http://dx.doi.org/10.24212/2179-3565.2018v9i1p55-73

RISUS - Journal on Innovation and Sustainability
volume 9, número 1 - 2018
ISSN: 2179-3565
Editor Científico: Arnoldo José de Hoyos Guevara
Editora Assistente: Lívia Lopes Aguiar
Avaliação: Melhores práticas editoriais da ANPAD

TOTAL FACTOR OF PRODUCTIVITY AND ITS COMPONENTS: EVIDENCE FROM CEMENT - AND ENERGY SECTORS OF PAKISTAN

Fator Total de Produtividade e seus Componentes: Evidência nos Setores de Cimento e Energia do Paquistão

Razzi Abbas Jafri[1], Shahbaz Khan[2], Muhammad Haroon Shah[2], Nida Baig[3]
1 General Banking Officer, National Bank of Pakistan, Pakistan
2 School of Finance, Zhongnan University of Economics and Law
3 College of Public Administration, Huazhong University of Science and Technology, China
E-mail: raziabbas322@yahoo.com; shahbaz.khans@yahoo.com; haroonmwt786@outlook.com; nida_iiie@yahoo.com

Abstract: This study employs "Data Envelopment Analysis (DEA)" method to calculate the "Total Factor Productivity (TFP)" growth and its components of 19 non-financial firms from Cement and Energy sectors of Pakistan listed on ISE-100 Index during the time period 2005-2011. The research focuses on to identify the factors like, technical change and technical efficiency change tends to influence the TFP of cement -and energy sectors of Pakistan. We use hand collected data from the annual reports of these non-financial firms included in our sample. Results show that cement sector has an overall positive TFP growth of 9.7%, and energy sector has an overall TFP growth of 1.5% during the study period. The study may assist us to recognize the extent to which these components can affect the TFP of a sector, and will further help us to explore new ways to boost up the productivity of these sectors which in turn may be beneficial to move country towards a sustainable path.
Key words: Data Envelopment Analysis; Malmquist Productivity index; Technical efficiency; technological efficiency; Cement Sector; Energy Sector; Pakistan.

Resumo: Este estudo emprega o método "Data Envelopment Analysis (DEA)" para calcular o crescimento da "Produtividade Total dos Fatores (PTF)" e seus componentes em 19 empresas não financeiras dos setores de Cimento e Energia do Paquistão listados no ISE-100 Index durante o período de tempo 2005-2011. A pesquisa se concentra em identificar os fatores como mudança técnica e mudança de eficiência técnica que tendem a influenciar a TFP dos setores de cimento e energia do Paquistão. Usamos dados coletados manualmente dos relatórios anuais dessas empresas não financeiras incluídas em nossa amostra. Os resultados mostram que o Setor de Cimento tem um crescimento positivo geral da PTF de 9,7%, e o Setor de Energia tem um crescimento global da PTF de 1,5% durante o período do estudo. O estudo pode nos ajudar a reconhecer até que ponto esses componentes podem afetar a PTF de um setor e nos ajudará a explorar novas maneiras de aumentar a produtividade desses setores, o que, por sua vez, pode ser benéfico para mover o país rumo a um caminho sustentável.
Palavras Chave: Data Envelopment Analysis; Malmquist Productivity Index; Eficiencia Técnica; Eficiencia Tecnologica; Setor Cemento; Setor Energia. Paquistão.

Recebido em: 10/02/2018
Aceito em: 01/03/2018

INTRODUCTION

Having its major role in the development of infrastructure, cement sector stayed to contain vital rank among all industrial sectors (Schneider et al., 2011). It has ever growing importance for Pakistan as well (Pakistan Economic Survey, 2016). In 1947, only two companies having four plants were producing cement in Pakistan (Ghulam and Jaffry, 2015). The process of development in this sector continued and, the number of cement companies in Pakistan reached to 23 in 1988 and finally 24 companies. Pakistan is among the highest population growth rate countries (Pew Research Center, 2014), which procedurally increases the demand for housing facilities. However, Pakistan is facing a backlog of over 9 million in housing units (Dawn, 2015). Moreover, Pakistan is a higher disaster prone country (INFORM, 2015), which creates the demand for rehabilitation projects. To fulfill such requirements, a higher production is required, so it might be estimated that the demand for cement sector will continue to grow with a fast pace (The Express Tribune, 2016).Last but not the least, the construction industry is concerned with improving the social, economic and environmental indicators of sustainability (Ortiz et al., 2009)

As the matter of energy sector's selection, it is composed of petroleum, natural gas, oil companies, coal, renewable energy industry and many others. And its availability is essential for all the industries which are involved in processes of production, manufacturing, refining and distribution. In the last 150 years, global energy demand has increased unprecedentedly, due to the rapid growth of population and industrial development. Vast consumption of fuel and energy is playing an important role in maintenance of infrastructure and society in all over the world. Fuel is an important part, for the extraction of thermal energy and production of electricity which is important determinant of economic development (udah, eneng B, 2010), and also used for transportation. Examining and controlling energy sector is much necessary for the economic growth of country because there is a strong relationship between energy availability and global, economic, social and political development (Mir Anees Mehmood, 2006). Despite of being major player in all industries and having too much emphasis in every country, Pakistan is facing a huge shortage of energy these days which has jammed the most of the activities of construction sector in the country.

These two sectors are interlinked however, none of the study previously did a comprehensive TFP comparison of these two sectors in Pakistan. So, we study "Total factor productivity (TFP)" of these two sectors which is one of the major tools in evaluating the performance of any firm as well as assessing overall economic growth of a country. We try to focus on following research questions: (1) What are the factors that affect TFP of any firm?; (2) among Technical change and Technical efficiency change, which one is more significant to affect TFP growth?; (3) what are the TFP growth trends over the period of study?; (4) what is the comparison between cement and energy sector of Pakistan for TFP growth?

The rest of the paper is arranged as follows: section 2 descries the literature review; section 3 includes methodology, variables and data sources; Results and discussions are given in section 4; and finally section 5 concludes the findings of the study.

LITERATURE REVIEW

From the literature it has been revealed that many researchers have estimated TFP of different sectors using variety of variables and methodologies for example Manufacturing sector of Pakistan (Rehman et al. 2008); India (Dash et al. 2010) and Indonesia (Ikhsan ,2007); Banking Sector of Pakistan (Ahmed et al. 2009), Malaysia (abd-kadir et al. 2010) and Greece (Pasiouras et al. 2010); Indian garment industry (Joshi et al. 2010); Malaysian food industry (Ismail, 2009); Greek winery industry (Georgeos et al. 2010); Saudi Arabian IPO's(Alanazi, 2010); Indian Textile Industry (Murugeshwari, 2011); Turkish Pension system (Bakurats, 2010); Egypt's Pharmaceutical sector (Shinaway, 2010); Spanish retail sector (Jorge et al. 2010); Agricultural sector of Pakistan (Kiani, 2008); Colombian paper manufacturing sector(Katayama et al. 2008) and English higher education sector (Johnes, 2006)

Different methods were used in these studies to estimate total factor productivity. Dash et al. (2010) used Translog production function. Ikhsan (2007) and Madheswaran (2009) used stochastic frontier approach while many other recent studies used data envelopment analysis (DEA) method (Rehman et al. 2008); (Ismail, 2009); (Murugeshwari, 2011); (Bakurats, 2010); (Kiani, 2008); (Alanazi, 2010) to estimate total factor productivity.

Similarly input-output variables used, also vary among studies depending upon their methodological frameworks and techniques. Dash et al. (2010) used two inputs Labor (L) and Capital (K) while Time (T) taken as measure of technical progress. In another study four inputs total assets, Shareholders equity, cost of goods sold, operating assets and one output was sales revenue (Rehman et al.2008). Labor and machinery were considered as input and gross value added as output by Murugeshwari, (2011). Variables used by Bakurats, (2010) were labor, equity capital and debts from pension activity as inputs and technical income of pension & investment income as output. Shinaway (2010) used three inputs labor, intermediate inputs and capital and current prices in each firm as output.

Some authors contributed in cement sector which includes Mohammadi et al.(2011) who decomposed TFP into its components i.e. technical efficiency and technological efficiency, for better evaluation of Iranian cement companies' performance; Sharma (2008) who measured the technical and scale efficiency for overall efficiency evaluation of Indian cement companies and Mandal et al.(2009) who analyzed that TFP growth in Indian cement industry was due to technical progress but not the technical efficiency change. He suggested that for further growth, our emphasis should be on promoting firm's capability through efficiency oriented action plans and by making use of the economies of scale. Studies on energy sector shows that energy consumption and economic growth are positively correlated (Mehmood, 2006) (Hussain, 2010).

Tauer and Lordkipenidze (1999) estimated the measurement of productivity of dairy production in various states of the U.S. The technique used was non parametric Malmquist index approach and they used recent census data. Distance function was used to measure technical and efficiency differences over time. This study covered a time period 1987 to 1992. The correlation between efficiency change and technology change found to be only 0.06 across 43 states. Average increase in productivity was 0.7% per year. All productivity increased because of technology so average technological change efficiency change was only 0.1%.

Mohammadi, Ranaei (2011) worked on the patterns of productivity change in 22 Iranian cement companies which are listed on Iran stock exchange market during 2003-2004. They used DAE based Malmquist approach and took the data from financial statements of selected companies. CA, FA, COGS were used as inputs & NI, profit and shareholders' equity were the outputs. Results showed that half of the companies faced productivity increase in 2003-2004. Out of these 11 companies, the company "V" had the most productivity due to technical efficiency growth and technological growth. Technical efficiency was further due to management efficiency and scale efficiency.

Halizma abd-kadir et al (2010) found that total factor productivity of Malaysian banks was increased during 2003-2007 after merger and acquisition. They used DAE &MPI using operating expenses and total loans & advances as outputs and concluded that banks has increased their TFP mainly due to technological change. Technical progress of nine banks was increased by 17.1% but technical efficiency was decreased by 6%. As a result overall TFP growth was 10.1%.

Adika Kausar Kiani (2008) estimated the TFP gains of Punjab in Pakistan's agricultural crop sub sector from 1970-2004 using DAE based MPI and concluded the overall decline in this sector over time. Though technological improvements were slightly high but large inefficiency in this sector due to illiteracy, poor infrastructure and govt. polices; caused the overall decline of 1.38%.

Katayama et al (2008) performed the firm level productivity in 22 Columbian paper mills. In their research there were false impression and a solution. They estimated the demand system parameter and vector auto aggressive (VAR) process parameter jointly using Bayesian techniques. The objective was to argue that many findings in the literature on plant-level performance might be false, to sketch an alternative approach, to inference that they felt hold more promise, and to contract their methodology with the standard approach by applying both to the same data. Their analysis was rough and used easy methods to find the empirical system, also assumed that marginal costs are flat with respect to output

Ikhsan (2007) examined the patterns of TFP and technical efficiency changes in Indonesia's manufacturing industries over the period of 1988-2000, using a stochastic frontier approach. Results showed that TFP growth was 1.55% during 1988-2000. The scale economics effect contributed 0.13%, technical progress shares were 1.3% and technical efficiency contributed about 0.21%. Breaking down the period into several sub periods, suggested that technical progress had been the highest important factor in explaining TFP growth.

The TFP growth in Egypt's 13 largest pharmaceutical generic firms was examined by Shinaway (2010) for a period from 1993 to 2005. The technique used was "nonparametric frontier methodology and DEA" to obtain the MPI for sample firms. In terms of TFP best performing firms belong to private sector firms while the straggler firms belong to state owned public sector firms. Three inputs of labor, intermediate inputs and capital was used and as an output current prices in each firm was used. It was estimated that here was a weak correlation between productivity growth and export direction.

Conclusion of all the studies were almost same in terms of total factor productivity growth, because all the researcher shown an increase of total factor productivity growth in their respective field except (Kiani, 2008) and (Georgeos et al. 2010) who concluded the overall decline of total factor productivity. Kiani, (2008) told Large inefficiency in this sector was due to illiteracy, poor infrastructure and govt. polices; caused the overall decline. Alanazi (2010), Madheswaran (2009), Mohammadi et al. (2011), Ismail, (2009), concluded that increase in technical change was the major cause in TFP growth. Their technical efficiency should be focused more to get better results.

METHODOLOGY

Total factor productivity is the ratio of multiple outputs to multiple inputs and is one of the major tools in evaluating the performance of any firm as well as assessing overall economic growth of a country (Chen 1997; Baier et al., 2006; Po-Chi et al., 2008). DEA divides TFP into two components; technical efficiency and technological efficiency. Technical efficiency is further divided into scale efficiency and pure efficiency. Technical efficiency is calculated by the weighted sum of outputs to weighted sum of inputs. A firm is said to be technical efficient if it generates maximum output from minimum quantity of inputs. While technological efficiency measures the technological aspects of production. If Malmquist Productivity index has any value greater than 1, than it is indication of growth from previous year and vice versa.

Data Envelopment Analysis in a linear-programming methodology where we use input and output data for Decision Making Units (DMU). In our study, each firm can be considered as a decision Making Unit (DMU). The DEA methodology was initiated by Charnes et al. (1978) who built on the frontier concept started by Farell (1957). It provides a suitable way to determine the relative efficiency of DMU. It is advancement over the Translog index approach, which ignore the technical inefficiency and consider only technical change, which is then mistakenly interpreted as TFP Growth. Whereas, according to the literature, TFPG is composed of both technical change as well as technical efficiency.

Due to its simplicity and reliability, DEA is a used by many researchers worldwide. Its popularity can be understood by reviewing the DEA bibliography, prepared by Gattoufi et al (2004). DEA have successfully been used in many areas like, School by (Charnes et al, 1981), hospital by (Banker et al, 1986), banks and branches by (Ferrier and Lovell, 1990), electricity services by (Fare et al, 1985) and the firms in stock exchange by (Ulucan, 2000) and (Al-Shammari, 1999).

Using DEA Technique, we get Malmquist productivity index which is Geometric mean of efficiency change and technical change. To calculate these indices, we have used the DEAP software which was developed by Coelli (1996). Any value of index greater than 1 shows the growth in pattern while any value of index less than 1 means there is decreasing trend in index. According to Fare et al (1994), the output oriented Productivity index between two periods and t is given by

$$m_0(y_s,x_s,y_t x_t) = \left[\frac{d_o^s(y_t,x_t)}{d_o^s(y_s,x_s)} X \frac{d_o^t(y_t,x_t)}{d_o^t(y_s,x_s)}\right]^{1/2}$$

In this equation
$d_0^s(y_t,x_t)$ = Production of firm t at time period s.
$d_o^s(y_s,x_s)$ = Production of firm s at time period s.
$d_o^t(y_t,x_t)$ = Production of firm t at time period t.
$d_o^t(y_s,x_s)$ = Production of firm s at time period t.
t =time period 1
s= time period 2
y =output
x = input.
mo>1.represents growth in TFP from period s to t
mo<1 indicates a decrease in TFP.
Productivity index described above can also be represented as follows.

$$m_0(y_s,x_s,y_t x_t) = \frac{d_o^t(y_t,x_t)}{d_o^s(y_s,x_s)}\left[\frac{d_o^s(y_t,x_t)}{d_o^s(y_t,x_t)} X \frac{d_o^s(y_s,x_s)}{d_o^t(y_s,x_s)}\right]^{1/2}$$

Where, TE change can be measured from the values outside the bracket between period *s* and *t.* Technical change can be measured by taking GM of the change in technology between two periods' xt and xs, which is represented in other part of equation 2.
We can also break up the TFP growth in this way.
MTFPI = Technical Efficiency Change X Technological change
(Catching up effect) (Frontier Effect)

As shown in above equation "MTFPI is calculated by the multiplying technical efficiency change & technical change. Efficiency change and technical change are also known as catching up effect and frontier effect respectively. Catching up effect is measured at t (current period) and s (previous period). And frontier effect is measured, by shift in a curve in the same period. With the help of contribution of technology or knowledge of technology use, the catching up effect measures that how much a firm is centered towards the curve. While the frontier effect calculates that how much the curve shows movement between two periods, with respect to the technological adoption? In DEA-Malmquist TFP Index it is not necessary that all firms must show efficient behavior. That's why it is possible to have inefficient performance by any firm". (Raheman et al, 2007)

We have focused on the output oriented analysis. The reason is that most of the firms focus to optimize their profits or revenue. The results will not show the TFP gain/losses yielding from scale effects if we do not assume constant return to scale (CRS) technology; which measures the distance functions for the purpose of measuring MTFPI.

Input and Output variables

DEA approach can be applied to those sectors/firms, which wants output in the form of revenue. For this purpose, we will use technical efficiency equivalents for calculating the firm's financial performance. We have followed the methodology of Raheman et al (2007), Feroz et al (2003) and Wang (2006). The method they used was firstly the breakdown of DuPont model. Therefore, ROE can be divided into total assets turnover, profit margin, and equity multiplier. Output and input variables can be used to develop the process of measuring indicators of financial performance.

The formula for general ROE using DuPont ratio is as follows;

$$\textit{Return on Equity} = \frac{\textit{Net Income}}{\textit{Sales}} \times \frac{\textit{Sales}}{\textit{Total assets}} \times \frac{\textit{Total Assets}}{\textit{SH Equity}}$$

"In the above equation profit margin, assets turnover or utilization, equity multiplier is net income/ Sales, sales /total assets, is total assets / equity respectively. This type of breakdown is helpful to examine ROE in terms of a measure of profitability (profit margin), assets turnover or assets required to generate sales and for financing of assets (equity multiplier). For the revenue producing firms these variables sales, net profit, total assets and equity are important aspects of technical efficiency. Accordingly input variables are sales, total assets and shareholder's equity and output variable is net profit. This profit should be maximized. DEAP does not work for negative values while net profit is such a variable which can be negative in case of loss, hence profit is not appropriate output variable. The solution of this problem lies in changing the input variables as total assets, SH equity, COGS and operating expenses while sales revenue of the firm as output". (Raheman et al, 2007)

The above methodology helps us to convert performance ratios into efficiency. So that, long term resources; total assets and equity, and short term resources; COGS and operating expenses are used to produce output in the form of sales revenue.

Theoretical framework

Total Factor Productivity is mainly composed of two components; Technical efficiency and technological efficiency. Technical efficiency is the weighted sum of outputs to weighted sum of inputs. A firm is said to be technical efficient if it generates maximum output from minimum quantity of inputs. While technological efficiency measures the technological advancement of a firm.

Therefore, we can briefly determine the total productivity change in a successive period of time with the following equation:

Productivity change = Technical efficiency change * Technological changes

Fare et al. (1994) further divided Technical efficiency into two parts; scale efficiency and pure efficiency. Scale efficiency shows the movement on the same frontier. If a firm has increased economies of scale being on the same frontier then it refers to increase in scale efficiency. While pure efficiency measures the performance of management. Therefore Productivity changes and its components can be calculated separately with the following equation:

Productivity change = Scale efficiency change * Management efficiency change * Technological change

The importance of the above technique is that, in an industry occasionally companies that we concern have faced similar productivity decrease in an specific period of time; by evaluating productivity elements, it can be observed that productivity decrease of one company was mainly due to lack of technological advancements and nonexistence of necessary investments, for the other corporation was because of the decline of the size of activities and the limitation of productivity scale, and the third corporation was generally because of inefficiency of managers. It is normal that in this case the third corporation's manager should be responsible for the productivity decrease. Therefore equal decline in productivity does not signify a common reason and it might have a specific reason for each company.

Sample and data collection procedure

We used annual reports and collected the panel data for those firms of cement and energy sector which remained listed on the KSE during years 2005-2011, and also performed their operations during this tenure. Positive equity and the availability of seven years annual reports were the conditions for inclusion of any firm in our sample. These conditions made it possible to use DEAP software. Therefore, in the end 19 firms were possible to be included in our study i-e., 11 firms from energy sector and 8 firms from cement sector.

RESULTS AND DISCUSSION

TFP Growth in cement sector

In table 4.1 we analyzed the total factor productivity of all firms in each year and compared productivity of all firms in each year with respect to previous year. We also analyzed that which factor is playing the most important role in TFP growth of each year. In second year of our analysis all of the companies are showing TFP growth of 27.4% relative to first year. In this year pure efficiency change and technical change are important contributors in this TFP growth. Although an earth quake occur in 2005 but after that Pakistan's economy was continuously expanding till 2006. In this year all of the companies are paying attention upon technical adoption.

Table 4.1. Malmquist index summary of annual means (2005-2011)

year	TE Change	Tech. Change	PE Change	SE Change	TFP Change
2	1.097	1.161	1.163	0.944	**1.274**
3	1.058	1.360	1.045	1.013	**1.438**
4	0.844	0.814	1.011	0.835	**0.687**
5	1.198	1.297	1.026	1.167	**1.553**
6	0.986	1.240	0.967	1.022	**1.223**
7	0.976	0.747	1.067	0.915	**0.728**
Mean	**1.022**	**1.075**	**1.045**	**0.977**	**1.097**

In third year of our analysis all of the companies are showing increase in TFP growth of 43.5% with respect of previous year and this increase in TFP is also due to more technical improvement and adoption of technological change. Now in fourth year we have seen a sudden decrease in TFP growth and it becomes negative -31.3%. There are many factors which may be involved in this sudden decrease. It has been observed that cement sector was ignored in this period. There was not any improvement in technical change as well as in efficiency change. Technical improvement in this period was only -18.6% and efficiency improvement and growth were also not observed and it decreased to -15.6%. Management is very much important in any company growth. If efficiency is ignored it means nothing has been done in a right manner and resources are not efficiently utilized. So TFP growth will decrease. By October 2007 Pakistan improve its exports as well as control its trade deficit so in fifth year all of the eight firms of cement sector are showing sudden increase in TFP growth of 55.3%. In this year GDP growth is improved and thus it shows impact on growth of cement sector. All of the four components are playing important role in this growth. The major contributing factor is technical change and then is efficiency change. Improvement in technical change is about 29.7% and efficiency change is about 19.8%. In last year of our analysis TFP growth is declining again and become -27.2%. In this year none of factor is playing any significant role only scale efficiency change has been observed of 2%.

If we analyze the aggregate impact of all factors upon all of eight firms of cement sector throughout that period of seven years than TFP growth is 9.7% and major contributing factor is technical change in this growth. Technical change has been observed of 7.5% while efficiency change is only 2%. Scale efficiency change is least contributing factor in this growth showing only -2.3%. In all of our seven years of analysis fifth year is the most successful year regarding TFP of cement sector because TFP growth 55.3% is highest in that period.

In table 4.2 it is analyze that cement sector shows a positive TFP growth of 9.7% during 2005-2011. The analysis shows that 6 out of 8 companies shows positive TFP growth while, Deewan cement and Fuji cement shows negative TFP growth involving all factors throughout the period.

The overall TFP growth is due to high technical change of 7.5% while scale efficiency change is the lowest contributor in TFP growth. All companies have their technical efficiency growth ranges from 0.907-1.194. Fuji cement shows negative technical change and has an impact on an overall TFP growth.

Table 4.2. Malmquist index summary of firm means (2005-2011)

Firm	TE Change	Tech. Change	PE Change	SE Change	TFP Change
Attock Cement	1.122	1.014	1.122	1.000	1.139
Best way Cement	1.071	1.129	1.071	1.000	1.208
Cherat Cement	0.938	1.144	1.000	0.939	1.076
D.G khan Cement	1.000	1.194	1.000	1.000	1.194
Deewan Cement	0.935	1.049	0.997	0.938	0.982
Fauji Cement	0.981	0.907	1.000	0.981	0.889
Kohat Cement	1.135	1.022	1.185	0.958	1.161
Lucky Cement	1.000	1.172	1.000	1.000	1.172
Mean	**1.022**	**1.075**	**1.045**	**0.977**	**1.097**

TE change is due to combine effect of SE change and PE change. One out of eight companies shows negative PE change and four out of eight shoes negative SE change therefore this decrease in SE change and PE change will result in decrease in TE change. In SE change most of values are close to unity means operating at optimum level.

In comparison of TFP growth in different companies' Lucky cement on an average shows the highest total factor productivity growth of 17.2% followed by best way cement which shows TFP growth of 20.8%. The worst performer in terms of TFP growth is Deewan cement and Fauji cement showing negative TFP growth of -2% and -11%.

Total factor productivity growth

In table 4.3 comparative analysis of different companies from 2005 to 2011 are shown. Through this analysis we come to know that the overall relative performance of eight companies of cement sector and which company is performing better from previous year.

If we analyzed TFP growth in the first year it shows that attock cement shows the highest total factor productivity growth of 184% while Cherat cement shows the lowest TFP growth in 2006 relative to 2005. Second highest performer in second year is D.G khan cement which shows TFP growth of 92.3%. Overall three companies show the negative growth in first year comparison and it will impact on overall performance of cement sector during this year. An average relative performance is positive 37.8%. In the next year 2006-2007 only two companies shows the negative performance and Kohat cement shows the highest performance relative to last year of

147.8% growth. So overall performance shows increase in this year relative to previous of 59.8%. In comparative analysis in 2007-2006 there has been seen a sudden decrease in overall performance and 6 companies shows negative performance out of 8 in cement sectors. None of any company shows good performance so that overall growth sudden decrease to -26.1% and become negative. In next year from 2008-2009 although 4 companies out of 8 shows negative performance but due to an excellent performance of Cherat cement, which shows a growth of 564.3% and another Deewan cement which also shows good performance and shows relative growth of 399.7%, in this year overall growth increase to 123.4% which is a highest performance throughout the period of 2004-2010. By analyzing relative performance in year 2009-2010 it has been shown that D.G khan cement shows the highest performance of 309.7% and Fuji cement shows the lowest performance of 3.2% while Cherat cement and Deewan cement shows the negative performance.

Table 4.3 Comparative total factor productivity of all firms during 2005-2011

Firms	2005-2006	2006-2007	2007-2008	2008-2009	2009-2010	2010-2011	Mean
Attock Cement	2.284	1.445	0.612	0.838	2.046	0.629	**1.309**
Best way Cement	1.462	0.910	0.804	1.688	1.393	1.238	**1.249**
Cherat Cement	0.868	0.813	0.537	6.643	0.776	0.795	**1.738**
D.G khan Cement	1.923	1.225	1.000	0.982	4.097	0.305	**1.588**
Deewan Cement	0.733	1.685	0.997	4.997	0.146	0.990	**1.591**
Fauji Cement	0.809	1.053	1.144	0.735	1.032	0.670	**0.907**
Kohat Cement	1.720	2.478	0.454	1.001	1.597	0.789	**1.339**
Lucky Cement	1.223	3.18	0.364	0.995	2.294	0.802	**1.476**
Mean	**1.377**	**1.598**	**0.739**	**2.234**	**1.672**	**0.777**	**1.400**

All companies show an average performance in this year, none of company shows an extra ordinary performance which results in a little decrease in overall growth of 67.2%. In the last year of our analysis of 2010-2011 it has been analyzed that again cement sector shows poor performance. Seven companies out of eight shows negative performance only second firm shows a positive growth of 23.8%. the best performer thorough out 7 years which has been shown is Cherat cement which shows overall growth of 73.8% while lowest performer in this period is Best way cement which shows 24 % overall growth. Fuji cement is the worst performer in cement sector throughout these seven years and shows negative growth of -9.3%. It is shown in table that all the companies have an average total factor productivity change of 40% during period of 2005-2011.

Managerial Efficiency Growth

Efficiency change means to produce more output from less inputs or available inputs more efficiently. Efficiency change is also analyze in our research and we try to find out the relative efficiency change of all of these 8 firms during a period of 2005-2011.we come to know that which company is efficiently utilizing its resources. During the first year of our analysis Attock cement shows the highest efficiency change of 100% while Deewan cement shows the lowest efficiency change during this period of -43.9%. In analysis of 2006-2007 Kohat cement shows maximum efficiency change among all 8 companies of 125% and it is the highest performer in this regards. Technical efficiency change of D.G khan cement and lucky cement remain constant throughout that period and not showing any growth. While Fuji cement also shows constant efficiency change till the period of 2009-2010 but in 2010-2011 shows a decrease in efficiency change and become negative of -11.1%. By analyzing all companies throughout 7 years it has been shown that in period of 2008-2009 all of 8 companies of cement sector show maximum efficiency change of 24.9%.

Table 4.4 Comparative efficiency change in all firms during 2005-2011

Firm	2005-2006	2006-2007	2007-2008	2008-2009	2009-2010	2010-2011	Mean
Attock Cement	2.000	1.000	0.728	0.944	1.455	1.000	**1.187**
Best way Cement	1.500	0.836	0.888	1.346	1.000	1.000	**1.095**
Cherat Cement	1.000	0.699	0.620	2.304	0.726	0.954	**1.051**
D.G khan Cement	1.000	1.000	1.000	1.000	1.000	1.000	**1.000**
Deewan Cement	0.561	1.188	1.215	1.235	0.565	1.181	**0.991**
Fauji Cement	1.000	1.000	1.000	1.000	1.000	0.889	**0.981**
Kohat Cement	1.247	2.257	0.529	1.169	1.496	0.821	**1.253**
Lucky Cement	1.000	1.000	1.000	1.000	1.000	1.000	**1.000**
Mean	**1.163**	**1.122**	**0.872**	**1.249**	**1.030**	**0.980**	**1.069**

During period of 2007-2008 all companies' minimum average relative efficiency change is of -12.8%. All the companies have average efficiency change of 6.9% during period of 2005-2011.

Technical Adoption

Table 4.5 Technical change of all firms during 2005-2011

Firm	2005-2006	2006-2007	2007-2008	2008-2009	2009-2010	2010-2011	Mean
Attock Cement	1.142	1.445	0.841	0.887	1.406	0.629	**1.058**
Best way Cement	0.974	1.088	0.905	1.254	1.393	1.238	**1.142**
Cherat Cement	0.868	1.163	0.866	2.883	1.069	0.834	**1.2805**
D.G khan Cement	1.923	1.225	1.000	0.982	4.097	0.305	**1.588**
Deewan Cement	1.306	1.419	0.821	4.047	0.258	0.838	**1.448**
Fauji Cement	0.809	1.053	1.144	0.735	1.032	0.754	**0.921**
Kohat Cement	1.379	1.098	0.857	0.856	1.067	0.962	**1.036**
Lucky Cement	1.223	3.18	0.364	0.995	2.294	0.802	**1.476**
Mean	**1.203**	**1.458**	**0.849**	**1.579**	**1.577**	**0.795**	**1.243**

TFP Growth in Energy Sector of Pakistan

In table 4.6 we analyze the combine effect of TFP growth of all eleven companies of energy sector in each year of our analysis throughout the period of 2005-2011.we also analyze the most contributing factor in overall growth.

Table 4.6 Malmquist index summary of firm means (2005-2011)

Year	TE Change	Tech. Change	PE Change	SE Change	TFP Change
2	0.565	1.543	0.624	0.904	**0.871**
3	1.407	0.764	1.128	1.248	**1.075**
4	1.159	1.207	1.453	0.797	**1.399**
5	1.004	0.898	0.742	1.354	**0.902**
6	1.105	1.026	1.263	0.875	**1.134**
7	0.905	0.905	0.95	0.952	**0.819**
Mean	**0.987**	**1.029**	**0.985**	**1.002**	**1.015**

In second year TFP growth is negative in energy sector (12.9%). Technical change is an only important factor in this year. This decline is due to the reason that country is facing major environmental crisis in shape of earth quake so overall GDP will decline; none of sector is given much importance. In 2007 energy sector is showing TFP growth of 7.5%. This growth is due to less technical adoption but more emphasis upon efficiency change means in this year all companies in energy sector are focusing on efficiently utilizing of their resources. In next year of our analysis energy sector is showing more TFP growth as compared to previous year. All of the eleven companies of our analysis are showing TFP growth of 39.9%. All of the four factors are contributing in this growth but the most significant role is playing by technical change (20.7%) because of more pure efficiency change of 45.3%. In fifth year again there is a decline in TFP growth of -9.8%. This decrease in TFP is due to decline in technical change.

Efficiency change is contributing only .4%. In next year there is again increase in TFP value (13.4%) of all eleven companies of our analysis. In this year great importance has been given upon getting more output from less available input, technical adoption is also considered in this year. In the last year of our analysis TFP growth declines again and reach at -18.1% this is because of decline in values of all of four factors of technical change(-9.5%), efficiency change (-9.5%). PE change (-5%) and SE change (-4.8%). Here an interesting factor is that efficiency change and technical change is same in this year. The overall TFP growth of all eleven companies throughout that period of seven years is 1.5%. If we analyze the mean or aggregate value of all firms in all seven years than also technical change is an important factor here in TFP growth of energy sector their main emphasis is upon adopting more technology. We have seen that the most successful year in energy sector is 2008 but cement sector is showing poor performance in this year.

In table 4.7 it shows that companies of energy sector show overall TFP growth of 1.8 % during 2005-2011. Analysis of industries reveals that 8 out of 11 companies of energy sector have the positive TFP growth. The overall TFP growth is due to 3.2 % increase of technical change and all industries have their technical change ranges from 0.815 to 1.189.

Table 4.7 Malmquist index of company means (2005-2011)

Firm	TE Change	Tech. Change	PE Change	SE Change	TFP Change
Attock Petroleum	1.034	1.119	0.864	1.197	**1.157**
Attock Refinery	1.208	1.189	1.173	1.029	**1.436**
Hub Power	0.960	0.815	0.963	0.997	**0.783**
Kohinoor Power	0.718	0.954	1.000	0.718	**0.686**
OGDCL	1.000	1.033	1.000	1.000	**1.033**
Pakistan Oil Fields	0.966	1.059	1.000	0.966	**1.023**
Shell Pakistan	0.972	1.082	0.982	0.990	**1.052**
Pakistan Petroleum	1.041	1.003	0.916	1.137	**1.045**
Pakistan State Oil	1.044	1.077	1.000	1.044	**1.124**
Sui Northern	0.923	0.962	0.925	0.998	**0.888**
Sui Southern	1.067	1.107	1.038	1.027	**1.181**
Mean	**0.987**	**1.032**	**0.985**	**1.002**	**1.018**

On the other side where TE change is less than one has the negative effect on overall TFP growth. Overall TE change of 5 out of 11 companies of energy sector has the decreased that is the main cause of dampening of TFP of energy sector. TE change is the result of PE change and SE change. With regards to PE change, it is 1 or less than 1 in 9 out of 11 companies of the sector whereas SE change is somewhat better as compared to PE change. But still only 6 out 11 companies showed the value 1 or less than 1. Therefore both PE and SE decrease caused the overall TE decrease. In this table the comparison of TFP shows that attock refinery has the highest TFP growth of 43.6% followed by Sui Southern with 18.1%. The worst performer was Kohinoor power and hub power with 31.4% & 21.7% decrease in TFP respectively.

Total factor productivity growth

Table 4.8 shows the results of TFP of individual companies which explains the TFP for all the companies' separately on yearly basis and gives the complete picture of their performance. In the first year of analysis in 2005-2006 Pakistan state oil was the best performer in terms of TFP with TFP growth of 140% followed by attock refinery with TFP growth of 135%.

Table 4.8 Comparative total factor productivity of all companies during (2005-2011)

Firms	2005-2006	2006-2007	2007-2008	2008-2009	2009-2010	2010-2011	Mean
Attock Petroleum	0.685	3.190	2.300	0.859	0.856	0.648	**1.423**
Attock Refinery	2.350	1.201	1.439	0.456	2.903	1.632	**1.663**
Hub Power	0.056	1.147	3.873	0.637	0.855	1.687	**1.375**
Kohinoor Power	0.146	0.667	1.100	0.933	1.142	0.909	**0.816**
OGDCL	2.234	0.603	1.625	0.572	0.925	1.050	**1.168**
Pakistan Oil Fields	1.564	1.179	0.622	1.286	1.873	0.414	**1.156**
Shell Pakistan	1.398	0.558	1.931	1.437	1.017	0.614	**1.159**
Pakistan Petroleum	1.866	0.661	1.482	0.817	2.792	0.312	**1.321**
Pakistan State Oil	2.406	1.339	0.423	1.897	0.874	0.894	**1.305**
Sui Northern	0.665	1.029	1.343	1.712	0.288	1.082	**1.019**
Sui Southern	1.137	2.085	1.737	0.489	0.042	0.846	**1.056**
Mean	**0.871**	**1.075**	**1.399**	**0.902**	**0.829**	**1.139**	**1.036**

Lowest performer was hub power with 94.4% decline In TFP. 4 out of 11 companies faces decline in TFP and due to this decline overall TFP growth for all companies of energy sector less than unity with -12.9%. In the next year 2006-2007 similar to previous year 4 companies had their negative TFP growth. While attock petroleum and Sui southern were top of the ranking in terms of TFP with 219% & 108% TFP growth respectively. Due to this TFP growth overall TFP growth was 7.5% this year. The year 2007-2008 showed 39.9% overall growth due to the best performance of hub power with 287.3 % growth and also because of only two companies decline the Pakistan oil field and Pakistan state oil. In 2008-2009 Pakistan state oil once again on the top of the list with TFP growth of 89.7% but it can't stop overall decline of TFP of all the companies due to the presence of 7 out of 11 declines and the overall decline was 9.8% in the year. Next year 2009-2010 was almost the same as the previous one with 6 declines and overall negative growth of -17.6%. In this year attock refinery showed the highest growth of 190.3 %. In the last year of analysis 2010-2011 hub power showed highest performance of 68.7% increase followed by attock refinery with 63.2% increase. In this year again 7 out 11 companies performs badly and given the values less than 1. in the complete period of 7 years from 2005 to 2011 Attock refinery and attock petroleum were top performer with 66.3% & 42.3% overall TFP growth. Kohinoor power was the only company which can't show overall TFP growth in 7 years and has the decline of 18.4%. It is shown in the table that on average all the companies had 3.6% TFP growth during the period of 2005-2011.

Managerial Efficiency Growth

Technical efficiency change is all about managing the inputs and the proper usage of resources. Managers can get more productivity through the same inputs with the help of efficient management. Experience is the main factor in improving management. Doing things again and again can make you efficient and you can find new ways to produce the things by introducing little modifications in your processes. It will leads to higher productivity. Therefore understanding the contribution made by technical efficiency in the productivity growth is necessary. For this purpose technical efficiency movement is presented in the table 4.9.

Table 4.9 Comparative efficiency change in all companies during 2005-2011

Firms	2005-2006	2006-2007	2007-2008	2008-2009	2009-2010	2010-2011	Mean
Attock Petroleum	0.281	4.162	1.498	1.091	0.801	0.799	**1.438**
Attock Refinery	1.126	1.710	1.138	0.613	2.309	1.000	**1.316**
Hub Power	0.159	1.537	2.352	0.917	0.798	1.853	**1.269**
Kohinoor Power	0.179	0.775	0.900	1.269	0.933	0.928	**0.830**
OGDCL	1.000	1.000	1.000	1.000	1.000	1.000	**1.000**
Pakistan Oil Fields	0.724	1.835	0.597	1.749	1.225	0.479	**1.101**
Shell Pakistan	1.000	0.664	1.505	1.000	1.000	0.845	**1.002**
Pakistan Petroleum	0.840	0.941	0.915	1.515	2.258	0.516	**1.164**
Pakistan State Oil	1.292	1.000	1.000	1.000	1.000	1.000	**1.048**
Sui Northern	0.618	1.252	1.293	1.000	0.536	1.156	**0.975**
Sui Southern	0.424	3.514	1.320	0.508	0.044	1.005	**1.137**
Mean	**0.565**	**1.407**	**1.159**	**1.004**	**0.803**	**1.245**	**1.030**

These results suggest that TE change is an important determinant in the TFP. The average TE change in the each company of energy sector is positive. It is one or more than one. During 2005-2006, being the first year of analysis TE for many companies is negative and shows the average decline of 43.5% and this is the worst year in terms of technical efficiency growth. While 2007-2008 shows the best performance and enjoys the technical efficiency growth of 15.9% for average of all companies of the sector. OGDCL never shows any technical efficiency growth and remained the same throughout the period. While Pakistan state oil shows growth in only first year of analysis otherwise it also remained unchanged. And koh e noor power was the lowest one with 16.9% decrease and the 2nd lowest was Sui northern with 2.5% decrease in technical efficiency change.

Technical adoption

The second important source of TFP growth is technological adoption. As squires and Reid (2004) defined the technology change as developing new technologies or improving and shifting production curve upward. Above table shows the technical change of all the companies of energy sector in the period of 2005-2011. In general TE change can be seen in attock refinery, Sui southern and Pakistan state oil with 28.13%, 24.38% & 21.5 % increase in technology respectively. There was only hub power which had decline of 9.6% in technical change. 2005-2006 was the best year with 54.3% technical growth because all the companies of energy sector showed huge growth except hub power and koh e noor power. 2006-2007 was the year of decline because all the companies had value less than unity except Pakistan state oil. Resultantly average decline this year was 23.6% and was the lowest throughout the period.

Table 4.10. Comparative technical change in all companies during 2005-2011

Firms	2005-2006	2006-2007	2007-2008	2008-2009	2009-2010	2010-2011	Mean
Attock Petroleum	2.436	0.766	1.536	0.787	1.069	0.811	**1.234**
Attock Refinery	2.088	0.702	1.264	0.745	1.257	1.632	**1.281**
Hub Power	0.353	0.746	1.647	0.695	1.072	0.910	**0.903**
Kohinoor Power	0.815	0.860	1.222	0.735	1.224	0.979	**0.972**
OGDCL	2.234	0.603	1.625	0.572	0.925	1.050	**1.168**
Pakistan Oil Fields	2.162	0.642	1.042	0.735	1.528	0.865	**1.162**
Shell Pakistan	1.398	0.840	1.283	1.437	1.017	0.727	**1.117**
Pakistan Petroleum	2.222	0.703	1.619	0.539	1.236	0.605	**1.154**
Pakistan State Oil	1.863	1.339	0.423	1.897	0.874	0.894	**1.215**
Sui Northern	1.076	0.822	1.039	1.712	0.536	0.936	**1.020**
Sui Southern	2.683	0.593	1.316	0.962	0.960	0.949	**1.243**
Mean	**1.543**	**0.764**	**1.207**	**0.898**	**1.032**	**0.915**	**1.133**

In 2007-2008 once again overall growth was seen due to the fact that only Pakistan state oil went in negative. Above table reveals that technical growth was seen in every alternate year ending the period at the decline of 8.5% in 2010-2011. In this year only attock refinery was on the top with 63.2% growth. Except from this all companies went in decline in terms on technical change.

CONCLUSION

Using DEA Methodology we have calculated Malmquist productivity index (MPI) for measuring productivity growth. Malmquist productivity index (MPI) got broken down into two components: technical efficiency & technical change, which was used in identifying change in efficiency, impact of technological adoption and advancement in productivity growth of both sectors.

FINDINGS

Cement sector

After applying MPI cement sector showed an overall positive TFP growth of 9.7% during 2005- 2011. In the individual firm analysis .Fauji cement showed a negative technical change due to which TFP of this firm is also negative. Deewan cement also showed a negative TFP because its efficiency change is negative. So, Fauji cement haven't adopt its technology effectively while, Deewan cement should strive to improve its managerial efficiency. These both will in turn improve the overall productivity of the firms as well as the sector.

Yearly analysis

The overall decline in Deewan cement is mainly due to the decline in the years 2009-2010, this period showed high negative value which was a major contributor in the decline of TFP of this firm. As far as, Fauji cement is concerned, period 2010-2011 was the major contributor in overall decline because in this period there was high negative value as compared to other years. In the yearly analysis only Fauji cement showed decline because there were 3 declining sub-periods identified from 2004-2007. The estimates on both sector's productivity performance yielded different striking results. Cement sector showed an overall positive TFP growth of 9.7%, during 2005-2011. While the TFP growth for energy sector is 1.5% during the same period. Our results showed that, Fauji and Deewan cement both lacks managerial efficiency. This efficiency decline was twice in 7 years in Deewan cement and once in Fauji cement. 4 more firms also showed this decline but it didn't affect their overall efficiency and yielded positive results. All the selected companies except Fauji cement have adopted the technology efficiently. Technical adoption for Fauji cement declined thrice in 7 years analysis in different years. D.G Khan Cement is at the top most among all in technical adoption, because they have adopted their technology very efficiently than others.

Energy Sector

Energy sector showed an overall TFPG of 1.5% during 2005-2011. Results show that, Year 2008 was the most successful year for Energy sector.

Yearly analysis

In yearly analysis, Kohinoor power has shown a negative TFP growth. Years 2005-2006 are mainly responsible for this decline because in these years the value of TFP has declined a lot. Kohinoor power and Sui northern have showed negative efficiency change. Which means there is need to improve management and other factors needs to be control as well e.g., capital, labor etc. managerial efficiency of Kohinoor power is worst among all. Overall efficiency change is positive for the energy sector. As far as technical adoption is concerned, again Kohinoor power has shown a decline. Hub power has also showed negative technical adoption. Both of them should work on their R & D to facilitate their technological adoption. This will result in a good TFPG. As a whole, all companies have showed a declining trend in terms of technical change. But overall all eleven companies have shown a positive technical change.

Recommendations

Our results show that, cement and energy sectors of Pakistan have increased TFP, evident from most of the companies under observation. These companies should strive to get a stable pattern of productivity growth. Technical efficiency and technological progress both need to be improved. Technical efficiency will be improved by improving inputs like labor and capital. For capital, management aspect should be taken into consideration. All improvements will help in the betterment of technical efficiency change. R & D will help to improve the technological adoption. So, efforts should be made to get improvement in the R & D activities in both sectors. In this way these two sectors will show more growth and can add up in the growth of Pakistan. Energy sector is an important sector of Pakistan and future researches on these sectors should be carried out. Presently, Pakistan is facing Energy crisis and more studies on this sector will help to find out the reason these crisis followed by the solution. More researches on TFP in Pakistan should be carried out either by changing variables or by changing sample.

REFERENCES

Abd-Kadir, H. et al. (2010). Productivity of Malaysian Banks after Mergers and Acquisition. European Journal of Economics, Finance and Administrative Sciences, 24.

Ahmed U. (2009). Efficiency Dynamics and Financial Reforms: Case Study of Pakistani Banks. International Research Journal of Finance and Economics, 25.

Alanazi A. (2010). Saudi Arabian IPOs Productivity and Efficiency. Middle Eastern Finance and Economics, 6.
Baier, S. L., Dwyer, G. P., & Tamura, R. (2006). How important are capital and total factor productivity for economic growth?. Economic Inquiry, 44(1), 23-49.

Chen, E. K. (1997). The total factor productivity debate: determinants of economic growth in East Asia. Asian-Pacific Economic Literature, 11(1), 18-38.

Dash, M. K. (2010). Productivity Growth of Manufacturing Sector in India an Inter-State Analysis. European Journal of Scientific Research, 44(3), 387-399.

Fare et al, (1994). Productivity Growth, Technical Progress, and Efficiency Change in Industrialized Countries. The American Economic Review (AER), 84(1), 66 - 83.

Georgios, & George. (2010). How Competitive are the Winery Firms in Greece? International Bulletin of Business Administration, 9.

Hussain, T. (2010). Pakistan's energy sector issue: energy efficiency and energy environment link. The Lahore Journal of Economics, 15, 33-59.

Ismail Z. (2009). Technical Efficiency, Technical Change and Demand for Skills in Malaysian Food-Based Industry. European Journal of Social Sciences, 9(3).

Ikhsan, M. (2007).Total Factor Productivity Growth in Indonesian Manufacturing: A Stochastic Frontier Approach. Global Economic Review, 36(4), 321-342.

Johnes J. (2008). Efficiency and Productivity Change in the English Higher Education Sector. 1996/97 TO 2004/5, The Manchester School, Volume 76, Issue 6, pages 653–674.

Joshi, R. N. (2009).Estimation of total factor productivity in the Indian garment industry. Journal of Fashion Marketing and Management, Vol. 14 No. 1, 2010 pp. 145-160.

Kiani, A. K. (2008). Total Factor Productivity and Agricultural Research Relationship: Evidence from Crops Sub-Sector of Pakistan's Punjab. European Journal of Scientific Research, ISSN 1450-216X Vol.23 No.1 (2008), pp.87-97.

Kucukaksoy I. (2011). An Analysis on Reel Sector Effectiveness: Application on Cement Companies Registered to IMKB (Istanbul Stock Exchange Market-ISE) in Turkey in Years 2006-2009. International Research Journal of Finance and Economics, ISSN 1450-2887 Iss.69.

Mohammadi, & Ranaei, (2011). The Application of DEA based Malmquist Productivity Index in Organizational Performance Analysis. International Research Journal of Finance and Economics ISSN 1450-2887 Issue 62.

Mandal, & Madheswaran, (2009). Technological Progress, Scale Effect and Total Factor Productivity Growth in Indian Cement Industry: Panel Estimation of Stochastic Production Frontier. Journal of Advances in Management Research ISBN 81-7791-172-4.

Ortiz, O., Castells, F., & Sonnemann, G. (2009). Sustainability in the construction industry: A review of recent developments based on LCA. Construction and Building Materials, 23(1), 28-39.

Pasiouras, F. & Sifodaskalakis, E. (2010). Total factor productivity change of Greek cooperative banks. Managerial Finance, Vol. 36 Iss: 4, pp.337 – 353.

Po-Chi, C. H. E. N., Ming-Miin, Y. U., Chang, C. C., & Shih-Hsun, H. S. U. (2008). Total factor productivity growth in China's agricultural sector. China Economic Review, 19(4), 580-593.

Mehmood, M.A. (2006). Energy issues in Pakistan. http://www.pide.org.pk/pdf/Books/Energy_Issues.pdf

Murugeshwari T. L. (2011). Impact of Policy Shift on Total Factor Productivity in Indian Textile Industry. European Journal of Economics, Finance and Administrative Sciences, ISSN 1450-2275 Issue 29.

Raheman, A. et al, (2008). Estimating Total Factor Productivity and its Components: Evidence from manufacturing sector of Pakistan. http://www.pide.org.pk/psde24/pdf/16.pdf

Sharma S. (2008). Analyzing the Technical and Scale Efficiency Performance: a Case Study of Cement Firms IN India. Journal of Advances in Management Research, Vol: 5 (II) pp. 56-63.

Udah & Enang B. (2010). Industrial Development, Electricity Crisis and Economic. European journal of Economics, Finance and Administrative Sciences, ISSN 1450-2275 Issue 18 (2010)

Willie T. (2000). Total factor productivity in Singapore construction. Engineering, Construction and Architectural Management, Vol. 7 Iss: 2, pp.154 - 158

Which six countries hold half the world's population? (July 11, 2014). Pew Research Center. Retrieved from<http://www.pewresearch.org/fact-tank/2014/07/11/half-the-worlds-population-live-in-just-6-countries/>

Housing shortage reaches 9m units: State Bank (January 25, 2015). DAWN. Retrieved From<https://www.dawn.com/news/1159259>

Cement industry poised for continued growth (June 14, 2016). The Express Tribune. Retrieved from <https://tribune.com.pk/story/1122920/cement-industry-poised continued-growth/>