CHAPTER - I

INTRODUCTION

1.1 Introduction

Education is a basic component of human capital. It captures capability of acquiring knowledge, communication and participation in community life. Quality of economic and social well being is systematically built on strong foundation of education. It is a key to increase economic efficiency and social consistency and it increases the overall productivity and intellectual flexibility of the labour force. By increasing the value and efficiency of labour, it helps to raise the poor from poverty.

The aggregate effect of human capital has been the subject matter of an active debate in growth theory. The neo-classical growth models particularly Solow (1957) explained differences in per capita income between nations and regions through differences in productivity. This productivity of a labour has causal relation with educational opportunities.

Stevens and Weale (2003) did not find conclusive evidence to propose that the returns to education are very different from returns to physical capital. But they observed that education is needed as a means of allowing countries to make good use of available technology and come to a conclusion that education plays a role in facilitating the best practice of technology. Knowledge of technology depends on investment on education in particular and investment on human capital in general.

Education has both the intrinsic and instrumental values; it is desirable not only for individuals but also for the society as a whole (Sen, 1999). Education is a major determinant of differences in productivity; in addition basic education produces greater social benefits than private benefits. As education level increases from elementary to higher level, private benefits will be greater than social benefits. This indicates greater investment in the elementary level is more significant as it is the foundation for the subsequent higher levels of education. It was observed that one year increase in the primary schooling of the workforce would raise output by 23 per cent (Lee, 1995). Further, the rate of return to primary education is greater than rate of return to higher education (Psacharopolous, 1973). Education has the characteristic of
both consumption good as well as capital good. It is also a way to diminish the inequality, improve the productivity. Furthermore, it has positive relationship with standard of living, productivity and negative relation with poverty and fertility (Todaro, 1972).

Elementary education distributes larger positive externalities to the society, Nerlove (1972) and other economists considered education as pure public good and Levin (1987) and others contended that education as a merit good. But market mechanisms do not operate more efficiently with respect to public and merit goods. This applies to education also, where market fails in the valuation of education leading to inefficient allocation of resources. This characteristic has been used to justify the rationale for public intervention in provision and financing of education. The United Nations Organization (UNO) also assured that ‘Everyone has the right to education. Education shall be free at least in the elementary level and fundamental stages. Technical and professional and higher education shall be generally accessible to all on the basis of merit (UNO, 1990). This declaration reiterates the fact that human beings should have desire and enjoy the education opportunity.

The concept of National Education System in India implies that up to a given level, all students irrespective of caste, sex or location, have access to education of a comparable quality. Education sector in India is receiving significant share under social sector in all five year plans and budgets. It was also included in the ‘National Programme of Minimum Needs’ in five year plans of the central government. Besides, Government of India (GOI) has appointed committees and commissions to deal with different issues related to education policy and financing of education. Most of these committees and policies have strongly recommended that the government should enhance the public spending on education to six per cent of the national income and at least half of this share should be spent on elementary education (Tilak, 1999). However, the state and central governments are not been allocating six per cent of national income to education.

Cost of primary education matters in India. Higher cost reduces the probability of children attending school which negatively affects the achievement of national goals. According to Mukhopadhyay (2006) to achieve better national goals, the government should provide free tuition for primary education and it should also borne other costs
i.e. cost of travelling, school fee and others. Targeted subsidies are very useful in improving enrolment at the school level for achieving crucial goal of Universal Elementary Education (UEE) which means 100 per cent enrolment and retention of children with schooling facilities in all habitation.

Several programmes namely Operation Black Board (OBB), District Primary Education Programme (DPEP), Mid Day Meals (MDM) and others have been introduced in India for the achievement of UEE. Sarva Shiksha Abhiyan (SSA) is one among such programmes and it has been introduced as the flagship programme by the Ministry of Human Resource Development (MHRD), GOI during 2001-02 with an objective of achieving UEE. At the operational level it aims at harmonizing the central government initiatives in school education with the efforts of the state governments. Despite several efforts there is an inter-state gap in achievement in literacy level, pupil-teacher ratio, inadequate finance and quality of education. Education inequality is increasing between developed and developing states.

According to the recent publications of MHRD and Selected Educational Statistics (SES) it is observed that the country has made significant progress in education in general and elementary education in particular. There is a significant improvement in institutions, teachers and students at elementary education. Number of recognized educational institutions of the primary education increased from 209.7 lakh in 1950-51 to 832.2 lakh during 2009-10 period. The upper primary schools increased from 13.6 lakh in to 367.7 lakh during same period. In terms of enrolment, the overall admission at the elementary level was 223 lakh in 1950-51 period and it attained to 1950 lakh in 2009-10. The Gross Enrolment Ratio (GER) of elementary education is increased from 32.1 per cent in 1950-51 to 102.5 per cent in 2009-10 and the dropout rate is significantly decreased from 78.3 per cent to 42.4 per cent during the same period. The Gender Parity Index (GPI), which is the ratio of male students to female students, is improved from a low level of 0.38 during 1950-51 increased to 0.97 in 2009-10. The Pupil Teacher Ratio (PTR) is one of the indicators which represent the quality of education. PTR at primary school increased from 24 to 42 and at upper primary school from 20 to 34 between 1950-51 and 2009-10.

The quality of learning at elementary level in India is very low. In 2008, the proportion of children in Standard III who could read a Standard I text was under 50
per cent. A child in Standard III has to learn to do two digit subtractions, but the proportion of children in government schools who can even recognize numbers up to 100 correctly was near 50 per cent over the last four years (ASER, 2012). According to Muralidharan (2012) increasing inputs to primary education are unlikely to change the trajectory of student learning in a meaningful way unless accompanied by significant changes in pedagogy and improvements in governance.

Despite several attempts to achieve UEE, still majority of the states have not achieved this objective. A huge number of children are still out of school and above half of them dropout before completing the elementary level. The government has observed that the UEE may be too big task for a single institution to deliver. Therefore, Village Education Committees (VECs), Non-Government Organizations (NGOs), community organizations, private education providers, local bodies and parents have been promoted to supplement efforts of the government. Along with International agencies like World Bank (WB), United Nations International Children Education Fund (UNICEF), United Nations Educational, Scientific and Cultural Organization (UNESCO) and Asian Development Bank (ADB) and other several countries are providing education aid for achieving UEE.

The decline in allocation of funds to education due to Structural Adjustment Programmes (SAP) following economic reforms and lack of political will are the major obstacles towards achieving UEE. The sources of funds for education include central and state government budget allocations, aid from international agencies, and mobilization of funds from local Non-Government Organizations (NGOs) and village level education committees. The funds from last two agencies are marginal. It is suggested that the collection of education cess from those who are getting benefitted was suggested to augment the financial resource for funding elementary education. However, government should strengthen decentralization system for mobilizing additional resources to fulfil this gap. The present research attempts to estimate the efficiency of education spending across different states and the transparency and accountability issues at the school level in Karnataka with an objective to identity the factors influencing these efficiency and accountability.
1.2 Conceptual Framework of the Study

Finance is commonly referred to providing funds for commercial activities. But public financing or public expenditure is referred to the expenses incurred by the government for maintenance of government responsibilities and stimulate welfare of the society. Financing is an economic activity of the government to provide and manage necessary resources for satisfying the needs of the people. Education is an important determinant of human development and human welfare. In this regard it is considered as a public good, which produces wide variety of positive externalities and social advantages to the society.

Some of the arguments justifying the government intervention in education are

1. Elementary education is recognized as a pure public good (Vaizey 1962). It distributes larger positive externalities to society, which have direct and indirect impact on the development of the nation.

2. Due to ignorance of people about the value of the education creating human capital there may be a short fall of private expenditure on education and this has to be supported by government institutions (Musgrave, 1959) and Levin, 1987).

3. Education is advocated on the grounds of providing equality of opportunity. Ensuring equality of opportunity in education to everyone irrespective of their social and economic background is considered as an important function of the modern state (Blaug and Woodhall, 1979)

4. Due to imperfect market and asymmetric information in developing and developed economies poor people still consider education as a consumption rather than investment (Arrow, 1993).

5. Market mechanism is determined by the demand for and supply of the private goods. But education is a public good, in nature and the marginal cost of an additional education unit is zero leading to market failure (Colclough, 1996). Therefore in the context of market failure state has to intervene.
6. Public expenditure on education played an important role in improving the education indicators in many developing countries (Gupta et al 1999; Mehrotra, 1998)

1.2.1 Efficiency

Efficiency is one of the main indicators to determine how the public resources are utilized for the development of the society. The concept of efficiency is about the relationship between inputs and outputs. Farrell (1957) advocated the concept of productive efficiency, ‘it is important to know how far a given industry can be expected to increase its output by simply increasing its efficiency. The input-output ratio is widely used to measure efficiency in the system. However, compared to productivity measurement, the efficiency concept incorporates the idea of the production possibility frontier, which indicates feasible output levels given the scale of education operation. The greater the output for a given input or the lower the input for a given output is the ways to achieve the efficiency. In educational system efficiency can be achieved through controlling and monitoring the educational resources into better educational outcomes.

A distinction can be made between technical efficiency and allocative efficiency. Technical efficiency gains are a movement towards the production possibility frontier. However, each point of technical efficiency does not make economic sense. It is captured by allocative efficiency. Allocative efficiency reflects the link between the optimal combination of inputs taking into account costs and benefits and the output achieved. Therefore, assessing allocative efficiency in the public expenditure on education requires the measurement of the inputs and outputs entering into the educational activities. Indicators of educational inputs under SSA are teachers salary, expenditure on civil works, teachers grant, school management grant, and school development grant, supply of free text books, teacher training and teaching learning equipment. The indicators of educational outcomes have increased in enrolment rate, completion rate, learning achievement levels and gender parity in educational attainment. This efficiency score helps to measure the performance of educational outcomes across the states. Further it also helps to understand the possible factors influencing on technical efficiency.
1.2.2 Accountability and Transparency

Accountability refers to an institutional relationship, which enables successful service delivery by giving interdependent actors the proper incentives. The World Development Report (WDR, 2004) identifies four sets of actors in a service delivery scenario: the clients / beneficiaries, the politicians / policy makers, the providing organizations, and the frontline providers. Ideally, these sets of actors are linked in relationships of power and accountability: citizens should be able to exercise voice over politicians. Policy makers should have contacts with organizational providers. Organizations should manage frontline providers, and clients should be able to exercise client power through interactions with frontline providers. Weaknesses in any of this relationship or in the capacity of the actors can result in service failures.

In another way, accountability is broadly defined as the obligation of those who holds power to take responsibility for their behaviour and actions (Malena et al. 2004). Fundamentally the term accountability summarizes five main elements; delegation, financing, performance, information on performance and enforceability.

Inter-linkages among the five core elements of accountability are called as transparency. Transparency is defined as ‘the degree of which information is available to outsiders that enables them to make informed decisions or to assess the information made by insiders (Florini, 2007). The links between the two are said to be fashioned along two axes – transparency of information is instrumental for demanding accountability because without information individuals cannot know the excess of resource being committed by the state and wastage of resource. Further transparency of information is also seen as a significant for motivating citizens to exercise voice power. Voice power is defined as the capacity of citizens to pressurize the frontline officials in ensuring effective delivery of services (Goetz and Gaventa, 2001). The role of transparency in strengthening the voice of the community has been occupied special emphasis. It is assumed that access to information mobilizes citizens for collective action and this in turn strengthens the incentive structure of frontline providers. The greater transparency leads greater accountability. In fact, accountability and transparency are inseparable. Moreover accountability is a form of transparency. Transparency leads people to look at results and this leads to accountability.
There are many factors which determine the success or failure of any government programme. Among them accountability and transparency are two main determinants. Information on accountability and transparency mobilizes the community and improves the awareness among the citizens to ask for their rights. This indeed positively and significantly affects the welfare of the society.

1.3 Process of Fund Flows to Elementary Education in India

The flow chart shows the flow of financial resources to elementary education at various stages. It explains the interconnectivity and dependence among the various financial stakeholders (Tilak, 2005). The interconnectivity and dependence will be studied through the variables such as allocation through plans, allocations to various programmes under different budgets, amount spent and the outcomes. Public financing of elementary education includes central, state and local government expenditure in order to provide educational infrastructure.

In the figure below:

- Public and private expenditure are the two main financial sources of education. Public expenditure comes from the expenditure of central government, state government, local government and foreign aid, which is distributed through the Centrally Sponsored Schemes (CSS). Private sources include private contribution, NGOs, household expenditure etc.,

- The central government expenditure comes from plan allocation, annual budgets and foreign aid. Expenditure under Five Year Plans is classified into two parts 1. Plan expenditure and 2. Non-Plan expenditure and the expenditure in the budget is divided as 1. Revenue budget 2.Capital budget.

- The bulk of tax revenue is collected by the centre while the states have main responsibility of maintaining and developing the education sector. A part of the resource gap of the state government is met through transfer mandated by the Finance Commission from central government to the states. States also receive funds from the Planning Commission; directly in the form of central assistance to states and indirectly through the central ministries in the form of CSS.
Along with the ministry of education, other ministries are also providing complementary support in the form of training, scholarship etc..

Chart 1.1: Stage of Fund flows to Elementary Education

1.4 Research Issues

The review of literature in the second chapter reveals that the government could not able to provide basic educational infrastructure to schools to a large extent. SSA came as flagship programme to take care of this aspect and provide accessibility to education to all the children. Large amount of funds was allocated for this programme. The implementation of the programmes raised several issues to be addressed. They are;

1. Can government invest sufficient share to elementary education in order to achieve elusive goal of UEE?

2. Can this existing pattern of allocation reduce inter-state variation in education attainment? How SSA programme has made effort to reduce the
interstate disparity in terms of expenditure or allocation on elementary education?

3. Is there a trade-off between equity and efficiency in allocations of educational funds under SSA?

4. What is the relationship between educational expenditure and educational outcomes?

5. Can decentralization play an important role in ensuring accountability and to undertake proper monitoring, especially involving the community?

6. Can government improve the outcomes of elementary education through increasing the accountability, transparency and increase the efficiency of the resource utilization in the system?

1.5 Statement of the Problem

Elementary education is the basic foundation of all levels of education. It faces both inter-sector and intra-sector competition in budget allocation for funds (Pandit, 1972). Bottlenecks in the public provisioning of education, inadequacy in spending, malfunctioning of schools, and huge deficit in the education sector are identified as main factors responsible for the delay in India’s progress towards UEE (Jha, 2007). After the introduction of SSA, the funds flow is increased considerably. But the utilization of these funds is a question to be addressed in order to understand the efficiency of the system. Given the scarcity of resources it is obligatory on the part of the government to improve the efficiency of resources. Along with improvement in transparency, accountability ensuring community participation to achieve the goal of UEE. In this context this present study attempts to measure the efficiency of public spending on elementary education across different states in the country after the introduction of SSA. The study has policy relevance as it mainly concentrates on understanding the efficiency of the resources spent on elementary education, efficiency of the existing institutions in ensuring accountability and transparency in the utilization of funds.
1.6 Research Gap

The debate on the government role in financing of elementary education dates back to Indian independence. Several educational committees have been formed to address various issues relating to financing of elementary education. Review of literature on financing of elementary education revealed that while some studies have justified traditional argument of increasing budgetary allocation, others have focused on mobilization of funds of financing of elementary education. Regarding the mobilization of funds for elementary education imposing education cess, cut down the unproductive expenditure on defence and internal security and reducing the subsidy to higher education, introduction of Public Private Partnership (PPP) are suggested as some of the measures. All these studies have focused on the issue of financing of elementary education at the macro level. But no attempt was made to analyze the efficiency of the public spending on elementary education relating the spending and outcomes.

The present study made an attempt to fill this research gap. Therefore, the study focuses on analyzing the technical efficiency of education financing at elementary level across states in India and transparency and accountability issues in Karnataka.

1.7 Objectives of the Study

The overall objective of this study is to estimate the efficiency of the existing system of financing of elementary education with a focus on SSA. The supporting objectives are

1. To analyze the trends in public expenditure on elementary education during 20 years i.e. from 1990-91 to 2010-11.
2. To study the interstate variation in financing of elementary education in India.
3. To examine the relationship between expenditure and outcomes of elementary education.
4. To identify the factors responsible for differential outcomes in elementary education.
5. To analyze the technical efficiency of financing of elementary education under SSA.

6. To understand the accountability and transparency issues at the school level in sample districts.

1.8 Hypotheses of the Study

It is proposed to test the following hypotheses

1. Inter-state variation in financing of elementary education declined after the introduction of SSA.

2. Public expenditure on elementary education has reduced dropout rate.

3. Economic status of the state does influence the utilization of funds

1.9 Methodology of the Study

1.9.1 Data sources

In order to understand the changes in the trends in funding on elementary education and their implications at the nation level and across the states, the study relies exclusively on secondary data for the period of 1990-91 to 2010-11. Secondary data were collected from various issues of National Council of Education Research and Training (NCERT), Annual Status of Education Report (ASER) published by PRATHAM, An Analysis of Budgeted Expenditure on Education and Selected Educational Statistics (SES) published by Ministry of Human Resource and Development (MHRD), Sarva Shiksha Abhiyan (SSA) reports, District Information System for Education (DISE) published by National University for Educational Planning and Administration (NUEPA) and various reports of World Bank.

The second part of the study which looks into the transparency and accountability issues relies on primary data collected from head masters and teachers and resource persons in the sample districts.

1.9.1.1 Sample Design

Multistage sampling technique was adopted for the study. In the first stage three districts were selected purposively based on the utilization of funds from SSA.
Utilization of Funds (UF), which indicates the expenditure capacity of the district and it was calculated by the following formula

\[ UF = \frac{\text{expenditure}}{\text{allocation}} \times 100 \]

Based on this, three districts i.e, Udupi, Mysore and C. H. Nagar were selected for the study. All three districts represent highest utilization, medium utilization and least utilization.

In the second stage 100 per cent of the taluks were covered. In the third stage sample schools were selected from all the taluks in each sample district by random sampling. Four per cent of the schools in each taluk of Mysore and three per cent of the schools in all the taluks of Udupi and Chamarajanagara were selected randomly and out of which 50 per cent are from rural and 50 per cent from urban areas.

Primary data was collected with a pre-tested interview schedule. Separate schedule were prepared for the school level information and for individual teachers. School level information was collected from Head Master (HM) of the following aspects;

1. School level information about the available infrastructure
2. Teacher and student strength
3. Experience of HM
4. Flow of funds and delay
5. Composition of SDMC
6. Transparency and accountability in spending money
7. Perceptions of HM

Information from individual teachers was collected on

1. Sanctioning and utilization of funds from SSA
2. Perceptions about the quality of teaching
3. Perceptions about strategy adopted by SSA.
Table 1.1: Details of Sample Schools

<table>
<thead>
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<th>Districts</th>
<th>Taluks</th>
<th>Elementary Schools</th>
<th>Total</th>
<th>Schools selected</th>
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<td>Rural</td>
<td>Urban</td>
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<td>312</td>
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<td><strong>613</strong></td>
<td></td>
<td><strong>18</strong></td>
</tr>
</tbody>
</table>

**Number of sample schools selected for study** 3298 117

1.9.2 Analytical Tools

The Study used various statistical and mathematical tools for the analysis of data. The statistical tools are Average, Standard Deviation (SD), Co-efficient of Variation (CV), Compound Annual Growth Rate (CAGR), Correlation and Regression analysis.

Multiple regression models were used to identify the factors responsible for the regional disparities in the performance of the states in educational outcomes. The following models are specified.
\[
\ln (enrol_i) = \alpha + \beta_1 \ln(lit_i) + \beta_2 \ln(pov_i) + \beta_3 \ln(uf_i) + u_i \]  \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \ Quad
Scheme (EGS), Alternative and Innovative Education (AIE), teachers training, community training, innovative activities, expenditure on research and evaluation, State Institute of Education and Management and Training (SIEMAT), National Programme for Education of Girls at Elementary Level (NPEGEL), Kasturba Gandhi Balika Vidhyalaya (KGBY) and expenditure on remedial teaching.

**Category III = Management Cost** (management cost of state and district).

**Educational outcomes** are measured by

a) Enrolment  
b) Completion rate  
c) Gender Parity  
d) Learning achievement levels

**1.9.2.1 Analytical Method**

A common approach to measuring efficiency is based on the concept of the efficiency frontier. There are many techniques available to estimate the shape of the efficiency frontier. Most of the studies aimed at measuring efficiency are based on either parametric or non-parametric methods. The study followed two stage procedures to analyze the efficiency. At the first stage efficiency was estimated using DEA analysis. In the second stage Tobit regression model was used to find out the factors responsible for variation in productivity and technical efficiency.

**1.9.2.1.1 Data Envelopment Analysis (DEA)**

Based on non-parametric mathematical model this approach assumes a specific functional form of the relationship between input and output. A non-parametric approach constructs an efficiency frontier using input/output data for the whole sample following a mathematical programming method. The calculated frontier provides benchmark against which the efficiency performance can be judged.

In DEA consider \( p \) inputs and \( q \) outputs for \( n \) DMUs (states). \( y_i \) is the column vector of the outputs and \( x_i \) is the column vector of the inputs for \( i \)-th State. The \((p*n)\) input matrix is defined as \( X \) and \((q*n)\) output matrix is represented by \( Y \). The linear
programming model then assumes that for a given State (the DMU) maximize efficiency:

$$\begin{align*}
\text{Max} & \; \lambda, \delta_i \delta_i \\
\text{subject to} & \; \delta_i y_i \leq Y \lambda \\
& \; x_i \geq X \lambda \\
& \; n l' = 1 \\
& \; \lambda \geq 0 \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots (1)
\end{align*}$$

In problem (1), $\delta_i$ is a scalar satisfying $I \geq \delta_i$. It is the efficiency score that measure technical efficiency of the i-th unit as the distance to the efficiency frontier, the later being defined as a linear combination of best practice observations. With $1 > \delta_i$, the decision unit is inside the frontier (i.e. it is inefficient), while $1 = \delta_i$ implies that the decision unit is on the frontier (i.e. it is efficient).

The vector $\lambda$ is a $(n*1)$ vector of constants, which measures the weights used to compute the location of an inefficient DMU if it were to become efficient. The inefficient DMU would be projected on the production frontier as a linear combination of its peers using those weights. The peers are other DMUs that are more efficient and therefore used as references. $n'1$ is a n-dimensional vector of ones. The restriction $l'1 = \lambda n$ imposes convexity of the frontier, accounting for variable returns to scale. Dropping this restriction would amount to admit that returns to scale were constant.

The problem (1) has to be solved for each of the 'n' DMUs in order to obtain 'n' efficiency scores (Afonso and Aubyn, 2005)

**1.9.2.1.2 Non-Discretionary Inputs and the Tobit Two-Steps Procedure**

In the efficiency analysis at the first stage using DEA (as described above) only those variables that are direct inputs into the system and is provided by the DMU (State's education departments) are included. However, social sector outcomes do not depend on the provision of inputs alone. There are various other factors that come in the way of the attainment of outcomes. Especially in a country as heterogeneous as India, the household and individual factors, especially those relating to social, economic, cultural and political aspects do have some influence on the social sector
outcomes. These are nondiscretionary inputs and not really within the control of the activities of concerned departments.

Since the analysis of efficiency and non-efficiency using DEA methods do not take into account these influences, usually two-stage models are suggested and used to deal with such situations.

Let $z_i$ be a $(1 \times r)$ vector of non-discretionary outputs. In a typical two-stage approach, the following regression is estimated:

$\hat{\delta}_i = z_i \beta + \varepsilon_i$ \hspace{1cm} (2)

Where $\hat{\delta}_i$ is the efficiency score that resulted from stage one, i.e., from solving (1). $\beta$ is a $(r \times 1)$ vector of parameters to be estimated in step two associated with each considered non-discretionary input. The fact that $1 \geq \hat{\delta}_i$ has led many researchers to estimate (2) using censored regression techniques (Tobit), although others have used OLS (Afonso and Aubyn, 2005).

Figure 1 illustrates the basic idea behind a two-stage approach. In a simplified one output and one input DEA problem, A, B and C are found to be efficient, while D is an inefficient DMU. The output score for unit D equals $(d_1+d_2)/d_1$, and is higher than one. However, unit D inefficiency may be partly ascribed to a “harsh environment” – a number of disturbing environmental factors may imply that unit D produces less than the theoretical maximum, even if discretionary inputs are efficiently used. In our example, and if the environment for unit D was more favourable (e.g. similar to the sample average), then we would have observed $D_c$. In other words, unit D would have produced more and would be nearer the production possibility. The environment corrected output score would be $(d_1c+d_2c)/d_1c$, lower than $(d_1+d_2)/d_1$, and closer to unity.
1.10 Chapter Design

The study is presented in six chapters. The first chapter deals with introduction, objectives, hypotheses and methodology.

The Second chapter is devoted to the review of literature including both theoretical as well as empirical literature.

The Third Chapter highlights the trends and patterns of public financing of elementary education.

The Fourth chapter focuses on educational expenditure, educational outcomes and the determinant of interstate variation in educational outcomes.

The technical efficiency of various states is estimated and presented in fifth chapter

Transparency and accountability issues at the school level are discussed in the sixth chapter.

Seventh chapter provides summary of finding, conclusions and policy suggestions.