DETERMINATION THE TECHNICAL EFFICIENCY OF PUBLIC SCHOOLS IN PAKISTAN

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ABSTRACT: *Education is an instrument which is used as a key role investing in human capital and economic growth of any nation. As a result, successful economies always adopted better education system as a factor of production. The education is always showered benefits on socioeconomic and political environment of the nations. So, this study evaluates the technical efficiency of the public schools (primary, middle and tertiary) in Pakistan. We have applied Data envelopment analysis (DEA) non-parametric approach by using the panel data set period from 1993 to 2012 in the entire country. This research paper covers 6 rural and 6 urban areas of Pakistan which are taken as a decision making unit (DMU) as well as 3 inputs and 2 outputs. Generally speaking, the public schools (primary, middle and tertiary) are technically inefficient under CRS and VRS while efficient on technical efficiency change, pure efficiency change and scale efficiency change. The GOP is need for improvement in technological advancement and total factor productivity change (TFP). This study helps to GOP to develop better strategies of education in order to achieve maximum output level and improve the quality of education in Pakistan.*

Key Words: DEA, CRS, VRS, TECHNICAL EFFICINECY, GOP

1 INTRODUCTION

Since 1947 the Government of Pakistan has spent the income of GDP on education department in order to achieve the best level of outputs which define as maximum enrollment of students in educational institutions or decrease out of school. Many domestic and international organizations are working to promote the quality of education by providing funding to the GOP in such a way that the GOP has spent financial resources on rural and urban areas of the entire country. Many educational institutions have been established and educational resources allocated in different areas of the country. So, we need to evaluate the performance of the public schools in Pakistan. The role of the public sector is very significant in each nation. The government is responsible investing in social overhead capital (SOC) in order to achieve human welfare and economic development. Furthermore, it is also responsible to distribute the resources among the provinces so that all resources may better utilize to gain specific goals. The government is spending budget of GDP to meet the basic necessities for instance, education, health, transportation, shelter, infrastructure and food etc. The education is one of these very important factors and basic necessity on which all other necessities are depend it. Each nation needs to more spend financial resources for education department so that all other necessities may meet in order to gain benefits. It should be primary priorities, investing in the education department by the public sector, very vigilant to allocate resources and achieving the objectives of education. The key role of education has increased the economic growth and total factor productivity of human capital. To improve the quality of education, it is required to spend huge budgets on education activities and make better strategies as well as policies. For instance, advance countries are spending a major portion of GDP, resultantly, economic growth and literacy rate reached at the top level which is indicative of the welfare of the society. Underdeveloped countries have been failing to make knowledge base society. So, less developed countries should adopt such education policies that may raise economic growth and human capital or literacy rate. Pakistan education status is very poor rather than the rest of the world. Its share in educational expenditure is lower than other countries due to many problems in the economic and political ground. According to Wikipedia, Pakistan has spent income 2.08 percent of GDP in the year 1987-88 which was higher education expenditure last 37 years. Public expenditure on education was reduced and maintained in 21 years out of 37 years. It is an alarming situation for the country, so, it is needed to evaluate the performance of education in allocating the resources of the public sector. The system of Pakistan education consists of formal education, informal education and religious education. Formal education is dominant in Pakistan education system and consists of educational levels, i.e. Primary education, middle education and secondary education. So this research paper will study on primary, middle and tertiary education in Pakistan. The primary education level consists of five classes from 1th to 5th. Every grade of primary education represents the specific age group of population, which is more need to enroll in school. The age group (2 years to 9 years) is compulsory to get educated. Similarly, Middle grade included 6^{th} to 8^{th} classes while secondary 9^{th} and 10^{th} classes. According to the population or age specific group of population, educational institutions have been established in rural and urban areas. The primary education is very important because it is a basic learning stage. Educational institutes are working to promote the quality of education by spending huge income, develop different strategies and providing the basic facilities as well as a better educational environment in order to achieve the maximum level of primary enrollment in schools. Unfortunately, the rural areas are less facilitated with educational resources than urban areas because many factors are influenced on education performance i.e. population size,

low income level, poverty, gender discrimination etc. Instead of these circumstances, the GOP is spending its budget and allocating the educational resources in rural areas. But the question arises here, is the GOP utilizing the proper available educational resources in rural areas. Similarly, we discuss on urban education. In urban areas the GOP is spending huge amount on education in order to promote the quality of education. Apparently, urban education is best performed in Pakistan due to which many factors are playing a role in educational performance. In fact, many external variables influence on educational performance. Internal variables defined as such variables which are taken for analysis in DMU while external variables do not take in DMU. These institutes are emphasizing the underdeveloped countries to improve the quality of education. Under such state of affairs, the importance of the public sector has radically increased resource allocation, utilization of resources and investment in human capital. So the GOP is also spending on human capital to break of this vicious circle of poverty. As a result, there is a dire need to estimate the rural and urban sector's technical efficiency so that the government cans device strategy in a better manner. For this research work, we will apply the technique of Data envelopment analysis. To estimate the production frontier DEA is used which is non parametric approach operation research and economics. Authors used to measure productivity efficiency of decision making units. Non-parametric methods have the benefit of not assumption a particularly well-made form for the frontier; nonetheless they do not recommend over-all relationships relating output and input. There are likewise parametric approaches which are used for the estimation of production frontiers. The framework has been adapted from input and output production functions and is applied in many industries. DEA develops a function hose system is determined by the most efficient producers. Data envelopment analysis (DEA) is different from the Ordinary Least Squares (OLS) statistical technique that bases assessments relative to an average producer. DEA detects a 'frontier 'on which the relative performance of all functions in the sample can be equated: DEA benchmarks firms only against the best producers. The DEA background has conventionally been applied with the implicit assumption that efficient production delivers an increase in outputs with increased inputs. For a recent application of DEA, see Mehmood et al. (2013). In reality, this assumption may not hold. DEA can also be used with non-parametric method in economics for estimation of production frontier. So through DEA we will estimate the technical efficiency of the public sector education in rural and urban areas of Pakistan.

2 LITERATURE REVIEW

A Previous study on school efficiency is very important; Authors [1] worked on the technical efficiency of classrooms. They applied the DEA technique to assess the efficiency scores in 199 rural and urban municipalities. They used 3 inputs and 1 output. Author [2] calculated the efficiency scores of rural and urban schools in Georgia. Two step estimation was used by him firstly Mann-Whitney U Test (2007) and secondly Tobit Regression analysis. The annual data have been used at country level of 153 countries in the State of Georgia for the 2005 year for estimation. There are two outputs and five inputs used. He calculated the results with the help of DEA output oriented linear programming model under VRS. Urban schools were found more efficient opposed to rural as a reference based pooled and separate schools. Comparatively All urban schools pooled were found more efficient to separate schools, while rural schools were found same under efficient. Author [3] calculated the technical efficiency of secondary school in Zambia. SFA and DEA technique have been used by author. The data has been collected on school level from examination council and the Ministry of Education, Zambia. In this research work, there are variables 4 inputs and 2 outputs that have been selected. The results showed thirty three schools were found fully efficient in pass rate and sixty three using VRS while remaining one hundred and thirty schools were less efficient. DEA represents 80% schools were found below the efficient frontier. This study suggests that Zambia schools could increase the pass rate 5% and 9% with current inputs. The authors [4] examined the technical efficiency of the primary education system in Uganda. In this research work, the data have been used based on panel data set from 2001 to 2008 period. This research has been done in two categories urban and private schools, the government-aided and rural schools. There are 8 variables selected for this study. The results exhibit that Urban and private schools were found technically inefficient than government-aided and rural schools. Their findings show that it was possible to improve the learning outcome in primary private schools because whose percentage deviation from their production frontier is 56% on the other hand it was impossible to increase the significantly improve learning outcome because whose percentage deviation from their production frontier is 1%. Author [5] investigated the efficiency in the public sector, education expenditure in two major provinces of Pakistan as a Punjab and Sindh. The data of Punjab for the year 2003-04 and Sindh for the year 2001-02 has been collected at the district level. He assessed the technical efficiency of educational expenditure of 34 DMUs of Punjab and 15 DMUs of Sindh by using DEA. Results show overall three districts were found efficient. This study represents the Faisalabad district was found efficient as opposed to Lahore district and over all 7 districts out of 34 districts worst performances. Author [6] evaluated the efficiency of public expenditure on education in Croatia. Author used both techniques of non-parametric approach, Free Disposal Hull (FDH) and DEA. The data has been selected 3 inputs and 1 output. Result showed resources (inputs) of Croatian education were misused 18.5 % in FDH while 45.9 % in DEA. Efficiency scores were 0.923 and 0.918 under FDH and DEA respectively, which indicates the 7.7 percent and 8.2 percent outputs resources were not used. The authors [7] assessed the technical efficiency and productivity scores of Swedish Higher Education Institutions (HEIs). DEA technique has been applied. The data have been collected data from 2005 to 2008 of 30 Universities and universities, colleges by the authors. For this study, they used some variables i.e.5 inputs and 3 outputs. Their findings represented inefficiency between 10 to 13 % yearly. The authors [8] evaluated the technical efficiency of schools in Chili. Their study covers on 2000 schools, private fee paying, private subsidized and public schools to comparative

evaluation. The two methods have been used for estimating the technical efficiency, DEA and SFA. The results showed that private fee paying schools were found most efficient. SFA technique indicates that minor difference between private subsidized and public schools. DEA showed that private subsidized schools had higher efficiency indices. They used 3 inputs and 1 output for finding the technical efficiency. The authors [9] analyzed the technical efficiency of public higher education institutes in Portugal. This study has been conducted by authors in three groups like public universities, polytechnics and faculties of the University of Porto. They considered three inputs and three output variables collected data for 2008. They analyzed 14 public universities, 20 public poly techniques and 14 faculties of the University Porto as DMU. DEA technique has been applied to estimating the technical efficiency of public higher education institutions. Results showed Group A (public universities) 83% average efficiency score, Group B (polytechnics) 77% mean efficiency scores while Group C (facilities of university Porto) average efficiency score 82.5%. The authors [10] estimated the technical efficiency of primary school education in Greece. They collected primary data through questionnaires, from parents and school principals. DEA and Regression analysis were used both techniques by authors. They have selected some variable 3 input while 1 output. Results showed 23% schools were found efficient while efficiency score was76.26 %. On the other hand, OLS result founded an efficient school rather than that DEA, because the DEA had failed to show of statistical characteristics and not enable to explain the causes.

3: METHODOLOGY

There are many methodologies to calculate the results for specific models or framework of the research base on different data sets. The researcher can use econometric or non-econometric techniques to calculate relevant results in order to achieve specific objectives. In this research work, we will use the technique under DEA for evaluation of the public schools in Pakistan for instance, Non-parametric technique using the linear programming which is non-parametric technique, it has no statistical properties. This concept has been introduced by authors [11] in 1978. A mathematical program provides the comparative efficiency of firms in different sectors based on empirical relation. A large number of studies have been shown of several firms like agriculture, insurance, shipping industry, banking, etc. DEA is a technique that evaluates the relative performance of a DMU based on the multiple-inputs and multiple-output quantities. DEA has many types, the most basic CCR [11]. It is also has different returns to scale CRS and VRS. It does not require restriction for using the DEA and on production technology; it does not hold the assumptions. DEA emphasized on the basic technological aspect of the production. DEA has been used by Banker Conrad and Straussin 1986 and 1984 in non-profit organization. Seiford and Thrall have documented the main development of DEA in 1970 and 1980. In this research paper, the DEA will be applied to calculate the technical efficiency of public schools in Pakistan. DEA is linear programming based mathematical technique which enables us to estimate the technical efficiency by using multiple inputs and outputs. Contrasting, the SFA, DEA shows the most efficient producer, operating at production frontier. DEA does not reveal inefficiency as data measurement error, instead, it helps us to investigate the reason behind inefficiency and facilitates in doing comparative analysis.

The Mechanism of the DEA can be understood by the following formula with the help of this example.

In this formula, N indicates decision making unit, whereas "m" inputs and "n" outputs in every DMU. The efficiency scores can be calculated individually DMU by using the following formula.

$$for \quad each \quad DMU_p \qquad P = 1, 2, 3.....$$

$$\max imize \qquad E_p = \frac{\sum_{j=i}^{n} u_j y_{jp}}{\sum_{k=1}^{m} v_k x_{kp}}$$

$$subject\ to \qquad \frac{\sum_{j=1}^{n} u_j y_{j_i}}{\sum_{k=1}^{m} v_k x_{k_i}} \le 1 \qquad \forall \quad i$$

$$u_{j,} v_k \ge 0 \qquad \forall \quad k, j \qquad (1)$$

Where

K = 1, 2, 3...n

J = 1, 2, 3…m

I = I, 2, 3…N

m = the amount of output j produced by ith unit,

n= the amount of inputs k utilized by ith unit,

u= weights given to output j

v= weights given to inputs k

The problem sets shown in (1) can be transformed into linear programming as follows;

DEA calculate the weights of inputs and outputs based on data in principle, of calculating the relative efficiency score of each DMU. The weights can be calculated by DEA individually DMU so, we can calculate the maximum level of efficiency scores.

$$\max \qquad \sum_{j=1}^{n} u_j\ y_{jp}$$

$$s.t \qquad \sum_{k=1}^{m} v_k\ x_{kp} = 1$$

$$\sum_{j=1}^{n} u_j y_{ji} - \sum_{k=1}^{m} v_k x_{ki} \le 1 \qquad \forall i$$

$$u_{j,} v_k \ge 0 \qquad \forall \qquad k, j. \qquad (2)$$

Moreover, weights must be positive that's why inputs and outputs may be missing during the estimating efficiency score of individually DMU.

3.1 Variables and Data

The selection of inputs and output variables for this research paper follows primarily previous studies in literature. Data

availability was a factor in determining the variable. On the input side, we used 3 variables; number of teachers, number of institutes and physical facilities including electricity, drinking water, washrooms, ownership, boundary wall and building. On the output side, enrollment defined as get registered or admission at specific grade in school and student teacher ratio defined as the number of enrollments, student at specific grade divided by number of teacher product of hundred. The data have been collected from annual reports of National Education Management Information System (NEMIS), Academy of Educational Planning and Management (AEPAM), Ministry of Education Trainings and Standards in Higher Education and Government of Pakistan. Education statistics available on annual report last from 1993 to 2012.Twenty year data of the entire country from 1993-2012 has been taken for comparative analysis with respect to gender, region and education.

4 EMPIRICALS RESULTS

4.1 The Efficiency and Productivity Estimates of Public Schools in Pakistan

We have used DEAP software version 2.1 for estimating the technical efficiency of the public schools in rural and urban areas. We have estimated the technical efficiency scores and productivity score of 12 DMUs entire country. The tables show the technical efficiency under CRS and VRS for last 20 years and aggregate summaries of efficiencies.

4.2 Technical Efficiency Estimates of Public Primary Schools Averages

Table No. 1 tabulated that technical efficiency of public primary schools in Pakistan. Results indicate that mean technical efficiency score of primary schools in rural and urban areas is founded 84.16%, which is less performed relatively under the CRS. The school management failed to use inputs efficiently like teachers, physical facilities. All DMUs were operating below efficiency, on average, under CRS. The highest technical efficiency score is 91.51% under VRS. The highest technical efficiency score of Punjab urban has 96% under VRS, it is not a bad performance of Punjab urban areas' school with the utilizing the educational inputs, whereas the lowest technical efficiency score of Baluchistan rural area is 82.35% under VRS. This table shows the average technical efficiency of every DMU for the last 20 years, which indicates relatively better performance than primary education in all DMUs under VRS. This performance indicates that inputs have been better utilized in order to achieve primary grade enrollment.

Table No.1 Technical Efficiency Estimates of Public Primary Schools Averages

Regions	*CRSTE*	*VRSTE*	*SE*
Punjab urban	0.8552	0.9600	0.9027
Punjab rural	0.8471	0.9220	0.8973
Sindh urban	0.8396	0.9180	0.8922
Sindh rural	0.8361	0.9135	0.8917
Baluchistan urban	0.8270	0.9087	0.8856
Baluchistan rural	0.8235	0.9051	0.8840
KPK urban	0.8631	0.9221	0.9228
KPK rural	0.8555	0.9100	0.9185
FATA urban	0.8475	0.9104	0.9140
FATA rural	0.8390	0.9104	0.9092
Islamabad urban	0.8301	0.9104	0.9042
Islamabad rural	0.8353	0.9241	0.9006
Mean	0.8416	0.9179	0.9019

Notes: **CRSRTE** = Constant Return to Scale Technical Efficiency, **VRSTE** = Variable Return to Scale Technical Efficiency, **SE** = Scale Efficiency **Source**: Authors' Calculation

4.3 Summary of Efficiency Aggregates

Table No. 2 indicates a summary of technical efficiency of primary schools. Results explain none DMU is found fully efficient on average under CRS and VRS.

Table No. 2 Summary of Efficiency Aggregates

Efficiency Aggregates	*CRSTE*	*VRTE*	*SE*
Number of Efficient	0	0	0
Number of Inefficient	12	12	12
Maximum Efficiency	85	92	92
Minimum Efficiency	82	90	88
Average Efficiency	84	91	90

Notes: **CRSRTE** = Constant Return to Scale Technical Efficiency, **VRSTE** = Variable Return to Scale Technical Efficiency, **SE** =

Each DMU has failed to achieve maximum primary enrollment by utilizing the proper educational inputs for instance, no. of teachers, electricity, drinking water, washrooms, boundary walls and expenditure on per student along with free stationary etc. The highest maximum efficiency is 92.6% under VRS, whereas the lowest maximum average efficiency is 85.55% under CRS. The lowest mean technical efficiency score is 84.16% under CRS, whereas the highest mean technical efficiency score is 91.79% under VRS.

4.4 Malmquist Summary of Public Primary Schools Annual Means

Table No.3 reveals Malmquist summary of annual means. This table gives an overview of annual efficiency score. Technical efficiency was declined in 12 years, which means that educational resources were not better utilized in the same period of time. The school management could not develop suitable strategies in order to enhance enrollment and decrease out of school by using available educational resources i.e. no. of teachers, physical facilities and establish institutes etc. Technological efficiency was improved in two years 2001 and 2008.

Table No. 3 Malmquist Summary of Public Primary Schools Annual Means

Year	Effch	techch	Pech	sech	tfpch

1994	0.9400	0.9290	1.0820	0.8690	0.8730
1995	0.8020	1.1180	0.7030	1.1410	0.8970
1996	1.5790	0.8840	1.4890	1.0600	1.3970
1997	0.9790	0.7550	0.9840	0.9950	0.7390
1998	0.9350	1.2230	0.9720	0.9620	1.1430
1999	0.7270	2.0580	1.0450	0.6960	1.4960
2000	1.0140	0.0980	0.9350	1.0850	0.1000
2001	0.2790	5.2870	0.8100	0.3450	1.4780
2002	5.2320	0.1110	1.3120	3.9870	0.5810
2003	0.8750	1.4320	0.9430	0.9280	1.2530
2004	0.9880	1.2770	0.9380	1.0530	1.2610
2005	1.1180	0.6550	1.1220	0.9960	0.7320
2006	0.9620	1.7010	0.9370	1.0270	1.6370
2007	1.0200	0.4950	1.0280	0.9930	0.5050
2008	0.9000	8.1950	0.9580	0.9390	7.3740
2009	1.1870	0.6110	1.1000	1.0790	0.7250
2010	0.7150	0.2510	0.7740	0.9240	0.1790
2011	0.8770	1.2060	0.8960	0.9790	1.0580
2012	1.5550	0.3010	1.4260	1.0910	0.4680
Mean	1.0080	0.8510	1.0060	1.0020	0.8570

Notes: **effch** = Technical Efficiency Change, **techch** = Technological Efficiency Change, **Pech** = Pure Efficiency Change, **sech** = Scale Efficiency Change, **tfpch** = Total Factor Productivity Change **Source**: Authors' Calculation

Pure efficiency remained positive in 8 years; it indicates that schools could better manage their resources for achieving specific goals while in other years it remained negative. Similarly, scale efficiency remained negative in the 11 years; it means that DMUs size is not suitable for efficiency, whereas in other years remained positive. TFP change has declined in 10 years, while in other years TFP change improves. Last 10 year schools remained inefficient by utilizing environment or physical facilities (electricity, water, washroom and drinking water etc) except for no. of teachers and capital. On average, there is declined in TFP and technological efficiency change, while increased in technical, pure and scale efficiency change.

4.5 Technical Efficiency Estimates of Public Middle Schools in Pakistan

Table No. 4 indicates the technical efficiency change of public middle schools in Pakistan. The highest technical efficiency of Sind urban area is 73.9%, which represents Sindh urban schools were not managing its resources, whereas the lowest technical efficiency of Sind rural is 64.6% under CRS. Under VRS, FATA urban area has highest technical average efficiency score 87.49%, whereas, the lowest technical efficiency score of KPK rural area is 77.62% under VRS. FATA urban schools remained relatively better performed due to manage inputs. The highest scale efficiency of KPK urban is 89.63%, whereas the lowest scale efficiency of FATA urban is 77.13%. The highest mean technical efficiency score of all DMUs is 83.7% for the 20 years under VRS. The results suggest that school's management team should make better strategy to enhance efficiency of schools by reducing student teacher ratio and increasing all other external factor i.e. parental education, expenditure on per student and physical facilities or the environment etc.

Table No. 4 Technical Efficiency Estimates of Public Middle Schools in Pakistan Averages

Regions	***CRSTE***	***VRSTE***	***SE***
Punjab urban	0.68270	0.83675	0.80122
Punjab rural	0.69575	0.86810	0.78523
Sindh urban	0.73975	0.84835	0.85360
Sindh rural	0.64670	0.79635	0.79507
Baluchistan urban	0.70930	0.83545	0.84889
Baluchistan rural	0.72470	0.82235	0.87216
KPK urban	0.73885	0.80175	0.89636
KPK rural	0.66885	0.77625	0.84209
FATA urban	0.68445	0.87495	0.77139
FATA rural	0.71125	0.86705	0.81501
Islamabad urban	0.71645	0.85265	0.83473
Islamabad rural	0.73490	0.86425	0.82553
Mean	0.70447	0.83702	0.82844

Notes: **CRSRTE** = Constant Return to Scale Technical Efficiency, **VRSTE** = Variable Return to Scale Technical Efficiency, **SE** = Scale Efficiency
Source: Authors' Calculation

4.6 Summary of Efficiency Aggregates

Table No. 5 depicts summary of public middle schools in Pakistan. Result showed all DMUs were found inefficient CRS and VRS. The maximum mean efficiency score is 73.97%, while minimum 64.67% under CRS. The mean efficiency score is 70.45% under CRS. The maximum scale efficiency score is 89.63%. The highest mean efficiency score is 83.70%, which shows the less efficient middle education in rural and urban areas. The results represent that non schools remained a success to manage resources in order to achieve reduced student teacher ratio and increase enrollment. It is alarming situations, some other variables that influence on the efficiency of the schools in rural and urban areas; for instance, not going school children, expensive study material, low income level and less parental education etc.

Table No. 5 Summary of Efficiency Aggregates

Efficiency Aggregates	***CRSTE***	***VRTE***	***SE***
Number of Efficient	0	0	0
Number of Inefficient	12	12	12
Maximum Efficiency (%)	73	87	89
Minimum Efficiency (%)	64	77	77
Average Efficiency (%)	70	83	82

Notes: **CRSRTE** = Constant Return to Scale Technical Efficiency, **VRSTE** = Variable Return to Scale Technical Efficiency, **SE** = Scale Efficiency
Source: Authors' Calculation

4.7 Malmquist Summary of Public Middle Schools Annual Means

Table No. 6 tabulates Malmquist summary of the annual of public middle schools in Pakistan. The results indicate middle schools were found fully efficient for the year 1993 to 2012 under technical efficiency change. It means that the school maintained a better policy to utilize the resources for instance teachers, environment, etc

The year 2008 showed best performance of all DMUs under technological efficiency change. Results show that in the year 2008 national education policy remained very effective by the Ministry of Pakistan in rural and urban areas. Only year 2008 was found highest efficiency score of all DMs is 118.3% under technological efficiency change. Last 20 years, middle schools were found inefficient on technological change so it needed to improve technology advancement i.e. New technique or methodology of education or learning in order to promote middle enrollment or education in rural and urban areas of Pakistan.

Table No. 6 Malmquist Summary of Public Middle Schools Annual Means

Year	effch	techch	pech	sech	tfpch
1994	0.6620	1.6900	0.4870	1.3600	1.1190
1995	2.9010	0.4160	2.6050	1.1140	1.2080
1996	0.6720	1.9830	0.8140	0.8260	1.3330
1997	1.5480	0.2060	1.2450	1.2440	0.3190
1998	0.8580	8.3670	0.9540	0.9000	7.1810
1999	0.5590	2.0710	1.1070	0.5050	1.1580
2000	1.8680	0.0540	0.9080	2.0570	0.1000
2001	0.2200	8.1350	0.9420	0.2340	1.7920
2002	5.1550	0.0980	1.1020	4.6770	0.5030
2003	0.4460	2.9680	0.5660	0.7870	1.3230
2004	0.7700	1.8930	0.7960	0.9680	1.4580
2005	2.6680	0.3350	2.1230	1.2570	0.8950
2006	0.9110	1.6470	1.1160	0.8170	1.5010
2007	0.8460	0.3100	0.8040	1.0520	0.2630
2008	0.9790	11.832 0	0.9270	1.0560	11.581 0
2009	1.5600	0.3700	1.3440	1.1610	0.5770
2010	0.6930	0.1970	0.7890	0.8790	0.1370
2011	0.6800	3.3320	0.7660	0.8890	2.2670
2012	2.1030	0.3210	1.6350	1.2860	0.6750
Mean	1.0420	0.9160	1.0160	1.0250	0.9540

Notes: **effch** = Technical Efficiency Change, **techch** = Technological Efficiency Change, **pech** = Pure Efficiency Change, **sech** = Scale Efficiency Change, **tfpch** = Total Factor Productivity Change **Source**: Authors' Calculation

4.8 Technical Efficiency Estimates of Public Tertiary Schools Averages

Table No. 7 indicates the technical efficiencies of public tertiary schools.

Table No 4.7 Technical Efficiency Estimates of Public Tertiary Schools Averages

Regions	*CRSTE*	*VRSTE*	*SE*
Punjab urban	0.7595	0.9460	0.8029
Punjab rural	0.8524	0.9460	0.9011
Sindh urban	0.7595	0.9358	0.9247
Sindh rural	0.8524	0.9134	0.8983
Balochistan	0.8038	0.8882	0.8661
Balochistan	0.8052	0.8930	0.8817
KPK urban	0.8401	0.8829	0.9235
KPK rural	0.7817	0.9253	0.8657
FATA urban	0.8713	0.9326	0.9319
FATA rural	0.8360	0.9240	0.8814
Islamabad	0.8521	0.9381	0.9183
Islamabad rural	0.8634	0.9035	0.9144
Mean	0.8231	0.9190	0.8925

Notes: **CRSRTE** = Constant Return to Scale Technical Efficiency, **VRSTE** = Variable Return to Scale Technical Efficiency, **SE** = Scale Efficiency **Source**: Authors' Calculation

The results show Punjab urban area's secondary schools were found 75% technical efficiency. The Punjab urban area schools are needed to manage resources to produce the maximum output level. The highest efficiency score of the Islamabad rural area is 863.4% under CRS; whereas the lowest score of both Punjab urban and rural area is 940.6 % under VRS. It was the best performance of secondary schools due to better planning. FATA urban tertiary schools were found 931% score on scale efficiency. These results exhibit that FATA urban area schools have better used its educational resource i.e. Teachers with less students attached (student teacher ratio) and physical facilities i.e. having electricity, drinking water, washrooms etc. Tertiary schools have highest efficiency score.

4.9 Summary of Efficiency Aggregates

Table No. 8 indicates summary of technical efficiency of public tertiary schools. All DMUs were found inefficient while the maximum efficiency score is 871.1 % under CRS and 946 % under VRS. All DMUs are failed to better utilize educational resources in order to achieve specific output level. The highest scale efficiency score was found 923.5% of tertiary schools last for the period 1993 to 2012. The minimum efficiency of tertiary schools is 759.5% under CRS, whereas the highest efficiency is 882.8% under VRS.

Table No. 8 Summary of Efficiency Aggregates

Efficiency Aggregates	*CRSTE*	*VRSTE*	*SE*
Number of Efficient	0	0	0
Number of Inefficient	12	12	12
Maximum Efficiency (%)	87	94	92
Minimum Efficiency (%)	75	88	80
Average Efficiency (%)	82	91	89

Notes: **CRSTE** = Constant Return to Scale Technical Efficiency, **VRST E**= Variable Return to Scale Technical

4.10 Malmquist Index Summary of Public Tertiary Schools Annual Means

Table No. 9 indicates Malmquist summary of public tertiary schools in Pakistan. Result showed public tertiary schools were found inefficient in rural and urban areas of Pakistan, which is indicated tertiary schools were not use laboratory and equipment, subject specialist teachers, lesson planning and revised syllabus according to ground realities, whereas remaining 13 years, they were found fully efficient under technical efficiency change. All DMUs remained fully efficient on technological and technically. Under technical efficiency, it was the best performance of tertiary schools last 13 years. In that period of time school management team had developed better planning technologically and technically. The highest efficiency score of all DMUs founded 161.5% for the year 2008, whereas the lowest efficiency score of all DMUs found 25.3% for the year 2007 under technological efficiency change. The highest mean efficiency score found 102% under technical efficiency change which shows the best performance of rural-urban public tertiary schools for last 20 years.

Table No. 9 Malmquist Index Summary of Public Tertiary Schools Annual Means

Year	effch	techch	pech	sech	tfpch
1994	0.4830	3.5480	0.9490	0.5090	1.7130
1995	2.6520	0.3290	1.3820	1.9180	0.8720
1996	1.0830	0.7320	1.0260	1.0560	0.7930
1997	1.0700	0.4530	1.0580	1.0120	0.4840
1998	0.9290	1.9380	0.9860	0.9420	1.8010
1999	1.0230	0.7730	1.0100	1.0120	0.7910
2000	0.9460	0.9780	0.9140	1.0350	0.9250
2001	1.0400	1.0000	1.0360	1.0030	1.0400
2002	1.0480	0.7990	1.0420	1.0070	0.8370
2003	0.5760	0.9430	0.7540	0.7640	0.5430
2004	1.0530	1.3060	1.0680	0.9860	1.3740
2005	1.1230	0.5220	1.1200	1.0030	0.5870
2006	1.1810	1.8810	1.0520	1.1220	2.2220
2007	1.1090	0.2530	1.0020	1.1070	0.2810
2008	0.8620	16.1500	0.9590	0.8990	13.9260
2009	1.3180	0.4470	1.1130	1.1840	0.5890
2010	0.9410	0.2980	0.9390	1.0010	0.2800
2011	0.7270	2.4560	1.0470	0.6950	1.7870
2012	1.4490	0.5400	1.0020	1.4460	0.7820
Mean	1.0200	0.9520	1.0180	1.0020	0.9720

Notes: **effch** = Technical Efficiency Change, **techch** = Technological Efficiency Change, **Pech** = Pure Efficiency Change, **sech** = Scale Efficiency Change, **tfpch** = Total Factor Productivity Change **Source**: Authors' Calculation

5 CONCLUSIONS

The results suggest that external factors are significant for the performance of schools in rural and urban areas. The socioeconomic status of student and parental education are very influenced on the efficiency of the schools especially in rural areas. Family status may effective the efficiency schools. Therefore, the government of Pakistan should take radical steps to decrease out of school. For instance, scholarship or financial support must be given to student by the State. To check school accountability, educational administration unit must be established in each municipality. A major portion of population relates to the agriculture sector in Pakistan. Agricultural related people have been facing many challenges for several decades. Consequently, schools remained inefficient because educational resources are not better allocate in rural and urban areas. Furthermore, having lunch, laboratories, free stationary, free transportation, furniture and internet facilities are required to improve efficiency of the schools in rural and urban areas. Apparently, educational activities have been occurring prominently by the GOP. In fact, public schools are being inefficient gradually in competition of private schools. The study suggests that trained teachers are very important. Reduction in student teacher ratio leads to the quality of education. Educational spending may attract enrollment and teachers who in turn improve the quality of education. Spending become an engine to run school system and may help to establish building in which physical facilities i.e. electricity, drinking water, boundary wall, etc are properly allocated and utilize. Better environment quality improves school efficiency. Efficient educational expenditures improve efficiency of the school. Transportation is also basic factor that influenced the school efficiency. In rural areas, schools remained inefficient due to lack of transportation facilities. The Ministry of Education should be vigilant to avoid misallocation of educational resources. It should not hesitate to accountability of the educational departments. The MOE should make plan to remedial of political issues, favoritism and corruption. Education is a basic necessity; it should be free providing the GOP. Per student expenditure should be increased. All schools should have the same characteristics so that it may provide better education to the student. Poverty is a fuel of all social diseases. It should remove from an equal distribution of resources under the GOP. As a result, schools will be efficient and remove educational business in the private sector.

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