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## Energy Consumption in Agriculture Sector, Environmental Cleanliness and Economic Growth: An Empirical Evidence of South Asian Countries

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**ABSTRACT**

This study plays its role in the literature by investigating the impact of energy consumption on agriculture sector, and environmental cleanliness on Gross Domestic Product, in five South Asian countries from the period of 1990 to 2015. Energy is now becoming a challenge for the South Asian countries especially country like Pakistan. Developing countries are in a race to gather more and more resource for the production of energy. The main objective of research is to examine the short-run and long-run relationship between economic growth and energy consumption on agriculture sector of economy in South Asian countries. Granger causality test and Error correction model is employed to get the results. The empirical results showed the presence of co-integration among the variables and it indicates gross domestic product has a positive relationship with energy consumption in agriculture sector and environmental cleanliness. Granger causality results showed that unidirectional causality is present between gross domestic product and agricultural sector while no causality is present among environment cleanliness.

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**1. Introduction**

Agriculture is the main area of source for creating nations and feeding people. It supplies sustenance and job to the greater part of the populace. An adequate supply of residential nourishment is extremely important for stable economy and political framework in creating nations. It is the primary reason of the strength of the horticulture part. Farming area in South Asian nations is exceptionally vital for the continuous nourishment supply to the local populace. This is additionally vital as horticulture records for almost 30 percent of the GDP. It connects with majority of the populace and for a great many people rural items make up a substantial piece of utilization and have a weight of 57 percent in the purchaser value record. Any strategy which influences the horticulture division in this manner influences everybody in the general public. The quick changes in the agrarian segment essentially

influenced the little agriculturists in South Asian nations amid the 1960s. The popular Green Revolution had profound impacts for profitability by the presentation of high-yielding seed assortments and enhanced composts. The new biotechnologies present new seeds that upgrade the physiological quality, synchronicity and energy. It empowers the foundation of yield in various environments which gave a catalyst to horticultural automation (Bakhsh, Ahmad, Hassan, & Gill, 2007).

Energy is a key wellspring of economic growth in light of the fact that numerous creation and utilization exercises include Energy as fundamental information. Energy is a standout amongst the most critical inputs for economic growth. From a physical perspective, the utilization of Energy drives economic profitability and industrial development and is a key to the operation of any present day economy. (Asghar, 2008a) contend that Energy is in charge of any event and a large portion of the industrial development in an advanced economy.

South Asia is otherwise called Southern Asia; it is the southern area of the Asian landmass. Amid the period of British Empire it was likewise named as "Indian Subcontinent". The present nations incorporated into South Asia are: Afghanistan, Bangladesh, Bhutan, Maldives, Nepal, India, Pakistan and Sri Lanka. In addition, the British Ocean region, Mauritius and Tibet locales are additionally incorporated into South Asia. The region of South Asian is around 5.1 million km<sup>2</sup>; it is 11.51% of the Asia subcontinent. South Asia covers 3.4 % of the world's property surface region. . It is most thickly populated geological locale of the world. It is the natural surroundings of one fifth of the world's populace. South Asian populace is around 1.749 billion. It involves more than 24% of the world's populace. Each of the eight countries involving South Asia is the part of the South Asian Association for Regional Cooperation (SAARC). It is an association for the economic collaboration of every one of the eight nations (Lucas, 1976).As indicated by the report of World Bank which was distributed in 2015, South Asia turns into the quickest developing conservative area on the planet. India is the biggest and quickest developing economy in the locale (US\$2.180 trillion). Pakistan has the following biggest economy in South Asia (\$250 billion) trailed by Bangladesh and Sri Lanka (Quah, 1996).

South Asia is the country of 24% of the world populace and the GDP development of this area is exceptionally promising, from 5.5% to 6.5% from 2004 to 2010. Yet at the same time South Asia is set apart as one of the locales with least per capita utilization of Energy. Normal appropriation of assets is uneven and it makes unevenness between territorial requests and supply in South Asia, because of a few different variables. A few locales have parcel of Energy assets while different districts have less assets For the most part developed countries have bunches of Energy sources and they are rich, while the developing nations also have Energy deficiency status.

South Asia demonstrates wide differences as far as Energy assets and Electricity which are delivered and utilized as a part of various nations. The rate of utilization of fills and the openness to the Energy assets differ incredibly in rustic and urban territories. South Asian nations are Energy inadequate nations since they have less oil and gas assets(Pereira). They intensely rely on imports to full fill their necessities of oil and gas. The utilization of renewable Energy assets additionally fluctuates extraordinarily in South Asian nations. For the most part South Asian nations hand-off on single Energy sources with the exception of India and Pakistan. Afghanistan, Maldives, Nepal and Sri Lanka expend 78%, 100%, 67% and 79% oil, individually. Bhutan utilizes half of hydroelectricity Energy. 74% Energy consumption of Bangladesh relies on upon common gas. More prominent reliance on sole Energy source creates Energy security worries and in addition it restricts the alternative of differing qualities. A standout amongst the most critical point that numerous south Asian nations have enough coal assets (India and Pakistan) however they are yet importing coal from different nations. Like India had imported 28 million tons of coal in year 2006.

To support the GDP of the locale or to keep up the development of economy, a consistent supply of Energy at sensible costs is the need of great importance. South Asian nations are utilizing distinctive sorts of imported Energy assets which are persistently expanding their import bills. Still the vast majority of the south Asian nations are not ready to full fill their Energy requests. When contrasted with developed countries, South Asian individuals have less extravagance. The Energy bills of South Asian residents are additionally high when contrasted with the subjects of numerous developed countries. It is additionally disturbing that the Energy needs of South Asian nations is expanding step by step and it will build three times in next 15 to 20 years. Key difficulties in the Energy division of South Asian nations are expanding Energy deficiency, predominance of single fuel, expanding import spending plan and the absence of required Energy framework. It is the need of great importance to pay consideration on the Energy approach of the SAARC nations.

To diminish import spending innovations must be created to build the profitability of oil, gas and coal in the area. South Asian nations have wide assortment of renewable Energy assets like hydra, wind, sun oriented and tidal. Bioenergy must be utilized as a part of various zones of life to build the economic growth or to full fill the provincial family unit request. The Energy interest of the area is expanding with a yearly rate of 5% because of family and modern division. Thus, it is the need of an ideal opportunity to step for the un-interfered Energy supply to all divisions of economy. Electricity is one of the central Energy source everywhere throughout the world. It is an optional type of Energy which is created from essential Energy sources like coal, oil and normal gas. Numerous different strategies for Electricity era are practically speaking now days like hydro-electric strategy, atomic innovation, sun oriented, and wind, geothermal and tidal techniques. Generation, transmission and dissemination of Electricity to every single part of the nation is a costly method and it needs parcel of spending plan. Electricity is a vital Energy source so it is ideal to examine it independently (Tang, Shahbaz, & Arouri, 2013).

Use of Electricity in the general public is the fundamental pointer of a dynamic economy. As indicated by UN Human Development Index the utilization of Electricity is straightforwardly related with way of life. Those nations which have per capita utilization of Energy is beneath 1,000 kWh have HDI scores under 0.6. In the event that the utilization level of Energy expanded in the nation the HDI score made strides. Utilization of Electricity in South Asia is most reduced per capita. Notwithstanding the way that South Asia is honored with numerous regular Electricity creating assets. Numerous South Asian nations like Pakistan, India, Nepal and Bangladesh are confronting the gigantic lack of Electricity. They are creating half less Electricity than the accessible potential. They require right around 40000MW more Electricity to full fill their necessities or to run their economy consistently. India had been confronting 9% Electricity lack in 2011. Bhutan is likewise confronting the lack of essential Energy as force supply. In Pakistan the HDI have medium quality which is 500kwh for every capita.

In South Asian nations conventional strategies are utilized for the era of Electricity. For the most part fuel is transported in from the created nations and after that it is utilized for Electricity era as a part of South Asia. Different techniques for Electricity generation are likewise in like manner practice. Like Bhutan, Nepal, Pakistan and Bangladesh are utilizing hydroelectric assets. India is likewise utilizing coal on expansive scale for the creation of Electricity. Coal gasification innovation is likewise presented in Pakistan, as of late (Brisse, Schefold, & Zahid, 2008)Energy is the critical criteria for the improvement of the economy of the nation. The development rate of GDP likewise relies on upon the interest of Energy and Electricity is one of the main components which decide the way of life in created nations. Electricity assumes the most fundamental part in the improvement of the economy. It decides the advancement of the nation. For the transformation of creating country into a created country the prerequisite of Energy increments commonly(Han, Özyilmaz, Zhang, & Kim, 2007)

Energy is considered as the most important factor for the generation of wealth and also an important component in economic progress of the country. This fact makes the energy resources as an essential fact for every country of the world. In an effort to balance energy supply and demand, every country is making policies and strategies. Every country aims to attain the perfect balance between energy supply and demand. Many factors determine the world energy consumption and production some of which are: population growth, economic performance, consumer tests, technological developments, government policies concerning the energy sector and developments on world energy markets. The energy is responsible for at least half the industrial growth in a modern economy (Asghar, 2008b; Foran & Poldy, 2002). Energy is a key source of economic growth because many production and consumption activities involve energy as a basic input. Energy is one of the most important inputs for economic development. From a physical point of view, the use of energy drives economic productivity and industrial growth and is central to the operation of any modern economy.

The specific research questions that this research aimed to answer are:

- What is the impact of energy consumptions of agriculture sector on economic growth of south Asian countries?
- What is the impact of environmental cleanliness (CO<sub>2</sub>) on economic growth of south Asian countries?

## 2. Literature Review

To achieve a managed development of farming efficiency, enough interest in the rural area is irreplaceable, particularly in the preparatory phases of monetary advancement. This improves rural generation and accordingly, there is a move in HR in the mechanical and administration division from agribusiness area. The end goal to change from agrarian segment to mechanical division an adequate improvement in the rural part efficiency is necessary

(Duranton & Puga, 2004). On the interest side, the development in agrarian creation increments rural wage which prompts increment in the interest for modern items. In addition on the supply side, the expansion in the profitability in the horticulture part moves HR from the farming to the modern segment(Jorgenson, 1967) Like numerous creating nations, South Asian Countries (SACs) have ensured their horticultural parts to settle their residential sustenance supplies.

This is additionally mandatory as farming part represents about 30 percent of the GDP. It offers vocation to the left of the populace and for some individuals horticultural items make up a gigantic piece of utilization and have a weight of 57 percent in the buyer value file. Any adjustment in the approach which influences farming segment subsequently straightforwardly impacts everybody in the general public.(Henneberry, Khan, & Piewthongngam, 2000) Agricultural division additionally helps in the quicker development of the modern segment. This may exchange the abundance work from horticultural segment to different areas by producing business. Strategy creators in these nations are going ahead to take after mechanical drove development strategies and they trust that it will upgrade monetary advancement, while the need to support agribusiness division is debilitating.

Hence, any component hindering the capital arrangement in the horticultural division may have unsafe results on highly required profitability development. Keeping in mind the end goal to obey with the usage of financial and basic change strategies and to balance the diminishing agrarian profitability, it is necessary to make substantial capital interest in the agribusiness and agro-subordinate mechanical areas in the locale. It will secure sustenance supply in these nations; particularly it readies these nations to adapt to expanding populace and nourishment request. Moreover, approach producers must need to consider the macroeconomic bearings of arrangement changes in the rural segment and their centrality in the general balance for development, circulation and welfare.

### **2.1 Environmental Cleanliness & Economic Growth**

The normal ascent in populace and the financial advancement that must happen in numerous nations have genuine risk for nature in light of the fact that the vast majority of the Energy creating frameworks (for instance, era of power, warming, cooling, or intention power for transportation vehicles and different uses) are crushing the earth and are unsafe for the biological community (Dincer & Rosen, 1998). The point of the effect of financial development and CO<sub>2</sub> outflows has been reported in the writing of economy. Distinctive specialists have focused on various nations, eras and have utilized diverse sorts of intermediary variables for Energy utilization. Creator examined the impact of monetary development, CO<sub>2</sub> outflows, capital, money related improvement, and populace on Energy utilization(Hamrita & Mekdam, 2016) utilized disintegration technique for their studies. They broke down the components that influence the move in the level of Energy related CO<sub>2</sub> emanations. They portrayed that outflow of CO<sub>2</sub> in the mechanical division demonstrated a diminishing pattern because of good Energy proficiency and fuel exchange. In any case, the effect of contamination coefficient and Energy force on CO<sub>2</sub> outflows in the horticultural area was verging on ignored. Then again, Energy force changed a more extensive territory and greatly affected Energy actuated CO<sub>2</sub> emanations than the contamination coefficient.

The natural effect of Energy utilization is lessened by upgrading the effectiveness of Energy asset usage (by and large alluded to as Energy protection), and by substituting all the more ecologically generous Energy assets for harming ones. Amid late years the ecological impact of human exercises has become drastically because of the increments in the total populace, asset utilization, and modern action.

## **3. Methodology**

The objective of the paper is to make it clear that how much South Asian Countries are investing over energy, how much they are consuming per annum and what is its impact over GDP. In this research, we consider the following; Pakistan, India, Nepal, Bangladesh and Sirilanka. It was aimed to study the history of these five South Asian countries for a long time, but managed to gather the data for 25 years. We will see in the descriptive data statistics that how other researchers use different testing for the analysis of the data gathered.

### **3.1 Variables and Data Source**

In the above model shows the list of independent variables, which have been utilized to fulfill the objective like; CO<sub>2</sub> used as proxy variables which has been used by different researcher. As independent variables used total energy consumption, trade openness, energy consumption in agriculture, services and industrial sector. The present study is based on panel data, for the time period of 1990-2015.In this study, collected from world development indicator and international energy agency to check the impact of energy consumption in different sector of the

economy of south Asian countries. There are different studies around the world, which fused these variables. The general functional form of the model is given as in the following:

$$GDP = f( ECIA, Env)$$

#### 4. Results and Discussion

**Table 1: Panel Unit Root**

Variables	Methods	Statistics	P-Value	Statistics	P-Value
		Level		First Difference	
LCO2	Levin, Lin & Chu t	-3.12677	0.5062	-2.44236	0.000
	Im, Pesaran and Shin W-stat	-0.39129	0.3478	-4.60874	0.000
	ADF-Fisher Chi-square	13.6792	0.1881	40.0183	0.000
	PP-Fisher Chi-square	12.0303	0.2830	353.665	0.000
LECIA	Levin, Lin & Chu t	-1.17367	0.1203	-4.09657	0.000
	Im, Pesaran and Shin W-stat	0.60347	0.7269	-5.35225	0.000
	ADF-Fisher Chi-square	5.67097	0.8421	48.1803	0.000
	PP-Fisher Chi-square	11.9863	0.286	99.167	0.000
LGDP	Levin, Lin & Chu t	0.27767	0.6094	-1.54526	0.0221
	Im, Pesaran and Shin W-stat	0.28871	0.5748	-3.84970	0.0061
	ADF-Fisher Chi-square	6.06292	0.8099	32.7442	0.0001
	PP-Fisher Chi-square	7.49211	0.6783	117.776	0.0003

**Table 2: Panel Descriptive Statistics**

	LNGDP	LNCO2	LECIA
Mean	1.806817	3.558678	3.341761
Median	1.625590	3.279030	2.950851
Maximum	4.968563	7.532955	4.375737
Minimum	-2.118042	-0.116534	2.424882
Std. Dev.	0.970870	2.073367	0.682282

**Table 3: Panel Correlations**

	LNGDP	LNCO2	LECIA
LNGDP	1.000000		
LNCO2	0.221609	1.000000	
LECIA	0.010413	0.192319	1.000000

**Table 4: Johansen Fisher Panel Integration Test**

Hypothesized	Fisher Stat.*	Prob.	Fisher Stat.*	Prob.
No. of CE(s)	(from trace test)		(from max-eigen test)	
None*	180.6	0.0000	180.9	0.0000
At most 1*	103.8	0.0000	62.32	0.0000
At most 2*	71.19	0.0000	48.58	0.0000
At most 3*	84.71	0.0000	67.96	0.0000

**Table 5: Granger Causality Test**

Null Hypothesis	Obs	F-Statistic	Prob.	Status
LECIA does not Granger Cause LNGDP	112	4.81013	0.0304*	Unidirectional Causality
LNGDP does not Granger Cause LE CIA		0.04162	0.8387	
LNCO2 does not Granger Cause LNGDP	111	2.27256	0.1346	No Causality
LNGDP does not Granger Cause LNCO2		0.84301	0.3606	

**Table 6: Error Correction Model**

Error Correction:	Standard Error	T-Statistics
CointEq1	(0.31739)	[-3.98441]
D(LNGDP(-1))	(0.26558)	[ 0.60775]
D(LECIA(-1))	(2.17190)	[-1.29085]
D(LNCO2(-1))	(0.43154)	[-0.16510]
C	(0.13966)	[ 0.01061]
R-squared	0.518750	
Adj. R-squared	0.358333	
Sum sq. resids	27.11139	
S.E. equation	0.640920	
F-statistic	3.233767	
Log likelihood	-73.38917	
Akaike AIC	2.166049	
Schwarz SC	2.809179	
Mean dependent	0.004836	
S.D. dependent	0.800109	

## 5. Discussion

Energy is a rising and a serious issue of the modern world. It is getting on more and more challenging for the policy makers with time. South Asian countries have limited energy resources. They rely on the exported energy resources for the fulfillment of their demands. In some South Asian countries the exploration of energy resources demand lot of investment but many South Asian countries have natural resources and they have the capacity to full fill their requirements or to control the energy crisis(Stjepanović, 2013). The governments of these countries are not focusing on their goals properly due to different causes. Pakistan is facing the serious issues of energy shortfall. It has enough natural resources for the generation of electricity but the country is not politically well established to solve this issue. Pakistan also lacks government funding and they are not focusing seriously on the issue of energy shortage.

Some of the South Asian countries have many other problems like they are not using the energy resources properly and efficiently. The wastage of energy resources is the serious cause of energy shortfall in these countries. Moreover, this inefficient utilization of energy resources has serious implication of the environment. This behavior caused many environmental problems and it is deteriorating are environment(Felipe, McCombie, & Naqvi, 2010). The pollution level is also increasing day by day due to inefficient use of the energy resources(Saidi & Hammami, 2015). Hygienic and human friendly environment is the necessity of life for all living things. It is the main need of the society because it enhances the life quality of the citizens. Intellectuals and researchers are working day and night to achieve the ever increasing energy goals of the world. On the other hand, the search of efficient, sustainable and environment friendly energy resources is on its peak. They are trying to cross all those hurdles which are creating problems in the achievement of nature friendly and enough energy resources.

## 6. Conclusion

A balanced panel of five South Asian countries was developed and considering the data of 25 years that also contains annual data of our variables we consider for this study. To satisfy the core purpose and objective of the study and considerable verification of the results originated from the test of the panel data we selected, we tried to incorporate many other countries as possible as we can with a considerable and reasonable time frame of the observations. The central objective of this study is to broadly survey and analyze the current landscape of the South Asia's service sector so as to assess its potential to serve as an engine for inclusive economic growth. Our study indicates that services are already an important source of output, growth, and jobs in the region. This observation is very calculated and measured for the particular reading of the variables that is required for the result of the study. This research work is done to conclude the importance of the energy and its utilization for the coming eras. The increased rate of energy consumption is a sign of ending resources and it is important to look after the other resources that can fix this issue of increased cost of energy production. The only reliable source of energy is feeding different sector but with the time world is running out of the resources to support energy that is supporting the industries. This research work emphasis over the effects of energy consumptions and costs bore to cope with the energy production(Siddique & Majeed, 2015). There were different studies in consideration that helped in

compiling this project. It is studied and observed all the studies related to South Asian countries that energy consumption is always an issue in such region and it is never taken in consideration. We studies different factors as variables for the countries individually and in a panel data that helped in understanding the real situation regarding energy consumption.

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