Working paper

International Growth Centre

Punjab Socal Expenditures

Education, Health, Urban-Water Supply - Issues Paper

Aisha Pasha
Parvez Hassan
Ijaz Hussain
Zeeshan Haider
Tahir Sadiq

December 2010

DIRECTED BY LSE UNIVERSITY OF OXFORD

FUNDED BY UKaid from the British people

CONTENTS

CHAPTER 1

TERMS OF REFERENCE OF STUDY **1**

CHAPTER 2

EDUCATION **3**

2.1. SITUATION ANALYSIS **3**

Primary Level **3**

Middle Level **9**

Secondary Level **9**

Inter/Higher Secondary Level **9**

Degree Level **9**

University Level **10**

Regional Disparities **10**

Public Versus Private Education **12**

2.2. MAJOR ISSUES OF EFFICIENCY **12**

Public Versus Private Provision **12**

Choice of Inputs **13**

Choice of Level of Education **13**

Choices Between Boys and Girls Education **13**

Choice of Location of New Education Facilities **14**

2.3. METHODOLOGY **14**

2.4. SOME PRELIMINARY FINDINGS **16**

2.5. DATA REQUIRMENTS **19**

CHAPTER 3

HEALTH **21**

3.1. SITUATION ANALYSIS **21**

Health Indicators **21**

The Health System **22**

3.2. MAJOR ISSUES OF EFFICIENCY **25**

Public Versus Private Provision **25**

Choice of Inputs for Curative Health **26**

Choice of Inputs for Preventive Health **26**

Choice of Location of New Health Facilities 26
3.3. METHODOLOGY 26
3.4. SOME PRELIMINARY FINDINGS 27
3.5. DATA REQUIREMENTS 29
CHAPTER 4
URBAN WATER SUPPLY 31
4.1. SITUATION ANALYSIS 31
Water Availability 31
Water Quality 31
Access to Tap Water 32
Development Schemes and Plans 32
4.2. MAJOR ISSUES OF EFFICIENCY 34
Rising Cost of Water Supply 34
Extent of Cost Recovery 35
4.3. DATA REQUIREMENTS 36
Development Costs 36
Tariff Schedule 36
Budget Statement 36
REFERENCES 37
STATISTICAL ANNEXURE 39

LIST OF TABLES

Table 2.1:	Results of Regression Analysis of The Production Function of Education, 1981-82 to 2007-08	**18**
Table 2.2:	Elasticities	**18**
Table 3.1:	Health Indicators in A Sample of Asian Countries	**21**
Table 3.2:	Health Indicators by Province	**22**
Table 3.3:	Presence of Health Facilities in the Public Sector of Punjab	**23**
Table 3.4:	Source of Financing of Health Services in Punjab 2005-06	**24**
Table 3.5:	Trend in Preventive Health Services in Punjab	**25**
Table 3.6:	Results of The Regression Analysis of The Production Function of Health, 1981-82 to 2007-08	**28**
Table 3.7:	Elasticities	**28**
Table 3.8:	Availability of Data on The Health Sector	**29**
Table 4.1:	Source Of Drinking Water in Urban Areas of Punjab	**33**

LIST OF FIGURES

Figure 2.1:	Enrolment	**4**
Figure 2.2:	Enrolment: Average Annual Growth Rate	**5**
Figure 2.3:	Enrolment Per Institution	**6**
Figure 2.4:	Gender Parity Index	**7**
Figure 2.5:	Student Teacher Ratio	**8**
Figure 2.6:	Index for Relative per Capita Access to Public Schools and Teachers by Level of Division	**10**
Figure 2.7:	Index for Relative per Capita Access to Public Schools and Teachers by District Level	**11**
Figure 3.1:	Hierarchy of Services	**23**
Figure 4.1:	ADP for The Last Six Years and 2010-11	**34**

CHAPTER 1
TERMS OF REFERENCE OF STUDY

The increased funding for social sectors particularly for Education, Health and Urban Water Supply is arguably one of the most important financial goals of the current Government of Punjab. Social services are mainly provided both through provincial and local government facilities and programs. The commitment of the Government to these services must be backed up by sufficient financial resources.

In the recent years, there has been a big increase in the public sector budgetary allocation / expenditures for these sectors, which have almost doubled. To explore recent funding and expenditures patterns in the social sectors, it is necessary to investigate allocation to different levels. This raises the question of allocative efficiency – Are funds directed to activities which will provide the greatest gains? Once resources are allocated to different levels, it is important to evaluate how they are used. But a key question is: Are public sector facilities proving to be efficient with the resources they receive in terms of both '**technical efficiency'** and '**allocative efficiency'**. Technical efficiency is defined as the ability to produce maximum output given a set of inputs and technology. Allocative (or price) efficiency measures success in choosing optimal proportions of inputs i.e., where the ratio of marginal products for each pair of inputs is equal to the input price ratio.

Technical efficiency plus allocative efficiency constitute economic efficiency. The general way to estimate allocative efficiency is to test the equality between the estimated Marginal Value Product (MVP) and Marginal Factor Cost (MFC), whereas technical efficiency focuses on the distance from the Production Possibility Frontier.

Given the above concerns, Government of Punjab has commissioned this study on Efficiency in Education, Health and Urban Water Supply Sectors of Punjab.

The Terms of reference of the study are as under:

- Literature review- national and international literature to explore the best practices of estimating / measuring the allocative efficiency especially of countries with similar context to that of Pakistan

- To review the Provincial Government Policies in the sector of Education, Health and Urban Water Supply, including allocation and expenditures in these sectors
- Estimating allocative efficiency- International perspective
- Methodology- Review and situational analysis, data constraints, specifying econometric model and identifying true functional form which best fits the data of the study
- Collection of data from the field, data analysis and report writing
- Policy implication of the estimated allocative efficiency of the sectors under study

CHAPTER 2
EDUCATION

Punjab has today one of the largest sub-national educational systems in the world with over 11 million students enrolled in over 58000 educational institutions with almost 320,000 teachers. Management of such a large and diverse educational system poses formidable challenges including the development of elaborate monitoring and reporting systems to ensure efficiency in the allocation and utilization of resources.

2.1. SITUATION ANALYSIS

Enrolment growth, except at higher levels of education, seems to have slowed down and figures continue to point to a flight to the private schools which suggests that decline in the quality of public education has not been halted. Pakistan still has a long way to go before meeting the MDGs relating to achieving universal primary enrolment and gender parity in school education. It is encouraging that growth in female Enrolments at all level of education, except inter mediate and degree colleges, has been relatively high.

Significant variation exists with respect to the growth and level of enrolment, (See Figure 2.1 and 2.2) enrolment per institution (Figure 2.3) and student-teacher ratio across various levels / categories of education institutions. (Figure 1-5). Student-teacher ratios for most of the institutions (excluding school level and degree colleges) indicate overstaffing in these institutions and are indicative of technical and allocative inefficiency.

Primary Level

Female enrolment growth, at 4 percent per annum, has significantly contributed to overall enrolment growth of 2.4 percent at primary level from 2000 to 2009. This highlights the impact of efforts of the Government of Punjab to provide incentives for girls' education, which has also led to decline in gender disparity at primary level. The number of institutions at primary level has, however, shown nominal growth of only 0.2 percent per annum. This obviously indicates the focus of the government on improving the rate of capacity utilization of existing schools. A low rate of expansion in the number of teachers has contributed to increase in student-teacher ratio from 30 in 2000 to 42 in 2009. Overall the net primary rate has shown some increase from 44 percent to 62 percent but is still far below the MDG target.

Figure 2.1: Enrolment

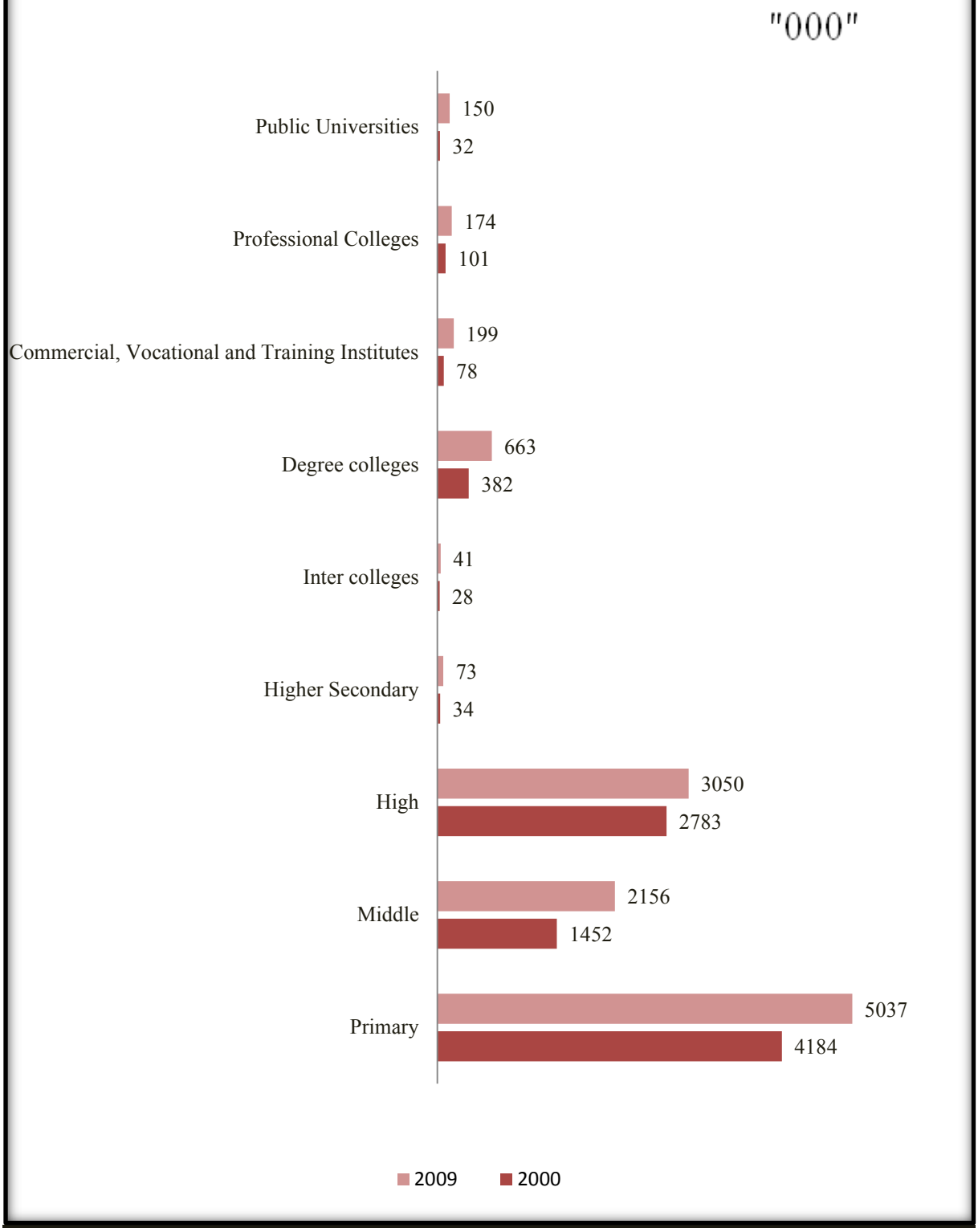


Figure 2.2: Enrolment: Average Annual Growth Rate

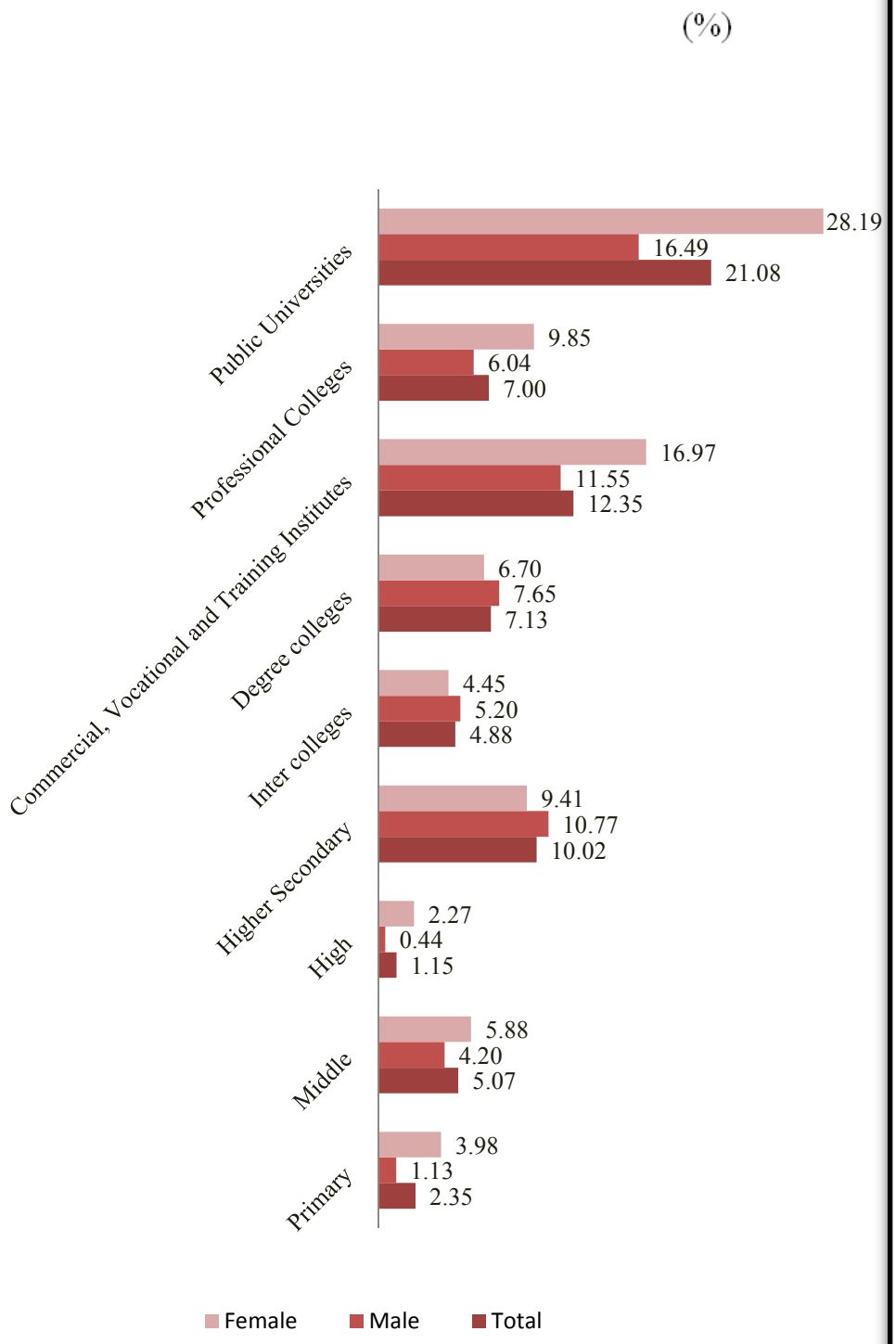


Figure 2.3: Enrolment per Institution

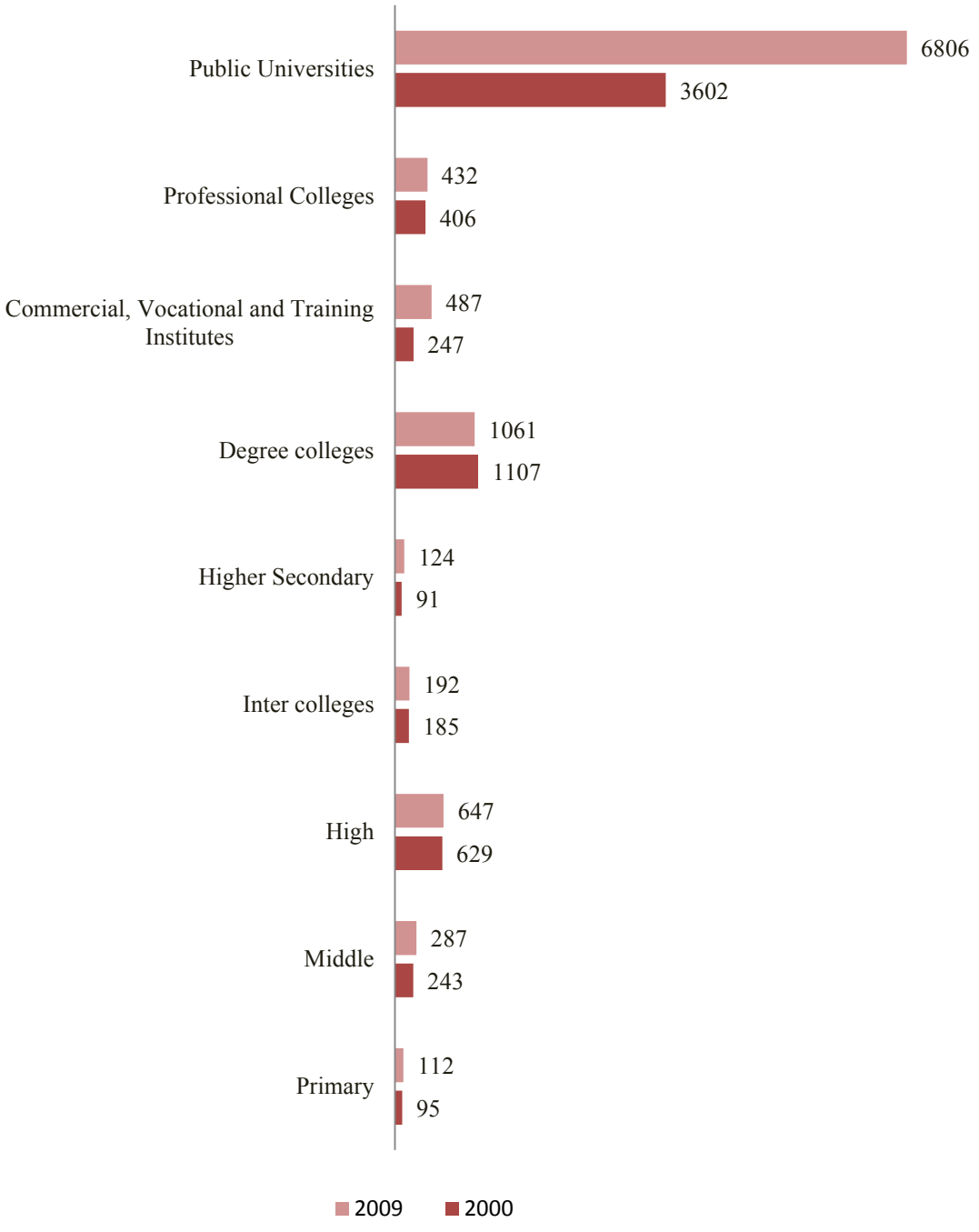


Figure 2.4: Gender Parity Index

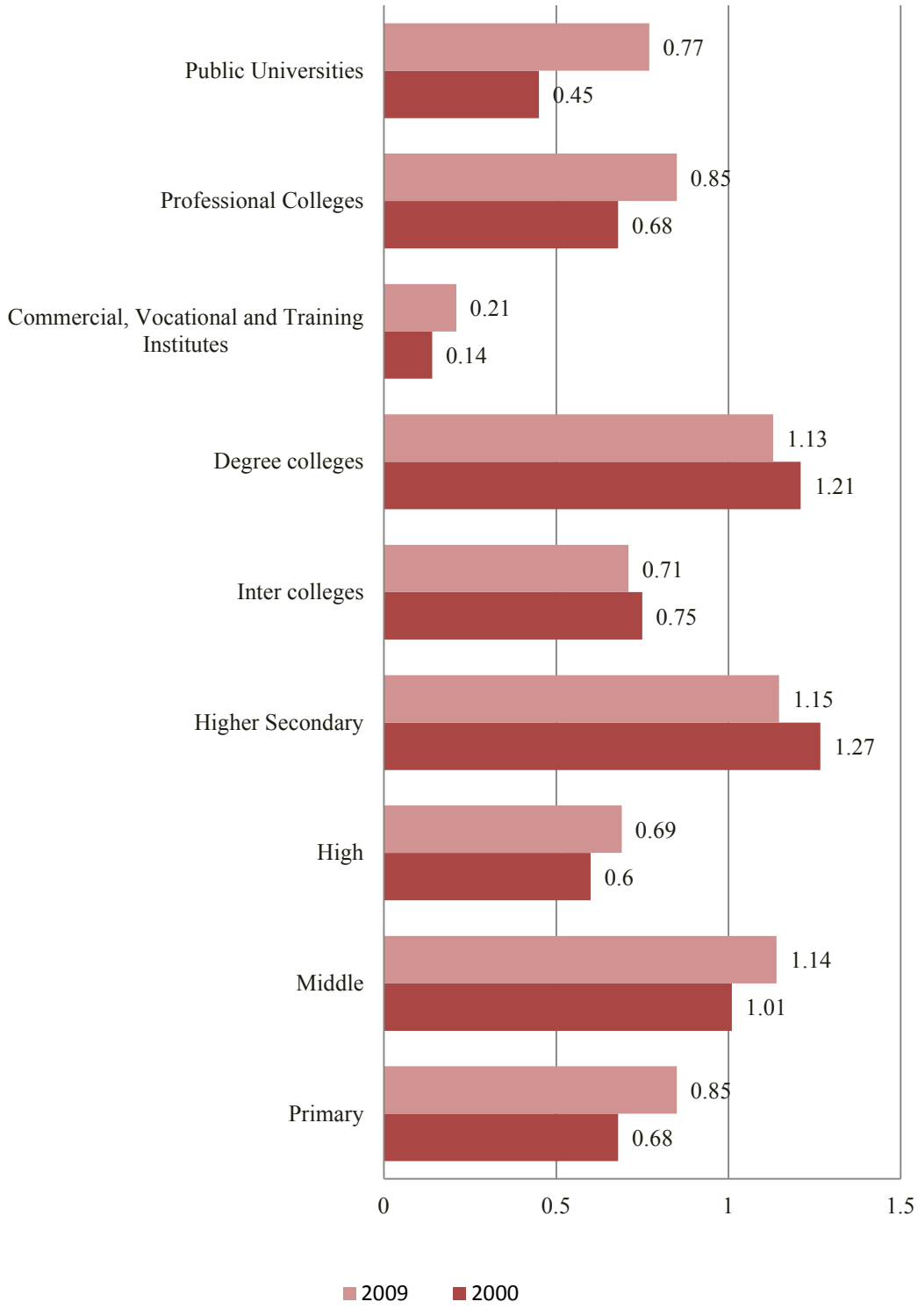
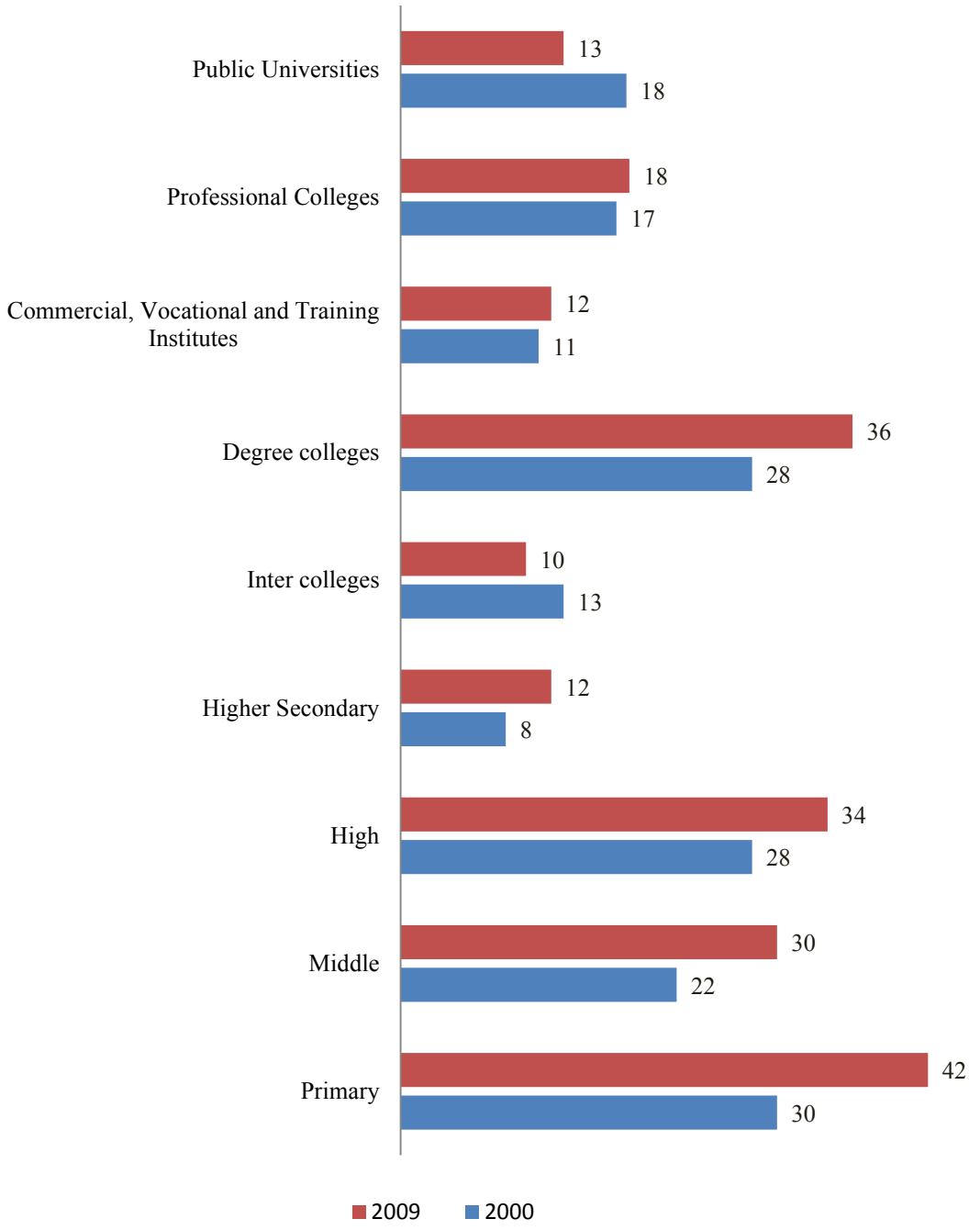


Figure 2.5: Student Teacher Ratio



Middle Level

Rapid annual female enrolment growth of almost 6 percent along with over 4 percent growth in male enrolment has significantly contributed to overall enrolment growth of 5 percent at middle level from 2000 to 2009. The enrolment growth appears to be linked with improvement in access to schools through expansion or up-gradation, more teaching staff and incentives for girls' attendance. Despite reasonable growth in Enrolment, net enrolment rates at middle level have not changed much. This may be due to two reasons: one, high growth in the population age group (10-12 years) and low transition rates from primary to middle level (approximately 71 percent). That is, approximately 29 percent of the students who complete primary education do not enter into middle education level. This seems to be linked to parents' education/awareness, affordability and high levels of poverty.

Secondary Level

Net enrolment rate at 13 percent currently at secondary level of education is notably low. A high student-teacher ratio of 34 and enrolment per institution of 647 apparently point to relatively high rate of capacity utilization. The still low gender parity index highlights the need to introduce more incentives for girls' education at matric level.

Inter/Higher Secondary Level

There appears to be reasonable growth in number of intermediate colleges, their teaching staff and enrolment. But low (10:1) and declining student teacher ratio, and low and almost stagnant Enrolment per college (195) is indicative of underutilization of human resources and infrastructure. Rapid growth in teaching staff of 8 percent annually, in particular, in girls' colleges of over 12 percent, has contributed to decline in student-teacher ratio. There also appears to be reasonable growth in enrolment (10 percent), number of teachers (5.30 percent) and schools (5.76 percent), Enrolment per institution (4 percent) and student-teacher ratio (4.49 percent) at secondary school level. Despite this, very low Enrolment per school and poor student teacher ratio speak loud about sub-optimal use of resources.

Degree Level

Significant growth in number of degree colleges accompanied with growth of teaching staff and enrolment has contributed to reasonable enrolment per college (963) and a balanced student-teacher ratio (36), which implies relatively better utilization of resources.

University Level

Policies and incentives of Higher Education Commission for students, faculty and universities has led to exceptionally rapid growth in enrolments of more than 25 percent per annum and faculty of 28 percent per annum. Student-teacher ratio has declined in almost all public universities in Punjab.

Regional Disparities

Contrary perhaps to expectations, relatively large and more developed divisions/districts have relatively low access to public schools and teachers **(**Figures 2.6 and Figure 2.7) this may partly be the outcome of allocative inefficiency on account of politically motivated decisions for setting up schools at wrong locations of relative low population. However, this may also reflect greater presence of private schools in developed divisions and districts. But the issue is access of the lower income groups who cannot afford private education.

Figure 2.6: Index for Relative Per Capita Access to Public Schools and Teachers By Level of Division

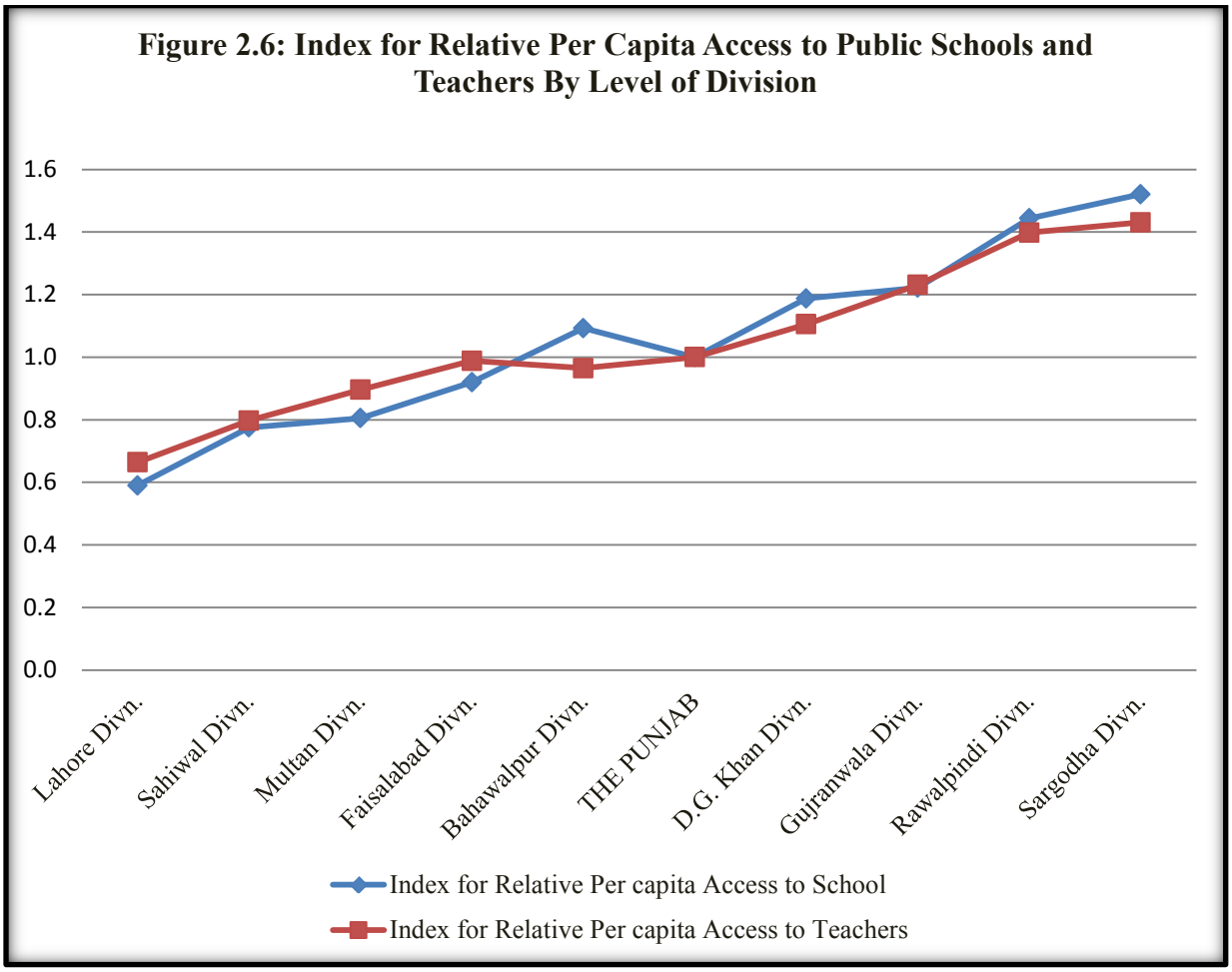
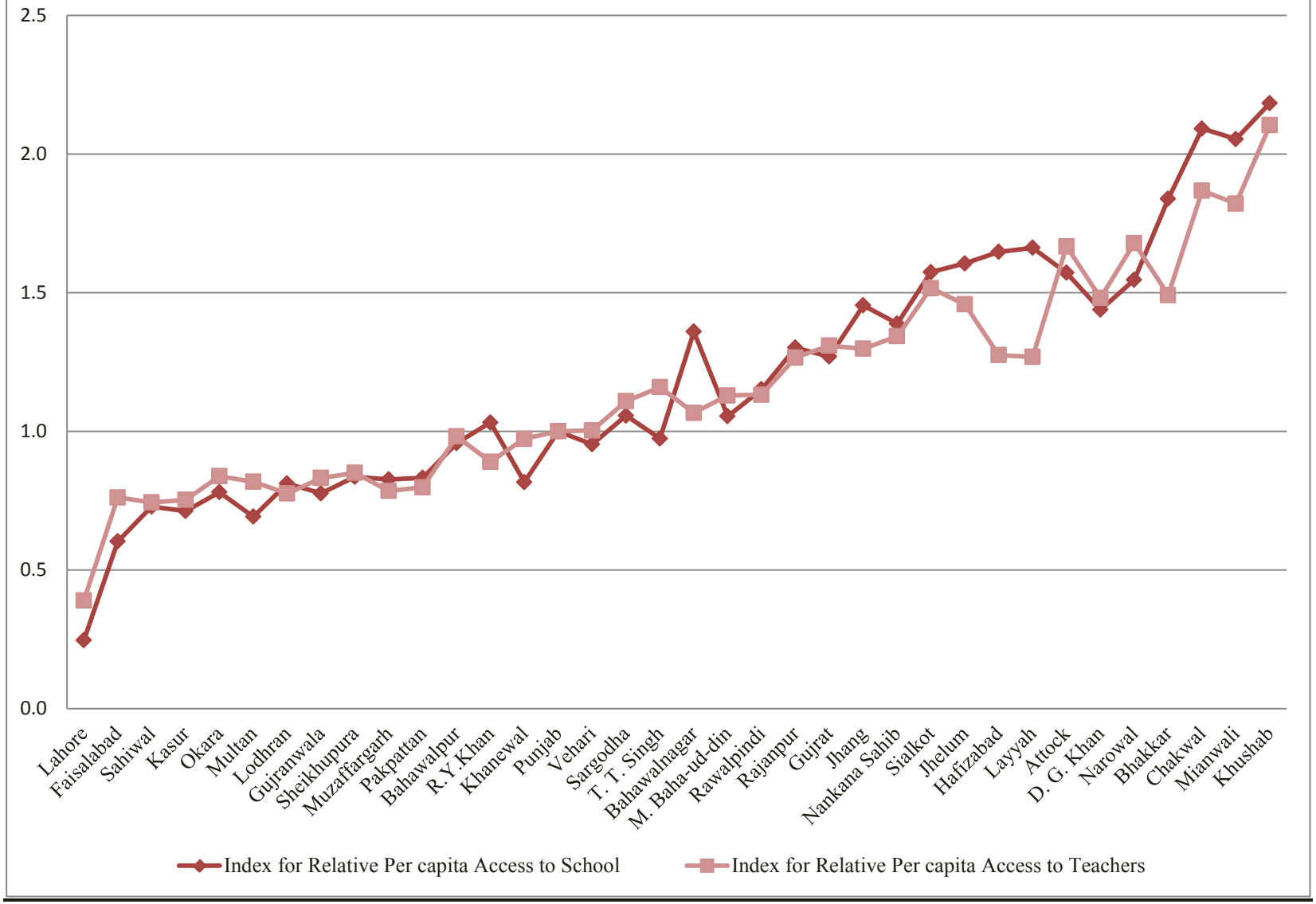


Figure 2.7: Index for Relative Per Capita Access to Public Schools and Teachers By District Level



Public Versus Private Education

On private vs. public education, a recent World Bank Repot (2007) says “Since the Private School Census conducted in 2000, private enrolment in Pakistan has gone up from Rs. 3.6 million to about Rs. 7.1 million in 2006. The number of private institutions in Punjab has more than doubled from about 23,700 to more than 46,000. Private enrolment now accounts for almost 40 per cent of total enrolment, and 42 per cent of all education institutions are in the private sector. The prevalence of private sector is not only an urban phenomenon, as almost 40 per cent of total private enrolment is in rural areas, and 47 per cent of all private institutions in Punjab are in rural areas. A majority of the private schools are low-cost schools, and private education is becoming increasingly affordable. Recent research shows that a growing number of children enrolled in private schools are not only from middle-class and but also poorer families, including from rural areas. Even on the quality side, findings of student achievement tests administered under survey of primary public and private schools in Punjab show greater differences between students of public and private schools (with private school students performing relatively better, although learning outcome levels are overall low) than between children from rich and poor households” (World Bank 2007).

2.2. MAJOR ISSUES OF EFFICIENCY

Based on the above and review of the earlier work by ADB, World Bank and the International Growth Center, a number of issues of technical and allocative efficiency can be identified in the area of education in Punjab as follows:

Public Versus Private Provision

The emergence of the private sector as a major provider of education services of varying levels of quality and price raises the fundamental question as to whether the government should continue with the policy of expansion of the public education system or focus more on consolidation through improvements in quality.

This is a fundamental issue because any change in technical efficiency is likely to be more due to factors on the demand-side, arising particularly from competition for enrolments with the private sector especially as income levels rise in the economy. As such, explanations for variation in the level of efficiency are less likely to be found on the supply- side like wrong locational choices of schools, higher proportion of less qualified teachers, etc.

Choice of Inputs

The traditional issue of allocative efficiency within any level in the education sector is the optimal mix of inputs which maximizes enrolment or some measure of the quality of output given a budgetary allocation or minimizes the cost of achieving a target level of enrolment. The choices are as follows:

- More schools (to improve coverage) or more teachers (to improve teachers-students ratio and quality thereof
- Construction of more schools or improvements in infrastructure and facilities in existing schools
- Construction of more schools or up gradation of existing primary schools to middle schools, middle schools to high schools, and so on

The impact of qualitative aspects relating to the pass out rates at the matric level and dropout rates at the primary level can also be analyzed.

Choice of Level of Education

A key issue of education policy and planning is the allocation of public resources to different levels of education-primary, secondary, college or university. During the last decade, as indicated earlier, the priority of the Government of Punjab had visibly shifted to higher levels of education, beyond primary education. This has happened despite continuing low net enrolment ratios in primary education and greater problems of absorption in the labor market of more educated youth.

An analysis of the issue of allocative efficiency of resources among different levels of education will require quantification of the social rates of return to expenditure at different levels of education. This will require estimation of lifetime earning profiles of workers endowed with varying levels of qualifications. Results of past studies on rates of return will be used for this purpose.

Choices Between Boys and Girls Education

As highlighted earlier, there still exist large gender disparities at lower levels of education in Punjab. There is need to identify if this is due more to factors more on the demand or the supply side. Derivation of education production functions for boys and girls separately at different levels of education will enable an answer to this question. For example, it will provide the answer to

the question whether the construction of a new school increases enrolment more in the case of boys or girls.

Choice of Location of New Education Facilities

To the extent that there is a justification for investment in the expansion of educational facilities, an issue of allocative efficiency is the choice of location of such facilities. In the more developed districts there is likely to be greater competition from the private sector while in the more backward areas the demand generally for education may be lower.

The above range of choices indicates that there are several important issues of technical and allocative efficiency in the education sector. The generic methodology that is proposed to be followed for analyzing these issues is given below.

2.3. METHODOLOGY

There are two main approaches extensively used in literature to measure technical efficiency:

- Stochastic Method or Parametric Approach
- Deterministic Method or Data Envelopment Analysis (DEA) or Non-Parametric Approach

Non-Parametric Approach or Data Envelopment Analysis is most appropriate for evaluating the relative efficiencies where there are similar outputs and inputs or multiple, non-commensurate and at least ordinal outputs and inputs or valued outputs and inputs although not easily priced [Ludwin. William G. and Guthrie. Thomas L. (1989)]

We propose to rely largely on the Stochastic Method or Parametric Approach. Accordingly, we will estimate following production functions for each gender and stage of education:

$$E = E (N, T, S)$$

Where,

E = Student enrolment as a proxy for output of education institutions. We use enrolment rather than graduates or student scores or grades for output due to non-availability of time series data on such indicators, S = student-age population (a variable to capture potential demand), N = number of schools/institutions. We use N as a proxy variable for capital stock T= number of teachers

The production function for education level can be written explicitly as follows:

$$E_i = AS_i^{\gamma} N_i^{\beta_1} T_i^{\beta_2} e^{v_i} \quad (1)$$

Where,

β's measure output elasticity with respect to respective inputs, $\boldsymbol{v_i}$ is a standard error term to capture random shocks outside the institution's /school's control, **A** represents efficiency parameter which can be specified as follows (Aigner, Dennis J., C. A. Knox Lovell, and Peter Schmidt. 1977):

$$A = A_0 e^{-u_i} \quad (2)$$

Where,

$u_i \geq 0$ and represents one-sided firm specified technical inefficiency component on substitution of Equation 2 in 1;

$$E_i = A_0 S_i^{\gamma} N_i^{\beta_1} T_i^{\beta_2} e^{v_i - u_i} \quad (3)$$

Taking linear log from Equation (3) regression can be run as follows:

$$lnE_i = A_0 + \gamma lnS_i + \beta_1 lnN_i + \beta_2 lnT_i + v_i - u_i \quad (4)$$

Former studies included only standard error and thus measured mean technical inefficiency. Jondrow et al (1980), decomposed error term into two components: systematic inefficiency and firm specific one-sided inefficiency. The former error term is common for all schools/institutions. Jondrow et al introduced the functional form of distribution of one-sided inefficiency and derived the conditional distribution of $[u_i | \, v_i - u_i]$ for half normal and exponential distribution to estimate firm specific technical inefficiency component.

In absence of technical inefficiency ($u_i = 0$) institution will operate on production frontier and thus realize its potential output. Therefore, production function in case potential output is realized can be written as follows:

$$E_p = A_0 S_i^{\gamma} N_i^{\beta_1} T_i^{\beta_2} e^{v_i} \quad (5)$$

Technical Efficiency Index of an institution can be calculated by using Equation

(5) and (3) as follows:

$$\text{Technical Efficiency Index (TEI)} = \frac{Actual\ Output}{Potential\ Output} = \frac{E_i}{E_p} = \frac{A_0 S_i^{\gamma} N_i^{\beta_1} T_i^{\beta_2} e^{v_i - u_i}}{A_0 S_i^{\gamma} N_i^{\beta_1} T_i^{\beta_2} e^{v_i}} = e^{-u_i}$$

Since $u_i \geq 0$, Therefore, $0 \leq e^{-u_i} \geq 1$ and Technical Inefficiency Index (TII) = $1 - e^{-u_i}$

We can calculate MP_N and MP_T from Equation (3)

$$MP_N = \frac{\beta_1 E_i}{N_i} \tag{6}$$

$$MP_T = \frac{\beta_2 E_i}{T_i} \tag{7}$$

Allocative efficiency is achieved where

$$\frac{MP_N}{P_N} = \frac{MP_T}{P_T} \tag{8}$$

By substituting Equation (6) & (7) in Equation (8)

$$\frac{\beta_1/N_i}{P_{N_i}} = \frac{\beta_2/T_i}{P_{T_i}} \tag{9}$$

Given the prices of inputs, equality of left and right hand side of Equation (9) indicates attainment of allocative efficiency. If left hand side of equation exceeds the right hand side, there exists need to increase number of schools rather than the number of school teachers. If right hand side of Equation exceeds the left hand side, there exists need to keep number of schools unchanged or close some schools and increase the number of school teachers.

2.4. SOME PRELIMINARY FINDINGS[1]

For purpose of analysis, the production function in (1) is specified as follows:

$$\left(\frac{E}{N}\right) = A\left(\frac{S}{N}\right)^{\propto}\left(\frac{T}{S}\right)^{\beta} \tag{10}$$

[1] These results have also been presented in a recent report**, Assessing Financial Impact of Development Portfolio**, prepared for the P & D Board, Government of Punjab.

Where;

A is a positive constant, and $\alpha > 0, \beta > 0$, E is the total enrolment in primary, middle and high schools combined in Punjab, $(\frac{S}{N})$ indicates the coverage of the network of schools, $(\frac{T}{S})$ is the teacher-school ratio and N is the effective number of school rooms[2]

Equation (10) implies that the growth rate,g_e, in enrolment is given by,

$$g_e = (1 - \alpha)g_N + \beta(g_T) + (\alpha - \beta)g_s \quad (11)$$

Where, g_N = growth rate in the number of schools, g_T = growth rate in the number of teachers

g_s = growth rate in school going-age population

According to (11) enrolments can increase even if the number of schools and teachers remains the same, due to rise in the school going-age population. Of course, this will imply increasing congestion in the schools and decline in quality due to the fall in the teacher-student ratio. Also, A can decline in magnitude over time due to the emergence of a larger network of private schools.

The fundamental issue, as highlighted earlier, with regard to allocative efficiency is the choice between teachers and schools. This requires the derivation of the marginal productivity of each input from the production function in (10), so that a comparison can be made between the ratio of marginal productivities with the ratio of marginal costs.

The marginal productivity of school (rooms) and teachers in terms of the impact on the level of enrolment are derived from (10) as follows:

$$\frac{\partial E}{\partial N} = \frac{(1-\alpha)E}{N} \quad (12)$$

$$\frac{\partial E}{\partial T} = \frac{\beta E}{T} \quad (13)$$

[2] This variable has been converted into number of school rooms on the basis of average number of class rooms in each type of school.

The OLS regression technique is used to measure the parameters of the production function on the data from 1981-82 to 2007-08, with suitable adjustments for changes in coverage by the education data base of the Government of Punjab.

Results of the regressions are presented in Table 2.1 below.

Table 2.1
RESULTS OF REGRESSION ANALYSIS OF THE PRODUCTION FUNCTION OF EDUCATION, 1981-82 TO 2007-08
LN (E/N) IS THE DEPENDENT VARIABLE

	Boys		Girls	
Variables	**Coefficient**	**t-ratio**	**Variables**	**Coefficient**
Constant	-2.903	-19.880*	Constant	-2.903
ln(S/N)	0.316	19.866*	ln(S/N)	0.316
ln(T/S)	0.751	17.116*	ln(T/S)	0.751
D_1	-0.096	-3.214*	D_1	-0.096
D_2	0.158	7.811*	D_2	0.158
$\overline{R}^2$	0.954	-	$\overline{R}^2$	0.954
D – W	1.679	-	D – W	1.679
F	136.907*	-	F	136.907*

D_1 is a dummy variable with a values of 1 in 1997-98 and zero otherwise; it captures the change in coverage in 1997-98.

D_2 is a dummy variable with a value of 1 from 2004-05 onwards and zero otherwise.

* Significance at the 1 percent level ** Significance at the 5 percent at the level

Tests were applied to determine if **A** has changed over time to reflect greater competition from the private sector. However, the results were inconclusive.

The resulting estimates of elasticities are given in Table 2.2:

Table 2.2
ELASTICITIES

	Boys	Girls
Schools	0.065	0.291
Teachers	0.751	0.680

These elasticities indicate the following:

- In the case of boys, a 1 percent increase in the number of schools leads to a 0.065 percent increase in enrolment while a 1 percent increase in the number of teachers yields an increase of 0.751 percent in enrolment
- In the case of girls, a 1 percent in the number of schools leads to a 0.291 percent increase in enrolment while a 1 percent increase in the number of teachers yields an increase an increase of 0.680 percent in enrolment

The elasticities give the first indication that in the case of boys expansion in the number of schools is not likely to be as efficient as devoting the same resources to increasing the number of teachers. In the case of girls, marginal productivity of both inputs appears to be relatively high. Therefore, at this stage of the analysis the conclusion is that there is a stronger case for expansion in the schooling system for girls in Punjab.

One problem with using this production function to getting a handle on technical efficiency is that the technique does not establish the direction of "causality" and, second, when there are two time series which are both trending upward you will always get a high R2 but that does not establish a relationship between the variables.

The study alongwith the above technique will also use simpler approach for "evaluating" technical efficiency. Given that they are likely to be substantial technical inefficiencies even a simple approach can provide very useful policy guidance. For example, the Figure 2.5 shows up the glaring inefficiency in Higher Secondary Schools and Inter Colleges.

2.5. DATA REQUIRMENTS

The major published sources of data on the public education system of Punjab are as follows:

- **Punjab Development Statistics,** Punjab Bureau of Statistics
- **Pakistan Education Statistics,** Academy of Educational Planning and Management
- **Pakistan Social and Living Standard Measurement Survey,** Federal Bureau of Statistics
- **Annual Budget Statement,** Finance Department, Government of Punjab

The major gaps in the data provided by the above sources are as follows:

Expenditure: Data on expenditure on primary and secondary education by district governments after the implementation of the Devolution Plan is not available.

Unit Costs: The costs of constructing a typical school at different levels and the total cost of a teacher at different grades is not available.

It is proposed to obtain this data from the Finance Department, Planning and Development Department or the Education Department of the Government of Punjab.

In addition, it is proposed to evaluate the following programs from the viewpoint of technical and allocative efficiency:

- Punjab Education Foundation
- Danish School Programme

Also, an extensive review of literature is being undertaken to determine the results of studies on efficiency in the education sector in other developing countries.

CHAPTER 3
HEALTH

3.1. SITUATION ANALYSIS

Health Indicators

Pakistan performs relatively poorly today in most health and population indicators. As shown in Table 3.1, in fact mortality rate in Pakistan is the highest in the sample of ten countries shown in the table including India, Sri Lanka, Nepal and Bangladesh. The population growth rate is also the highest at 2.1 percent as compared, for example, to 1.5 percent in India and 1.3 percent in Bangladesh. It is only in life expectancy where Pakistan is somewhat better placed.

Table 3.1
HEALTH INDICATORS IN A SAMPLE OF ASIAN COUNTRIES

Country	Life Expectancy (2008)	Infant Mortality rate per 1000 (2009)	Population Average annual (percent) growth (2009)
Pakistan	66.5	65.1	2.10
Sri Lanka	74.1	18.5	0.94
Bangladesh	66.1	59.0	1.29
Nepal	66.7	47.5	1.28
China	73.1	20.2	0.66
Thailand	68.9	17.6	0.62
Philippines	71.1	20.5	1.96
Malaysia	74.4	15.8	1.72
Indonesia	70.8	29.9	1.14
India	63.7	30.1	1.55

Source: Economic Survey of Pakistan, 2009-10

Within Pakistan, the total fertility rate is the lowest in Punjab at 3.9 children according to the Health and Demographic Survey of 2007 (see Table 3.2). This implies that the natural rate of population increase in the province is lower than in the rest of the country. However, infant mortality is significantly higher in Punjab than the national average, even higher than in the two backward provinces of K-PK and Balochistan. Overall, according to the UNDP [2003] the health index of Punjab is somewhat below KKP but above Sindh and Balochistan.

Table 3.2 HEALTH INDICATORS BY PROVINCE						
		Punjab	**Sindh**	**K-PK**	**Balochistan**	**Total**
Total Fertility Rate	No.	3.9	4.3	4.3	4.1	4.1
Infant Mortality Rate	No. per 1000	81	81	63	49	78
Child Mortality Rate	No. per 1000	97	101	75	59	94
Overall Health Index (2003)		0.83	0.78	0.84	0.78	0.82

One of the principal reasons for the relatively poor health indicators in Pakistan is the extremely low level of health spending by federal, provincial and local governments. The combined expenditure was estimated at 0.72 percent of the GDP in 2000-01 which has since fallen to 0.54 percent of the GDP by 2009-10. Comparable levels of public expenditure on health in other countries are 4.1 percent of the GDP in India, 3.4 percent in Bangladesh and 4.2 percent in Sri Lanka.

The Government of Punjab devotes about 6 percent of its current budget to the health and about 7 percent of the ADP for expansion of the health services network.

Clearly, the basic issues are enhancement in public outlays on health and the need to ensure the efficient allocation and utilization of the limited resources that are made available to enable greater impact on the health status of the people of Punjab.

The Health System

The health system of Punjab, like other provinces of the country, is depicted in Figure 3.1. There is a hierarchy of services with the first level consisting primarily of Lady Health Workers and the highest level of tertiary curative health services. The rural network consists primarily of BHUs and RHCs.

The presence of various health facilities in Punjab is indicated in Table 3.3. During the last decade, there has been very slow expansion in the health services network especially on the curative side.

The number of hospitals has increased by only 1 percent annually while the number of beds in these institutions has grown by just over 2 percent. The number of dispensaries, MCH Centres, TB clinics, etc., has actually declined.

Figure 3.1: Hierarchy of Services

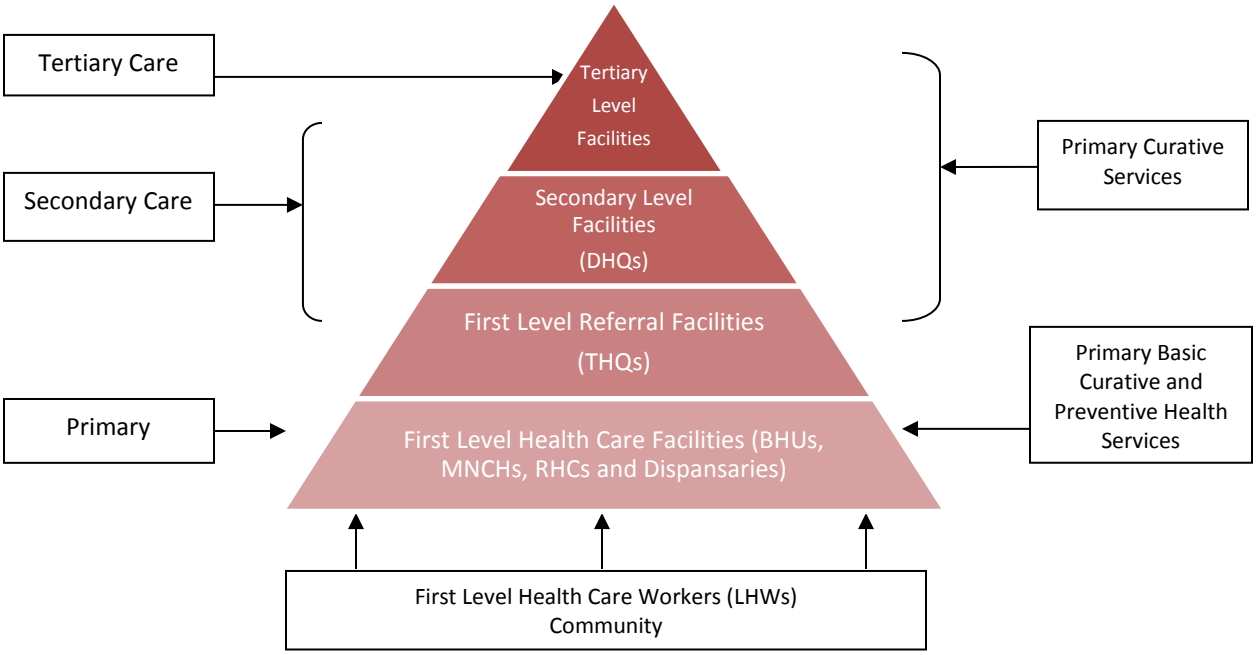


Table 3.3
PRESENCE OF HEALTH FACILITIES IN THE PUBLIC SECTOR OF PUNJAB

		2000	2004	2008	Annual Growth Rate (percent)
Hospitals	No.	298	306	326	1.3
	Beds	32341	3334	37653	2.2
Dispensaries	No.	1452	1227	1286	-1.8
	Beds	1605	1950	358	-19.3
Rural Health Centers	No.	295	298	334	1.8
	Beds	5774	5800	5934	1.4
Basic Health Units	No.	2347	2405	2535	1.5
	Beds	4486	3944	4930	1.4
Others	No.	1093	1116	922	-2.5
	Beds	36	36	295	35.0

There is growing perception that the curative side of health sector has essentially been handed over to the private sector. According to the Health Accounts for Punjab prepared by the Federal Bureau of Statistics almost 75 percent of the financing of the provision of medical services in the Province is in the form of out-of-pocket expenses by households (see Table 3.4). Since user charges are low in public hospitals and dispensaries, most of the payments by households are to private providers. Provincial and district governments combined are responsible for only 17.7 percent of the financing of health services in Punjab. Other significant sources are federal (civil) government and the military establishment. Services provided by the former are likely to be transferred to the Provincial Government following the 18th Amendment.

Table 3.4
SOURCE OF FINANCING OF HEALTH SERVICES IN PUNJAB 2005-06

Source	Level of Financing (Rs. in Millions)	Share (percent)
Federal (civil) + military	5569	5.8
Provincial Health & Other Depts	7161	7.5
Population Welfare Dept	1072	1.1
Reimbursement of Medical Charges	747	0.8
Health Education	172	0.2
District Governments	7720	8.1
Cantonment Boards	100	0.1
ESSI	1475	1.5
Zakat Health Exp	100	0.1
Private Households Out-of-Pocket Expenditures	71507	74.7
Donor Agenies	159	0.2
TOTAL	95,872	100.0

Source: National Health Accounts, FBS.

Turning to the preventive side, there appears to have been significant improvement in coverage of the immunization program. However, the expansion in coverage of improved source of drinking water has been limited.

Table 3.5 TREND IN PREVENTIVE HEALTH SERVICES IN PUNJAB				
	2001-02	**2004-05**	**2006-07**	**2008-09**
At least one Immunisation (percent of children aged 12-23 months)	80	91	92	97
Full Immunisation (percent of children aged 12-23 months)	57	84	83	85
Tetanus Toxoid (percent of married women aged 15-49 years)	53	62	64	76
Access to Piped Water (percent of households)	25	26	27	28
Source: PSLSM, FBS.				

3.2. MAJOR ISSUES OF EFFICIENCY

The need for health sector reforms has been highlighted by Cassels [1995] on the grounds that scarce resources are not efficiently utilized as most of the time public expenditure is spent on inappropriate and cost ineffective services, existing services are badly managed and money is not spent where it is needed. Further, the money spent is not monitored and the system of purchasing goods and services does not ensure the value of money. People do not have access to health care because of poverty, geographical locations, age, sex, lack of employment, non-availability of services for particular health problems and bad planning and management of services. Further in the public sector people face unmotivated and poorly trained staff, waiting times are long, inconvenient clinic hours, inadequate supplies of drugs and lack of confidentiality.

According to Roemer [1991] the health system is combination of finances, resources, infrastructure development and administration that delivers health services. Frenk (1994) argues that health reform policies are formulated at four different levels, that is, systemic, programmatic, organizational and instrumental. Reforms at each of these levels can be introduced to achieve different policy objectives. The systemic level deals with equity of reforms and links of institutions with health system, programmatic level deals with allocative efficiency, organizational level focuses on technical efficiency while the instrumental level is concerned with information which ensures performance.

The major issues identified on the basis of the above situation analysis are as follows:

Public Versus Private Provision

The dominant role of the private sector in the provision of medical services, especially by doctors, raises the issue of what role can be efficiently provided by the public sector. Prima

facie, the argument can be made that the public sector should largely concentrate on preventive health, in view of the externalities associated with this service, and on treatment of catastrophic/ major illness, treatment of which is beyond the ability-to-pay of the poor.

One of the ways of testing for the degree of competition between the public and private sector is to determine the demand for outpatient services in the hospitals, dispensaries, RHCs and BHUs of the former. This will require determination of the trend in technical efficiency of the public curative health system, which is likely to be influenced at least partially by demand factors. A similar exercise can be carried out of the demand for in-patient services.

Choice of Inputs for Curative Health

Within curative health services, there is the issue of allocative efficiency of use of inputs like beds, doctors, nurses, other paramedical personnel, medicines and other supplies. In addition, there is also the issue whether the public sector health system should focus on primary care facilities like RHCs, BHUs, MCHs, etc., or on secondary and tertiary care facilities like specialized hospitals and District/ Tehsil HQ hospitals.

Choice of Inputs for Preventive Health

Bulk of the preventive health services are provided by the government. The issue is which inputs are more effective in controlling the incidence of illnesses among adults and children, tetanus/ toxoid to married women, oral rehydration treatment, pre and postnatal care, etc.

Choice of Location of New Health Facilities

An issue of allocative efficiency is the location of new facilities in districts of Punjab. In the more developed districts there is likely to be greater competition from private medical services although inputs of qualified doctors, nurses, etc. will be more forthcoming and levels of technical efficiency are likely to be higher.

Therefore, there are a number of major issues of technical and allocative efficiency also in the health sector. The methodology proposed for analysis of these issues is given below.

3.3. METHODOLOGY

The methodology essentially involves the estimation of production functions of the type described in Section 2.3. For example, the production function of outdoor and indoor patients separately is as follows:

$$\frac{P}{N} = f[\frac{B}{N}, \frac{D}{B}, \frac{S}{D}, Z] \quad (14)$$

Where, P = number of indoor/ outdoor patients treated, N = population, B = number of beds, D = number of doctors, S = number of nurses, Z = set of exogenous variables

Equation (14) can be estimated over time for the province as a whole or on a cross-sectional basis across the districts. There also exists the possibility of pooling of data. On the preventive side, issues of allocative efficiency can be analysed with the following function,

$$\frac{I}{N} = f[w, o, m, t, n, z] \quad (15)$$

Where,

$\frac{I}{N}$ = incidence of illness, w = percent of households with improved water source, O = percent of children receiving oral rehydration treatment, m = percent of children immunized, t = percent of married women getting tetanus / toxoid, n = percent of pregnant women getting pre-or past-natal care, z = vector of exogenous variables (including levels of nutrition, access to health infrastructure, etc.)

This analysis will largely be undertaken at the district level.

Besides, to undertake an analysis with regards to resources allocated to tertiary, secondary, etc. level facilities as well as between allocations for preventive and curative health care, burden of disease analysis can be very useful.

3.4. SOME PRELIMINARY FINDINGS[3]

Equation (1) is estimated for Punjab from 1981-81 to 2007-08 for outpatients. Results of the regressions are presented in Table 3.6. An additional variable included in the analysis is the share of beds in RHCs and BHUs in the total number of beds.

[3] These results have also been presented in a recent report**, Assessing Financial Impact of Development Portfolio**, prepared for the P & D Board, Government of Punjab.

Table 3.6 RESULTS OF THE REGRESSION ANALYSIS OF THE PRODUCTION FUNCTION OF HEALTH, 1981-82 TO 2007-08		
Variable	**Coefficient**	**t-ratio**
Constant	15.172	3.430**
ln$(\frac{TB}{POP})$	4.250	8.928*
ln$(\frac{DOC}{TB})$	1.257	8.554*
ln$(\frac{RTB}{TB})$	-0.930	-10.479*
ln (PCY)	-0.758	-1.833
	0.521	7.411**
$\bar{R}^2 = 0.965,\ D - W = 1.792$ **F = 186.856***		

The magnitude of the derived elasticities of number of outpatients with respect to the inputs is given below:

Table 3.7 ELASTICITY	
Doctors	1.257
Urban Beds	3.993
Rural Beds	0.110

The very low elasticity of rural beds is due to the negative coefficient of the variable measuring the share of rural beds in total beds in the estimated production function. It may also be noted that the sign of the per capita income variable is negative, implying that as household incomes rises in the province, demand is likely to shift increasingly to private medical services.

The magnitude of the elasticities enables the following conclusions:

- A 1 percent increase in the number of doctors in government health facilities leads to a 1.257 percent increase in demand, as measured by the number of out-patients
- A 1 percent increase in the number of urban beds, in tehsil and district-level hospitals, leads to a very big increase of 3.993 percent in the number of out-patients
- A 1 percent increase in the number of rural beds, in BHUs and RHCs, leads to only a minor increase of 0.11 percent in the number of out-patients. In fact, this low efficiency ratio highlights the need for an in-depth field investigation of RHUs and BHUs to identify factors hindering performance

Given the large differences in elasticities, the initial implications derived for allocative efficiency of health sector budgets of the Government of Punjab are as follows:

FIRST PRIORITY: EXPANSION IN CAPACITY AND NUMBER OF TEHSIL AND DISTRICT-LEVEL HOSPITALS

SECOND PRIORITY: INCREASE IN THE NUMBER OF DOCTORS IN EXISTING FACILITIES

As opposed to the earlier policy of setting up of more BHUs and RHCs there is need now to study the efficiency of these health outlets before any plans for expansion are implemented.

3.5. DATA REQUIREMENTS

Relevant data on health is available in **Punjab Development Statistics** and in the following surveys:

- Multiple Indicator Cluster Survey (MICS)
- Pakistan Demographic Survey (PDS)
- Health and Demographic Survey (PH & DS)
- Pakistan Social and Living Standards and Social Measurement Survey (PSLM)

An inventory of health-related data available is given in Table 3.8.

Table 3.8
AVAILABILITY OF DATA ON THE HEALTH SECTOR

	Source*	Data Availability	
		Province	District
HEALTH INPUTS			
Public Sector Health Institutions by Type	PDS	*	*
Beds in Public Sector Health Institutions	PDS	*	*
Number of Registered Medical & Paramedical Personnel	PDS	*	-
Physical Access to Health Facility, Public or Private	MICS	*	*
Care Provided by Lady Health Workers	MICS	*	*
Access to Improved Water Source	MICS PSLM	*	*
Access to Improved Sanitation	MICS	*	*
Type of Ante-Natal and Post-Natal Care	MICS	*	*
Coverage of Child Immunisation	PSLM	*	*
Access to Oral Rehydration & Vitamin A Supplement	MICS	*	*
HEALTH OUTPUT			
Number of Patients Treated in Public Sector Health Institutions	PDS	*	*
HEALTH STATUS			
Incidence of Illness	PSLM	*	*
Incidence of Diarrhoea	PSLM	*	*
Infant & Child Mortality Rate	MICS	*	*
Birth Rate and Death Rate	PH & DS	*	*
***Data available**			

Major gaps in the data are as follows:

Expenditure: data on curative and preventive health services by district governments.
Personnel: data on number of doctors, nurses, etc., in public sector health facilities at the district level of Punjab has not been published.
Unit Costs: The cost of constructing typical health facilities, public health programs and the costs of different types of medical personnel are not available.
It is proposed to fill these gaps with the help of the Health, Finance, P&D and PHE departments.

Also, the literature is being reviewed extensively to identify results of analyses of efficiency issues in the health sector of other developing countries.

CHAPTER 4
URBAN WATER SUPPLY

4.1. SITUATION ANALYSIS

Safe drinking water is a basic necessity, for every individual and as such is one of the key targets for improved coverage in the MDGs. It is also vital for sustainable environmental conditions and for combating water-borne diseases.

With the process of urbanization, households increasingly have to rely on large-scale public provision through tap connections as compared to private hand pumps and wells in rural areas. Therefore, as the province of Punjab gets more urbanized and the population, especially in the large cities, increases, access to drinking water of good quality will assume an area of greater priority for, the provincial and local governments.

Water Availability

Pakistan is becoming an increasingly water short country. The per capita availability soon after Partition was 5300 cu.meters, which fell to 2700 cu.meters by 1971, 1600 cu.meters by 1991 and is currently at about 1000 cu.meters. The main contributing factor has, of course, been the growth in population. Household and industrial consumption of water accounts for about 6 per cent of total water availability. As pressure on water resources increases, water sources for cities and towns are likely to be at greater distances thereby raising the marginal cost of the additional supplies. Also, pumping of water is likely to require more power, leading to an increase in energy costs.

Water Quality

Poor quality levels of drinking water are to be found in and around the big cities due to the presence of toxic synthetic organic chemicals, heavy metals, municipal wastes and untreated sewage. As reported by UNICF (2009) the arsenic contamination in different parts of Punjab is as follows:

- More than 30 percent of total water sources in 147 villages/bastis of Rahim Yar Khan have arsenic above 50ppb
- More than 30 percent water sources in 3 villages/bastis of Bahawalpur have arsenic above 50ppb

- More than 30 percent water sources in 33 villages/bastis of Sheikupura have arsenic above 50ppb
- 92,549 people in Kasur are drinking contaminated water with arsenic above 50ppb

As estimated by the Multiple Indicator Clusters Survey of 2007-08, 7 percent the contamination in of the water sources tested in Punjab is above the Maximum Permissible Limit (MPL). There are 10 districts where fluoride (MPL=1.5 mg/l) contamination is higher than 10 percent. The highest figures are in the following districts:

- Chakwal (46 percent)
- Bhakkar (36 percent)
- Khushab (33 percent)
- Sargodha (27 percent)

Access to Tap Water

Only about half the households in the urban areas of Punjab have access to tap water, as per the PSLSM Survey of 2008-09 (see Table 4.1). There is wide variation in coverage among the various cities and towns of the province. Lahore has the highest coverage of households at 94 percent, followed by Islamabad at 85 percent and Rawalpindi at 83 percent. Other large cities have relatively low levels of coverage, at 36 percent in Faisalabad, 19 percent in Gujranwala and 27 percent in Multan.

Access to tap water is extremely low in some of the more backward districts of Punjab with relatively small towns at the rural-urban inter-face. For example, the extent of coverage is only 3 percent in the urban area of Hafizabad district, 6 percent in Jhang, 9 percent in Khanewal, 4 percent in Muzaffargarh and so on. Between 2004-05 and 2008-09 a worrying trend is the decline in coverage in as many as 20 districts.

Development Schemes and Plans

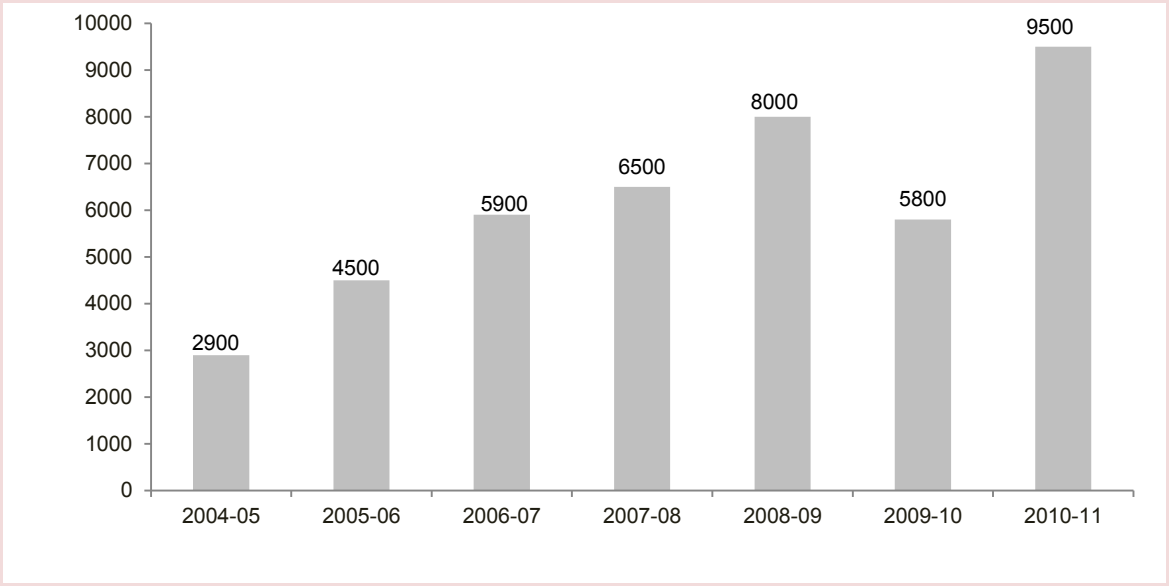
In view of the large gaps in coverage, the number of urban water supply schemes completed by PHED is as many as 2355 at the total cost of Rs. 10.6 billion.

Overall, the allocation in the ADP for this sector has gone up from Rs. 2.9 billion in 2004-05 to Rs. 9.5 billion in 2010-11 as shown in figure 4.1 below.

Table 4.1 SOURCE OF DRINKING WATER IN URBAN AREAS OF PUNJAB percent OF HOUSEHOLD WITH TAP WATER			
	2004-05	**2008-09**	**percent change**
Islamabad	91	85	-6
Attock	58	62	.4
Rawalpindi	73	83	10
Jhelum	95	71	-24
Chakwal	69	72	3
Sargodha	26	27	1
Bhakkar	19	12	-7
Khushab	39	23	-16
Mianwali	34	43	9
Faisalabad	45	36	-9
Jhang	9	6	-3
TT Singh	47	51	4
Gujranwala	24	19	-5
Gujrat	58	46	-12
Sialkot	67	35	-32
Hafizabad	22	3	-19
Mandi Bahauddin	10	15	5
Narowal	35	19	-16
Lahore	88	94	6
Kasur	55	58	3
Okara	23	15	-8
Sheikhupura	43	59	16
Nankana Sahib	-	27	-
Vehari	26	51	25
Sahiwal	58	32	-25
Multan	24	27	3
Khanewal	12	9	-3
Pakpattan	20	47	27
Lodhran	23	20	-3
DG khan	83	58	-28
Rajanpur	39	28	-9
Layyah	8	12	4
Muzaffergarh	14	4	10
Bahawalpur	24	20	-4
Bahawalnagar	88	76	12
Rahim Yar Khan	34	25	-9
TOTAL	**49**	**52**	
Source: PSLSM			

Figure 4.1
ADP FOR THE LAST 6 YEARS
and 2010-11

(Rs. in Millions)



The MTDF in the sector focuses on the following:

- Achievement of MDG target for coverage of Water Supply and Sanitation
- Priority to medium sized cities and semi urban towns/areas
- Establishment of water testing labs in each district
- Control of water-borne diseases

4.2. MAJOR ISSUES OF EFFICIENCY

Rising Cost of Water Supply

The growing water scarcity and the need to access more distant sources of water along with higher energy costs is the fundamental issue of technical efficiency in the urban water supply sector. This will require estimation of the cost function of water with respect to the quantity supplied so that the average and marginal costs of water provision can be determined.

The proposed methodology is to study different vintages of development schemes especially in large cities like Lahore, Rawalpindi, Faisalabad, Multan and Gujranwala, which have specialized

WASAs. For each development scheme, the amortised capital cost will be derived at constant prices as follows:

$$FC = (\tau + \delta)K \quad . (16)$$

Where, FC = amortised annual cost, τ = real interest rate, δ = rate of depreciation, K = Capital cost

$$AFC = \frac{(\tau + \delta)}{Q}K \quad . (17)$$

Where,

Q is the quantity of water supplied by the particular development scheme

The estimated O & M cost can similarly be worked out and added to the amortised capital cost. In fact, the estimated average cost per say 1000 gallons for the latest scheme indicates the long-run marginal cost of water supply in the particular city of Punjab. A steeply rising marginal cost curve will indicate growing problems of technical efficiency.

Extent of Cost Recovery

A potentially serious financial problem is the low level of cost recovery in the urban water supply sector throughout Punjab. This is the consequence of poor and unreliable service, high levels of water losses of up to 35 percent in conveyance and distribution, low tariffs and low collection efficiency, sometimes as low as 25 percent.

A good example of these problems is WASA Lahore, which has prepared a large budget for the fiscal year 2010-11. The revenue is Rs. 3.1 billion against the expenditure of Rs. 5.8 billion, showing a short fall of Rs. 2.7 billion. Current expenditure is estimated at Rs. 4.3 billion while Rs. 1.5 billion is for on-going development projects. The major increase in costs is due to higher electricity tariffs and 50 percent hike in salaries of employees. Outstanding dues to LESCO stand at over Rs. 1.8 billion. Last year the deficit was Rs.1.7 billion. Like previous years, WASA Lahore is looking to the Punjab Government for special grant to make ends meet. Therefore, with many of other WASAs recovering only about 50 percent of their O & M costs, the burden on the provincial exchequer is rising exponentially and could become unbearable in years to come.

A major factor also contributing to under recovery even of the O & M Costs is the low and poorly designed water tariffs, which also include elements of cross-subsidisation to privileged consumers like cantonment boards, commercial and industrial consumers, etc. Domestic consumers are charged either on the basis of plot size or annual rental values (as assessed for property tax). Unmetered commercial consumers pay flat rates which can be as low as Rs. 200 per month. Metered consumers are charged water rates per 1000 gallons which bear little relationship with the costs of supply.

Overall, one of the prime objectives of the study in the Urban Water Supply sector will be to design a rational water tariff structure for a typical city which ensures full recovery at least of the O & M costs. The implied costs will then be compared with the ability-to-pay of households in different income quintiles of the urban population.

4.3. DATA REQUIREMENTS

The primary requirements of data are as follows:

Development Costs

Costs of complete and on-going development schemes will be required for the following:

- Two large cities with WASAs
- Two medium sized cities
- Two small towns

In addition, information will be obtained on the extent of expansion in water supply due to each scheme.

Tariff Schedule

Tariff schedule for water supply will also be obtained for the sample cities/towns

Budget Statement

Budget statements for at least the last three years and for 2010-11 will be required of the WASAs in the two sample large cities and of the TMAs in the sample smaller towns/cities.

REFERENCES

- Aigner, D. J., Lovell, C. and Schmidt, P., (1977), "*Formulation and estimation of stochastic frontier production function models",* Journal of Econometrics Vol. 6, pg. 21-37.
- Ali, M., and Byerlee, D., (1991), *"Economic efficiency of small farmers in a changing world: A survey of recent evidence",* Journal of International Development Vol. 3, pg. 1-27.
- Asian Development Bank (2008), *"Proposed program cluster and loan for subprogram 1 Islamic Republic of Pakistan: Punjab Millennium Development Goals Program",* Project No: 41641.
- Aslam, A., (2002), *"Health sector reform in Pakistan: Why is it needed?"* Department of Community health Sciences, The Aga Khan University, Karachi, Journal Pakistan Medical Association, Vol. Mar 52, No. 3.
- Bosch., *et'al* (2002), *"Poverty Reduction Strategy Paper Sourcebook, Water and Sanitation",* Macroeconomic and Sectoral Approaches, Volume 2, World Bank, Washington, D. C.
- Broeck, V. D., Koop, J. G., Osiewalski, J., and Mark, F. J. S., (1994), *"Stochastic frontier models: A Bayesian perspective"*, Journal of Econometrics, Vol. 61, pg. 273-303.
- Cassels, A., (1995), *"Health sector reform: key issues in less developed countries",* Journal of International Development, Vol. 7, No. 3, pp. 329-347.
- Coelli, T. J., (1995), *"Recent developments in frontier modeling and efficiency measurement"*, Australian Journal of Agricultural Economics, Vol. 39, pg. 219-45.
- Dil, A. S., (1997), *"100 Communicable diseases Associated with Water",* Proceedings of NSMTCC on Environmental Pollution, Islamabad, Pakistan.
- Friel, M. C., *"Two-Stage Least-Square Regression (2SLS)",* Criminal Justice Center, Sam Houston State University.
- Government of Punjab (2004), *"Multiple Indicator Cluster Survey",* Planning and Development Board.
- Government of Pakistan (2010), *"Economic Survey of Pakistan 2009-10"*.
- Government of Punjab (2010), *"Assessing Financial Impact of Development Portfolio"*, Planning and Development Board.
- Greene, W. H. (1993), "*The econometric approach to efficiency analysis",* In The measurement of production efficiency: Techniques and applications, edited by H. O. Fried, C. A. Knox Lovell, and S. S. Schmidt. New York: Oxford University Press.

- Jessani, S., Israr, M. S., and Hasnain, F. S., (2005), *"Assessing the effects of training on knowledge and skills of health personnel: A Case study from the family health project in Sindh, Pakistan",* Deparment of Community Health sciences, The Aga Khan University, Karachi, Pakistan, Ayub Medical College, Vol. 17, No. 4.
- Julio, F., (1994), *"Dimensions of health system reform"*, *Health Policy by Elsevier,* Vol. 27, Issue. 1, pp. 19-34.
- Kahlown, M. A., *et'al* (2006), *"Water Quality Status, National Water Quality Monitoring Programme, Fourth Technical Report",* Pakistan Council of Research in water Resources.
- Laredo, D., (1991), *"Principles of Tariff Design For Water and Wastewater Services",* WASH field report No. 348 prepared for the office of health, Bureau for Science and Technology, U.S. Agency for International Development.
- Lovell, C., (1993), *"Production frontiers and productive efficiency",* In The measurement of productive efficiency: Techniques and applications, chapter 1, edited by H. O. Fried, C. A. Knox Lovell, and S. S. Schmidt. New York: Oxford University Press.
- Ludwin. W. G., and Guthrie, T. L., (1989), *"Assessing Productivity with Data Envelopment Analysis",* Public Productivity Review, Vol. 12, No. 4, pp. 361-372.
- Monfardini, C. and Fabbri, D. (2002), *"Public Vs. Private health care services demand in Italy", Giornale degli Economisti e Annali di Economia,* Vol. 62, No.1, pp. 93-123.
- Pakistan Council of Research in Water Resource (2002), *"Strategies to Address the Present and Future Water Quality Issues",* Islamabad.
- PHED., (1991), *"Monitoring of Water Quality from community hand pumps and wells in Sweet water areas of the Punjab, Pakistan",* Brief of the project report, WHO-CRL/1-A/1990, Public Health Engineering Department, Central Research Laboratories, Lahore.
- Roemer, M. I., (1991), *"National health system of the world"*, Oxford University Press, New York.
- Salman, M., Kazi, B. M., and Ghaffar, A., (2000), *"Health care system in transition III. Pakistan, Part I. An overview of the health care system in Pakistan",* Department of community health and health systems, Health service Academy, Islamabad, Pakistan, Journal Public Health Medicine, Vol. 22, No. 1.
- Tahir, M. A., *et'al*. (1994), *"Survey of Drinking Water Quality in the Rural Areas of Rawalpindi District",* Pakistan Council for Research in Water Resources, Islamabad.
- World Health Organization (2009), *"World Health Statistics".*

STATISTICAL ANNEXURE

A. Primary Schools

	2000			2009			Growth			Gender Parity Index	
	Total	Male	Female	Total	Male	Female	Total	Male	Female	2000	2009
No. of Institutions	44175	21291	22884	44970	22307	22663	0.22	0.58	-0.12	-	-
Enrolment (000)	4184	2494	1690	5037	2728	2309	2.35	1.13	3.98	0.68	0.85
Teaching Staff	138169	74967	63202	120500	61559	58941	-1.70	-2.43	-0.87	-	-
Enrolment Per Institution	95	117	74	112	122	102	2.12	0.54	4.10	-	-
Teacher Per Institution	3	4	3	3	3	3	-1.91	-3.00	-0.75	-	-
Student Teacher Ratio	30	33	27	42	44	39	4.11	3.65	4.89	-	-
Net Enrolment Rate (NER)	44	47	41	62	64	60	4.38	3.93	4.87	-	-

B. Middle Schools

	2000			2009			Growth			Gender Parity Index	
	Total	Male	Female	Total	Male	Female	Total	Male	Female	2000	2009
No. of Institutions	5974	2451	3523	7504	3118	4386	2.89	3.05	2.78	-	-
Enrolment (000)	1452	724	728	2156	1006	1150	5.07	4.20	5.88	1.01	1.14
Teaching Staff	64608	29245	35363	71081	31446	39635	1.20	0.91	1.44	-	-
Enrolment Per Institution	243	295	207	287	323	262	2.11	1.11	3.02	-	-
Teacher Per Institution	11	12	10	9	10	9	-1.64	-2.08	-1.30	-	-
Student-Teacher Ratio	22	25	21	30	32	29	3.82	3.26	4.38	-	-
Net Enrolment Rate (NER)	19	20	17	22	23	21	2.08	1.80	2.95	-	-

C. High Schools

No. of Institutions	4425	2921	1504	4717	2960	1757	0.80	0.17	1.96	-	-
Enrolment (000)	2783	1744	1039	3050	1807	1243	1.15	0.44	2.27	0.60	0.69
Teaching Staff	100472	66073	34399	90245	55663	34582	-1.33	-2.12	0.07	-	-
Enrolment Per Institution	629	597	691	647	610	707	0.35	0.28	0.30	-	-
Teacher Per Institution	23	23	23	19	19	20	-2.12	-2.28	-1.86	-	-
Student-Teacher Ratio	28	26	30	34	32	36	2.52	2.62	2.20	-	-
Net Enrolment Rate (NER)	10	11	9	13	14	13	3.33	3.06	4.70	-	-

Source: Punjab Development Statistics 2010, Bureau of Statistics, Government of Punjab Lahore.

D. Higher Secondary

	2000			2009			Growth			Gender Parity Index	
	Total	Male	Female	Total	Male	Female	Total	Male	Female	2000	2009
No. of Institutions	375	211	164	587	288	299	5.76	3.97	7.80	-	-
Enrolment (000)	34	15	19	73	34	39	10.02	10.77	9.41	1.27	1.15
Teaching Staff	4051	2504	1547	6122	3149	2973	5.30	2.91	8.51	-	-
Enrolment Per Institution	91	71	116	124	118	130	4.03	6.55	1.49	-	-
Teacher Per Institution	11	12	9	10	11	10	-0.44	-1.02	0.66	-	-
Student Teacher Ratio	8	6	12	12	11	13	4.49	7.64	0.83	-	-

E. Inter Colleges

No. of Institutions	151	97	54	214	123	91	4.46	3.01	6.74	-	-
Enrolment (000)	28	16	12	41	24	17	4.88	5.20	4.45	0.75	0.71
Teaching Staff	2134	1511	623	3948	2369	1579	7.99	5.78	12.33	-	-
Enrolment Per Institution	185	165	222	192	195	187	0.41	2.12	-2.15	-	-
Teacher Per Institution	14	16	12	18	19	17	3.39	2.69	5.23	-	-
Student-Teacher Ratio	13	11	19	10	10	11	-2.88	-0.55	-7.01	-	-

F. Degree Colleges

No. of Institutions	345	170	175	625	324	301	7.71	8.40	7.01	-	-
Enrolment (000)	382	173	209	663	312	351	7.13	7.65	6.70	1.21	1.13
Teaching Staff	13742	7832	5910	18506	10610	7896	3.79	3.87	3.69	-	-
Enrolment Per Institution	1107	1018	1194	1061	963	1166	-0.53	-0.69	-0.30	-	-
Teacher Per Institution	40	46	34	30	33	26	-3.64	-4.18	-3.11	-	-
Student-Teacher Ratio	28	22	35	36	29	44	3.22	3.64	2.90	-	-

Source: Punjab Development Statistics 2010, Bureau of Statistics, Government of Punjab Lahore.

G. All Universities

	2000			2009			Growth			Gender Parity Index	
	Total	Male	Female	Total	Male	Female	Total	Male	Female	2000	2009
No. of Institutions	11	10	1	36	34	2	15.97	16.53	9.05	-	-
Enrolment	33270	22869	10401	204989	115546	89443	25.52	22.44	30.86	0.45	0.77
Teaching Staff	1838	1526	312	13604	9137	4467	28.43	25.07	39.47	-	-
Enrolment Per Institution	3025	2287	10401	5694	3398	44722	8.23	5.08	20.00	-	-
Teacher Per Institution	167	153	312	378	269	2234	10.74	7.33	27.90	-	-
Student-Teacher Ratio	18	15	33	15	13	20	-2.27	-2.10	-6.17	-	-

H. Public Universities

	2000			2009			Growth			Gender Parity Index	
	Total	Male	Female	Total	Male	Female	Total	Male	Female	2000	2009
No. of Institutions	9	8	1	22	20	2	11.82	12.14	9.05	-	-
Enrolment	32417	22218	10199	149724	75348	74376	21.08	16.49	28.19	0.46	0.99
Teaching Staff	1786	1484	302	11207	7353	3854	25.81	22.15	37.48	-	-
Enrolment Per Institution	3602	2777	10199	6806	3767	37188	8.28	3.89	17.55	-	-
Teacher Per Institution	198	186	302	509	368	1927	12.51	8.93	26.07	-	-
Student-Teacher Ratio	18	15	34	13	10	19	-3.76	-4.63	-6.76	-	-

I. Private Universities

No. of Institutions	2	2	0	13	13	0	26.36	26.36	-	-	-
Enrolment	853	651	202	34181	23069	11112	58.6	56.2	65.0	0.31	0.48
Teaching Staff	52	42	10	2228	1691	537	60.0	58.7	64.5	-	-
Enrolment Per Institution	427	326	-	2629	1775	-	25.5	23.6	-	-	-
Teacher Per Institution	26	21	-	171	130	-	26.6	25.6	-	-	-
Student-Teacher Ratio	16	16	20	15	14	21	-0.8	-1.6	0.3	-	-

Source: Punjab Development Statistics 2010, Bureau of Statistics, Government of Punjab Lahore.

J. Distance Learning Universities

	2000			2009			Growth			Gender Parity Index	
	Total	Male	Female	Total	Male	Female	Total	Male	Female	2000	2009
No. of Institutions	-	-	-	1	1		-	-	-	-	-
Enrolment	-	-	-	21084	17129	3955	-	-	-	-	0.23
Teaching Staff	-	-	-	169	93	76	-	-	-	-	-
Enrolment Per Institution	-	-	-	-	-	-	-	-	-	-	-
Teacher Per Institution	-	-	-	-	-	-	-	-	-	-	-
Student-Teacher Ratio	-	-	-	-	-	-	-	-	-	-	-

K. Professional Colleges

No. of Institutions	249	230	19	402	375	27	6.17	6.30	4.49	-	-
Enrolment	101116	78059	23057	173689	124786	48903	7.00	6.04	9.85	0.68	0.85
Teaching Staff	5876	4626	1250	9533	6537	2985	6.24	4.42	11.49	-	-
Enrolment Per Institution	406	339	1214	432	333	1811	0.78	-0.25	5.13	-	-
Teacher Per Institution	24	20	66	24	17	111	0.06	-1.77	6.70	-	-
Student-Teacher Ratio	17	17	18	18	19	16	0.72	1.55	-1.47	-	-

D. Commercial, Vocational and Technical Training Institutes

	2000			2009			Growth			Gender Parity Index	
	Total	Male	Female	Total	Male	Female	Total	Male	Female	2000	2009
No. of Institutions	317	196	122	408	260	148	3.205	3.595	2.444	-	-
Enrolment	78212	68341	9900	198594	163905	34689	12.35	11.55	16.97	0.14	0.21
Teaching Staff	6878	5867	1011	16442	5160	1636	11.51	-1.592	6.201	-	-
Enrolment Per Institution	247	349	81	487	630	234	8.865	7.684	14.18	-	-
Teacher Per Institution	22	30	8	40	20	11	8.047	-5.007	3.667	-	-
Student-Teacher Ratio	11	12	10	12	32	21	0.757	13.36	10.14	-	-

D. Selected Ratios by Level of Education Institution (2008-09)

Institution level	Gender Parity Index	Enrolment Per School/College			Student Teacher Ratio			Teachers Per School		
		Total	Male	Female	Total	Male	Female	Total	Male	Female
Mosque	-	57	-	-	46	-	-	1	-	-
Primary	0.87	114	123	106	42	44	41	3	3	3
Middle	1.13	286	323	259	30	32	29	9	10	9
High	0.65	646	609	725	34	32	37	19	19	19
Higher Secondary	1.56	119	111	127	12	11	14	10	10	10
Inter	0.47	148	149	117	9	9	8	14	14	11
Degree	1.12	969	874	1094	41	32	59	25	28	20
Public Universities	0.99	6806	3767	37188	13	10	19	509	368	1927
Professional Colleges	0.85	432	333	1811	18	19	16	24	17	111
Commercial, Vocational and Technical Training Institutes	0.21	487	630	234	12	32	21	40	20	11

Source: Punjab Development Statistics 2010, Bureau of Statistics, Government of Punjab Lahore.

The International Growth Centre (IGC) aims to promote sustainable growth in developing countries by providing demand-led policy advice based on frontier research.

Find out more about
our work on our website
www.theigc.org

For media or communications
enquiries, please contact
mail@theigc.org

Subscribe to our newsletter
and topic updates
www.theigc.org/newsletter

Follow us on Twitter
@the_igc

Contact us
International Growth Centre,
London School of Economic
and Political Science,
Houghton Street,
London WC2A 2AE

IGC
International
Growth Centre

DIRECTED BY
LSE
UNIVERSITY OF OXFORD

FUNDED BY
UKaid
from the British people

Designed by soapbox.co.uk