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Educational requirements of Pakistan: A normed planning approach

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Abstract The study assesses the performance of a developing economy's educational sector by comparing some fundamental educational statistics from Pakistan to those of ten better performing nations, and it outlines the required levels of education for the following decade. It presents a road map for the educational sector in Pakistan for the next ten years after identifying the gap between the existing and required levels of educational statistics. For each level of education, projections for the following variables are created. The required levels of Gross enrolment ratios, student-teacher ratios, the number of enrolments and the number of teachers. The required distribution of government spending across educational levels. Normed Planning approach is followed for the purpose by using panel data of 10 selected countries over the time period 2003-2017. It has also been observed that enrolments at each level of education are far below the required level based on international norms. In primary and secondary education, there are significant disparities between actual and necessary student-teacher ratios. In Pakistan, educational funding appears to be unbalanced, with primary and secondary education receiving more public funds than tertiary education. The analysis also demonstrates that the percentage of capital spending in total government expenditure on education is lower than

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what is required.

Keywords Educational Requirements, Road Map for Educational Sector of Pakistan, Comparison With Selected Countries, Normed Planning

1 Introduction

Manpower development is closely associated with economic growth and this fact is well acknowledged in the economic literature. Economic growth theories and their advancement emphasize the role of human capital and education in economic growth. Education is seen as an investment that generates magnanimous returns for individuals and societies. Developing countries consider education as a tool for developing their manpower and ladder in a process of development.

Education increased explosively all around the world after World War II. Efforts were made by governments besides international donor agencies to increase the overall level of education. At the same time, awareness among individuals was increasing to have a higher level of education. The need for manpower planning and educational planning was realized and attempts were made to forecast educational requirements to achieve a certain level of economic growth. In the modern era, the need and practice of manpower and educational planning gained importance and popularity during the 1960s.

The question of determining the required manpower in the labour market remained a challenge for educational and manpower planners for decades. The model designed by Correa and Tinbergen (1962)is considered as the first model that guide to forecast the educational requirements of the economy. There are a variety of manpower forecasting techniques but the three dominant ones in the educational planning literature are manpower requirement approach, rate of return technique and the social demand methods (Asher 1988). However, Debeauvais and Psacharopoulos (1985) states that nearly 90% of manpower and educational planning is done by manpower requirements approach.

The advancement in data availability on education and human resource development for all countries by the international agencies like UNESCO, World Bank and UNDP made it possible to base the educational planning on the cross country/ international comparisons (Cohen 2013). The normed planning approach is the latest technique developed by Cohen (2013) that integrates country by country planning and cross country comparisons to forecast the educational requirements.

Pakistan lies in the list of medium human development countries with an HDI rank of 150 in a list of 189 countries in the year 2017 (UNDP 2018). Pakistans HDI value for the year 2017 is 0.562 that lies below the average value of 0.638 for the South Asia region. The review of Pakistans educational policies shows that while higher targets are set in each educational policy, they lack the proper quantitative targets and the strategy to achieve them. The education system in Pakistan lacks uniformity, accessibility and quality. The vast differences in private and public schooling, high numbers of out of school children, low personal investments in education due to poverty, poor policy formulation and

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implementation, lack of adequate teacher trainings, lack of proper infrastructure, low participation and poor quality of higher education and low learning outcomes in terms of personal development & productivity are few of the challenges. These facts indicate the need for focusing on educational planning and human development in Pakistan.

The core objective of the study is to judge the performance of Pakistans educational sector by comparing some basic educational statistics of Pakistan with 10 better performing countries and to define a road map of required levels of education for next decade. More precisely projections for the following variables are made for each level of education.

1) The required levels of Gross enrolment ratios and the number of enrolment.
2) The required levels of student-teacher ratios and the number of teachers.
3) The required composition of government expenditure among different levels of education.
4) Comparison of actual and required levels of all above-mentioned variables in the current time-period 2017.

This aim will be realized by utilizing the normed planning approach following Cohen et al (2015). The experience of better performers (10 selected countries) will be compared with the existing situation in Pakistan and then projections will be made for the year 2025 and 2030. The basic idea is that, first, the group of 10 better performing countries will be selected and their basic education statistics will be linked to their GDP per capita through some simple equations. Then to know the requirements of Pakistan economy to perform better in terms of education, the GDP per capita of Pakistan is incorporated in the estimated equations. It will give the required levels of education statistics like gross enrolment ratio and student-teacher ratio for Pakistan based on the fitted model of better-performing countries. So basically, it is knowing how these countries would have performed in terms of education if their GDP would be equal to the GDP of Pakistan. Hence, the study contributes to the literature by comparing the existing situation of Pakistans educational sector with 10 selected better-performing countries by means of some basic statistics of the education sector.

2 Literature review

The history of gathering manpower statistic could be traced back to conducting a Roman census to account slaves. Followed by a trend of gathering population census at the end of the eighteenth century (Morton 1969). In the modern era, the need and practice of manpower and educational planning gained importance and popularity during the 1960s. International organizations like UNESCO, World Bank and Organization for Economic Cooperation and Development (OECD) have a major role in the development and implementation of educational plans, especially for developing countries. Several methodologies were developed that are summarized as follows.

The employer survey method is aimed to specify the future needs of the labour categorized by education through the survey based on the employers

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responses. The results are then aggregated to know the need for labour with a certain level of education in a certain year in an economy. This method is used by developed countries like Canada, France, Sweden, UK and USA and for forecasting of some specific sectors in the developing countries also (Niazi 1996; Williams 1993). **Existing labour output ratios** to the future method is applied for forecasting labour/ education needs of the whole economy (Spalletti et al 2008), this method is more extensively used for projecting the needs for a certain type of occupations like doctors, teachers, engineers and scientists. **The Density ratio method** associates one type of manpower with a level of another type of manpower like student-teacher ratio or with a total population of economy or sector of the economy e.g. doctor-patient ratio or doctors per head in district, province or economy. **International comparisons method** analyzes the experience of a single advance country or group of relevant countries. Targets are set to be achieved for the country that is aimed for taking guidelines, in light of experiences of advance country. **Manpower requirements** approach is the most popular approach among manpower forecasting techniques. This technique emerged as a result of the Mediterranean Regional Project (MRP) by OECD in Parnes (1962) that aims to construct a model for educational and manpower planning. This method is based on three major steps; forecasting the future demands for manpower with different levels of education, projection of supply of educated labour and then balancing demand and supply of manpower.**Correa and Tinbergen (1962) model** expresses the relationship between educational requirements and output of a country. The required enrolment and number of teachers are estimated in absolute terms. **Linear-programming models** used linear programming as a tool to calculate the shadow prices for different kinds of labour based on their education. Optimal levels of school enrolment were suggested by the model (Psacharopoulos 1987). **Social-demand models** are about considering the demands of students and their families for schools of a certain type in their area. These models are only applicable to the developed countries where fulfilling this type of demand is possible due to the availability of funds and needed manpower. **Rate of Return Analysis** estimates and compares the social and private cost and benefits of education (Spalletti et al 2008). **Harbison's Method** is based on the idea that human capital is essential for economic growth that means a healthy, skilled and educated population. This method is about finding educational and manpower requirements as a result of setting targets. Targets are set for each level of education separately. These targets also include on-job training, deciding about manpower mix and defining incentives to achieve targets. **Labour Absorption Method** analyzes the ability of the economy to employ and absorb a certain type of educational output. France and Germany have utilized this method for their educational and manpower planning (Niazi 1996). **Trends Method** undertakes that the trends experienced in past can be projected in future assuming that the variables of interest will follow the past trend. It predicts the amount and kind of education that could easily be absorbed in the economy (Youdi and Hinchliffe 1985). **Normed Planning Approach** the latest technique developed by Cohen (2013) integrates the country by country planning and international comparison method. It provides with the road map for what should be the enrolment, teachers and government

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expenditures at different educational levels in a particular country. This method utilizes the experiences of a pool of better-performing countries to define a road map for a developing country. It is long term planning approach for educational sector representative statistics.

2.1 History of Pakistans National Educational Policies

At the time of independence in 1947, the areas that were emerged as Pakistan were far backward in terms of education. 85% of the population was illiterate and women education statistics were even worse. However, the importance of education in nation-building was well realized. The national educational policies of Pakistan are reviewed and discussed in detail by Siddiqui (2016); Ali (2013); Ahsan (2003); Bengali (1999). The national educational policies are very briefly discussed as follows. **The first educational conference** was called in November 1947. Universal primary education is recommended to be achieved in the first 20 years. The **Second National Education Policy 1959** emphasized on compulsory primary education, gender equality, character building, education of science and technology, increased numbers of universities and making religious education compulsory till middle and optional at secondary level. **New Education Policy (1970)** was defined again to achieve universal primary education that was the aim of the previous education policies but could not be achieved. The policy aimed to achieve 100% primary education and to make it free. National Education Policy (1979) intended to achieve free education for all up to metric. The promotion of Pakistan ideology, to make education equally accessible to all, the promotion of technical and scientific education were the main objectives of the policy. National Education Policy (1979) was announced with the goals of promoting the concept of Muslim Ummah, gender equality in education and promotion of technical and scientific education. It was also decided to revise the curriculum, to adapt Urdu as a medium of education, to make separate institutions for male and female, integration of religious and traditional education. National Education Policy (1992)undertook the target of achieving universal primary education again. Aims were set to increase non-formal, technical and female education. It was recommended to make social services compulsory for students. Programs for teachers training were initiated. Attempts were made to increase the number of teachers in schools and to provide better infrastructure. National Education Policy (1998-2010) aimed to make primary education accessible to all and also to improve its quality. The provision of quality teaching by initiating teacher training programs. Increasing the involvement of parents, community, non-government organizations and media in provision of primary education. Making the education system equitable and inclusive. Considering non-formal education systems complementary to the formal system.Considering non-formal education systems complementary to the formal system. Development of monitoring system and accountability. Decentralization to improve management and supervision. **National education policy 2009-2015** included early childhood education for the first time. Issues

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of out of school children due to child labour and older child labourers were highlighted and it is planned to facilitate the children in work. The policy highlighted the need to focus on curriculum, standard textbooks, teachers, the facilities at learning institution and their environment, assessments and link of education to the labour market. Educational policy National Education Policy in Pakistan 2017 intended to increase the enrolment of tertiary education to 15% from 8%. Setting up 15 public and 50 private universities are in the plan. Virtual education is focused in the policy. Setting up new libraries, modernization of libraries and easy access to libraries with the help of internet is part of the policy. The policy also includes the promotion of sports and physical education. It is recommended to facilitate the education of special children and to increase their participation rate, for this purpose 5% of the education budget is allocated.

3 Model Specification and Methodology

This section illustrates the model, selection of countries for estimation and methodology. Section 3.1 explains the model. Section 3.2 describes the selection of countries for comparison. Section 3.3 explains the followed methodology.

3.1 The Model

The basic purpose is to frame a model which can guide us to determine educational mix depending upon enrolment in primary, secondary and higher education, teacher-student ratio and government expenditure on education. The model will first compare the actual and required levels of variables that define the basic structure of education e.g. enrolments, student-teacher ratio and government expenditure on education and then it will give a road map for next decade.

The basic idea is to link the educational sector variables like gross enrolment ratio, student-teacher ratio to GDP per capita as it was done in the seminal work of Correa and Tinbergen (1962). The innovation of the model is that instead of estimating the equations based on country data, they are estimated on the basis of panel of selected advance countries in terms of education, GDP per capita and with a comparable population. Then these estimated regressions are used to estimate the required level of educational variables in current and future years for the country of interest by incorporating its current and projected GDP per capita.

The model is based on the work of Cohen et al (2015) and consists of the following 9 equations comprising of 6 reaction equations and 3 definitional equations. The model assumes and implies that along with the growth of GDP the educational sector also develops accordingly. The first four equations characterize the educational structure by means of gross enrolment ratios, enrolments, student-teacher ratios and numbers of teachers while the next five illustrates the government expenditure on education.

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$$GER_e = \alpha_{1e} + \beta_{1e}\, GDP_{pc} \qquad e = 1, 2, 3 \tag{1}$$

$$ENR_e = GER_e.SAG_e.POP \qquad e = 1, 2, 3 \tag{2}$$

$$STR_e = \alpha 3_e + \beta_3 e GDP_{pc} \qquad e = 1, 2, 3 \tag{3}$$

$$TCH_e = [1/STR_e]ENR_e \qquad e = 1, 2, 3 \tag{4}$$

Government Expenditure on education.

$$\frac{GTS}{GDP} = \alpha_5 + \beta_5\, GDP_{pc} \tag{5}$$

$$\frac{GTE}{GTS} = \alpha_6 + \beta_6\, GDP_{pc} \tag{6}$$

$$\frac{GRE_e}{GRE} = \alpha_{7e} + \beta_{7e} GDP_{pc} \qquad e = 1, 2, 3 \tag{7}$$

$$\frac{GRO}{GRE} = 1 - \frac{GRE_1}{GRE} - \frac{GRE_2}{GRE} - \frac{GRE_3}{GRE} \tag{8}$$

$$KRC = \alpha_{0e} + \beta_{9,e} GDP_{pc} \qquad e = 1, 2, 3 \tag{9}$$

Where notations are explained as under:
Educational levels are denoted by index e, where 1, 2 and 3 denote primary, secondary and tertiary education respectively.

- GER_e Gross Enrolment Ratio
- GDP_{pc} Gross Domestic Product per capita
- ENR_e Number of enrolment in level e
- SAG_e Share of age group associated with a particular level of education e in total population
- POP Total population of Pakistan
- STR_e Student-teacher ratio
- TCH_e Number of teachers
- KRC The ratio of governments capital to recurrent expenditure
- GTS Government total spending (all sectors)

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- GTE Government total expenditure on education
- GRE Government recurrent expenditure on education
- GRE_e Government recurrent expenditure on education by level e
- GRO/GRE The proportion of overhead and other activities in government recurrent expenditure on education

Equation 1 relates gross enrolment ratio at each level of education to the GDP per capita. Equation 2 is definitional and shows that enrolment at any level of education can be found by multiplying the gross enrolment ratio to the product of total population of the country and share of the age group that associates to a particular level of education. Equation 3 describes the relation of the student-teacher ratio of any particular level of education to GDP per capita. Equation 4 is again definitional equation showing that the number of teachers of any level of education can be found by dividing the enrolment by student-teacher ratio.

The next five equations (5-9) give information about the governments expenditure on education. Equation 5 narrates the relationship of the governments total spending on all sectors as a proportion of GDP to GDP per capita. This gives information about the size of the government budget. Equation 6 explains the relationship of governments total spending on education as a proportion of its all sectors spending to GDP per capita. It informs about the size of the education budget. Equation 7 illustrates the proportion of expenditure on each level of education in the governments recurrent expenditure on education to GDP per capita.

Equation 8 is the definitional equation and shows that governments overhead and other activities expenditure can be found as a residual of total and sum of government expenditures on different levels of education. As we are taking GRO as a proportion of governments recurrent expenditure on education(GRE) so it can be found by deducting proportions of expenditures in all sectors from 1, as 1 represents total in terms of proportions. Equation 9 gives information about the governments capital expenditure on education as a ratio of its recurrent cost. It relates this ratio to GDP per capita. This model will be solved to get the required levels of above-mentioned education statistics for Pakistan.

3.2 Selection of countries for Estimation

The idea behind solving the basic model of the study is to employ the experience of the better performers in terms of education and economic growth to develop guidelines for Pakistan. For this purpose, the objective was to carefully select a group of ten better-performing countries (Cohen, 2015). Pakistan is on the list of nations with medium human development, hence the target list for country selection was the list of countries with high human development. Furthermore, 52 countries were on the list of those with a high HDI index (Human Devel-

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opment Report, 2018). The list is further refined by selecting countries with larger or at least comparable populations considering the population ranks and its comparison with Pakistan (World Development Indicators, 2018). It reduced the list even further. The following criteria suggested by Cohen (2015) were used to narrow down the list to the better performers and most relevant countries in terms of education and GDP per capita ranking.

a) The countries have experienced high economic growth during the last decade.
b) Have population size comparable or bigger than Pakistan
c) Have ranked HDI higher than the ranked index of GDP per capita.

The application of above-mentioned criteria results in the selection of the following countries summarized in Table 3.1 along with their HDI, population and GDP per capita rank and of Pakistan.

3.1: HDI, Population and GDP Per Capita Rank of Selected Countries

Country Name	HDI rank	Population rank	GDP per capita
Algeria	85	33	80
Brazil	79	5	78
China	86	1	75
Colombia	90	28	85
Iran (Islamic Republic)	60	18	61
Malaysia	57	44	43
Mexico	74	10	67
Russian Federation	49	9	53
Thailand	84	20	70
Turkey	64	19	50
Pakistan	150	6	127

*HDI and GDP per capita ranks are acquired from Human Development Report, 2018
*Population ranks are based on data derived from World Development Indicator, 2018

3.3 Methodology

To solve the model given above and to deduce fruitful results the following procedure is followed. The model given in section 2.1 is solved by initially estimating the reaction functions explained by equation 1, 3, 5, 6, 7 and 9. These equations link the basic variables that describe the performance of the education sector of a country to its GDP per capita. For estimation, panel data of 10 selected countries for the years 2003 to 2017 and the fixed effect method is utilized further detail about data is provided in Appendix A and B. These equations are tested for their functional form by estimating the equations in linear, semi-log, quadratic and hyperbolic form and the model with high R2 and low standard error of the regression is selected. These equations are solved repeatedly for a primary, secondary and higher level of education.

The estimated regression equations 1, 3, 5, 6, 7 and 9 provides the information that how education sector variables like gross enrolment ratio, the share of

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education in total government spending are linked to GDP per capita in these better performing countries.

Once the panel estimation is done and the parameters of equations 1,3,5,6, 7 and 9 are estimated by utilizing the data of 10 selected countries, the next step is to solve these equations to find guidelines for Pakistan economy. For this purpose, these estimated equations will be solved by incorporating the GDP per capita of Pakistan for the year 2017. The incorporation of GDP per capita of Pakistan for the year 2017 in equation 1 that is estimated separately for each level of education will give the required level of gross enrolment ratio for primary, secondary and higher level of education in the year 2017. Similarly, plugging the GDP per capita of Pakistan for the year 2017 in estimated equation 3 will give the required student-teacher ratio in each level of education. Solving equation 5, 6, 7 and 9 by incorporating GDP per capita of Pakistan in the year 2017 will give the required level of a particular education statistics. The same procedure will be repeated for finding the estimated values of dependent variables in equation 1,3,5,6,7 and 9 for future years by incorporating the projected GDP per capita of Pakistan for the years 2025 and 2030 that is explained in Appendix B.

Next step is to solve the remaining three equations of the model that is equation 2, 4 and 8. The required level of enrolment in each level of education is solved by equation 2. The required information for solving equation 2 is information deduced from equation 1, the share of the age group in population and population (given in Appendix A). This equation will repeatedly be solved to get the required level of enrolment in each level of education for the years 2017, 2025 and 2030. Equation 4 will be solved by utilizing information derived from equation 2 and 3. The incorporation of information relevant to the year 2017 and then calculated values for years 2025 and 2030 in equation 4 will give the required number of teachers in each level of education. The same procedure is followed for solving equation 8 that gives information about the proportion of overhead expenditures in government recurrent expenditure on education.

4 Results and Discussion

This section discusses and reports the results of the basic model of the study illustrated in section 2. The results are based on the data from 10 selected high achieving countries in terms of education as well as economic growth. The model is solved to derive important guidelines for Pakistan for the next decade about the required levels of the variables that define the basic structure of the education system. These variables include Gross enrolment ratio (GER), Enrolment (ENR), Student-teacher ratio (STR), Number of teachers and government expenditure on education and distribution of government expenditure on different levels of education. The results are then compared with the actual values to analyze the existing situation and gaps that are needed to be covered to accelerate in terms of education. The results are illustrated in the following sections.

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4.1 Gross Enrolment ratio

Gross enrolment ratio (GER) gives important information about the participation level in the education system. It is one of the basic statistics in defining and analysing the education system of a country. It is expressed as a percentage of those who are enrolled in a particular level of education (e.g. primary) to the population that belongs to official age- group of that particular level of education. An analysis is carried out to describe the relationship between GER and GDP per capita. The estimation results are based on data from 10 selected countries over the years 2003-2017. The results of equation 1 of the model described in section 2.1 are reported as under:

$$\begin{aligned} GER_1 &= 221.75 - 11.78\, LnGDP_{pc} \\ R_2 &= 0.77 \quad S.E = 5.25 \end{aligned} \tag{10}$$

Equation 10 shows that the relationship between the gross enrolment ratio at the primary level is negatively associated with GDP_{pc}. The reason is that all the countries included in the estimation have achieved a 100% gross enrolment ratio long ago and have much higher GER(primary) during the period under consideration. The mean GER for the primary level of education in the data was 108 while the maximum was 151. So as they have already achieved higher than 100% GER with more advancement they need not to have further higher GER at the primary level.

$$\begin{aligned} GER_2 &= -138.18 + 23.50\, LnGDP_{pc} \\ R_2 &= 0.66 \quad S.E = 6.83 \end{aligned} \tag{11}$$

The link between Gross enrolment ratio at the secondary level of education and GDP_{pc} is described by equation 11. The estimates show a positive association between gross enrolment ratio of secondary education and GDP per capita implying that as GDP per capita increases in a country the gross enrolment ratio at the secondary level also increases.

$$\begin{aligned} GER_2 &= 22.08 + 0.001273\, LnGDP_{pc} \\ R_2 &= 0.86 \quad S.E = 7.37 \end{aligned} \tag{12}$$

The association between GER at tertiary level and GDP per capita is found positive that is as expected, indicating an increase in GER at the tertiary level of education as a result of an increase in GDP per capita of a country.Based on the information given in equation 10-12 the required level of GER at the primary, secondary and tertiary level of education for Pakistan is estimated by incorporating the GDP per capita of the country in the year 2017 and projected GDP per capita in the future years. The results are summarized and in table 4.1 along with the actual GER in the year 2017.

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4.1:Pakistans Required and Actual Gross Enrolment Ratio

Year	Gross Enrolment Ratio		
	Primary	**Secondary**	**Tertiary**
2017 (Actual)	95.92	45.48	10.12
2017 (Required)	121.36	62.17	28.49
2025	116.76	71.34	31.55
2030	113.61	77.63	34.46
Gap 2017 (Actual/required)	**0.78**	**0.73**	**0.36**

It is found that despite the focus of national government as well as the guidelines of the international agencies like UNESCO to achieve 100% GER at the primary level, Pakistans latest statistic available for the year 2017 shows that the target is not met yet. Although the country is close to the value of 100, still the estimated figures that predict the requirements of GER in the country shows a wide gap (a gap of 25 percentage points). Similarly, the estimates of GER (Primary) for year 2025 and 2030 are also listed showing the need for not only achieving 100% GER at the primary level of education but to maintain this statistic well above 100%. The results for the secondary levels of education also demonstrates a wide gap. While the actual GER is around 45% the required level is 62%. The ratio gap calculated as ratio of actual GER and required GER shows that Pakistan so far has achieved 78% of required GER at Primary, 73% at secondary and 36% at Tertiary level of education. *The highest gap exist for GER(Tertiary) and the value 0.36 shows that in Pakistan at tertiary level the GER is around one third of what is required. Also, not only catching up the required level of GER is needed but it needs to go up in the following years 2025 and 2030 at each level of education.*

4.2 Enrolments (ENR)

This section solves equation 2 of the model described in section 2.1. The solution of equation 2 requires information on the share of the age group (SAG) associated with each level of education, the actual and projected population of Pakistan, and the estimated gross enrolment ratios. The information on the first two variables is explained in Appendix A and B. The estimated values of GER are explained and listed in section 4.1. Required enrolments can be found by just incorporating these values in equation 2 of the basic model. These required enrolment are calculated, listed, compared, and explained in this section and reported in Table 4.2. Equation 2 of the model is reproduced for easy reference.

$$ENR_e = GER_e.SAG_e.POP \quad e = 1, 2, 3 \tag{13}$$

The results in Table 4.2 identify a wide gap between actual and required enrolment at the primary level. It is found that a gap of 7.78 million exists in enrolment at the primary level. Moreover, the coming years require a higher level of enrolment until 2030. The required enrolment at the secondary level of

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education are also calculated. There is huge gap of 7.09 million in enrolment in year 2017 at the secondary level. The results show that the required numbers of enrolment are increasing from its preceding value for every 5th year it is calculated. Similarly, the comparison of actual and required enrolment in the year 2017 shows that Pakistan needs to increase its enrolment at the tertiary level of education about 326% to catch-up the trend of selected countries in this study. The estimated values for future years show an increasing need for expanding enrolments.

4.2:Required and Actual Enrolment in millions of persons

Year	Enrolments		
	Primary	**Secondary**	**Tertiary**
2017 (Actual)	21.686451	12.529168	1.941478
2017 (Required)	29.47036	19.62045	8.280692
Enrolment Gap	*7.783909*	*7.091282*	*6.33921*
2025	32.525728	24.712689	9.858803
2030	34.355988	29.396787	11.50819

*Figures are converted to millions for readability, ignoring decimal gives raw numbers
* Row listed as gap shows the difference between required and actual enrolments in the year 2017

Summing up, it is found that the numbers of enrolment are far below the required level at each level of education. It is important to note here that this analysis implies that if the GDP per capita of the selected countries were equal to the GDP of Pakistan in the year 2017, still their education would be higher by the value shown under the heading Enrolment gap in the table, showing there better performance in terms of education.

4.3 Student-Teacher Ratio (STR)

Another important determinant of the education structure analyzed in this study is the student-teacher ratio (STR). A lower value of STR indicates a higher quality of education as it indicate that there are more teachers available in the system. The results of equation 3 of the basic model of the study are reported in this section. The results of STR for primary education is represented by equation 14. The negative sign implies that as GDP per capita increases the student-teacher ratio at primary level declines signifying improvement in the quality of education.

$$\begin{aligned} STR_1 &= 64.32 - 4.4\, LnGDP_{pc} \\ R_2 &= 0.91 \quad S.E = 1.54 \end{aligned} \tag{14}$$

The estimated equation for student-teacher ratio at the secondary level is found best in semi-log form and is presented by equation 15. The relationship

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is found to be negative.

$$\begin{aligned} STR_2 &= 48 - 3.1596\, LnGDP_{pc} \\ R_2 &= 0.92 \quad S.E = 1.44 \end{aligned} \tag{15}$$

The result of the link between STR at tertiary level and GDP per capita is explained by the equation 16. The relationship is found to be negative implying that an increase in GDP per capita lowers the student-teacher ratio at tertiary level as well.

$$\begin{aligned} STR_3 &= 22.70 - 0.00031\, LnGDP_{pc} \\ R_2 &= 0.88 \quad S.E = 2.28 \end{aligned} \tag{16}$$

The actual and estimated values of STR at each level of education are reported in Table 4.3. The calculations are done by using equations 14-16 and actual and projected GDP per capita in future years. The gap ratio 2017 is showing that Pakistan is lagging by 71% at primary level, by 57% in tertiary level and is ahead by 9% at secondary level as compared to the normed STR. The guidelines from the selected countries in the analysis suggest lowering STR and hiring more teachers at primary and tertiary level. Moreover, the required STR at both levels needs a further decline in future years explained by projections of 2025 and 2030.

The results for the secondary level of education apparently show that in Pakistan the student-teacher ratio is lower than the required level, showing better performance at the secondary level. But the deeper look shows that this low level of STR is at the cost of the low level of enrolment at the secondary level. More elaborately, the actual GER at the secondary level is 45% while the required level is roughly 62% while the actual STR is 19.4 and required is 21.4. So the low actual STR is due to fewer enrolment than required.

4.3: Actual and Required Student-Teacher Ratios

Year	**Student-Teacher Ratio**		
	Primary	**Secondary**	**Tertiary**
2017 (Actual)	45	19.4	33.1
2017 (Required)	26.18	21.4	21.13
2025	24.44	20.16	20.39
2030	23.24	19.3	19.68
Gap ratio 2017(Actual/Required)	1.71	0.91	1.57

Required values are estimated values from equation 10-12

4.4 Required Number of Teachers (TCH)

This section reports the required numbers of teachers for each level of education in Pakistan by using information derived from equation 2 and 3 and substituting

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it in equation 4 of the basic model. Equation 4 of the basic model is reproduced here for ready reference.

$$TCH_e = [1/STR_e]ENR_e \tag{17}$$

The results for the required number of teachers for each level of education are represented in table 4.4. The results indicate the need to hire more teachers in the system of primary, secondary as well as the tertiary level of education to fill the gap between the actual and required number of teachers. The number of teachers required for the year 2017 at different levels corresponds to the required level of student-teacher ratio and gross enrolment ratio. While the actual value for the year 2017 relates to the actual GER and STR in Pakistan. The table depicts that a huge gap exist in the actual and required numbers of teachers.

More specifically at primary level 0.6414152 million more teachers are required to be in the system to follow the norm. The system of secondary level of education indicates a shortage of 0.27 million teachers and for tertiary level the shortage is of 0.333 million. The estimated values for future years at the interval of 5 years urges the need for hiring more teachers than the preceding period to lower STR and match the required increase in enrolment at the secondary level. *The gap is so big regarding the number of required teachers making it necessary to substitute online teaching for in person teachers, which is feasible for secondary and higher education. It will help in achieving the objective and will be cost effective.*

4.4 : Required and Actual Number of Teachers

Year	**Number of Teachers**		
	Primary	**Secondary**	**Tertiary**
2017 (Actual)	0.484267	0.646318	0.058733
2017 (Required)	1.125682	0.916843	0.391893
Gap	*0.641415*	*0.270525*	*0.33316*
2025	1.33084	1.225828	0.483512
2030	1.478313	1.52315	0.584766

*Figures are converted to millions for readability, ignoring decimal gives raw numbers.
*Row listed as gap shows the difference between required and actual values in the year 2017

4.5 Government Expenditure on Education

This section discusses different aspects of government expenditure on education. The share of government expenditure on education in proportion to its overall spending and the share of overall government expenditure in GDP is discussed. Moreover, the distribution of government expenditure on education among different levels of education is also considered and deliberated.

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4.5.1 Share of Government Total Spending in Gross Domestic Product (GTS/GDP)

Share of government total spending in the gross domestic product (GTS/GDP) shows the size of government spending in the economy. The estimated equation that shows the link of GDP per capita to the size of government spending as a proportion of GDP is represented in equation 18. The semi-log form of the equation is found best in terms of high R2 and low standard errors.

$$\begin{aligned} GTS/GDP &= -0.56 + 0.089 LnGDP_{pc} \\ R_2 &= 0.88 \quad S.E = 0.027 \end{aligned} \tag{18}$$

The equation implies that as the GDP per capita increases governments tend to spend more. The estimated values for the year 2017 and for year 2025 and 2030 are reported in table 4.5. The actual value of GTS/GDP is 0.21, it shows that governments overall spending in the economy is 21% of the total GDP. The estimated value is, however, less than the actual value and suggests 19% of GDP as government total spending. However, in the future years, it shows an increasing trend with an expected increase in GDP per capita. Pakistans size of government is little more than suggested international norm.

4.5: Actual and Required Share of Government Total Spending

Year	GTS/ GDP	
	Actual	**Required**
2017	0.21	0.19
2025		0.23
2030		0.25

4.5.2 Share of Government Spending on Education in its Total Spending (GTE/GTS)

The share of government total spending on education in the governments total spending is analysed in relation to GDP per capita. The results are represented in the form of equation 19.

$$\begin{aligned} GTS/GDP &= 0.0568 + 0.0000696 GDP_{pc} \\ R_2 &= 0.85 \quad S.E = 0.017 \end{aligned} \tag{19}$$

The equation shows a positive relationship indicating that as the GDP per capita of a country increases the government devotes higher share to education in its overall spending. The estimated values are reported in table 4.6 along with actual value for 2017. The guidelines from 10 selected countries advocate 9.2% of overall government spending to education while its actual value in Pakistan

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is 13.8% suggesting less share of spending as compared to the existing value. Contrary to the general perception that the government should spend more the norm is to spend less. Nonetheless, it can be inferred from results and overall analysis that the selected countries are efficient in utilizing funds and less share of overall government spending is devoted to education to achieve higher targets.

Moreover as their overall budget is big so lesser proportion is enough to promote higher education levels. These results point out the inefficiencies in the Pakistans education system as Pakistan is spending larger portion of government spending on education compared to the normed spending and results in lesser achievements. Similarly it highlights the need of private spending on education along with public spending.

4.6 : Actual and Required Share of Government Total Spending

Year	GTE/ GTS	
	Actual	**Required**
2017	0.138	0.092
2025		0.108
2030		0.124

4.5.3 Share of each Level of Education in Government Spending On Education

This section is reserved to analyse and compare the needed distribution of the governments recurrent expenditure on education among different levels of education. The following equations are estimated by using panel data of 10 better-performing countries.

$$GRE_1/GRE = 0.29 + 0.00000244GDP_{pc} \quad R_2 = 0.71 \quad S.E = 0.036 \tag{20}$$

The result of the estimation for the governments recurrent expenditure to primary education is listed in equation 20. It describes a positive relationship between GDP per capita and the proportion of government spending on primary education in its overall recurrent spending on education. For government recurrent expenditure on the secondary level of education and its relationship with GDP per capita, equation 21 is estimated. The results show that as the GDP per capita of a country increases, it increases the proportion of expenditure ratio of secondary level of education in overall recurrent expenditures of government on education.

$$GRE_2/GRE = 0.21 + 0.0000907GDP_{pc} \quad R_2 = 0.74 \quad S.E = .038 \tag{21}$$

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Equation 22 suggests a negative relationship between the proportion of the governments recurrent expenditure on tertiary education to its total education recurrent expenditure and GDP per capita. It implies that as GDP per capita increases government reduces the ratio of its expenditures to tertiary level. However, the positive and relatively high intercept combined with small slope coefficient suggests higher expenditures when GDP per capita is low and then a gradual reduction in the proportion.

$$\begin{aligned} GRE_3/GRE &= 0.44 - 0.0000133 GDP_{pc} \\ R_2 &= 0.79 \quad S.E = .033 \end{aligned} \tag{22}$$

Table 4.7 reports calculations based on equations 20-22. The results indicate that Pakistan is devoting a higher proportion of government recurrent expenditure on education to primary education than what is required. Specifically the gap ratio shows that 47% more is spent on Primary level than required. The problem with devoting more proportion to primary education in total governments recurrent expenditure to education is that it could only be done at the cost of reducing the proportion for secondary or tertiary education or both. Similarly for secondary the comparison of actual and required values through gap ratio shows that 12% is spent more than required. The actual proportion of government recurrent expenditure for the tertiary level is quite low than required in the year 2017.

The gap ratio 2017 for tertiary education is 0.27 implying that 73% less than required proportion is spent on tertiary education. The project values for year 2025 and 2030 are also listed in the table. The educational spending in Pakistan appears to be unbalanced with more of public expenditure going to primary and secondary than tertiary. Understandable in view of the social demand for elementary universal education and in the lack of private sector financing for elementary education.

4.7: Share of Government Recurrent Spending to each level of Education in Pakistan

Year	Type	Primary	Secondary	Tertiary
2017	Actual	0.44	0.29	0.1017
2017	Required	0.3	0.26	0.37
2025	Required	0.309	0.28	0.34
2030	Required	0.314	0.3	0.31
Gap ratio 2017		1.47	1.12	0.27

*The actual value for 2017 is missing so the actual value for the year 2016 is reported

4.5.4 Governments Recurrent Expenditure on Education in Overhead and Other Activities

The Governments recurrent expenditure on education in overhead and other activities (GRO) is calculated as a residual of government total recurrent spending

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on education and the sum of its recurrent spending on primary, secondary, and tertiary education. It is calculated by utilizing equation 8 of the basic model and is reproduced here

$$\frac{GRO}{GRE} = 1 - \frac{GRE_1}{GRE} - \frac{GRE_2}{GRE} - \frac{GRE_3}{GRE} \tag{23}$$

The results are derived by the mere substitution of actual and estimated values of $\frac{GRE_1}{GRE}$, $\frac{GRE_2}{GRE}$, $\frac{GRE_3}{GRE}$ (see table 4.7 for easy reference). The results summarized in table 4.8 indicate that the actual value of governments recurrent expenditures in overhead are quite high. The suggested value is 0.07, implying that less and less should be left as residual to allocate more on different levels of education.

4.8: Actual and required values of Government Recurrent Spending

	Government Recurrent Spending (Overhead)	
Year	**Actual**	**Required**
2017	0.17	0.07
2025		0.07
2030		0.08

4.5.5 Capital and recurrent cost atio (KRC)

Another important variable that defines the structure of the education system is the ratio of the governments capital expenditure to its recurrent expenditures. Its higher value means that the capital expenditures are higher. The higher ratio is preferable as capital expenditures can be considered as an investment in the education system implying benefits over a larger period as compared to recurrent expenditures. The association between KRC and GDP per capita is described by equation 24 is found negative. However, there is a relatively high intercept, 0.37 which shows that initially, this ratio needs to be high but then with an increase in GDP per capita this value gradually declines.

$$\begin{aligned} KRC &= 0.37 - 0.0000151 GDP_{pc} \\ R_2 &= 0.75 \quad S.E = 0.055 \end{aligned} \tag{24}$$

The estimated values based on equation 4.12 are shown in Table 4.9. The actual figure of 0.16 shows that the proportion of capital expenditure is less as compared to recurrent cost. The required value is 0.30, the government is required to increase the proportion of capital expenditures in its overall expenditure on education. Over time, and with an increase in GDP per capita this requirement of an increased proportion of capital expenditures goes down as evident from the required future values listed in the table 4.9.

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4.9: Ratio of Capital and Current Expenditure on Education

Capital/ Current ratio (KRC)		
Year	Actual	Required
2017	0.16	0.3
2025		0.26
2030		0.23

5 Conclusion

This study examines the educational system of a developing country by comparing some basic statistics from Pakistan with those of ten higher-performing nations. It also presents the required levels of education for the following decade. The findings indicates that Pakistan lags behind international norms in terms of enrolment and the number of teachers at all levels of education. It reveals that the gross enrolment ratio is lower than what is required. We observed that the significant gap existed for GER (tertiary). That amounts to roughly one-third of what is needed. Enrolment at each level of schooling has also been observed to be substantially below the required levels. There are significant disparities between the actual and needed number of teachers in the system. Furthermore, Pakistan devotes a greater proportion of its government spending on education than the norm. Paying more and achieving less than expected highlights inefficiencies in education system of Pakistan.

Additionally, educational spending in Pakistan appears to be imbalanced, with more public money going to primary and secondary education and less going to postsecondary (tertiary) education. The proportion of capital spending in overall government expenditure on education is found to be lower than required, indicating lower investment and lower benefits over a longer period of time. Following the valuable insights and policy implications of the study, additional research may well be initiated to extract guidelines from the best performers about subject categorization and education composition in terms of professional and vocational training. The optimal share of the private sector in education was not included in this study and may thus be addressed in future research. Similarly, utilising the methodology of the paper, a study can be undertaken to compare the education sector of Pakistan with its regional counterparts or with countries that are comparable in terms of GDP and GDP growth.

6 Policy Implication

The following policy implications emerged from the analysis: Enrolment at each level of education, whether primary, secondary, or tertiary, can and should increase in order to close the gap between the actual and required levels of gross enrolment ratios. There is also a need to strengthen the education system by hiring more teachers at each level of education, which will assist in reducing

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student-teacher ratios and improving educational quality. Complementing in person teaching with online teaching could be a solution for increasing enrolment and teachers availability to students. It will be cost-effective for both the government and those who are unable to attend educational institutions. Motivating private spending could also help in this regard.

There is a need to correct the imbalance between the proportions of public spending among different levels of education. To follow the norms, more money must be spent on tertiary education as part of public education spending. The study identified that Pakistan is spending a larger portion of government spending on education compared to international norms and hence has inefficiencies in the education system because it is lacking in its achievements. There is an urge to make the system more cost effective and to dig into the reasons for its inefficiencies. The share of capital spending in total government spending on education is lower than expected and should be raised if the government wants to spend most of its money on education on capital.

By adding up the estimates made in this study, the gaps between the actual educational structure of Pakistan and what is needed are shown. It not only identifies the gaps, but also clearly states in numbers what is required. The study can be used to help plan Pakistan's educational sector.

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7 Annexure

7.1 Data

The study utilizes panel data containing 10 cross-sections and time-period from 2003 to 2017. The data for most of the variables is acquired from the UNESCO Institute for Statistics. Others from the world development indicators of the World Bank. The data on the share of the age group for various levels of education for the years 2017, 2025, 2030 is acquired from UN world population prospects 2019 and some calculations are done to get the share of relevant age group. For primary education relevant age group is 5-9, for secondary 10-16 and for tertiary, it is 17-23. The data on the share of each age group is reported in the table A

Table A: Share of Age Group in Total Population

	Share Of Age Group in Total Population		
Year	**Primary**	**Secondary**	**Tertiary**
2017	0.1168	0.1518	0.1398
2025	0.115	0.143	0.129
2030	0.107	0.144	0.127

Similarly, to get data on GDP per capita ($PPP) for future years the actual data on GDP per capita in the constant dollar (PPP) is used along with the assumption that growth rate will be 5% for years 2017 to 2025, then it will rise by 0.5 percentage points after every 5 years. So during 2025-2030, the growth rate is assumed to be 5.5% .

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Table B: Projected Values of GDPpc ($PPP)

Year	GDPpc ($ 2011 PPP)
2017 (Actual)	5035
2025	7439
2030	9722

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