Dumayup Station, Sto Domingo Station, Baler Station, Casiguran Station, Maddela Station, Nagtipunan Station and Saguday Station. All the missing records of stations with missing data were calculated through the application of multiple linear regression analysis.

Double-mass curve technique was used in testing the consistency of rainfall records of each station and it was found out that the rainfall records of the seven stations were consistent.

The estimated optimal number of rain gauge stations in the province of Quirino needed to estimate the annual rainfall at percentage allowable error of 10, 5, and 1 are 18, 72 and 1799, respectively.

The frequency distribution of annual rainfall was fitted to the Log-Normal Distribution. At 50% probability of occurrence, Casiguran station had the highest amount of rainfall of about 4241.25 mm while the lowest rainfall amount of about 1011.227 mm was observed at Saguday station.

In order to avoid the occurence of missing rainfall data, it is recommended that raingauges be regularly monitored. Rainfall frequency analysis on daily and weekly basis must be also analyzed. Develope rainfall distribution and rainfall maps can be utilized in any water resources development planning purposes for the province.

References

Akasaka, I., Morishima, W. & Mikami, T. (2007) Seasonal March And Its Spatial Difference Of Rainfall In The Philippines. International Journal of Climatology. 27:715-725(2007). DOI: 10.1002/joc.1428

Amiri, M. A. & Mesgari, M.S. (2017) Modeling The Spatial And Temporal Variability Of Precipitation In Northwest Iran. Atmosphere 2017, 8, 254; doi:10.3390/atmos8120254

Ayugi, B.O., Wen, W. & Chepkemoi, D. (2016) Analysis Of Spatial And Temporal Patterns Of Rainfall Variations Over Kenya. Journal of Environment and Earth Science. ISSN 2224-3216 (Paper) ISSN 2225-0948 (Online). Vol. 6, No. 11, 2016

Cho, J., Bosch,D.D. , Lowrance, R. et. al. (2009). Effect of spatial distribution of rainfall on temporal and spatial uncertainty od swat output. Transactions of the ASAABE. 52. 10. 13031/2013.29143

Flores JF, Balagot VF (1969) Climate Of The Philippines. Climates Of Northern And Eastern Asia. In: Arakawa H (ed) World survey of climatology, vol 8. Elsevier, Amsterdam, pp 159–213

Gallego, M., Trigo, R., Vaquero, J., et. Al. (2011). Trends in Frequency Indices of Daily Precipitation Over the Iberian Peninsula During the Last Century. J. Geophys. Res.: Atmosphere, 116 (2011)

Hu, Ling. (2014) Research On The Application Of Regression Analysis Method In Data Classification. Journals of Networks, Vol. 9, No. 11, November 2014

Liu, Y., Yang, R., Long, H. et al.(2015) Spatio-temporal characteristics of rural settlements and land use in the Bohai Rim of China. J. Geogr. Sci. 25, 559–572. https://doi.org/10.1007/s11442-015-1187-6

Loo, Y.Y., Billa, L. & Singh, A. (2015) Effcect Of Climate Change On Seasonal Monsoon In Asia And Its Impact On The Variability On Monsoon Rainfall In Southeast Asia. Geoscience Frontiers 6 (2015) 817-823

Merabtene, T., Siddique, M and Shanableh, A. (2016). Assessment Of Seasonal And Annual Rainfall Trends And Variability In Sharjah City, UAE. Vol. 2016. Advances in Meteorology. https://doi.org/10.1155/2016/6206238

Onyutha, C., Rutkowska, A., Nyeko-Ogiramoi, P., et. al. (2018) How Well Do Climate Models Reproduce Variability In Observed Rainfall? A Case Study Of The Lake Victoria Basin Considering Cmip3, Cmip5 And Cordex Simulations. Stochastic Environment Research and Risk Assessment (2019) 33:687-707

Prabakaran, S. Naveen Kumar, P. and Sai Mani Tarun, P.(2017) Rainfall Prediction Using Modified Linear Regression. APRN Journal of Engineering and Apllied Sciences. Vol 12, No. 12, June 2017.

Subramaya, K., (1984), "Engineering Hydrology", Tata McGraw-Hill Publishing Company Limited.

University of Delaware. Double-Mass Curves. https://udspace.udel.edu/handle/19716/1592

Zhou, Z., Smith, J.A. Yang, L. et.al. (2017) Regional frequency analysis of extreme rainfall for the Baltimore metropolitan region based on stochastic storm transposition NASA astrophysics data system (ads).

Journal of Environmental Science and Economics ISSN: 2832-6032
https://doi.org/10.56556/jescae.v1i2.41

RESEARCH ARTICLE

COVID-19 Pandemic: Macroeconomic Impacts and Understanding its Implications for Jordan

Omar Mohammad Alkasasbeh[1*]

[1]Faculty of Economic and Management Science University Sultan Zainal Abidin Terengganu, Malaysia

Corresponding Author: Omar Mohammad Abad Alkasasbeh , Omar_kasasbeh@yahoo.com
Received: 05 January, 2022, Accepted: 28 March, 2022, Published: 03 April, 2022

Abstract
These editorial reviews the potential short- and long-term macroeconomic impacts of the Covid-19 pandemic according to the data announced in Jordan, Provides evidence of certain of these impacts in the coming days, and the economic repercussions. Since Jordanian economic growth was slow before the Covid-19 outbreaks, the economic contraction could be serious, and the government intervention would necessitate a cautious weighing of priorities and goals. Given that resources are limited, strategies that better handle the short-run crisis while yielding substantial long-run gains should be seriously considered. The economic effects of the COVID-19 have been highlighted in this study and emphasized policy options to reduce its effects. The study comes to the conclusion that monetary, macroprudential, and fiscal policy can help mitigate the effects of the COVID-19.

Keywords: Coronavirus Pandemic; COVID-19; Fiscal policy; Monetary Policy, Productivity Growth

Introduction

Jordan bears a superfluous burden of poverty and unemployment, which be compounded by the COVID-19 epidemic. Although the situation is constantly changing, the original focus was on the clinical and epidemiological aspects of COVID-19, including measures to prevent transmission and infection. fundamentally, the COVID-19 pandemic raised awareness that a sickness has no nationality and that we are all linked as one 'global nation.' The fact that coronaviruses do not respect national borders is at the heart of the global reaction and unity.

Jordan began taking precautionary measures early on. For example, thermal screening of passengers arriving. By early March, the government had drawn up plans to deal with a worsening of the pandemic in the country. In April, the Jordanian government stopped issuing new visas. Compulsory screening and quarantined for 14 days of all international passengers arriving in Jordan. Moreover, all land borders with neighboring countries were closed for passenger traffic.

The virus, according to experts, will deliver a negative supply shock to the global economy by causing many industries to shut down and disrupting global supply lines (OECD, 2020). But how severe and long-lasting will this supply disruption be? Will this have an impact on aggregate demand? What is the best monetary policy response? What about fiscal policy? These are the topics of a contentious debate right now.

Given the huge uncertainty surrounding the future evolution of the epidemic, however, it is useful to work out the macroeconomic implications of more pessimistic scenarios. To do so, we highlight three results. First, the virus's spread might depress worldwide demand. Second, a supply-demand doom cycle might take place, exacerbating the virus-caused supply disruption. Third, the global economy may become subject to stagnation traps, which are periods of low growth and significant unemployment, as a result of this epidemic. While monetary easing can assist to ameliorate the reduction in global demand, our research implies that significant fiscal policy actions to stimulate investment will be required to get the global economy out of its slump.

The epidemic appears to have resulted in a 'de-globalization process by compelling nations to close borders, stopping normal movements of capital, goods, and humans and causing business and production to shut down, at least temporarily. However, nations have already begun to experience the effects of the outbreak's macroeconomic impact, and economists are increasingly looking into them. Aside from the devastating health implications, the COVID-19 epidemic is causing huge and far-reaching economic costs for all nations, including Jordan.

However, since the first COVID-19 case was announced in December 2019, there has been a scarcity of scholarly study

on the economics of the outbreak, despite the fact that policy think tanks and news media outlets are progressively covering analytical briefs Barua (2020).

This paper aims to comprehensively identify the present and future potential economic effects of the COVID-19 epidemic. The purpose of this paper is not to create any quantitative estimate of the future implications (since it may take some time to make reliable forecasts), rather it goals to provide a thorough and indicative review of the observed and probable impacts that may emerge in the following days. Moreover, different strategies and plans made through government intervention to cope with the challenges of COVID-19 are also assessed in this study.

Economic Impact of COVID-19

The COVID-19 pandemic will have long-term effects on the worldwide economy. The COVID-19 pandemic impacts individuals and societies all over the globe, and it will have a long-term influence on the global economy and commerce. The COVID-19 economic impact begins as a negative supply shock (Hausmann, 2020). There are two things. First, workers become infected and manufacturing capacity is reduced. According to Atkeson (2020), when 10% of the population is infected, vital financial and economic infrastructure would face significant personnel shortages. Second, restrictions of activity that is needed as part of disease suppression. As previously stated, a decrease of up to 75% reduction in interpersonal contact may be required to put COVID-19 under control. These would eventually result in a demand shock. The initial supply shock might lead to exacerbated demand shocks in nations with imperfect markets and liquidity-constrained consumers (Guerrieri et al., 2020). Disease suppression policies, according to Suryahadi, Al Izzati, and Suryadarma (2020), would save lives but worsen the extent of the economic recession. Long-term impacts might include supply-side chain destruction. Millions of people would be pushed into poverty in the economic recession. COVID-19 may impoverish an extra 85 million people, according to a quick simulation including 138 developing and 26 high-income nations (Sumner, Hoy & Ortiz-Juarez, 2020).

In terms of electronics manufacturing and supply, the coronavirus pandemic has had a negative influence. According to reports, the outbreak began in China, the country that manufactures the bulk majority of electronics and their components (McKibbin & Fernando, 2020).

Many experts have already begun to discuss what life may be like after the coronavirus. However, there are long-term, short-term, and medium-term prospects. Many issues are already apparent, and necessary steps must be done immediately. The crisis is spreading unevenly across regions and activities. It was found by Al-Tammemi (2020) that the government played an important role to fight against COVID-19 in Jordan but still, the basic needs of the poor were not fulfilled as they lost the income. Also, the decrease in the income levels led to mental issues including the anxiety that turned into domestic violence, child abuse, child labor, and a decrease in food consumption. Moreover, economic growth declined because of a reduction in the production of products and services. Many organizations were not able to pay salaries to their employees that caused mental issues in employees, especially on female employees.

Research Methodology

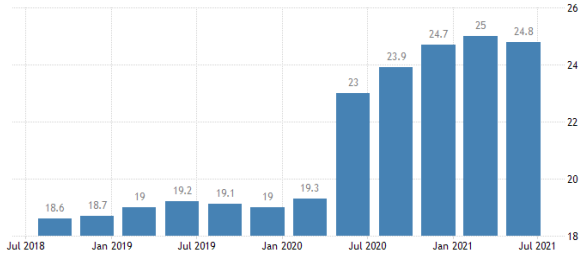
Secondary data is gathered from a variety of sources, including articles, books, and the internet. For the analysis and interpretation of the obtained data, several statistical tools and techniques were used.

Analysis and Interpretation

Impact on the Jordanian Economy

According to Trading Economics (2021), the unemployment rate is one of the important economic factors for a country, the lower unemployment rate indicates the economic growth of the country and vice versa. The unemployment rate in Jordan is fluctuating over the past few years and its rate suddenly increased after January 2020 (Trading Economics, 2021). This can be evident from the figure below:

Figure 1. The unemployment rate in Jordan

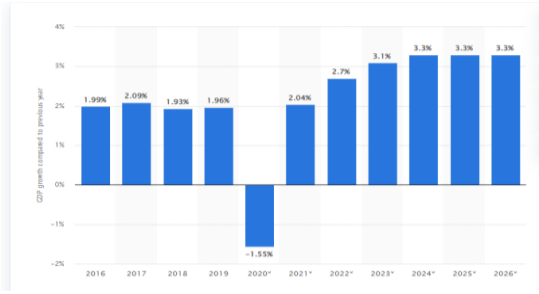


(Source: Trading Economics, 2021)

It can be seen that the unemployment rate in January 2020 was 19.3% while it increased up to 23% in July 2020. Also, a further increase can be observed in January 2021 and this is because of the consequences of COVID-19. The people in Jordan have lost their jobs due to pandemics. Thus, the impacts of COVID-19 on the economic growth of Jordan are quite negative.

Growth domestic product or GDP is one of the important economic factors that indicate the value of all finished products or services in the monetary term that is produced in a certain period (Abueid el al., 2018; Sunmer, 2020).

Figure 2. GDP rate in Jordan



Source: Statista, 2021

The COVID-19 has impacted the GDP of Jordan because of several reasons. Some of the reasons include lockdowns and decrease in the production activity, decrease in the customers' demand, the decline in tourism activities, weakened confidence of investors, the decline in exports, and a huge decline in economic activities. Below is the representation of GDP in Jordan as per Statista (2021). It can be understood that the GDP rate in Jordan was 1.93 percent in 2018 that increased in 2019 but it abruptly decreased in 2020 and even became -1.55 percent. This shows the huge decline of the GDP rate in Jordan due to COVID-19. However, it is a positive sign to observe that the GDP rate in Jordan increased from -1.55 percent to 2.04 percent in 2021 and is expected to increase in the coming years. However, the impact of COVID-19 on the GDP rate of Jordan was highly negative but the country coped with the situation.

Analyzing the Government Intervention during COVID-19 in Jordan

The government of Jordan is highly concerned about the uplift of the country's economy (Al-Dmour et al., 2021). The World Bank is showing high commitment towards supporting the Jordanian government and uplifting its economy because the impacts of COVID-19 on the economy are negative and destructive (Alshoubaki & Harris, 2020). That is why the World Bank is taking steps for protecting the vulnerable and poor, buffering economic activity, and making investments in human capital. The Senior Economist of the World Bank named Saadia Refaqat was of the view that the consequences of COVID-19 can be buffered through resources' mobilization because the global liquidity situations have deteriorated and more funds are required to cope with pandemic crisis (UNDP, 2020). Moreover, it is highly dependent upon the resilience of the economy as well as the global recovery pace that how the economic growth will be revived in Jordan. Also, it is extremely important to focus on job creation so that people's vulnerability and poverty can be eradicated.

It was mentioned by Kebede et al., (2020) the COVID-19 got spread in Jordan at a high pace while the government measures and responses were quick along with the high trust of people in governmental measures. Also, the households in Jordan were negatively impacted by COVID-19 and they had to face much crisis. Likewise, the impact of COVID-19 on the businesses in Jordan was also tremendous unemployment rate raised many other associated challenges. One of the phases of COVID-19 was the lockdown that restricted people and businesses from external activities and this phase has tremendously impacted the households as well as businesses in Jordan (UNDP, 2020). Also, the lockdown measure was taken by the government greatly impacted the livelihoods of people. One of the main impacts of the lockdown measure was the loss of employment along with loss of savings by the households. A survey carried out to assess the impacts of lockdown measures in Jordan indicates that the majority of the people in the country reported that they lost their whole incomes due to lockdown measures and the variations were noted in different cities of the country. For instance, 62 percent of households in Amman reported having lost all their incomes during lockdowns, while the percentages for other cities are 69%, 32%, 65%, 40%, and 39% in Zarqa, Tafileh, Irbid, Ajloun, and Ma'an, respectively (UNDP, 2020). Moreover, the lockdown measure taken by the government led towards the restriction of households towards their basic needs including food, rent, medicine, and heating. Also, one of the main issues was access to clean water for drinking along with access to healthcare facilities. The access to internet facilities during lockdown was also a major concern of Jordanian people as they needed it for education, for work from home as well as to run an e-commerce business.

It was mentioned by Alshoubaki and Harris (2021) that the Jordanian government needed international community support that was promptly provided and it enabled the government to work on a 5-year growth plan. Also, there are different aspects and parts of this growth plan. Some of the major components include reduction in the inequalities of socio-economic nature, increasing access to social services, education as well as health insurance. It is also extremely important to understand that the economic conditions of Jordan were not quite good before COVID-19 and the poverty rates in the country were increasing even before COVID-19. Also, the COVID-19 has decreased the pace of economic development in Jordan as businesses, individuals and households have restricted access to resources. Just like the international community, Jordan got prepared to face the impacts of COVID-19 and to engage in robust planning. Some of the governmental measures taken by the Jordanian government at the start of the year 2020 included the issuance of the defense orders for controlling the spread of the virus and to lessen the economic and social impacts of the pandemic on the Jordanian economy and

people (UNDP, 2020). Some of the starting measures included the curfew at the national level as well as penalties for disobeying the governmental orders at the time of the pandemic. These measures proved to be highly beneficial for the country and the infection rate was lower that enabling the government to ease the lockdowns and economy re-opening. This indicates that the intervention of the government in Jordan in the pandemic situation was quite fruitful for the country and without government support as well as help, Jordan could not regrow its economy.

Analysing the strategies during COVID-19 in Jordan

It was mentioned by Hynes et al., (2020) that whenever a country faces any crisis, then it is highly important for the crisis management authorities to come forward and make effective strategies to cope up. Moreover, in the challenging and hard times of the COVID-19 pandemic, the government, authorities, as well as different international communities, worked together to minimize the impacts of the pandemic and to restore their positions. Likewise, different strategies and plans were made and worked upon in Jordan. It is planned by the government of Jordan to make the country more sustainable and to achieve economic growth by introducing the 5 Year Reform Matrix (Abu-Mater et al., 2020). Also, the main focus of this matrix is job creation, mainly for females and youth. The government of Jordan has collaborated with the World Bank to implement major reforms in the private sector, social safety nets as well as labor markets, and governance (UNDP, 2020). Also, the COVID-19 has posed different economic challenges and the Jordanian government is focusing on the main structural changes in tourism, agriculture, digital transformation, and trade. By doing this, the business environment and the financial position of Jordan can also be improved through which the recovery can be accelerated. This indicates that this plan can work effectively to make the country more economically developed and stable.

In addition to the 5-year Reform Matrix, Economic Priorities Program has been released by the Jordanian government for 2021 to 2023 (Abu-Mater et al., 2020). The main objective of this program is to promote programs, prioritize investment and make investments in different sectors for creating jobs. Moreover, different structural challenges can be tackled by Jordan by focusing on the EPP and implementing the major reforms in different sectors. Another strategy that is used by Jordan in response to COVID-19 is named Emergency Cash Transfer in which the vulnerable and poor people can get financial support. 237,000 vulnerable families were supported in 2020 and cash is transferred to 85,000 families through Takaful Cash Transfer Program.

According to The World Bank (2021), Jordan has started recovering from the negative consequences of COVID-19, has fully reopened its economy in September 2021 after the successful pandemic campaign. Furthermore, it is extremely significant to note that Jordan's recovery process is quite better than other countries, economy contraction percentage in 2020 was 1.6 percent while it attained the GDP rate of 0.3 percent in the first quarter of the year 2021. Also, this happened because of the proactive approaches used by the government related to monetary and fiscal policies. However, it is important to understand that the unemployment level in Jordan has increased and was 25 percent in the first quarter of 2021. The majority of the unemployment is present among youth and females and the low labor force participation of females in Jordan is an important dilemma. Another important issue related to economic factors is that the country debt of Jordan increased about 10% from 2019 to 2020 (The World Bank, 2021). Furthermore, despite the economic issues due to the pandemic, Jordan has played a significant role in regional stability by promoting cross-border trade and cooperation and by hosting the refugees. Also, 1.3 million Syrian refugees were hosted by Jordan and the country has tried to give them access to the services as well as employment (The World Bank, 2020). Nevertheless, the COVID-19 crisis has worsened current operational weaknesses in the economy of Jordan, caused social issues, and has negative impacts on the macroeconomics of the country. Also, the Syrian crisis impacted Jordan in a negative way i.e. decrease in economic growth, increase in poverty as well as debt. Furthermore, the deteriorated trade balance, as well as a decrease in the investment trend, are the main consequences posed by COVID-19 on Jordan's economy.

In Jordan, corrective measures and strategies were made to minimize the impacts of COVID-19 in different sectors. According to Al-Qutob et al., (2020), the education sector of Jordan was highly concerned about the health of students as well as faculty members along with the associated personnel and introduced distance learning in institutes. Also, it is extremely important to understand that distance learning was a new concept for the students and different issues were faced by teachers as well as by students. For such issues, Jordan tried to improve its Information and Communication Technology (ICT).

In Jordan, various media channels were used for altering people about the coronavirus and its potential danger to human beings (Habes et al., 2020). Also, the main channels used in Jordan were social media because technological advancement has enabled people to use social media for seeking information about any issue. The danger of the virus and associated risks were told to people through social media channels. Different types of personal protection measures and social distancing strategies were told to the people. The awareness messages were specifically for the aged people who were above 60 years old and the children. These age groups were considered to be highly vulnerable

and the strategy to stay-at-home was specifically made for these people. Also, it was not permitted for caretakers to take such people outside their homes unless and until there is an emergency. In addition to this, educators, religious leaders as well as opinion leaders, and educators were involved in the awareness campaigns so that they can educate people related to prevention measures and social distancing (Habes et al., 2020).

COVID-19 and policy suggestions

This section explains the relevance of three policy options to mitigate the effects of the COVID-19: fiscal policy, monetary policy and macroprudential regulation.

Fiscal policy

During the current epidemic as well as in the aftermath of the event, fiscal policy may be used to successfully safeguard people, stabilize demand, and aid in the recovery of various economies throughout the world (Kasasbeh, 2021). When taking into consideration the consistency of lockdowns across economies, fiscal policies should be tailored to healthcare services in order to offer emergency lifelines to safeguard individuals (Chakraborty and Thomas, 2020). While lockdowns are becoming less severe, fiscal measures should be directed at providing assistance to households and businesses in order to address the informality of the sector. Moreover, employment assistance measures may also assist in promoting a speedy recovery of the economy after the epidemic by promoting a safe return to work and facilitating structural shifts.

Once the epidemic has slowed, fiscal stimulus will be critical for healthcare systems, public investment and physical and digital infrastructure. Economies should promote productive investment, increase spending and generate revenue in order to make the most of limited fiscal resources. To reduce fiscal risks, all policy initiatives must be arranged into a medium-term fiscal framework that is transparently managed (IMF, 2020; Alkasasbeha et al., 2018).

Monetary policy

The role of monetary policy in mitigating the impacts of the COVID-19 might be critical. However, depending on the state of an economy's economy during the continuing pandemic, the nature of the implementation of monetary policy may differ from one country to the next. As argued by Hofmann et al. (2020), the use of monetary policy by emerging economies in response to the COVID-19 epidemic may be ineffective owing to the significant volatility of currency rates and international capital movements in the region. When it comes to dealing with the fluctuations in capital flows and currency rates, emerging economies may use a mix of inflation targeting and macroprudential measures, as well as forex reserve accumulation, as their policy framework to tackle the changes in exchange rates and capital flows. In light of the fact that this policy framework promotes financial stability, emerging economies may apply the same mix of measures to react to the financial instability created by the epidemic. Inflation targeting may be useful in reducing the impact of exchange rate fluctuations on inflation. The use of macroprudential instruments helps to strengthen the financial system's resilience. Furthermore, the building of reserves may aid in the absorption of shocks and the alleviation of financial stress in emerging economies since central banks are capable of coping with currency depreciation, default risk on external borrowings, and capital outflows (Hofmann et al., 2020).

Macroprudential regulation

In light of the financial instability induced by the COVID-19, macroprudential measures might aid in the preservation of financial stability and the reduction of systemic risk in the financial system. As a result, a wide variety of macroprudential policies may help to strengthen the economy's ability to withstand global financial shocks. For example, these measures include mechanisms that increase bank capital and liquidity, prevent risky credit and limit foreign exchange exposures (Drehmann et al., 2020, Restoy, 2019). These instruments have a diverse impact on the reduction of global financial shocks that damage a country's economy. Macroprudential regulation, on the other hand, reduces the sensitivity of domestic credit to changes in global financial conditions. This assertion is consistent with the premise that a stronger bank balance sheet results in a more stable credit supply. Furthermore, macroprudential regulation helps to stabilize nominal and real exchange rates by creating a more stable financial system that minimizes the volatility of currency premiums (Kasasbeh, 2021; IMF, 2020).

Conclusion and policy implications

The COVID-19 epidemic has wreaked unparalleled damage on the Jordanian economy, both in terms of the number of people who have died and the economic repercussions. It posed a greater challenge for the governments and investors to limit the impacts of this pandemic.

The economic effects of the COVID-19 have been highlighted in this study and emphasized policy options to reduce its effects. The study comes to the conclusion that monetary, macroprudential, and fiscal policy can help mitigate the effects of the COVID-19.

A number of policy implications may be drawn from this study. From the standpoint of monetary policy, the monetary expansion will enhance aggregate demand while also encouraging enterprises to increase their investment. From the standpoint of fiscal policy, government actions such as subsidizing enterprises' investment and the implementation of public investment programs might aid in the promotion of investment in the economy. Independently, monetary expansion may fall prey to expectation-driven traps, which would have a negative impact on the fundamentals of an economy's growing. Traditional macroeconomic theories should be adjusted in accordance with the current environment and coordinated in order to preserve the aggregate demand–supply equilibrium as effectively as possible. Traditional macroeconomic policy, it seems, cannot be limited to merely conventional instruments. It should be utilized in conjunction with social measures, such as a whole-of-government approach, to deal with the public health crisis produced by the COVID-19. Conventional macroeconomic policies must be arranged into three categories: recovery policies, relief measures and international coordination measures.

Future study should concentrate on the implications of the COVID-19 on exchange rates, capital flows and the different sectors of the economy. It will be a difficult effort for policymakers to deal with the health crisis or to solve the macroeconomic and financial crises that have arisen as a result of the COVID-19.

References

Abu-Mater, W., Alsufy, F., & Afifa, M. A. (2020). The Effect of Coronavirus (Covid-19) on the Jordanian Economy: A Comprehensive Analysis of the Economy and How to Return Growth Rapidly. *Journal of Accounting, Finance & Management Strategy*, *15*(2), 1-30.

Al-Dmour, H., Salman, A., Abuhashesh, M., & Al-Dmour, R. (2020). Influence of social media platforms on public health protection against the COVID-19 pandemic via the mediating effects of public health awareness and behavioral changes: integrated model. *Journal of medical Internet research*, *22*(8), e19996.

Alkasasbeha, O. M. A., Haron, N. F., & Abueid, A. I. S. (2018). The impact of government expenditures, taxes on economic growth in Jordan. *American based research journal*, *7*(12).

Alqutob, R., Al Nsour, M., Tarawneh, M. R., Ajlouni, M., Khader, Y., Aqel, I., & Obeidat, N. (2020). COVID-19 crisis in Jordan: Response, scenarios, strategies, and recommendations. *JMIR Public Health and Surveillance*, *6*(3), e19332.

Alshoubaki, W. E., & Harris, M. (2021). Jordan's Public Policy Response to COVID-19 Pandemic: Insight and Policy Analysis. *Public Organization Review*, 1-20.

Al-Tammemi, A. A. B. (2020). The battle against COVID-19 in Jordan: an early overview of the Jordanian experience. *Frontiers in Public Health*, *8*, 188.

Atkeson, A. (2020). *What will be the economic impact of COVID-19 in the US? Rough estimates of disease scenarios* (No. w26867). National Bureau of Economic Research.

Barua, S. (2020). Understanding Coronanomics: The economic implications of the coronavirus (COVID-19) pandemic. *Available at SSRN 3566477*.

Chakraborty L., Thomas E. 2020. *COVID-19 and Macroeconomic Uncertainty: Fiscal and Monetary* Policy Response (No. 20/302).

Drehmann, M., Farag, M., Tarashev, N., & Tsatsaronis, K. (2020). *Buffering Covid-19 losses-the role of prudential policy* (No. 9). Bank for International Settlements.

Habes, M., Alghizzawi, M., Ali, S., SalihAlnaser, A., & Salloum, S. A. (2020). The Relation among Marketing ads, via Digital Media and mitigate (COVID-19) pandemic in Jordan. *International Journal of Advanced Science and Technology*, *29*(7), 12326-12348.

Hausmann, R. (2020). *Flattening the COVID-19 Curve in Developing Countries*. Retrieved from: https://www.project syndicate.org/commentary/flattening-covid19-curve-in-developingcountries-by-ricardo-hausmann-2020-03

Hofmann, B., Shim, I., & Shin, H. S. (2021). Emerging market economy exchange rates and local currency bond markets amid the Covid-19 pandemic. *Available at SSRN 3761875*.

Hynes, W., Trump, B., Love, P., & Linkov, I. (2020). Bouncing forward: a resilience approach to dealing with COVID-19 and future systemic shocks. *Environment Systems and Decisions*, *40*, 174-184.

IMF, J. (2020). A crisis like no other, an uncertain recovery. *World Economic Outlook Update*.

Kebede, T. A., Stave, S. E., Kattaa, M., & Prokop, M. (2020). Impact of the COVID-19 pandemic on enterprises in Jordan. *Int. Labour Organ*.

McKibbin, W., & Fernando, R. (2020). The economic impact of COVID-19. Economics in the Time of COVID-19, 45(10.1162).

OECD. (2020). *OECD Economic Outlook, Interim Report March 2020*. OECD Publishing.

Restoy, F. (2020). *Central banks and financial stability: A reflection after the Covid-19 outbreak*. Financial Stability Institute, Bank for International Settlements.

Setyadi, S., & Indriyani, L. (2021). Dampak Pandemi COVID-19 Terhadap Peningkatan Resiko Kemiskinan Di Indonesia. *PARETO: Jurnal Ekonomi Dan Kebijakan Publik*, *4*(1), 53-66.

Statista. (2021). *GDP Growth Rate in Jordan.* Retrieved from: https://www.statista.com/statistics/385554/gross-domestic-product-gdp-growth-rate-in-jordan/

Sumner, A., Hoy, C., & Ortiz-Juarez, E. (2020). *Estimates of the Impact of COVID-19 on Global Poverty* (No. 2020/43). WIDER working paper.

Suryahadi, A., Al Izzati, R., & Suryadarma, D. (2020). The impact of COVID-19 outbreak on poverty: An estimation for Indonesia. *Jakarta SMERU Res. Inst*.

The World Bank. (2020). *Jordan: COVID-19 Pandemic Weighs Heavily on the Economy, as it does on the Region.* Retrieved from: https://www.worldbank.org/en/news/press-release/2020/07/14/jordan-covid-19-pandemic-weighs-heavily-on-the-economy-as-it-does-on-the-region

The World Bank. (2021). *The World Bank in Jordan.* Retrieved from: https://www.worldbank.org/en/country/jordan/overview#3

Trading Economics. (2021). *Unemployment rate in Jordan.* Retrieved from: https://tradingeconomics.com/jordan/unemployment-rate

UNDP, M. (2020). COVID-19 Impact on Households in Jordan: A Rapid Assessment.

Kasasbeh, O. (2021). Public Debt and Economic Growth: Is There Any Causal Effect? An Empirical Analysis With Structural Breaks and Granger Causality for Jordan. INTERNATIONAL JOURNAL OF TRENDS IN ACCOUNTING RESEARCH, 2(1), 106-110.

Abueid, A. I. S., Haron, N. F., & Abad, O. M. (2018). The Impact of Foreign Direct Investment, Aids and Economic Growth: Evidence from Structural Breaks for Jordan. INTERNATIONAL JOURNAL OF ACADEMIC RESEARCH IN BUSINESS AND SOCIAL SCIENCES, 8(11).

Kasasbeh, O. (2021). Fiscal Policy and its Relationship with Economic Growth a Review Study. Available at SSRN 3789109.

Journal of Environmental Science and Economics ISSN:2832-6032
https://doi.org/10.56556/jescae.v1i2.97

RESEARCH ARTICLE

Information Managers as Change Agents in achieving Sustainable Development in the 21st Century

Bakare, Oluwabunmi.D[1], Nosakhare Okuonghae[2*]

[1]Department of Information Management
Faculty of Communication & Information Sciences,
Lead City University, Nigeria
[2]SamuelAdegboyega University, Ogwa, Edo State

Corresponding Author: Nosakhare Okuonghae, nosakhareokuons@gmail.com
Received: 01 March, 2022, Accepted: 02 April, 2022, Published: 01 May, 2022

Abstract
The purpose of this paper is to examine the role of information managers and libraries in accomplishing Nigeria's sustainable development goals in the 21st Century. The paper explored the notion of sustainable development, examines the 17 Sustainable Development Goals (SDGs) including their respective targets. It identifies and discusses the role of libraries and information managers (librarians) in achieving SDGs, as well as the philosophy of information theory of communication as proposed by Claude Shannon (1948). Libraries all over the world offer a variety of products and services that support the accomplishment of all 17 SDGs. Libraries are secure, friendly spaces at the heart of communities, fostering reading and providing free access to information. Libraries are vital instruments in society, and they play a critical role in accomplishing long-term development goals. Citizens must be well informed if Nigeria's sustainable development goals are to be met and sustained. This can be accomplished by selecting, processing, organizing, and disseminating information based on the parameter of development as indicated in the Sustainable Development Goals (SDGs), and organizing training programs or forums where issues such education, environmental, climate change, gender inequality and health issues can be discussed, and so on.

Keywords: Information manager; librarian; library; information sustainable development Goals

Introduction

Sustainability is a popular topic in most political and academic discuss but there is a dearth of it within the discipline of Library & Information Science. The concept enunciates a strong normative value towards equitable resource utilization in attaining intergenerational justice. This philosophy, entrenches the principles of conservation of natural environment as well as global equity. The world is changing and many scholars have had to grapples with the complications brought about by a fast-changing world where by the living pattern of the present generation consciously altered to a more beneficial way, to accommodate generations yet unborn (Lewis, Kenerson, Sorrentino & Rowse, 2019). The role of Information Managers also known as Librarians in this transition is essential, as Information Managers play a critical role in accomplishing long-term development goals through the provision of essential information services which has the capacity to enhance the quality of decision taken by individual members of the society towards in achieving the set goals.

Expectantly, the drive of this new orientation of sustainability is being spearheaded by the United Nations through a framework known as the Sustainable Development Goals (SDGs). The SDGs are global in nature, taking into cognizance national realities, capacities and level of development. In Nigeria, like other nations, the expectation is that all hands must be on deck in attaining these goals. However, it appears from available records, that countries from third world nations especially from the Africa sub-region are lagging behind in the attainment of these global agenda. (Onyam & Benson, 2020).

Okuonghae and Igbinovia (2019) noted that one profession that may bring about the needed change in achieving these goals are those engaged in information management of which Librarians are core. According to them, each of the goals relies on the product – "information" for sustainability. The information Managers like other information professionals are squarely proficient in

information handling in satisfying the cognitive, psychological and affective needs for their diverse users. The fact remains that, proper information management affects information usability which might then translate to its sustainability when its essence has been felt positively. Conversely, information usability may be affected by information availability and accessibility. Thus, the role of Information Mangers in information management dissemination is crucial for the achievement of the SDGs. Particularly because, the provision of information services stands to address the three aspects of the global agenda. More reason, there is the need to systematically examine information managers as change agents in achieving sustainable development in the 21st century knowing the significant role they play in the knowledge economy.

The Concept of an Information Managers

To understand the concept of Information Managers, one need to examine the meaning of each term in phrase, 'information' and "Manager". Basically, "Information" is often regarded as a processed data giving the user a meaningful insight. According to Buckland (1991) cited in Aina (2004) opined that information may be discussed under three heads; information – as- a process; information-as-knowledge as well as information- as - thing. According to the cerebral researcher, information is seen as a process when it performs the function of enlightening, that is, conveying information from a source to a recipient, it is a knowledge if it is performing the role of imparting knowledge to an individual, thus, reducing anxiety and uncertainty. Information as a thing represent data and documents recorded in written, printed or digitized formats, such as books, manuscripts, periodicals, databases artefacts, compact disc, etc.

"Managers" on the other hands, denotes someone who administers or supervises a business, office, or other organization (Gardner,2019).

Therefore, Information Managers are information professionals that specializes in organizing, coordinating, and supervising relevant resources including human and capital resources within an information system. Information Managers are significantly responsible for the gathering, preservation and dissemination of information within an organization. Aina (2004) posits that a librarian, archivist, and a record manager may all be regarded as information professionals because, they are involved with the following information handling activities such as purchase and processing of information; preservation of information sources, services and system and delivery of information to users, either directly or through intermediaries. However, the most notable information managers among these groups are the librarian as they deal directly with a lot of information resources and the user in public or private setting including academic environment; more reason the nomenclature information managers within this discourse is weaved round them.

Nagarkar (2017) while clarifying the roles of librarian in Digital era, noted that librarians are information professionals that works as information managers in academic organization. He equally noted that, like the business managers, who markets and promotes their goods and services, the librarian objective is to promote and market information service delivered in the library to users. Accordingly, while Information Managers may work in any organization that collects and utilizes information, Librarians are essentially Information Managers because they are principally involved with information users, and also, with the management of information.

Okuonghae and Abimbola (2019) agree that Information Managers are gateway to knowledge management and are specially trained to aid information availability and sustainability through effective mechanism for gathering, storage, distribution, and conservation of information. The study also posits that the performance of these roles, will allows other stakeholders to concentrate in utilizing their time appropriately.

Sustainable Development: A Conceptual Clarification

Sustainable development is a philosophy that has its origin in the report published by Bruntland commission in 1987. The report which was titled "Our Common Future" made extensive reference to the term 'sustainable development', which the report defined as "development that meets the need of the present without compromising the ability of the future generation to meet their own needs" (WCED,1987). Unarguably, this notion appears simple as it advocates for the equitable use and distribution of natural resources across different generations of users. In essence, the aim of sustainable development is for society to maintain balance between the drive to pursue or secure economic development and the need protect the environment through international framework, putting in perspective the fusion of environmental policies and viable developmental plans.

According to Asemah and Imafidon, (2021), the notion of Sustainable Development is better understood within the three pillars of, 'development' which entails socio-economic development in line with environmental considerations; the second, focus on the principle of 'needs' which advocate for the reorganization of natural resources to ensure the quality of life for all, and last pillar which is weaved around the principle of 'future generations' which advocates that resources should be utilize in such a way that will not undermine the quality of life for future generation. Basically, sustainable development involves the ability to sustain human, material and socio-economic progress without endangering the ecosystem over a long period of time.

In the words of Dernbach (2011: 617),"the core idea of sustainable development is the integration of

environmental protection with development, rather than development at the expense of the environment or environmental protection instead of development, the idea is to achieve both development and environmental protection at the same time." Because sustainable development modifies development, development is important to the definition of sustainable development."

Several scholars have criticized this concept on the grounds that it lacks objective practicality. Thus, many of its critics' harp on the inability to maintain socio-economical equilibrium within the social ecosystem. This argument evidently advances the view that the practical implementation of the concept is elusive. Again, it is argued that the principle attempts to oversimplify a complex concept like sustainable development. Jacobs (1991) cited in Elliot (2013) posit that sustainable development, like other concepts such as 'equality' and 'democracy' all have basic definition which everyone can relate with. However, conflict always arise when there is need to implement or interpret it. Bakari (2013) in his critical remarks found it difficult to apply the idea because of the challenge of determining how certain natural resources should be sustained. According to the study, "what exactly should be sustained in sustainable development"?

The study further postulates: "it has been argued that there is no such thing as a sustainable use of a non-renewable resource, since any positive rate of exploitation will eventually lead to the exhaustion of earth's finite stock. This perspective renders the industrial revolution as a whole unstainable"

Although the idea has been subject of fierce debate and contention amongst scholars due to the high degree of impossibility in ensuring equilibrium in some resource utilization, it has no doubt gain widespread popularity in the global political arena, and has wedged into the consciousness of relevant stakeholders the need to pursue every act of exploration of natural (environment) resources for economic development within the prism of long-term sustainability. It has been noted that oftentimes, political debate and scientific discussions on the notion of sustainable development either informally or formally have been carried out with the hope of winning more votes or to score political point or better still by business organizations to sell their products which is deemed to be environmentally or ecosystem friendly. Such activities lend credence to the uncontroverted fact that the concept has a universal application and the idea behind of sustainable development is applicable in almost every sphere of life (Elliot, 2013)

Klarin (2018) asserted that the modern pursuit of man in achieving social fairness, environment protection, social justice, climate change and cultural diversity are enshrined in the principle of sustainable development which aimed at combating some of the most basic needs of man. For better understanding, the concept is usually fitted into three pillars; economy development, environment protection, and social justice. This division envisages an inter-relationship between these three major aspects in achieving the needed sustainable development.

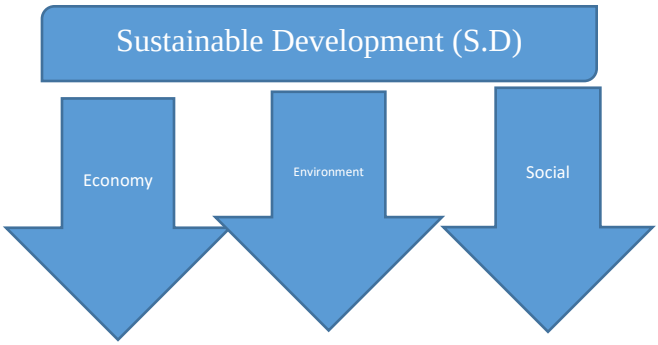


Fig 1: Three pillars of Sustainable Development (Adopted from Elliot, 2013:20)

As shown above, the three pillars of Sustainable Development are economy, environment, and social pillars (Imafidon & Ogbaisi, 2021). Information Managers as knowledge facilitators play a significant role in achieving these three pillars. Firstly, it must be noted that the main stay of the 21st century economy is information which is core to the Librarianship profession. Several terms such as information age, information economy as well as the knowledge economy emphasises this fact where information is rated as the medium of exchange. The result therefore is that, economic growth is a factor of the amount of the quality of information available to a nation or organization through research and development which are effectively communicated by Information Managers. Similarly, Information Managers through information dissemination, are instrumental in achieving the environmental, social and economic aspect of the SDG. This is achieved through the platform of education (Osunwusi,2020) and information literacy. The provision of information resources to the users, help to empower them with necessary knowledge, skill, values, promote new orientations, attitude and ideals in addressing any of the crucial challenges facing the world today such as loss biodiversity, environmental degradation, climate change or issues such as gender inequality and poverty. In essence, the insight gained from the learning process is extremely useful in the shaping users' perception, attitude and prepares him or her in making informed decision in solving any environmental or social problems confronting the nation (Igbinovia, 2017).

In summary, Information Managers are agents in achieving sustainable development in the 21st Century in view of the fact that they are engaged in information management and as a result, provide quality information which helps users and indeed members of the public in exercising better judgement. Okuonghae and Abimbola (2019) citing

Lehman Brown (2018) identified eight reasons for information management in the achievement of the SDGs;

1. It supports the creation, control and development of records
2. It facilitates seamless exchange of useful information
3. It facilitates the integration new records management technologies
4. It provides mechanism for protecting vital information from loss and ensure data integrity are maintained
5. It helps to anticipate information needs together with the needed resources
6. it helps in collecting and analyzing primary and secondary records of SDGs.
7. It ensures in information flow processes and communication are controlled
8. The insight gained from information management provides user with the necessary tool to prepare and plan for the future.

The Contribution of Information Managers to the Actualization of Sustainable Development in the 21st Century.

As already noted, the objectives of the SDGs, is geared toward combating some of the most crucial challenges confronting humanities by the year 2030. The 17 SDGs is specifically aimed at promoting systemic change on earth (Kalu, Kalu, Okidi & Abigail, 2020). Accordingly, the table below indicates each goal and their targets.

Table 1: SDGs goals and their targets

S/N	Goals	The Target
Goal 1	No Poverty	To end poverty in all its forms everywhere
Goal 2	Zero hunger	To end hunger, achieve food security and improved nutrition, and promote sustainable agriculture
Goal 3	Good health and well-being for people	To ensure healthy live and promote wellbeing for all at all ages
Goal 4	Quality education	To ensure inclusive and equitable quality education and promote lifelong learning opportunities for all
Goal 5	Gender equality	To achieve gender equality and empower all women and girls
Goal 6	Clean water and sanitation	To ensure availability and sustainable management of water and sanitation for all
Goal 7	Affordable and clean energy	To ensure access to affordable, reliable, sustainable and modern energy for all
Goal 8	Decent work and economic growth	To promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all
Goal 9	Industry, Innovation and infrastructure	To build resilient infrastructure, promote inclusive and sustainable industrialization, and foster innovation
Goal 10	Reducing inequalities	To reduce income inequality within and among countries.
Goal 11	Sustainable cities and communities	To make cities and human settlements inclusive, safe, resilient, and sustainable
Goal 12	Responsible consumption and production	To ensure sustainable consumption and production patterns using eco-friendly production methods and reducing the amount of waste
Goal 13	Climate action	To take urgent action to combat climate change and its impact by regulating emissions and promoting development in renewable energy
Goal 14	Life below water	To conserve and suitably use the oceans, seas, and marine resources for sustainable development
Goal 15	Life on land	To protect, restore and promote sustainable use of terrestrial ecosystem, sustainably manage forests, combat desertification, and halt and reserve land degradation and halt biodiversity loss
Goal 16	Peace, justice and strong institutions	To promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institution at all levels.
Goal 17	Partnership for the goals	To strengthen the means of implementation and revitalize the global partnership for sustainable development.

Okuonghae and Igbinovia (2019) rightly noted that a common thread among these agenda is information. They further conceived that suitable and accurate information is necessary for the actualization of these targets. This assertion is corroborated by Igbinovia and Osuchukwu

(2018) when they emphasized that information professionals are in better stead to boost the attainment of SDG through proper dissemination of information and knowledge sharing. Therefore, it will seem that there is an inextricable nexus between the activities of information management and the actualization of the SDG. Then, it goes without saying that the role of Information Managers is essential for the realization of the set goals since the discipline is weaved round information which is core to the achievement of the SDGs. In a world where information increases at an exponential rate, the information manager is expected to adopt any efficient means like new technology to manage this vast pool of information. A large chunk of the Information Manager's time and energy is spent processing information and developing the proper system for processing it efficiently. The role of information manager emerges from his normal every duty of collecting, processing and providing avenue for the utilization of processed data to give the user insight to previously unknown knowledge.

Again, one of the salient pursuits of sustainable development is the attainment of quality education, peace and justice. The attainment of these goals in the 21st century, requires the contributory role of information managers who through their skillful approach, facilitates knowledge impartation, by making available quality information using ICT tools. According to the UN, the growth of ICT as well as global interconnectedness, have great potential to advance accelerated human development meant to connect the digital divide and to foster the growth of knowledge-based civilizations (Kalu et al, 2020)

Proper information management in the 21st century will ensure that information is easily available to achieve knowledge sustainability. The information manager has the arduous task of planning, collecting, evaluating information from different sources and providing same to the end user. As information experts they ensure that quality information is accessible to relevant stakeholders for informed decision making (Owojuyigbe & Owojuyigbe, 2021).

Roles of Libraries in Supporting the Achievement of the Sustainable Development Goals

Libraries are important component of an informed society and appear in various forms and sizes to serve variety of audience. Ayaowei, Memory & Mercy (2021); and Igbinovia & Osuchukwu (2018), aver that library are platforms for information dissemination and knowledge sharing. This fact, demonstrates that libraries play a vital role as well, in realizing the SDGs (Gani, Kasa & Allahmagani, 2016). The SDGs rely heavily on libraries providing the requisite information in achieving their objectives which is hinged on the principles of the five laws by Ranganathan, the laws are summarized as follows (information are for use; every information has its user; every user his/her information resource; do not waste the time of the user; the library is a growing organism). Information are for use; every user his/her information; every information its user; the time of the library user is not wasted as requisite information is readily available; the library is a growing organism as information can be presented in different format to different categories of users.

Libraries are widely regarded as a research centre and a source of information empowerment, a role that cannot be overstated because the general public benefits much from them. The_traditional responsibility of the library is to evaluate, select, purchase, process, arrange and preserve of materials in various formats for the benefit of the users. Nicholas and Perpetual (2015) defined a library as an information hub that collects, organizes, stores, retrieves, and disseminates information to users.

Issa (2018) stated that libraries are the mind of the societies, a live depository of cultural past and sustainer of the intellectual activities that anticipates the future. They are connected with the culture of continual learning and reading, which instils the culture of reading in students. Thus, Okuonghae, Ijeh & Erhabor(2018) asserted that libraries are custodians of knowledge and the most dependable information institution whose activities revolves around the acquisition, organization, dissemination, and protection of information resources for the purpose of achieving cultural.

The information Managers (librarians) with the following activities can help libraries in support of the SDGs:

Aiding Research Development

Librarians play a key role in facilitating research development. According to Gani, Kasa & Allahmagani, (2016) librarian, through the supply of literatures, literature mining and acquisition of information resources, could be of help to other researchers in their research process and development. Thus, Achieving SDGs, will necessitates librarians to articulate each of the goals and provide relevant information resources to researcher in their research activities

Provision of Guidance to Literature

Librarians by their training, are skilful in providing guidance to patrons' in the choice of available publications in the library. Often times, the patron may be unaware about the existence of a particular information resource available for use. Through proper guidance, patrons are able to locate useful resources (Gani, Kasa & Allahmagani, 2016). The library gives the patron the platform to bring to the knowledge of the patron relevance literature concerning SDGs.

Reduces Patrons' Uncertainty:

According to Kuhlthau, (1991) information seeker often approaches an information system with the feeling of uncertainty and apprehension in conducting research. However, with the active guidance of librarians, information seekers are able to retrieve relevant information. This feeling of uncertainty gives way to a feeling of clarity, satisfaction and a sense of relieve. Thus, librarians' services to patrons, help to reduces uncertainty and enhance awarenes of possible cause of action to take in solving any of the identified problems under the SDGs.

Promoting Information Literacy:

Librarians' role in promoting information literacy is perhaps one of the most important functions in librarianship. Information literacy has been defined as an intellectual ability for an individual to personally identify, evaluate, comprehend and utilize information (Ojo, Odunlade, & Adedokun, 2020). Supporting SDG will entail that the librarian equips library patron with the necessary skills in accessing information effectively, as well as evaluate information and its sources. In the end, the patrons are able to navigate the myriad sources of information available today for personal development. Ojo, Odunlade, & Adedokun, (2020) equally noted that proper identification of information and use are prerequisite for objective decision making.

Sustainable Development Goals and Librarians

Librarians are important collaborators in accessing quality information for the attainment of the SDG. Information as an important variable in achieving SDGs is critical for information user for different reasons. Some use it for taking health decisions, other for politics, agriculture, and investment decisions. However, others use it for the advancement of knowledge (Ayaowei, Memory & Mercy, 2021). The International Federation of Library Association (IFLA) (2013) while noting the unique role of the library in supporting sustainable development, called on other stakeholders to recognise libraries all over the world as partner in contributing to sustainable development agenda. According to IFLA, libraries:

•Provide opportunities for all

• Inspire people to improve and develop themselves

• Provides a platform for patrons to have access to the world's knowledge

• Provides librarians the avenue to offer expert assistance to patrons

• Constitutes an integral part of a multi-stakeholder society.

As a result of the library's inclusion, librarians' tasks extend beyond organizing resources, but now involves taking the responsibility of providing appropriate information to patrons in order to actualize long-term developmental goals (Gani, Kasa & Allahmagani, 2016). Consequently, librarians must provide well-articulated services that are targeted towards specific goals based on the library's mandate and the population they serve.

In addition, Gani, Kasa & Allahmagani (2016), in their study, proposed that the Librarian Council of Nigeria (LRCN) as well as the Nigerian Library Association (NLA) with its various sub-sections could collaborate to ensure that the SDGs are achieve, through the formulation of policies and action plan. These scholars further suggested that, through policy formulation, advocacy programmes, collaborations with NGO, training programs, promotion of open access initiative, promotion of literacy campaigns for citizens, motivations and evaluation, library and librarian can support the actualization of sustainable development goals.

Theoretical Underpinning: Information Theory

Information theory was formulated by Claude Shannon (1948). The theory which arose out of mathematical process describes how signals ("message or information"), such as written language, spoken words, and body motions, are transmitted from source, to the receiver in various formats. The receiver, reviews the information and communicate back to the sender, through a process of feedback to inform him of any gap in communication process. The feedback mechanism therefore assists the communicator in correcting the subsequent output.

Information Managers in transmitting information to the user within the library, solves different societal problems. The library is a platform for sharing enduring knowledge, values, attitude, and skills for promoting economy, environmental and social sustainability (Osunwusi, 2020). In addition, Issa (1997) cited in Ayaowei (2021) asserted that information resources provide the impetus for social, cultural, spiritual, political and scientific advancement of achieving social-political equity. Thus, the Information Manager carries out a fundamental duty in promoting the sustainable development goals, which cut across all aspects of human life. The significance of this theory to the study is that, it emphasized how Information Managers through the transmission of information from the source (Government, Writers, Researchers and Agencies such as the United Nations) to the users within the library community, imparts knowledge. This unique service rendered by the Information Manager help to minimize the uncertainty, disorganization, promote good perception by the user towards the SDGs and its overall attainment. It must be said that the impartation of knowledge of SDGs, sharpens individual's attitude and disposition towards the actualization of these universal goals. Similarly, with the mechanism of feedback as postulated by the theory by interfacing with the users, Information Managers are able to fill the gap in the individual's knowledge through

further research and clarification using various channels such as social media in meeting the users' needs (Bakare, 2018). In sum, the Information Manager carries out a fundamental duty of promoting SDG through information service delivery in Nigeria.

Summary

It is important to note that information is a vital tool and a common thread that cut across each of the SDGs. In view of this fact, it is correct to state that accurate information is necessary for the actualization of these goals. Consequently, Information Managers with their skill-set, as information professionals, are in better stead to boost the attainment of SDG through proper dissemination of information and knowledge sharing. By so doing, they promote new orientations, ideal, and values necessary for securing, economic, environmental and social sustainability. According to Ayaowei, Memory & Mercy (2021), without dissemination of information, end user-would not be informed about current issues and policies of government. The orientation gained from the service function, enhances better decision making, foster societal awareness for combating the challenging outlined under the SDGs.

Conclusion

Libraries are vital institutions in society, and they play a critical role in accomplishing long-term development goals. Citizens must be well informed if Nigeria's sustainable development goals are to be achieved. This can be accomplished by selecting, processing, organizing, and disseminating information based on the development indicators raised in the Sustainable Development Goals (SDGs), and hosting local forums where people can discuss issues such as community health, education, environmental issues, climate change, and so on. The truth is that Information Managers and libraries are critical components in achieving the SDGs. The International Federation of Library Associations (IFLA) believes that increasing access to information and knowledge across society supports sustainable development and improves people's lives, just as it has declared that unrestricted access to knowledge is essential in any developmental process for individuals and nations. (International Federation of Library Associations and Institutions, 2017). This is, without a doubt, the information Managers' area of competence, as well as the exclusive responsibility of any library.

Recommendations

In the light of the finding from this study, it is recommended as follows'

1.The Government at different level should establish and encourage the establishment of libraries (and other information centres) in strategic parts of the country.

2.Government at all levels should partner with Information Managers as important stakeholder in the drive to achieve the sustainable development goals. This can be achieved by giving recognition to deserving member of the profession.

3.Government should refrain from any act that may hinder the Information Manager from performing their role effectively. For instance, the conversion of State library or information centres to a shopping mall without alternative arrangement should be discouraged

4.Given the fact that education transfer global values to individuals, LRCN and NLA should ensure that members of the profession are brought to speed with the latest practice and knowledge. This can be done through organizing useful workshops and seminars.

The Significant of the Study

1.The study reveals that beyond the provision of information services, for educational purposes, Information Managers are change agents needed for the attainment of the SDGs.

2.When Information Managers play their role effectively with respect to the social, economic or environmental aspect of SDG, we have an informed society that can make meaningful decisions.

3.It will inform Government policy in knowing that the discipline of librarianship plays a key role for creating an informed society and in achieving SDGs in Nigeria

References

Adesoji, F.F (2007). Need for Re-Introduction of Reading Corners in Primary School Libraries in Nigeria: A Cursory Look at Non-Conventional School Libraries. Niger. Sch. Libr. Journal.6:73-83.

Aina L.O. (2004). Library and Information Science Text for Africa, Ibadan, Nigeria: Third World Information Service Limited.

Aliero, S. A. (2016). Reading Culture and National Development in Nigeria. Paper Presented at Nigerian Library Association Conference/AGM, Funtaj Academy, Abuja.

Anyaoku, E. N. (2016). Medical Libraries and Achieving Sustainable Development Goals in Nigeria: Issues and Problems. Paper Presented at Nigerian Library Association Conference/AGM, Funtaj Academy, Abuja.

Asamoah-Hassan, R. H. (2003). Information: The oil in the wheel of national development. An inaugural lecture

of the President Elect of the Ghana Library Association held at GNAT Hall, Accra, 16p.

Australian Library and Information Association (ALIA) (2014). Future of the Library and information science profession: Special libraries Canberra ACT. Available online at www.alia.org.au/futureoftheprofession, 20p.

Ayaowei, I. T., Memory, D.& Mercy, U. (2021). Information Preservation and security in Bayelsa State College of Health Technology, Otuogidi-Ogbia Town. Lagos Journal of Library & Information Science (LAJLIS) Vol. 10 (1/2) 125-137.

Bakare, O. D. (2018). Social Media Use for Service Delivery in Academic Libraries. Bull. IEEE Tech. Comm. Digit. Library 14(1) 1-8

Bakari, M. E (2013). Globalization and Sustainable Development: False twins. New Global Studies 7(3), 23-56.

Dernbach, J.C. (2011). Creating the Law of Environmentally Sustainable Economic Development. Pace Environmental Law Review Vol. 28. No. 3

Ekere, J. N., Benson, O. V., & Amaechi, N. (2016). Areas of Partnership between Non- Government Organization, Private Sector and Libraries towards Actualization of Sustainable Development Goals in Nigeria. Paper Presented at Nigerian Library Association Conference/AGM, Funtaj Academy, Abuja.

Elliot, J. A (2013). An introduction to sustainable development (4th ed). Routledge, Taylor & Francis Group.

Flugstad, M. & Farmer, T. (2010). Technology news: Monitoring the Heartbeat of the modern library. Arkansas Libraries, 67(3), 4 – 6.

Ford, S. (2002). Old problems for new reasons: Overcoming the challenges presented by mentally ill library users. In: Helping the difficult library patron: New approaches to examining and resolving a long-standing and on-going problem. Kwasi Sarkodie-Mensal (Ed.) The Haworth Information press, pp. 83 -90.

IFLA (2013). The Role of Public Libraries in the Attainment of Botswana's Vision 2016 http://library.ifla.org/258/1/201-radijeng-en.pdf

Gani, E., Kasa, M.G. & Allahmagani. K. (2016). Roles of Library in Supporting Sustainable Development Goals. Paper presented at the 3rd Conference of Certified Librarians in Nigeria, National Space Research and Development Agency, Obasanjo Centre, Airport Road, Abuja.

Garner, B. A (2019). Black's Law Dictionary (11th Ed.). Texas: West Publishing Co. p. 1149

Gupta, Sangita (2015). Role of Libraries in Knowledge Society. International Journal of Management and Applied Science, Vol. 1, issue 6, 66- 68.

Iginovia, M. O (2017). Librarians' Involvement in Cross-Disciplinary Research and its Implication for Sustainable Development Goals (SDGs): the Nigeria Experience. Library Review Vol. 66 No. 4/5, 2017 251-265.

Igbinovia, M. O & Osuchukwu, N. P. (2018). Predictors of Knowledge Sharing behaviour on

Sustainable Development Goals among Library personnel in Nigeria. IFLA Journal, 44(2): 119-131. Available at http://dx.doi.org/10.1177/0340035218763445

Imafidon, K. & Ogbaisi, S. A (2021). Small and Medium Scale Enterprise for Sustainable Development in Nigeria. Multidimensional Approaches to Sustainable Development in Nigeria, (Enugu, GO University Press P. 11-28).

Issa, A.O, (2018). The role of public libraries in communities and National Development: the

big issues. Paper presented at the conference of Directors and Chairmen of States Public Library Board in Nigeria. Odeleye, D.A(n.d). Repositioning Nigerian education for relevance in the 21st century. Ibadan. university Press.

Klarin, T. (2018). The concept of sustainable development: from its beginning to the Contemporary issues. Zagreb International Review of Economics and Business, 21(1), 67-94.

Kalu C.O, Kalu, E.I, Okidi, I.A.A, Mafe, T.A (2020) ICTs Tool for Achieving Sustainable Development Goals (SDGs): A Conceptual Overview. Journal of the Nigerian Library Association Vol. 53 No. 2. 11-22

Lewis. R. A,Kenerson M.J, Sorrentino & Rowse T. H (2019). Experiencing Sustainability Education Insight from a Living and Learning Programme SAGE publication Vol. 13(1) 24-44.

Nagarkar, S. R (2017). Roles of Librarian as Information Manager in Digital Age. Sinhgad Institute of Business Review. Conference Issue 16th and 17th Feb 366-370.

Nicholas, M.T & Perpetual, A.E (2015). Library and Education: Panacea for Sustainable Development in Nigeria. Asian Journal of Information Science and Technology, 5(2),28-31

Ojo, J.O., Odunlade, R.O. & Adedokun, T.O. (2020). Information Literacy for Sustainable Agricultural Development in Nigeria: A Case of Farmers in Lagos-State. Nigerian Libraries, Journal of the Nigerian Library Association. Vol. 53 No. 2, 23-36

Okuonghae, O. & Abimbola M.O (2019). Information Management in Herbal Research: Nexus of Trends and Application of Emerging Technologies, International Journal of Knowledge Content Development & Technology Vol. 9, No. 3, 63-74.

Okuonghae, O. & Igbinovia M. O (2019). The Role of Academic Libraries Towards the Attainment of Sustainable Development Goals: The Nigerian Perspective. Covenant Journal of Library & Information Science (CJLIS) Vol. 2 No.2 51-68

Okuonghae, O., Ijeh, C. I & Erhabor, J. O. (2018). User Delinquency as a Factor Affecting Effective Service Delivery in University Libraries in Ekiti and Ondo State, Nigeria. Library Philosophy and Practice (e-journal). Retrieved from https://digitalcommons.unl.edu/cgi/viewcontent.cgi?Article=4842&context=lipphilprac

Onyam I. D & Benson V.O (2020). Achieving Sustainable Development Goals in Nigeria: Library and Information professionals As Catalysts, The Information Technologist: An Information Journal of Information and Communication Technology (ICT) Vol. 17. No. 1 205-215.

Osunwusi, A.O. (2020). The Nigerian Education Milieu in the SDG Era: The Roles, Values, Challenges and Prospects of ODL and Lifelong Learning. International Journal of Learning and Development Vol. 10. No. 1 140-158

Owojuyigbe A. A & Owojuyigbe P. F (2021). Archival Digitization: A Vibrant Education and Research Tool for Sustainable Development. Lagos Journal of Library & Information Science (LAJLIS) Vol.10 No. ½ pp14-27

World Commission on Environment and Development. (1987). Our Common Future. Oxford: Oxford University Press.

Journal of Environmental Science and Economics ISSN:2832-6032
https://doi.org/10.56556/jescae.v1i2.10

RESEARCH ARTICLE

Corporate Social Responsibility (CSR) Programs in Sarangani Province: Promotion of the Triple Bottom Line Framework of Sustainability

Cheryl Marie M. Cristobal-Cipriano[1], Jinnifer D. Arroyo[2], Alvin Q. Romualdo[2]

[1]Department of Trade and Industry XII, Philippines
[2]Philippines Public Safety College-National Police College Davao, Philippines

Corresponding Author: Alvin Q. Romualdo, alvin.romualdo@ppsc.gov.ph
Received: 27 February, 2022, Accepted: 22 April, 2022, Published: 05 May, 2022

Abstract

This study aimed to determine the Corporate Social Responsibility (CSR) programs implemented by business organizations in Sarangani Province in the frame of Triple Bottom Line Framework of Sustainability – People, Planet, and Profit (3Ps). It employed the mixed method research design using sequential qualitative and quantitative survey-type techniques. It involved fifty-two (52) respondents from medium-sized and large companies. Findings show that the main CSR drivers were customer satisfaction and company reputation/image while the major barrier was the lack of support from top management. In terms of involvement, the companies made efforts to address social injustice; partnered with communities to provide financial assistance; promoted waste management, energy, and water conservation; and, ensured employee well-being. In terms of integrating corporate citizenship, the companies recognized the role of leaders as CSR champions; incorporated CSR policies and integrated CSR initiatives in program development; installed CSR in their operational systems, as well as enabled M&E mechanisms. In assessing CSR program implementation, the companies established safety protocols in the workplace; educated their employees and the communities on environmental protection; and, hired local people from host communities. On issues and challenges, financial constraint was cited as a major concern while the benefits were gained from the areas of environmental conservation and compliance to national and local laws. Hence, the study concluded that many business organizations in Sarangani have already taken 3Ps- anchored proactive steps through CSR to make valuable contributions for the continuous development of medium and large-scale enterprises. It is therefore recommended that business organizations should increase their CSR program focus on Gender Equality, develop more CSR champions, increase employee involvement in CSR initiatives, and further CSR efforts through increased funding, while the government should introduce strategic measures to further encourage more companies to undertake CSR.

Keywords: Business organizations; people; planet; profit; sustainable development

Introduction

Since the start of the industrial revolution in the 1970s, the world has seen the birth of more business organizations which has in turn led to the creation of companies – the conglomerates and multinational companies (MNCs) that we know today. These business organizations have since taken over the world of commerce and trade, changed the landscape of doing business, and in the process, became an integral part of many of the world's economies spanning across continents – from North and South America, Europe, Australia, Africa, and Asia (Kordos & Vojtovic 2016).

Through the years, business organizations have grown and become an indelible presence in many parts of the world. In the Philippines, there are 1,017,187 registered corporations and partnerships operating in the country as of December 31, 2018 according to the Securities and Exchange Commission. Corporate social responsibility emerged at the turn of the century, which centered on the growing awareness and concern of business leaders on the responses of their respective communities, as well as the sustainability of their environments (Hamidu, Haron, & Amran, 2015). It was a strategy for them to comply with regulatory requirements, uphold standards, build corporate reputation, as well as create customer loyalty – the end-goal being to increase

profitability and the overall attainment of organizational objectives (Moir, 2001). All these are rooted on the premise that "business only contributes fully to society if it fulfils its economic responsibilities to stakeholders and is socially responsible (Moir, 2001).

This applies to all industries, as well as in the case of the Philippines and Sarangani province in particular, where agriculture and fisheries are the dominant industries, and where natural disasters, such as typhoon, flood, earthquake, fire, among others, pose imminent danger to life, property, and the environment. By promoting CSR, agri-fishery companies help address the fundamental issue of sustainability in their business, while contributing toward the Sustainable Development Goals (SDGs) of the United Nations (Mazur-Wierzbicka, 2015), viz., "for a world with less poverty, hunger and disease, greater survival prospects for mothers and their infants, better educated children, equal opportunities for women, and a healthier environment (Visser, 2009). CSR initiatives will likewise build the capacity of communities to withstand disasters brought about by natural and man-made calamities, and enable them to respond accordingly.

One popular definition of sustainability comes from the Brundtland Report which defines it as "development that meets the needs of the present generations without compromising the ability of the future generations to meet their own needs" (Brundtland, 1987). Central to this definition is the applicability of sustainability to the three basic elements of life: community development, environmental protection and stewardship, and, in the case of business organizations, organizational productivity (economic or financial considerations): the triple bottom line of sustainability (Arowoshegbe, Emmanuel, & Gina, 2016).

The "triple bottom line" is a new term to define sustainability, i.e., "Sustainable development involves the simultaneous pursuit of economic prosperity, environmental quality, and social equity. That companies aiming for sustainability need to perform not against a single, financial bottom line but against the triple bottom line (Elkington, 1998).

Companies are considered to be contributing to the triple Bottom Line of People, Planet, and Profit when they acknowledge and take responsibility for their actions that affect the economy, their employees, the society, and the environment (KsiężaK & FischBach, 2017). This definition heightens awareness on the positive impact of CSR to the organization's performance in terms of productivity and return (Waddock & Graves, 1997). It also strengthens the efforts from both the government and the private sector to capacitate communities in the face of disasters and natural calamities, thereby ensure public safety especially to the vulnerable sectors of society.

Region 12 or the SOCSKSARGEN Region ranked as the 5th poorest province in the country with 47.3% poverty incidence among its population (Authority, 2015). With the aforementioned realities, the researcher was prompted to gather evidence about the Corporate Social Responsibility programs being implemented by the business organizations in Sarangani Province. It was hoped that evidences gathered from business organizations may serve as inputs in the development of policy alternatives that would ensure sustainability in terms of the three bottom lines of community (People), environment (Planet), and organizational productivity (Profit), which would then then redound to the communities' resiliency in the face of natural and man-made disasters.

This study aimed to determine the Corporate Social Responsibility (CSR) programs implemented by business organizations in Sarangani Province which contributed to the Triple Bottom Line Framework of Sustainability – People, Planet, and Profit (3Ps). Being one of the poorest provinces in the country, the province of Sarangani needed the presence of investment locators to boost its economy. Existing locators, such as private corporations, had been able to contribute significantly to this goal of alleviating poverty in the province. However, there was a lack of information whether they have established and implemented CSR programs in the province; and what specific program foci especially in the areas of community development (People), environmental conservation (Planet), and organizational productivity (Profit). Thus the need to conduct this study as the information that will be generated can aid in future policy interventions, most especially in the area of public safety in the face of man-made disasters and natural calamities.

Literature Review

CSR is commonly viewed as a corporate initiative that is basically discretionary and extends beyond the legal minimum by helping companies achieve the following: developing good relationships with stakeholders; increasing their competitive edge; catalyzing innovation; and, promoting goodwill (Crane et al., 2008; Singh & Misra, 2019). Thus, there is a dire need to have leaders who can anticipate the changes in society and are willing to become catalysts in transforming their organizations toward a sustainable society through CSR (Gorski, 2017).

Externalities in CSR refer to all factors that have an impact on the various stakeholders. One example was the Asian tsunami which prompted companies to introduce CSR initiatives as their humane corporate assistance to the victims (Fernando, 2007). In terms of the barriers to CSR, a study in Bangladesh identified 12 barriers to their pursuit of CSR, to include: lack of stakeholder awareness; financial constraints; and, lack of top management commitment (Govindasamy & Suresh, 2017). Addressing these mean taking responsibility for the negative environmental impact of their business activities, thus mitigate any damage arising from their activities (Stojanović, Mihajlović & Schulte 2016). To do this, companies need to develop new

organizational frameworks such as CSR programs, to be able to rise to the challenges that society expects of them (Yuan, 2011).

By defining stakeholder orientations, companies will be able to prioritize which to focus in view of their organizations' limitations and constraints (Ahmad et al., 2014). A study in South Korea found that employee participation in CSR contributed to the attainment of organizational outcomes, thus promoting healthy work environments (Im, Chung & Yang, 2016). This supports the need to embed CSR in human resource management programs that will redound to a healthy working environment that boosts organizational productivity (Sarvaiya, 2014). Organizations do this through consultation with stakeholders – their employees, environmental groups, local communities, and governments (Maon, Lindgreen & Swaen, 2009).

Another core feature of CSR is going beyond shareholder interest to consider the interests of other stakeholders, or the "business case for CSR" – how firms can benefit economically from being socially responsible (Hamidu, Haron & Amran, 2015). A research on managers of African-American businesses showed that economic and ethical responsibilities came first, followed by legal responsibility and philanthropic activities (Edmondson & Carroll, 1999). Consumers in China attach more importance to CSR orientations, revealing that they are more concerned with economic responsibility than ethical and legal considerations (Ramasamy & Yeung, 2009).

In Malaysia, business organizations realized the importance of becoming socially responsible for them to stay competitive in a rapidly changing environment due to a growing expectation from various stakeholders (Masum, Aziz & Ahmad, 2020). They get involved in the community to leave lasting impacts in society, in the environment, and in the economy (Ismail, 2009).

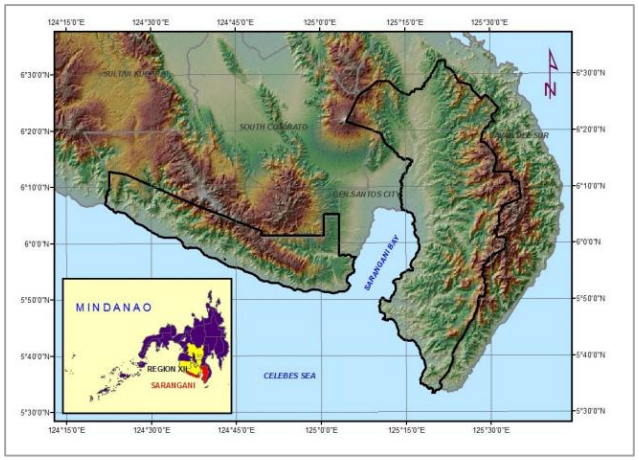
CSR is a set of values that has come to underpin company practices, such as undertaking CSR activities in areas where traditions and cultural practices are valued (Wang, 2011). This adheres to the definition of what constitutes CSR. By treating the various stakeholders responsibly, companies demonstrate that they have a right not to be treated as means to some end; but are active participants in determining the future direction of the companies where they also have a stake (Hopkins, 2006). The notion that CSR extends beyond philanthropy has become a viable and strategic platform to satisfy stakeholder expectations while serving to achieve organizational objectives. This is in stark contrast to the idea of it serving simply as an ordinary added-value to the business organization (Grayson & Hodges, 2004).

Methods

This study followed the mixed-method research design integrating both quantitative and qualitative research approaches characterized by the collection and analysis of quantitative data from the respondents followed by the collection and analysis of qualitative data from the informants.

The respondents of this study were the 52 representatives from business organizations in Sarangani Province belonging to the medium and large companies, and those with capital/gross sales of PhP15 million to PhP100 million for the medium-sized companies and PhP100 million and above for the large companies (Republic Act 9501 or the Magna Carta for Small Enterprises). Eight (8) employees from four (4) selected companies composed the informants of the study.

Figure 1. Geographical Location of Sarangani Province



Manufacturers and processors in the municipalities in the province belonging to the micro, small, medium and large enterprises are the identified respondents of the study. These enterprises have capital/gross sales of from less than PhP3 million to more than PhP100 million. All industry sectors were included in the study, provided that they had operations/are operating in one or more of the seven (7) municipalities in the province, namely: Glan, Malapatan, Alabel, Malungon, Maasim, Kiamba, and Maitum.

This study used simple random sampling for selecting the respondents from the medium and large companies that have operations/ are operating in Sarangani Province. The identified respondents were the owners of the company, the top and middle level management such as the Managers and Department or Division Heads in charge of their CSR programs, the personnel in charge of the CSR unit such as the Human Resource Officer and the CSR Program Executive Directors, as well as their staff in case of the formers' absence or unavailability, but with permission from their department/division/program/unit heads. This technique was employed to ensure representation of the variables of the study. A total of 30 respondents were required for the Online Survey and eight (8) participants for the Key Informant Interview (KII).

For the 1st set of questionnaire which was done through Online (Gmail and Google Form) and Face-to-Face Survey, a total of 98 respondents were sent the questionnaire, of which 52 responded. From this set of companies, a total of five (5) companies were identified to participate in the Key Informant Interview (KII) – 2 medium-sized and 3 large – and provided with the 2nd set of Questionnaire. The five (5) companies were selected based on their positive response to the study – their willingness to undertake both the Online Survey and the KII within the timeframe that was relayed to them. Of these, four (4) companies participated.

This study was a combination of quantitative and qualitative methods; thus, analysis for both methods were applied. For quantitative design, data were gathered using the 5-point and the 3-point Likert Scales wherein responders specify their level of agreement to a statement typically in five and three points. These were then presented in table form based on the prescribed template of the Likert Scale. It showed the analyzed data and the results (Frequency, Percentage, Mode), as well as a discussion on what the various data sets mean, and their relevance to other data in the study.

The use of the 5-point and 3-point Likert Scales in data analysis were employed using the Likert Scale Response Anchors to measure the attitudes or opinions that were generated from the questionnaire. With this scale, the respondents were asked to rate the items on the following: rank of importance, agreeableness, extent of motivation, impact of barriers, extent of involvement, and extent of integration. Lastly, the data generated were also segregated according to the medium-sized companies on the one hand, and the large companies on the other hand. The analysis for these were then discussed in textual presentation after each of the tables.

For the qualitative data analysis, the answers of the informants were recorded and transcribed according to the nature of the data collected. After which, textual analysis was done to come up with the words/phrases that were frequently mentioned, thus come up with thematic areas that were common to all the Key Informant Interview (KII) respondent companies. These were then computed to get the percentage share of each theme from all the rest of the themes. A general picture was then arrived at for each of the three areas mentioned, and according to the themes that surfaced, to come up with an overall picture for each of the areas identified, namely: their Assessment of their CSR programs/ services; the Issues and Challenges they faced; as well as the Benefits that they gained from pursuing CSR in their operations.

Results and Discussion

Profile of Business Organizations

Of the 52 companies who took part in the survey, 30 were medium-sized (58%) while 22 were large (22%). This represented the composition of business establishments in the province based on aggrupation. Majority of the companies belonged to the Agriculture and Fishery (23%) and Financial Services (23%) sectors. This reflected the province's industry landscape, which is predominantly agriculture and fishery-based. The financial services sector, composed of private banks and micro-finance institutions, provide critical support services to the local economy. It validated the growing roles that agriculture and fishery-based companies play in promoting CSR in their business (Mazur-Wierzbicka, 2015).

Table 1. Profile of Business Organizations by Business Category and Industry Sector

Business Category	**Frequency**	**%**
Medium (PhP15M-PhP100M)	30	58
Large (PhP100M above)	22	42
Total	**52**	**100**

Industry Sector	**Frequency**	**%**
Agriculture & Fishery	12	23
Financial Services	12	23
Consumer Products	8	15
Trading	4	7
Education	3	6
Energy	3	6
Construction and Real Estate	2	4
Health	2	4
Industrial Equipment and Supplies	2	4
Distribution and Transportation	2	4
Hotels and Restaurants	1	2
Information & Communication Technology (ICT)	1	2
Total	**52**	**100**

Emerging Views on CSR

The emerging views on CSR revealed that the companies considered CSR as "highly important" (69%), reflecting the idea that a good CSR policy impacts positively to the organization's performance in terms of productivity and return (Waddock & Graves, 1997).
In ranking the six (6) areas of good corporate citizenship, the greater majority identified "providing safe and reliable products/ services" at the top of their priorities, followed by "working to improve conditions". With this, it can be gleaned that vital importance was given to product/service excellence to ensure consumer/customer satisfaction.

Table 2. Perceived Level of Importance of CSR

Responses	Frequency	Percent
Highly important	36	69
Moderately Important	10	19
Important	6	12
Total	**52**	**100**

This paves the way for companies to build good relations with stakeholders, boost competitive advantages, innovate, and enhance goodwill (Singh & Misra, 2019).
In terms of which areas of good corporate citizenship is the most important, majority declared their "strong agreeableness" with the statements. "Corporate citizenship is important to our customers", had the most number of companies (69.23%) who stated their strong agreeableness. This show that the companies value the views of their customers/consumers; and since the latter regarded CSR to be important, the companies followed suit. As to their views on what constitutes good corporate citizenship, primary consideration was placed on what customers/consumers think. This supports their belief that CSR improved their image and reputation which was linked to their goal of satisfying their customers/consumers. As such, they looked on CSR as an effective business strategy (Hopkins, 2006).

A significant number of companies (38.46%) ranked Poverty as the No. 1 area of concern where they feel they should most actively play a role. This was followed by Hunger and Health Care (29%). Majority saw Poverty – the No 1. Goal under the United Nation's Sustainable Development Goals (SDG) – as their foremost area of concern, given that Sarangani has long been ranked as one of the country's poorest provinces. This aligns with the "global aspirations faced by developing countries as they face critical issues of human development and environmental sustainability" (Visser, 2009). It is worth noting that Gender Equality and the Development of Alternative Energy Resources fared poorly in the ranking, compared to poverty, hunger, and healthcare, which are deemed to be basic human needs.

More than half of the companies declared that "Importance to customers" (59.62%), "Improvement of reputation/image" (50%), and "Fits in company traditions and values" (50%) as the motivating factors that pushed them to pursue CSR. All these supported previous declarations which indicated that for them, customers and company reputation/image were the building blocks of CSR. This supported the view, however indirectly, that CSR is a business strategy that companies willingly undertake to develop relationships with customers/consumers and their families, as well as with their employees (Ismail, 2009).

Barrier to CSR.

The statement, "Top management does not support it" was the only barrier that had a "significant impact" to the companies surveyed (48%). This acknowledged the critical role that top management plays in determining whether to pursue or not to pursue CSR. According to Govindasamy and Suresh (2017), companies in Bangladesh also identified these barriers, i.e., the lack of top management commitment, financial constraints, and lack of knowledge pointing at a common experience faced by companies worldwide.

Table 3. Emerging Views on CSR

	Importance of Good Corporate Citizenship						
Area	**5**	**4**	**3**	**2**	**1**	**Mode**	**Verbal Description**
Providing safe and reliable products/ services							
Frequency	43	8	0	1	0	**5**	**Most important**
Percent	82.69	15.38	0.00	1.92	0.00		
Working to improv conditions in your company		11	0	1			
Frequency	40	21.15	0.00	1.92	0		
Percent	76.92				0.00	**5**	**Most important**

Area	Agreeableness on What Constitutes CSR 5	4	3	2	1	Mode	Verbal Description
Corporate citizenship important to our customers. Frequenc							
Percent	36	12	4	0	0	**5**	**Strong Agreeableness**
	69.23	23.08	7.69	0.00	0.00		

Roles of Business Organizations

Area	Rank 1	2	3	4	5	6	7	8
Development of alternative energy sources								
Frequency								
Percent	3	4	5	5	2	6	15	12
	5.77	7.69	9.62	9.62	3.85	11.54	28.85	23.08
Education								
Frequency	8	3	6	8	12	7	6	2
Percent	15.38	5.77	11.54	15.38	23.08	13.46	11.54	3.85
Gender equality								
Frequency	1	2	2	6	9	11	7	
Percent	1.92	3.85	3.85	11.54	17.31	21.15	13.46	14
								26.92
Health care								
Frequency	5	8	12	14	5	3	2	3
Percent	9.62	15.38	23.08	26.92	9.62	5.77	3.85	5.77
Hunger								
Frequency	5	15	8	9	4	4	2	5
Percent	9.62	28.85	15.38	17.31	7.69	7.69	3.85	9.62
Poverty								
Frequency	20	8	7	1	2	5	6	3
Percent	38.46	15.38	13.46	1.92	3.85	9.62	11.54	5.77

CSR Drivers

Table 4. Drivers and Barrier to CSR

Drivers/Motivators of CSR

CSR Driver	Drivers to CSR 5	4	3	2	1	Mode	Verbal Description
Important to our customo consumers							
Frequency						**5**	**To the Highest Extent**
Percent	31	11	5	4	1		
	59.62	21.15	9.62	7.69	1.92		
Improves our reputation/ image							
Frequency						**5**	**To the Highest Extent**
Percent	26	18	6	2	0		
	50.00	34.62	11.54	3.85	0.00		
Fits our company traditions a values							
Frequency						**5**	**To the Highest extent**
Percent	26	18	7	1	0		
	50.00	34.62	13.46	1.92	0.00		

Barriers to CSR

Barriers to CSR Practice	Impact			Mode	Verbal Description
	3	2	1		
Top management does support it				**3**	**Significant Impact**
Frequency	25	17	10		
Percent	48.08	32.69	19.23		

Extent of Personnel Involvement in CSR

A total of 29 company personnel (56%) stated that they were involved in their companies' CSR operations "to a great extent". This shows that knowledge and awareness about CSR are passed on to employees who then ensure that CSR programs/ services are implemented; thus contributing to job satisfaction. This supports a study in South Korea which suggested that CSR participation positively affected organizational productivity, contributed to employee job satisfaction, and helped promote a healthy work environment (Im, Chung & Yang, 2016).

Extent of Company Involvement in CSR

In terms of social investment, a significant number were "greatly involved" in addressing social issues such as education, health, and housing. These are recurring social issues that they wanted to actively involve themselves in, such as addressing poverty, hunger, and health care, which still persist in the province given the high incidence of poverty. Several also located their facilities in the communities, hired local people, and helped create jobs.

This aligned with their declaration to positively impact in the lives of the local people who, as of 2015, earned an estimate of PhP20,753.00 per person per year or around PhP56.86 per day. This was below the national level of PhP21,753.00 (PhP59.60 per day) Annual Per Capita Poverty Threshold (Sarangani Ecological Profile, 2015). A study in Malaysia found out that today's companies were realizing the importance of becoming socially responsible to help them stay competitive (Masum, Aziz, & Ahmad, 2020).

In terms of Corporate-Community Partnership, a significant number declared their involvement to a great extent in partnering with host communities to extend financial assistance, provide jobs, and engage the latter in their business operations. By involving the community as partners for development, the companies were cognizant of their link with the community. This goes hand in hand with the idea behind CSR, which presupposes community involvement to be able to leave lasting impacts in society, the environment, and the economy (Ismail, 2009).

With regard to environmental stewardship, a significant number considered practice of waste management (55.77%) and encouraging energy and water conservation (46.15%) at the top of their priorities while their involvement in the purchase from socially responsible partners and assumption of responsibility for any environmental impact is moderate. This strengthens the principle that CSR is not just fulfilling the social and economic requirements from business, but is also about giving attention to environmental issues and taking responsibility for the negative environmental impact of their business activities (Stojanović, Mihajlović & Schulte, 2016).

Table 5. Extent of Company Involvement in CSR Areas: Environmental Stewardship

Areas	Extent of Company Involvement Environmental Stewardship					Mode	Verbal Description
	5	4	3	2	1		
Practice of waste managemer							
Frequency						**5**	**To a Great Extent**
Percent	29	19	2	1	1		
	55.77	36.54	3.85	1.92	1.92		
Encouraging energy and wate conservation							
Frequency						**5**	**To a Great Extent**
Percent	24	20	4	2	2		
	46.15	38.46	7.69	3.85	3.85		
Purchasing from socially responsible partners							
Frequency							
Percent	15	26	6	4	1	**4**	**To a Moderate Extent**

	28.85	50.00	11.54	7.69	1.92		
Assume responsibility for an environmental impact							
Frequency	20	24	4	2	2	**4**	**To a Moderate Extent**
Percent	38.46	46.15	7.69	3.85	3.85		

Extent of CSR Integration

The companies were all highly involved in managing workplace concerns in the areas of: (1) compensating employees above the minimum wage; (2) providing the best working conditions; and, (3) providing training and development opportunities to employees. Not only were they involved in CSR programs for the community and the environment, they were also keen and deeply interested in ensuring the well-being of their employees. Through CSR, the companies are able to inject social and ethical concerns of employees which redound to better working conditions and a healthy working environment that boost organizational productivity (Sarvaiya, 2014).

Majority of the companies stated that leadership had been "integrated to the highest extent" in their organizations in the following areas: as Champions of Corporate Citizenship principles and values (46.15%); Support and commitment to Corporate Citizenship goals and objectives (42.31%); and, Assuming full responsibility to the company's economic, social, and environmental impacts (51.92%). These findings solidify the role of leaders as champions of CSR and act as catalysts who will shift their organizations toward a sustainable society by promoting the CSR's values and principles (Gorski, 2017).

Table 6. Extent of CSR Integration: Leadership

Areas	Extent of CSR Integration Leadership					Mode	Verbal Description
	5	**4**	**3**	**2**	**1**		
Leadership serves as champions Corporate Citizenship principle and values							
Frequency	24	18	6	3	1		
Percent	46.15	34.62	11.54	5.77	1.92	**5**	**To the Highest extent**
Leadership supports and commits CC goals and objectives							
Frequency	22	18	10	1	1		
Percent	42.31	34.62	19.23	1.92	1.92	**5**	**To the Highest extent**
Leadership assumes full accountability to the company's economic, social and environmen impacts							
Frequency	27	16	6	2	1		
Percent	51.92	30.77	11.54	3.85	1.92	**5**	**To the Highest extent**

Majority of the companies have largely integrated CSR policies in their operations, particularly in communicating and sharing CSR policies to their employees "to the highest extent". This indicated that the companies were deeply committed in pursuing CSR initiatives by putting in place the policies that will enable them to define their roles in society and adhere to social, ethical, legal, and responsible standards (Maon, Lindgreen & Swaen, 2009).

A large number of companies stated that CSR had been integrated "to the highest extent" in terms of designing CSR programs "with clear objectives, policies, procedures, and workable implementation strategies" (46%). These findings lend support to the proposition that companies need to accommodate within their core structures organizational changes. By developing a new organizational framework

through CSR program integration, companies are able to rise to the challenges that society expects of them (Yuan, 2011).

In terms of systems installation, a significant number of companies had incorporated CSR in their operational systems, from organization and communication to management and financial systems. The findings add strength to the proposition that standardized systems facilitate the implementation and integration of CSR within companies. This results to improvement in company performance attributable to the introduction of CSR (Bernal-Conesa et al., 2016).

Majority of the companies declared that Monitoring & Evaluation (M&E) mechanisms have been integrated "to a large extent" in their organizations while "reporting of CSR program accomplishments on a regular basis, such as monthly, quarterly, etc.", were already "highly integrated". "What gets measured gets managed". By employing the tools of reporting, verification, and evaluation, companies are provided with bases for informed decision-making, which then lead to improvements and modification (Hohnen & Potts, 2007).

Assessment of CSR Program Implementation

Initiatives undertaken to effectively manage the workplace ranked high in their assessment of CSR programs implemented. This delved more on the Safety Programs established, such as the provision of Personal Protective Equipment (PPEs), safety protocols on hygiene and sanitation, and compliance to Occupational Safety and Health Standards (OSHS). Educating employees and the communities about the environment also ranked high on their list of CSR activities, as well as providing employment to locals –their way of acknowledging and taking responsibility for their actions that affect the economy, their employees, the society, and the environment (KsiężaK & FischBach, 2017).

Table 7. Assessment of CSR Programs/ Services

Assessment			
#	**Areas**	**Frequency**	**Percent**
1	**Community Development**	**41**	**17**
	- Balancing capability and community needs	9	4
	- Provision of employment to locals	19	10
	- Assistance to schools	5	2
	- Coordination with government (LGUs/barangays)	8	3
2	**Environmental Conservation**	**93**	**39**
	- Environmental stewardship/education	29	12
	- Air/ Water/Coastal management	17	7
	- Solid Waste management	29	12
	- Forest/Tree planting	10	4
	- Others (coordination with LGUs/ barangays, commur development)	8	3
3	**Management of workplace concerns**	**106**	**44**
	- 5S	17	7
	- Safety programs	52	22
	- Health care program	15	6
	- Workplace environment (compliance to environmental la disciplinary process)	22	9
TOTAL		**240**	**100**

Issues and Challenges

Internal issues such as budgetary constraints and the forms of assistance they extend to their employees in times of need were at the top of their concerns. Related literature show that the challenges faced by the companies were not unique to them and to the province of Sarangani, but were in fact common threads that surface in other business organizations worldwide. These shared concerns and shared values somehow enable companies to come closer to solving differing and competing stakeholders' interests (Aseghehey, 2018).

Benefits Gained

A high percentage of companies reported the most benefits gained in the area of environmental conservation, followed by compliance to national/local laws, employee well-being, and building corporate image/reputation. This supports the view that CSR benefits both ways -- the companies achieve

financial gains by reaching out to the communities, creating a good reputation, and securing their position in the market. Communities become recipients of jobs, quality education, and infrastructure, as well as better health and security for their people (KsiężaK, 2016).

Reliability Test through Cronbach's Alpha

A Cronbach's alpha test was done to test the reliability and internal consistency of the survey tool. Results showed that the tool used reached the minimum required reliability as all variables showed α-values above or higher than 0.70 which indicate the reliability of all scales. Nunnally (1978) supported the rule of thumb on internal consistency which is set at 0.70 value –a baseline reference which indicates that all items and coefficients are acceptably reliable.

Conclusions

Sarangani's private sector, particularly its business organizations, need to show to society that business success need not be compromised when pursuing community, environmental, and workplace development. In fact, these can go hand in hand, thus contributing toward the business' sustainability.

Findings show that Agriculture-Fishery and Financial Services comprised the bulk of companies from all the sectors. The emerging views from the companies show that majority recognized the important role that CSR plays in their organizations; that the main CSR drivers were customer satisfaction and company reputation/image while the major barrier was the lack of support from top management.

In terms of involvement, the companies made efforts to address social injustice; partnered with communities to provide financial assistance; promoted waste management, energy, and water conservation; and, ensured employee well-being. In terms of integrating corporate citizenship, the companies recognized the role of leaders as CSR champions; incorporated CSR policies and integrated CSR initiatives in program development; installed CSR in their operational systems, as well as enabled M&E mechanisms.

In assessing CSR program implementation, the companies established safety protocols in the workplace; educated their employees and the communities on environmental protection; and, hired local people from host communities.

On issues and challenges, financial constraint was cited as a major concern while the benefits were gained from the areas of environmental conservation and compliance to national and local laws. Hence, the study concluded that many business organizations in Sarangani have already taken 3Ps'- anchored proactive steps through CSR to make valuable contributions for the continuous development of medium and large-scale enterprises.

It is imperative, therefore, for business organizations to increase their focus on gender equality; further the knowledge of companies' leaders on the importance of good corporate citizenship and its impact; engage employees to advocate and promote CSR within and outside of the organization; and assess their financial portfolio and determine if more funds can still be aligned toward CSR programs, thereby enable them to make more inroads toward sustainability in the three areas of People (community), Planet (environment), and Profit (organizational productivity).

The government also needs to craft innovative programs and projects, as well as introduce strategic measures that will further encourage more Philippine companies to undertake CSR. There are as yet very few issuances – whether national or local – that provide incentives for business organizations to adopt CSR as a program, with the exception of House Bill No. 306, or the Corporate Social Responsibility Act of 2013.

As it is, HB 306 needs relevant laws that will strengthen it, and give more reasons for companies to seriously consider having their own CSR programs. National government agencies such as the Securities and Exchange Commission (SEC), the Department of Trade and Industry (DTI), as well as the Board of Investments (BOI), can explore ways to contribute toward this end. Even the local government units at the city and municipal levels, can also do so as part of their Annual Investment Plan (AIP), among others.

Acknowledgment

The authors of this research work would like to extend their heartfelt gratitude to their respective agencies –Department of Trade and Industry and Philippine Public Safety College-National Police College Davao; families and friends; and above all to the Almighty God for the gift of life and the ability to hope and have dreams and wisdom, and the strength to realize them.

References

Ahmad, A., Bosua, R., & Scheepers, R. (2014). Protecting organizational competitive advantage: A knowledge leakage perspective. Computers & Security, 42, 27-39.

Arowoshegbe, A., Emmanuel, U., & Gina, A. (2016). Sustainability and triple bottom line: An overview of two interrelated concepts. Igbinedion University Journal of Accounting, Okada, Nigeria.

Aseghehey, M. A. (2018). Challenges in Implementation of CSR: A case study of Karlstad Bus.

Authority, P. S. (2015). Economic indicators. NSCB.

Bernal-Conesa, J. A., Briones-Penalver, A. J., & De Nieves-Nieto, C. (2016). The integration of CSR management systems and their influence on the performance of technology companies. European journal of management and business economics, 25(3), 121-132.

Brundtland, G. H. (1987). Our common future—Call for action. Environmental Conservation, 14(4), 291-294.

Crane, A., McWilliams, A., Matten, D., Moon, J., & Siegel, D. S. (Eds.). (2008). The Oxford handbook of corporate social responsibility. OUP Oxford.

Edmondson, V. C., & Carroll, A. B. (1999). Giving back: An examination of the philanthropic motivations, orientations and activities of large black-owned businesses. Journal of Business Ethics, 19(2), 171-179.

Elkington, J. (1998). Partnerships from cannibals with forks: The triple bottom line of 21st-century business. Environmental quality management, 8(1), 37-51.

Fernando, M. (2007). Corporate social responsibility in the wake of the asian tsunami:: A comparative case study of two sri lankan companies. European Management Journal, 25(1), 1-10.

Gorski, H. (2017). Leadership and corporate social responsibility. In International Conference, Knowledge-based Organization, (Vol. 23, No. 1, pp. 372-377).

Govindasamy, V., & Suresh, K. (2017). Exploring approaches to drivers and barriers of corporate social responsibility implementation in academic literature. In SHS Web of Conferences (Vol. 33, p. 00021).

Grayson, D., & Hodges, A. (2017). Corporate social opportunity!: Seven steps to make corporate social responsibility work for your business. Routledge.

Hamidu, A., Haron, H., & Amran, A. (2015). Corporate social responsibility: A review on definitions, core characteristics, and theoretical perspectives. Mediterranean Journal of Social Sciences. MCSER Publishing, Rome, Italy. Vol. 6 No. 4.

Hohnen, P., & Potts, J. (2007). Corporate social responsibility: An implementation guide for business.

Hopkins, M. (2006). What is corporate social responsibility all about?. Journal of Public Affairs: An International Journal, 6(3-4), 298-306.

Im, S., Chung, Y. W., & Yang, J. Y. (2016). Employees' participation in corporate social responsibility and organizational outcomes: The moderating role of person–CSR fit. Sustainability, 9(1), 28.

Ismail, M. (2009). Corporate social responsibility and its role in community development: An international perspective. Journal of International social research, 2(9).

Kordos, M., & Vojtovic, S. (2016). Transnational corporations in the global world economic environment. Procedia-Social and Behavioral Sciences, 230, 150-158.

KsiężaK, P. (2016). The Benefits from CSR for a Company and Society. Journal of Corporate responsibility and leadership, 3(4), 53-65.

KsiężaK, P., & FischBach, B. (2017). Triple Bottom Line: The Pillars of CSR. Journal of corporate responsibility and leadership, 4(3), 95-110.

Maon, F., Lindgreen, A., & Swaen, V. (2009). Designing and implementing corporate social responsibility: An integrative framework grounded in theory and practice. Journal of business ethics, 87(1), 71-89.

Masum, A., Aziz, H., & Ahmad (2020). Corporate social responsibility and its effect on community development: An overview." IOSR Journal of Business and Management (IOSR-JBM), 22(1), pp. 35-40.

Mazur-Wierzbicka, E. (2015). The application of corporate social responsibility in agriculture. University of Szczecin, West Pomerania, Poland.

Moir, L. (2001). What do we mean by corporate social responsibility?. Corporate Governance: The international journal of business in society.

Nunnally, J. C. (1978). Psychometric theory (2nd ed.). New York: McGraw-Hill

Ramasamy, B., & Yeung, M. (2009). Chinese consumers' perception of corporate social responsibility (CSR). Journal of Business Ethics, 88(1), 119-132.

Sarvaiya, H. (2014, July). CSR for HR: Embedding CSR in Workplace Practices. In Proceedings of the International Association for Business and Society (Vol. 25, pp. 82-90).

Singh, K., & Misra, M. (2019). Corporate social responsibility (CSR): an emerging opportunity or a forced liability. International Journal of Advance & Innovative Research, 6(1), 85-94.

Stojanović, A., Mihajlović, I., & Schulte, P. (2016). Corporate social responsibility: Environmental aspects. In International May Conference on Strategic Management-IMKSM2016. Bor, Serbia.

Visser, W. (2009). Corporate social responsibility in developing countries. Antwerp Management School, Belgium.

Waddock, S. A., & Graves, S. B. (1997). The corporate social performance–financial performance link. Strategic management journal, 18(4), 303-319.

Wang, L. (2011). Factors affecting perceptions of corporate social responsibility implementation: an emphasis on values. Dissertationes Forestales 130.

Yuan, W., Bao, Y., & Verbeke, A. (2011). Integrating CSR initiatives in business: An organizing framework. Journal of Business Ethics, 101(1), 75-92.