Management and Economics Journal

ISSN: 2456-2661 Volume:2_Issue: 08 2018

The Nexus between Energy, Capital Stock, and Economic Growth: An Empirical Analysis of Pakistan

Author: **Kamran Hamid *[1]**

[1] COMSATS Institute of Information Technology

Corresponding Author:

Kamran Hamid *[1]

[*] COMSATS Institute of Information Technology

Abstract:

"This study has examined the output of sugarcane and its impact of economic growth of Pakistan. Sugarcane has positive impact on economic growth of Pakistan. Data is taken from 1981-2013 and taken from different sources. An ARDL approach to cointegration is used to investigate the long-run cointegration in the series. Then, VECM test is applied and investigated the short and long-run relationship. The study reveals that Pakistan has efficient potential in sugarcane sector of Pakistan. Prices of energy and prices of fertilizer badly affected the output of sugarcane sector. Investment in agriculture has a long term relationship with output of sugarcane."

Keyword: Sugarcane, Wage Rate, Growth-output-relationship, VECM

JEL Classification: C32, C01, Q18,

Introduction:

"Economic growth generally refers to increase in productive capacity of an economy. Discussion about output-gap has a great significance in the literature economic growth. To achieve economic growth, it is tried to reduce output gap and Economic policies are formulated to raise output level of all sectors of the economy.

Economy comprises of three sectors Primary, Secondary and Tertiary sector. If all these sectors of an economy are performing to their potential level, then the output gap can be minimized and hence economic growth can be achieved. However, all these sectors are usually not performing to their potential level of output. Therefore, government policies are devised in such a way that is helpful to achieve efficient level of output level. Governments' policies that are targeted to specific sector are usually effective to reduce the output gap.

Primary sector of the economy has utmost importance to achieve economic growth. It is because the growth of other two sectors is highly dependent upon primary sector. Primary sector includes the production of raw material as well as food items. To achieve economic growth, primary sector plays an important role especially in developing countries. It is

because of share of agricultural output to total output ranges from 50% to 60% in developing economies.

In Pakistan sugarcane sector is not performing at its maximum potential level. There is a gap between its actual level of ouput and potential level of output. Pakistan sugarcane sector currently suffers from underutilizing of its potential resources resulting in unnecessarily low yields per hectare and per unit of water consumed. Pakistan is major exporter of sugar in all over the world. To increase the output level of sugarcane sector, two ways may consider, one is to increase the productivity of sugarcane which is currently below its potential level. Second is the full utilization of end products of Sugarcane. Efficient usage of these end products can contribute positive role in economic growth of country. There are very few studies in the literature that looks at the potential role of sugarcane sector in the economic growth of the country. The study aims at filling out the gap between potential and actual output level and efficient use of end products of sugarcane sector.

Objectives of the Study:

Keeping in view the above discussion the following objectives are outlined in the study.

- Estimation of output function to determine the factors that is significant to raise sugarcane production in Pakistan.
- Analyzing the ways through which end products of sugarcane can be utilized to raise output level of the economy."

Literature Review:

Rizvi (2001) had discussed in this article that Sugar industry of Pakistan is a key source of foreign revenue. "Bagasse can be used as a medium to fire steam turbine boilers which can further lead to the generation of Electricity. Molasses are being used both in processed and raw forms, the processed form of molasses is known as industrial alcohol. If 100% molasses is processed and converted into alcohol, it will generate relatively higher amount of foreign exchange or revenue. Author concludes by recommending that if the production of Sugar cane yielded per ton increases through advanced technological methods then it can generate a heavy amount of foreign exchange."

Pakistan's Sugar industry by (PASMA 2012) in which they argue that Pakistan is the 5th largest in terms of area under sugarcane cultivation, 11th by production and 60th in yield. "Area under cultivation has increased more rapidly than any other major crop. Sugar industry in Pakistan is the second largest agro based industry comprising of 85 sugar mills with annual crushing capacity of over 6.1 million tones. Sugar manufacturing and it's by products contributed significantly towards the foreign exchange resources through import substitution. Contribution to economy of sugar industry is, 1.9% share in total GDP, employment level reached at 1.5 million, total investment became 100 billion Rupees and contribution to exchequer was 12.16 billion rupees. Sugar Industries are majorly located in rural areas of Punjab and Sindh. Pakistan exporting more sugar, molasses and ethyl alcohol, So Pakistan has tremendous potential for exports of sugar, molasses and ethyl alcohol. The major buyers are Nether land, UK, Germany, Spain, Italy and Korea. Nether land is bigger buyer with 40% share in overall exports. There are much investment opportunities in this industry. The opportunities are, Improvement in sugar crop yield through R&D and planning, Improvement in procurement and storage to reduce wastages, Export potential of sugar/molasses, Development of Industries for proper utilization of by-products by adding equipment (distillery, chipboard etc.) which can earn / enhance revenues, and Power co-generation by the sugar industry using bagasse."

Hussain (2012) found the impact of credit disbursement, area under cultivation, fertilizer consumption and water availability on rice production in Pakistan. "Almost 90 percent of the total rice production is grown and also consumed in Asia. Pakistan is the country where the method of cultivation and production of rice changes every year with great margin, in other sense there exist ups and downs in area under cultivation and production of rice. This study is based on time series analysis, data is taken from 1988 to 2010 and the data is found from Economic Survey of Pakistan and National Fertilizer Development Centre (2010). The study has checked the data for stationarity by using the Philips Perron Test. Akaike Information Criterion was used to select the optimal lag length. Some variables were not stationary, that's why the study made them stationary after taking first difference. It also used the Johansen

Co-integration test to detect long-term relationship among the variables. This study used log-linear Cobb-Douglas Production function to estimate the impact and importance of the variables used. After applying regression analysis, the study has found the positive and significant relationship between rice production and area under cultivation and water availability. This study has also found no significant relationship between rice production and credit disbursement and fertilizer consumption."

Enaami *et al.* (2013) found the model development for wheat production, outliers and multi-co linearity problem in Cobb-Douglas production function. "This study has proposed the development of Cobb-Douglas production function parameter through the partial least squares path modeling (RPLS-PM) method to be applied on Libyan Agriculture sector data. PLS-PM is an approach that is used for complex modeling multivariate relationships among observed and hidden variables. This model has described by two models; measurement model relating the manifest variable and structural model. Data set is taken from 1960 to 2010. The data covered almost all important economic activity inputs. The assemblage of this work yielded the Cobb-Douglas production function which is utilized widely as a part of hypothetical and connected exploration. The outline of a Cobb-Douglas production function model comprises of few steps. In the first place, the general model structure ought to be dead set; enter and yield parameters and also their shared connections. At that point, parameter qualities ought to be controlled by first linearizing the models through logarithmic conversion and afterward applying the technique for slightest squares to the linearized parameters."

Data and Methodology:

"In this study we have specified an output function where output is a function of inputs. The following model will be constructed using time series data of Pakistan from 1981 to 2013.

$$\ln Y_t = \beta_0 + \beta_1 \ln K_t + \beta_2 \ln WA_t + \beta_3 \ln CD_t + \beta_4 \ln PE_t + \beta_5 \ln PF_t + \beta_6 \ln WG_t + \epsilon_t$$

Where,

Y= Output of Sugarcane Sector, K= Capital stock of Agricultural sector, CD= Credit Disbursement, WA= Water Availability, PE= Price Index of Energy, PF= Price Index of Fertilizer, WG= Wage Rate of Agriculture.

After specification of the model, the next step is to collect the data. We have taken data of the variables from different sources and various problems in the collected data have been tackled. The following section contains discussion about the data.

Table 1:

Data Sources:

Data Source/Year	Published By	Variables
Economic Survey of Pakistan(2006-07 & 2012-13)	Government of Pakistan	Price Index of Fertilizer, Price Index of Energy, Credit Disbursement and Water availability. Output of sugarcane (Prices of sugarcane*Quantity of sugarcane)
Hand book of Statistics on Pakistan Economy (2010)	State Bank of Pakistan	GDP deflator 2001 base year (Investment in agriculture)
Pakistan Statistical year Book (2007 & 2011) Article "Pakistan's Wage Structure"	Pakistan Bureau of Statistics Dr. Irfan Article	Wage rate of agriculture

Ardl Cointegration Bounds Testing:

Autoregressive Distributed lag (ARDL) model is used when there are both type of stationary levels exists in the series, level and 1st difference. ARDL model includes both short and long-run parameters. This technique is preferred as compared to other conventional co integration approaches because it can be applying irrespective of order of integration and provide reliable results in case of small samples.

$$\Delta Y_t = \sigma + \sum_{i=1}^{p} \beta_i \Delta Y_{t-i} + \sum_{i=0}^{p} \delta_i \Delta K_{t-i} + \sum_{i=0}^{p} \Upsilon_i \Delta CD_{t-i} + \sum_{i=0}^{p} \lambda_i \Delta WA_{t-i} + \sum_{i=0}^{p} \eta_i \Delta PE_{t-i} + \sum_{i=0}^{p} \rho_i \Delta PF_{t-i} + \sum_{i=0}^{p} \pi_i \Delta WG_{t-i}$$

$$+\alpha_1 Y_{t-1} + \alpha_2 K_{t-1} + \alpha_1 CD_{t-1} + \alpha_1 WA_{t-1} + \alpha_1 PE_{t-1} + \alpha_1 PF_{t-1} + \alpha_1 WG_{t-1} + \in_t$$

Where $\beta, \delta, \Upsilon, \lambda, \eta, \rho, and\ \pi$ are the short parameters and α_{1-7} are long run parameters in the above equations.

H_0: $\alpha_1 = \alpha_2 = \alpha_3 = \alpha_4 = \alpha_5 = \alpha_6 = \alpha_7 = 0$ (No Co-integration exists)

H_1: $\alpha_i \neq 0$ (Co-integration exists)

ARDL bounds testing used to check the long run cointegration in the series. This is checked by restricting the long run variables and using Wald test. The value of F-statistics is compared with the table values provided by pesaran *et al.* (2001). There are two bounds in the table. Upper and lower bound. If calculated valued is greater than upper bound, then there is cointegration and if the value is less than lower bound then there is no cointegration but is between the bounds then the results are inconclusive.

Error Correction Model (Ecm):

ARDL model consists of both long run and short run estimators. To find the short run dynamics in the series, an error correction term is used which shows the speed of adjustment towards the equilibrium from short run to long run in certain time period. Model is as follows

$$\Delta Y_t = \sigma + \sum_{i=1}^{p} \beta_i \Delta Y_{t-i} + \sum_{i=0}^{p} \delta_i \Delta K_{t-i} + \sum_{i=0}^{p} \Upsilon_i \Delta CD_{t-i} + \sum_{i=0}^{p} \lambda_i \Delta WA_{t-i} + \sum_{i=0}^{p} \eta_i \Delta PE_{t-i} + \sum_{i=0}^{p} \rho_i \Delta PF_{t-i} + \sum_{i=0}^{p} \pi_i \Delta WG_{t-i}$$

$$+\theta EC_{t-1} + \nu 1_t$$

Where ΘEC error correction term and rest of variables is are short-run variables."

Results and Discussion:

An ARDL model is estimated in this study and VECM to find the short and long-run dynamics between in the series.

Table.2

"Unit Root Testing:

Augmented Dicky Fuller Test Results		
Null Hypothesis: Unit Root		
	Levels	**First Difference**
LCD	0.649 (0.845)	4.817 (0.000)***
LK	1.018 (0.734)	5.585 (0.000)***
LPE	0.579 (0.986)	5.745 (0.000)***
LPF	1.068 (0.713)	4.193 (0.003)***
LWA	3.056 (0.040)**	7.438 (0.000)

LWG	0.224 (0.925)	4.863 (0.000)***
LY	1.382 (0.998)	4.569 (0.000)***

***, **, * significant at 1%, 5%, and 10% respectively

First step of estimation is to check the stationary level of data. ADF unit root test is used to check the stationary level of the data. This test shows that all variables are stationary at 1st difference except LWG which is stationary at level. These results suggested that ARDL cointegration technique will be used.

Table.3

Lag length Criteria:

Lag	LogL	LR	FPE	AIC	SC	HQ
0	80.05030	NA	2.12e-11	-4.712923	-4.389119	-4.607371
1	264.2866	273.3829	3.74e-15	-13.43784	-10.84742	-12.59343
2	356.2065	94.88508*	4.00e-16*	-16.20687*	-11.34982*	-14.62359*
*** indicates lag order selected by the criterion**						

Now the 2nd step is to find the optimal lag for the data. Lag length criteria is used to find the optimal lag for the data. Results suggested that lag 2 is optimal lag for this data (AIC). We will use this lag for further estimations

Table.4

Bounds Testing:

Model	Specification	Lower Bounds	Upper Bounds	F-statistics	Decision
1	$(LY, LWG, LWA, LPF, LPE, LK, LCD)$ ARDL (2, 2, 2, 1, 1, 0,2)	2.27	3.28	41.601	Co integration

ARDL bounds testing is applied and results showed that there is long run cointegration in the series and diagnostic tests (see table 5 and 6) proved the validity of the results. Our calculated value is greater than upper bound so there is long run cointegration in the series (see table 4).

Table.5

Bg Serial Test

F-statistic	2.310080
Prob. F(2,16)	0.1314

Table.6

White Test

F-statistic	1.089479
Prob. F(12,18)	0.4224

Above two tests are used to detect the problem of Serial Correlation and Heteroskedasticity in the model. LM test shows that there is no problem of Serial correlation because P value is greater than 0.10 or P > 0.10. White test shows that there is no problem of Heteroskedasticity because P value is greater than 0.10 or P > 0.10.

Table.7

Long-Run Estimates:

Variables	Coefficient	t-statistics
LWG	1.094085	4.21243
LPF	0.661271	0.89032
LPE	-1.220441	-2.37083
LK	0.877368	3.06360
C	-5.920889	

After checking the cointegration, VECM is used to find the long and short run relationship of the variables. Long run coefficients are positive except LPE which shows that are variables are positively related with the output of sugarcane in long run and LPE is negatively effecting the output of sugarcane in long run (see table 7). Sugarcane output if increases also increases the economic growth indirectly because when the output increases, more end-products of sugarcane will be available and more energy and other products will be made by those raw material. Energy is also produced by utilizing the end-product of sugarcane. So, in case of Pakistan the output is increasing in the long run and hence the economic growth.

Table 8
Short-Run Estimations:

Variables	t-statistics	t-statistics
ECM (-1)	-0.354881	-4.56422
ΔLWG	-0.351330	-2.72471
ΔLPF	-1.355093	-1.93605
ΔLPE	0.183347	0.39850
ΔLK	-0.448645	-3.53944
ΔLN	-1.081969	-0.25845
ΔLCD	0.400568	-2.81498
C	0.176284	1.31360
R-squared	0.699601	
F-statistic	6.404484	

Error correction term shows the speed of adjustment but the value of ECT must be negative and statistically significant. Our results show that there is 35% speed of adjustment. All variables are showing the short run relationship with output of sugarcane. In short run all variables are negatively related with the output but LPE is positively related with the dependent variable (see table 8).

Wage rate has negative effect on the sugarcane output in the short run because initially by giving wages to labour it would be a cost in short term but eventually with the passage of time it positively affects the output of sugarcane in long run. Price index of fertilizer has negative effect on the output of sugarcane in short run because as we know that the price is actually a cost to the firm so that cost always has the negative effect on the production in short run. Price index of energy has positive coefficient which means that in short run the price of energy has positive effect on the output of sugarcane because prices of energy include electricity and oil which increases sugarcane output shortly by supplying water through tube wells but in long term it affects badly output of sugarcane due to higher cost. Capital stock also has negative effect on the output of sugarcane in short run because initially it is a cost.

Figure.1 Model Stability Test (Cusum):

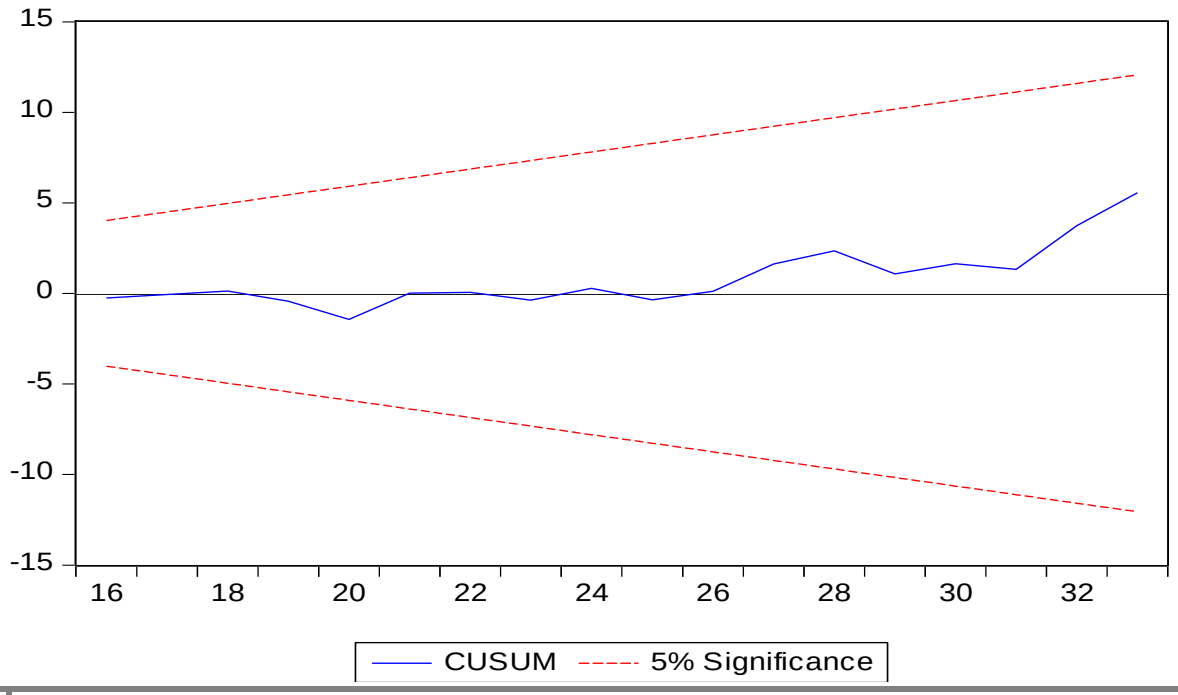
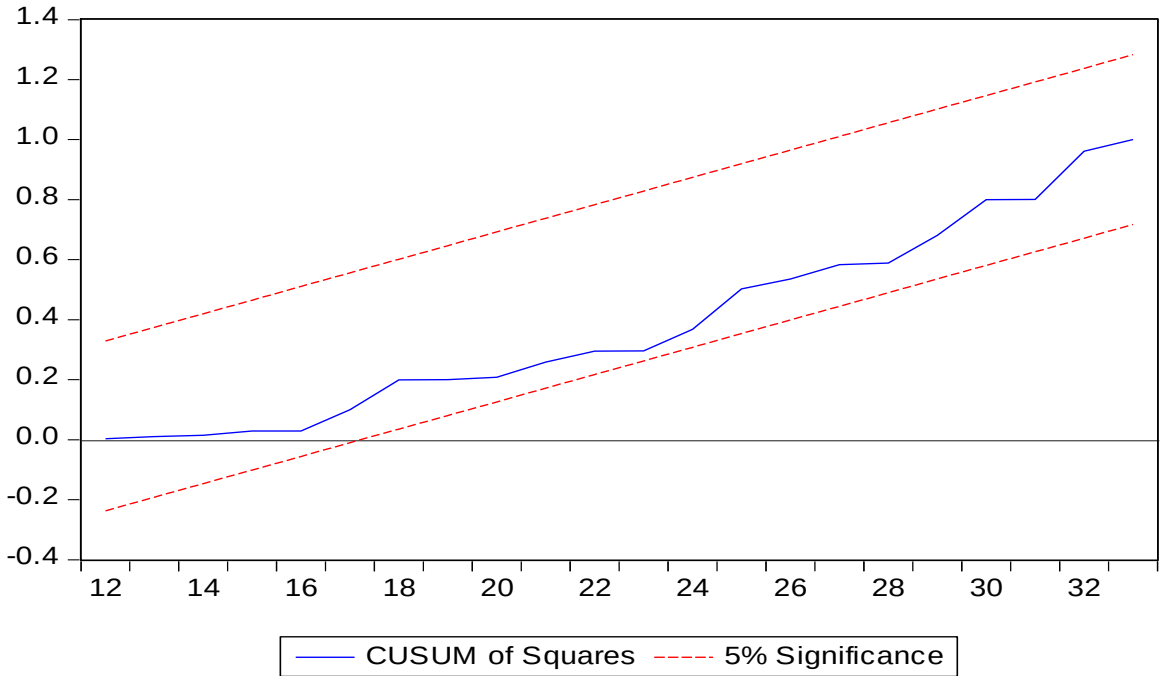


Figure.2 Model Stability Test (Cusum Ssq):



Conclusion and Policy Implication:

According to the results of present study it can be conclude that there is need of investment and attention to sugarcane sector of Pakistan. Sugarcane sector has a more potential to produce sugarcane if it's properly manage and its end products efficiently used then it could play significant role in economic growth of country in long term way."

According to SWOT analysis Pakistan has many opportunities in sugarcane sector as follows:

- "Can get more benefits from Agriculture Extension & Adaptive Research Department and Revenue Department with coordination and collaboration for getting latest knowledge and techniques in promotion of Agriculture sector and sugar cane crop.
- SSI (Sustainable sugarcane initiative) technique to plant sugar cane to get best quality of seed.
- SBP's Schemes, ZTBL & PPCBL and other bank's products for financial support to promote agriculture sector.
- SBP awareness initiatives (Focus group meetings, awareness & information dissemination programs, exhibitions fairs, seminars & workshops, capacity building programs, linkages with academia, research institutes & district/ local governments)."

Reference:

Abedullah, et al. (2007). "Analysis of Technical Efficiency of Rice Production in Punjab (Pakistan) Implications for Future Investment Strategies." Pakistan Economic and Social Review 45(2): 231-244.

Ameer, O. (2012). Managing Impacts from the bulk storage of bagasse. Environment and Heritage Protection, 1, 1-6.

Irfan, D. M. (2008). Pakistan's Wage Strucuture. PIDE. From pide.org.pk/pdf/pws.pdf

Economic Survey of Pakistan. (2006-07). Ministry of Finance. 6, from http://www.finance.gov.pk/survey_0607.html

Hand book of Statistics on Pakistan Economy. (2010). 10, from http://www.sbp.org.pk/departments/stats/PakEconomy_HandBook/

Hofsetz, K. and M. A. Silva (2012). "Brazilian sugarcane bagasse: Energy and non-energy consumption." Biomass and Bioenergy 46: 564-573.

Hussain, A. (2012). "IMPACT OF CREDIT DISBURSEMENT, AREA UNDER CULTIVATION, FERTILIZER CONSUMPTION AND WATER AVAILABILITY ON RICE PRODUCTION IN PAKISTAN." Sarhad J. Agric. 28(1): 95-101.

(June 2000). "10th Special Report to the US Congress on Alcohol and Health: Highlights from Current Research." National Institute of Health.: 134.

Khatiwada, D., et al. (2012). "Power generation from sugarcane biomass - A complementary option to hydroelectricity in Nepal and Brazil." Energy Policy 48: 241-254.

Li, Y., & Solomon, S. (2003). Ethephon: a versatile regulator for sugar cane industry. Sugar Tech, 5(4), 213-223.

Moreira, M. A. (2011). SIGNIFICANT LEARNING: AN UNDERLYING CONCEPT. Meaningful Learning in Revista, 6(3), 25-46.

Morand, A. (2004). Bagasse Cogeneration - Global Review and Potential, WADE.

Paturau, J. M. (N/A). "Alternative Uses of Sugarcane and Its Byproducts in Agroindustries." FAO CORPORATE DOCUMENT REPOSITORY: 1.

Qureshi, S. (2012). Annual Report 47th Annual General Meeting Pakistan Sugar Mills Association (Vol. 12, pp. 3-60): PSMA.

Rask, M., Magnuson, J. J., Tonn, W. M., Banerjee, A., Toivonen, J., & Sanchez, O. (1998). Isolation vs. extinction in the assembly of fishes in small northern lakes. Ecology, 79(8), 2941-2956.

Restuti, D. and A. Michaelowa (2007). "The Economic Potential of Bagasse Congenration as CDM Projects in Indonesia." Energy Policy 35: 3952-3966.

Rizvi, S. J. A. (2000). Sugar Industry in Pakistan - Problems, Potentials. SJAR, 1-25.

Rincon, L. E. and L. A. Becerra (2013). "Techno-Economic Analysis of the Use of Fired Cogeneration System Based on Sugarcane Bagasse in South Eastern and Mid-Western Regions of Mexico." Waste Biomass Valor 13: 1-10.

Sharma, M. P. and J. D. Sharma (1999). "Bagasse based Cogeneration System for Indian Sugar Mills." Renewable Energy 16: 1011-1014.

Sharpe, P. (1998). "SugarCane: Past and Present." Illinois: Southern Illinois University: 1-4.

Shehu, J. F., et al. (2007). "Analysis of Technical Efficiency of Small-scale Rain-fed Upland Rice Farmers in North-west Agriculture Zone of Adamawa State, Nigeria." JOURNAL OF AGRICULTURE AND SOCIAL SCIENCES 3(4): 133-136.

Yazdanie, M. (2010). Renewable Energy in Pakistan: Policy Strenghts, Challenges and the Path Forward. Energy Economics and Policy.