An Economic Study of Performance of Secondary and Higher Secondary Education in India

SYNOPSIS

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The system of Secondary and higher-secondary (H.S.) education have been recognized as the crucial stages of education due to its inevitable roles in forming the bridge towards higher education. In the view of the essentiality of this phase of education, the government of India initiated 'Rastriya Madhyamik Shiksha Abhiyan' scheme in 2009 with the objective of access and quality enhancement in this targeted stage of education. Additionally, the Secondary stage, taken as a whole, receives the second highest portion of the aggregated education expenditure, following the elementary education expenditure. Keeping these in mind, evaluating the performance of Secondary-stage and H.S. (also referred as Senior-Secondary) stage individually in the form of technical efficiency (TEF) analysis, seems to be fundamentally essential. Therefore, the question arises, whether Indian Secondary and H.S. stages of education are capable of generating the maximum extent of output with the given extent of input; or conversely, can these stages of education (individually) produce the given extent of output while utilizing the inputs at the 'minimum required' extent under a certain technology?

Accordingly, the present study wants to address this issue. In the present study, the efficiency analysis of Indian Secondary and H.S. stages of education is classified into two broader segments: one dealing with the state-level analysis of efficiency while segregating Indian states and union territories into two categories for the time span 2010-11 to 2015-16 based on secondary data; and the other dealing with the school-level analysis of efficiency based on primary survey data for the government and government-aided schools located in Kolkata for the year 2019-2020.

Considering the voids in the existing research relating to TEF analysis of school education, the present study attempts estimating TEF of Secondary and H.S. stages at Indian-state-level as well as at school-level using the data obtained from Secondary source (Unified District Information System for Education (UDISE)) and collected from primary source respectively. Further, the state-level analysis of TEF of Secondary and H.S. stages are conducted following separated perspective based approaches i.e. output oriented technical efficiency (TEF_{out}) and input oriented technical efficiency (TEF_{inp}) approaches. In contrast to the prevailing studies in Indian context, the state-level TEF analysis of Secondary and H.S. stages (following both TEF_{out} and TEF_{inp} approaches), are segregated for the two categories of states i.e. general category states (GCS) and special category states & union territories (SCS&UT). This classification of all Indian states and union territories (UT) into two groups is supported by the fact that these units are not operating under the homogenous fiscal as well as economic environments. In the succeeding segment, the school-level analysis of TEF relating to

Secondary and H.S. stages are performed individually following TEF_{out} and TEF_{inp} approaches. The state-level analysis segment of this study, is essential for identifying those GCS and SCS&UT, performing inefficiently. Further, the school-level analysis of TEF is also crucial for developing the idea of what percentage of schools are performing inefficiently in Secondary as well as H.S. education. Relevantly, for raising TEF of the bad performing units (school or Indian state here) at Secondary as well as H.S. stages of education, the policies are prescribed depending on the determinant analysis and following such policies the underachievers can also perform like the fully efficient units. Therefore, the present study sheds light on the elaborative analysis relating to TEF at Secondary and H.S. education and also discusses about policy formulation targeting the improvement in performances of the underachievers.

The exploration of literature indicates some voids in the existing studies dealing with estimation of TEF accompanied by determination of the affecting factors on TEF of Secondary and H.S. education in the Indian context.

Therefore, while mitigating the gaps, **the present study contributes to the literature** in the following direction. **First of all,** the present study contributes by estimating TEF, applying non-parametric data envelopment analysis (DEA) under variable returns to scale assumption, for each year and determining the affecting factors of the estimated TEF at Secondary and H.S. stages individually during the period 2010-11 to 2015-16 using Secondary-source data at Indian state-level, while constructing separated benchmark production frontiers for two distinguished state categories namely, GCS and SCS&UT, and accordingly conducting the separated TEF analysis for the two referenced state groups, as these two groups are not homogeneous. To be specific, the Indian states, considered as GCS are: Andhra Pradesh (AP), Bihar (BI), Chhattisgarh (CHHAT), Goa (GO), Gujarat (GUJ), Haryana (HAR), Jharkhand (JHAR), Karnataka (KAR), Kerala (KER), Madhya Pradesh (MP), Maharashtra (MH), Orissa (ORI) , Punjab (PN), Rajasthan (RAJ), Tamil Nadu (TN), Uttar Pradesh (UP) and West Bengal (WB), while the SCS&UT are: Andaman & Nicobar Islands (A&N), Arunachal Pradesh (ARU), Assam (AS), Chandigarh (CHAND), Dadra & Nagar Haveli (D&N), Daman & Diu (D&D), Delhi (DEL), Himachal Pradesh (HP), Jammu & Kashmir (J&K), Lakshadweep (LAKH), Manipur (MAN), Meghalaya (MEGH), Mizoram (MIZO), Nagaland (NG), Puducherry (PUD), Sikkim (SIK), Tripura (TP) and Uttarakhand (UK). This segment of the study (i.e. the state-level analysis), is conducted on the basis of the data obtained from State Report Cards, UDISE. Prevailing study on TEF evaluation of Secondary and H.S. education has not attempted the separate (TEF) analysis for the two distinguished categories of Indian

states (& union territories). Additionally, comparison of TEF across time in this sector is also found to be very scanty. Notably, TEF is estimated, in the present study, from different perspectives, referred to as TEF_{out} and TEF_{inp}. The measure of TEF_{out} helps to point out whether any state as a decision making unit (DMU) becomes capable of attaining the maximum producible extent of output with the given extent of input usage or not (under a certain technology) in production of Secondary and H.S. education and also represents the extent of output that is possible to expand without expanding the extent of input usage. From another perspective, the measure of TEF_{inp} recognizes whether any state becomes capable of producing the given extent of output using the minimum required extent of input or not in production of Secondary and H.S. education and also represents the extent of input usage that is possible to reduce without reducing the extent of output. As guided by the literature, the estimation of TEF rests on the production relation between output and input variables. Relevantly, it is essential to point out the following deviations of education production function from the conventional micro-economic idea: (1) the output of education sector is intangible. Therefore, representation of output by appropriate measures is essentially required; and in the state-level analysis segment of the present study, as output variables (i) Retention rate and (ii) Passing Percentage of students are included. The output, revealing 'passing percentage of students' stands for the quality aspect. However, other than these outputs, several alternative compatible outputs can also be taken into account. Likewise, the inputs, included for state-level analysis are: (i) Number of schools for each lakh of population (referred as input 1), (ii) Teacher-student ratio (referred as input 2), (iii) Classroom-pupil ratio (referred as input 3) and (iv) Percentage of teachers qualifying post-graduation or higher degree (referred as input 4). The quality aspect of input is incorporated while including 'qualification of the teacher'. Contextually, the included output and input variables in the school-level analysis segment of the present study should be pointed out. The output variables, included for analyzing TEF of Secondary-stage of the schools are: (i) Highest score obtained in board examination, (ii) Percentage of students scoring first division marks, (iii) Average scores obtained in language group, (iv) Average scores obtained in mathematics, (v) Average scores obtained in science group. Since most of the surveyed schools for the school-level analysis have not introduced commerce as a stream, the Science and Arts streams are taken together for considering and analyzing the TEF aspect in the overall sense for the H.S. stage at the school level. The output variables, included for analyzing TEF of H.S. stage of the schools are: (i) Highest score obtained in (H.S. level) board examination, (ii) Percentage of students scoring first division marks, (iii) Average scores obtained in Language group, (iv) Average scores obtained in Mathematics, (v) Average scores

obtained in Science group and (vi) Average scores obtained in Arts group. For the school-level analysis of the present study, the included input variables are: (i) Classroom-pupil ratio, (ii) Teacher-student ratio, (iii) Percentage of teachers qualifying master's or higher degree and (iv) Per student monthly expenditure incurred by the school. Revisiting the aspect of deviation of education production function (from the standard), it is relevant to state that in the education production process, prices of output and inputs are absent and hence shadow prices have to be derived. Following the estimation of TEF, in the subsequent stage, while performing the regression for the Secondary dataset based determinant analysis of TEF in the present study, the infrastructural variables relating to schools, policy indicator, social indicators and macro indicator are taken into account for identifying the affecting factors of TEF of Secondary and H.S. education at the state-level.

Thus, the **second** contribution of the present study towards the literature is examining the individual influence of each explanatory variable included in the determinant analysis on TEF instead of forming the composite index for every broad category of indicators which was executed in earlier studies. Notably, in order to design the specific policy for enhancing the level of TEF, individually identifying the affecting factors is crucial.

Thirdly, addressing the literature gap relating to TEF analysis at school-level in the Indian context, a segment of the present thesis estimates TEF of Secondary and H.S. stages of the schools based on primary survey data, collected following stratified random sampling method from twenty five government-aided and government schools located in Kolkata for 2019-2020 and also determines the affecting factors of resulting TEF scores at both the stages of school education.

Fourthly, while collecting the data it is noted that the majority of the students depend on the private educational assistance (outside the school), leading the TEF score attainment of the schools at the respective educational stage, upwardly inflated; therefore, the present study obtained that extent of TEF variation in these schools which is not explained by private educational assistance. Since the exploration of such an extent has not been attempted in the earlier studies (to the best of our knowledge), the estimation of the extent of TEF variation that is not explained by private educational assistance is a substantial contribution towards the literature.

Fifthly, another contribution of the present study is derived from mitigating the gaps in the prevailing literature, relating to the extensive determinant analysis of TEF (of Secondary and

H.S. stages) at school-level in Indian context, using primary survey data, specifically incorporating the individual factors under all the following aspects: (a) Percentage of students receiving private educational assistance; (b) Government policy; (c) Teacher's Characteristics; (d) School characteristics; (e) Socio-economic condition of the child; (f) School managerial role of Head of the school (HM); (g) Characteristics of the head of the school; (h) Student's opinion regarding school attributes.

Sixthly, as the West-Bengal government has introduced 'Kanyashree Prakalpa' for encouraging schooling of teenage girls under the age of eighteen years, the present study examined the influence of this kind of a policy on TEF attainment of the school and contributes to literature following this direction.

Based on the state-level analysis segment of the present thesis, some specific policies are prescribed for raising (i) TEF_{out} and (ii) TEF_{inp} at (a) Secondary and (b) H.S. stages of education for GCS and SCS&UT separately. Likewise, depending on the school-level analysis segment of the present thesis, the specific policies are formulated for boosting (i) TEF_{out} and (ii) TEF_{inp} of (a) Secondary and (b) H.S. stages at school-level. Finally, in view of the whole analysis, some common policies are tried to suggest for improving TEF (1) at state-level and also (2) at school-level for the sample schools under the study.

Paying attention to the preceding research questions, the analysis of the present thesis is performed and the major findings are documented.

Major Findings

The important findings of the thesis are noted below:

Findings on State-Level Analysis

In the state-level analysis segment of the present thesis, TEF_{out} and TEF_{inp} are measured for a specific level of education (either Secondary or H.S.) separately for GCS and SCS&UT for each specific year considered under the study i.e. 2010-11 to 2015-16; and the mean TEF_{out} score and mean TEF_{inp} score for each GCS and each SCS&UT is calculated over the reference period individually for Secondary and H.S. stages of education. The grand average of TEF_{out} measure as well as TEF_{inp} measure are obtained, for Secondary and H.S. levels separately, by calculating the average over (i) the whole of GCS taking into account all the six years and (ii) the whole of SCS&UT accounting all six years. The calculated grand average figures are used

for observing the TEF_{out} and TEF_{inp} performances in an overall sense for GCS and SCS&UT relating to the Secondary and H.S. stages of education.

Findings on TEF_{out}: State-Level Analysis

Relating to both Secondary and H.S. levels of education, the findings of TEF_{out} estimates indicate that all GCS and SCS&UT are not perfectly efficient and the extent of TEF_{out} variation across the GCS group and the SCS&UT group are also evident.

Concerning the Secondary-level, the grand average TEF_{out} score is observed as better for the GCS group in comparison to the SCS&UT group.

Particularly, focusing on the **Secondary-level** (for TEF_{out} estimate) following observations can be made:

A. **Throughout efficient or inefficient States/UT**

(i) **Throughout efficiently performing GCS over the sample time** duration are KER, MH, GO, WB, BI and JHAR.

(ii) **Throughout inefficiently performing GCS** are MP and RAJ.

(iii) Considering SCS&UT, over the referenced time period, **the SCS&UT, appearing as throughout efficient** are DEL, LAKH, D&N, AS and TP.

(iv) **Throughout inefficient SCS&UT** are J&K and PUD.

B. **The states /UT for which efficiency has increased**

(i) In the GCS group, during the course of the years **TEF_{out} scores have improved for** RAJ and KAR.

(ii) In the SCS&UT group, TEF_{out} scores have **improved** for ARU, MEGH and PUD.

C. **The states /UT for which efficiency has decreased**

For GCS group, **TEF_{out} scores deteriorated f**or MP, PN, GUJ, HAR and CHHAT from the initial level of efficiency.

D. **The states /UT which turned efficient to inefficient**

(i) AP, PN and CHHAT **initially started as efficiently performing** GCS, but across-time **transformed into inefficient** units.

(ii) On the other hand, in the SCS&UT group, MAN and D&D **initially started as efficiently** performing units, but **across-time changed into inefficient** units.

E. **The states /UT which turned inefficient to efficient**

Considering SCS&UT group, NG and ARU remained **inefficient at the initial year** and **subsequently attained efficiency**.

In accordance with the findings of H.S. level, it is noted that the grand average TEF_{out} score for GCS has been higher in relation to SCS&UT.

Particularly, focusing on the **H.S. level** (for TEF_{out} estimate) following observations can be made:

A. **Throughout efficient or inefficient States/UT**

(i) **Throughout efficiently performing GCS** over the specified time frame are KER, ORI, UP, JHAR, MH and BI.

(ii) **All over inefficient remaining GCS** are MP, CHHAT, PN and HAR.

(iii) Over the referenced time interval, the **SCS&UT, appearing as throughout efficient** are: ARU, DEL, AS, MAN, D&N, UK, NG, PUD.

(iv) **Throughout inefficient SCS** is observed as TP.

B. **The states /UT for which efficiency has increased**

(i) In the GCS group, during the referenced years, **TEF_{out} scores have expanded** for GUJ, GO and KAR.

(ii) In the SCS&UT group, TEF_{out} scores have **improved** for J&K and TP.

C. **The states /UT for which efficiency has decreased**

(i) For GCS group, TEF_{out} scores **deteriorated** for WB, HAR, TN, PN, CHHAT and MP.

(ii) For SCS&UT group, TEF_{out} scores **worsen** for MEGH, D&D and A&N.

D. **The states /UT which turned efficient to inefficient**

(i) TN and WB initially **started as efficiently performing GCS**, but in **the subsequent years performed inefficiently.**

(ii) Considering SCS&UT group, it becomes evident that MEGH, A&N, SIK and D&D **initially started as efficiently performing units**, but **across-time deteriorated to inefficiently performing units.**

E. **The states /UT which turned inefficient to efficient**

In the GCS group, KAR and GUJ **attained TEF_{out} in the later years though being inefficient initially.**

Comparing TEF_{out} of Secondary-level with that of the H.S. level reflects the following facts: The GCS, achieving perfect TEF_{out} across all years under observation at both Secondary and H.S. levels are KER, JHAR, MH, BI; while WB, GO appeared as efficient throughout the time span exclusively at Secondary-level and ORI, UP exclusively at H.S. level. Likewise, the SCS&UT, achieving perfect TEF_{out} throughout at both the levels are AS, D&N, DEL while LAKH, TP reflect TEF_{out} throughout exclusively at Secondary-level and NG, PUD, UK, MAN, ARU exclusively at H.S. level. Additionally, the GCS, appearing as inefficient across all years at both Secondary and H.S. levels is MP while RAJ remains inefficient throughout only at Secondary-level and PN, CHHAT, HAR only at H.S. level. The SCS&UT, becoming inefficient throughout at Secondary level are PUD, J&K while at H.S. level is TP. Further, the GCS, deteriorated to inefficient, from the perfect efficiency at Secondary-level are CHHAT, AP, PN while at H.S. level are TN,WB. Similarly, the SCS&UT changing to inefficient, from efficient at both Secondary and H.S. levels is D&D, while MAN reflects this same pattern of TEF_{out} deterioration exclusively at Secondary-level and A&N, SIK, MEGH exclusively at H.S. level. The GCS, transformed from inefficient to efficient, within the referenced time duration, are KAR and GUJ at H.S. level while at Secondary-level, this same pattern of TEF_{out} change is reflected by the SCS&UT like, NG and ARU.

While conducting the determinant analysis of TEF_{out} of Secondary-level, it is noticed that TEF_{out} ,for GCS is significantly determined by social indicator, policy variable, the general environment of the state revealing macro indicator, in addition to, infrastructure indicating

factors, and for SCS&UT, is significantly affected by infrastructure specifying indicators, social indicator, in addition to, the policy indicator.

In particular in GCS, TEF_{out} of Secondary-level is observed to be positively impacted by government education expenditure, proportion of girls' enrolment to boys', per capita net state domestic product, proportion of para teachers, implying that an increase in government expenditure in education, girls' enrolment to boys', per capita net state domestic product, proportion of para teachers can increase the level of TEF_{out}.

Similarly, TEF_{out} is negatively impacted by the lack of school infrastructure reflecting variable 'percentage of schools without building' in GCS. This necessitates improvement in school infrastructure as revealed by formation of school building for the required school.

On the other hand, in SCS&UT, TEF_{out} of Secondary education is observed to be positively influenced by the proportion of girls' to boys' enrolment, percentage of Scheduled Tribe enrolment, government expenditure on education, implying increase in enrolment of girls in relation to boys, increase in Scheduled Tribe (ST) enrolment and improving government expenditure in education may enhance TEF_{out}.

Conversely, for SCS&UT, TEF_{out} is negatively influenced by insufficient infrastructure denoting variables like, percentage of "bad" condition classrooms, proportion of schools with single teacher, percentage of schools with absence of drinking water facility and percentage of schools with absence of electricity, suggesting that improvement in condition of the classroom, increase in number of teachers, provision of safe drinking water and electricity may foster the level of TEF_{out}.

Moving towards the determinant analysis of TEF_{out} of H.S. level, in GCS the evidence of government education expenditure, proportion of para teachers, proportion of girls' to boys' enrolment impacting positively is observed, implying that the increase in government expenditures in education, proportion of para teachers, girls enrolment to boys may have a favourable effect on TEF_{out}.

Similarly, for H.S. level and in GCS, 'percentage of schools without building' and 'percentage of schools without girls' toilet' are impacting negatively on TEF_{out} score. These negatively impacting variables are actually revealing the fact that the lack of infrastructural conditions prevailing in the school are being detrimental to the efficiency performance.

Dealing with the SCS&UT group for H.S. level, it is observed that the factors which are positively determining TEF_{out} scores are percentage of scheduled caste (SC) enrolment, percentage of scheduled tribe enrolment and proportion of female to male teachers, supporting that increase in percentage of SC and ST enrolment, proportion of female to male teachers can boost up TEF_{out}.

Similarly, for SCS&UT the negatively determining factor is 'proportion of schools with single classroom', suggesting that increase in number of classroom can increase TEF_{out}.

Additionally, a crucial finding reveals that for SCS&UT group and for H.S. level, there exists a threshold level after which the positive effect of government education expenditure on $TEF_{out.}$ is felt and the sample value of the government expenditure on education is below that of the threshold level. Thus, the government should prioritize more on increasing expenditure on education for experiencing the favourable influence of government education expenditure on TEF_{out} score corresponding to H.S. level.

Our analysis also supports some common determinants for $TEF_{out.}$ for Secondary and H.S. levels. Dealing with the GCS, it is observed that percentage of schools without building, proportion of girls' to boys' enrolment, proportion of para teachers and government expenditure on education appear as the common determinants of TEF_{out} at both Secondary and H.S. levels of education, out of which 'percentage of schools without building' is adversely while the other three are favourably determining TEF_{out} at both the levels. Likewise, in SCS&UT, the evidence of 'percentage of scheduled tribe enrolment' influencing TEF_{out} positively at both Secondary and H.S. levels is observed and also empirically found that government expenditure on education imparting positive impact on TEF_{out} relating to both the education levels.

Other than such common determinants, in GCS, 'per capita net state domestic product' with positive sign influences TEF_{out} exclusively at Secondary-level and 'percentage of schools without girls' toilet' with negative sign influences TEF_{out} solely at H.S. level. Further, in SCS&UT, percentage of bad condition classrooms, proportion of single teacher schools, percentage of schools with absence of drinking water facility and percentage of schools without electricity affect TEF_{out} adversely specifically at Secondary-level while percentage of scheduled caste enrolment and proportion of female to male teachers affect TEF_{out} favourably at H.S. level. For this category of states, empirically the negative influence of 'proportion of single classroom schools' on TEF_{out} of H.S. level is also found.

Findings on TEF_{inp} : State-Level Analysis

In line with the results of both Secondary and H.S. education related analysis, it is noticed that TEF_{inp} scores are not the same within & between 'GCS' and 'SCS&UT' corresponding to a specific level of education. Further, not all GCS as well as not all SCS&UT achieve full TEF_{inp} for each of the years taken under consideration (i.e. 2010-11 to 2015-16).

Exploring the Secondary-level, the grand average TEF_{inp} score is observed as better for the GCS group in comparison to the SCS&UT group.

Specifically, focusing on the **Secondary-level** (for TEF_{inp} estimate) following observations can be made:

A. **Throughout efficient or inefficient States/UT**

(i) For GCS, it is found that **over the specified time duration, TEF_{inp} score equal to unity is continuously achieved** by GO, MH, KER, JHAR, BI, WB and ORI.

(ii) In GCS, a **continuous input oriented technical inefficiency** is experienced by MP and RAJ.

(iii) Considering SCS&UT, **TEF_{inp} is observed to be consistently achieved** by AS, TP, LAKH, DEL and D&N during the time span.

(iv) In SCS&UT group, **input oriented technical inefficiency is consistently experienced** by J&K and PUD.

B. **The states /UT for which efficiency has increased**

(i) Considering GCS, **a growing pattern of TEF_{inp} score** is reflected by KAR, MP and GUJ referring to the initial TEF_{inp}.

(ii) Considering SCS&UT, PUD, ARU, MEGH and NG **reflect a rising pattern of TEF_{inp}** in comparison to the initial TEF_{inp} score.

C. **The states /UT for which efficiency has decreased**

(i) In GCS group, CHHAT, PN and AP reflect a **deteriorating pattern of TEF_{inp}**.

(ii) In SCS&UT group, MAN, D&D and J&K reflect a **diminishing pattern of TEF_{inp},** though J&K shows recovery in the midway.

D. **The states /UT which turned efficient to inefficient**

(i) In the GCS group, CHHAT, AP and PN proved **input efficiency at the beginning, but afterwards became inefficient**.

(ii) Likewise, in SCS&UT group, D&D, MAN and MIZO, reflected **TEF_{inp} at the beginning and these states became inefficient later.**

E. **The states /UT which turned inefficient to efficient**

ARU and NG appeared as **inefficient states at the start but across-time these SCS&UT gained perfect TEF_{inp}.**

According to the findings of H.S. level, the grand average TEF_{inp} score is observed as better for the GCS group as compared to the SCS&UT group.

Referring to the **H.S. level** (for TEF_{inp} estimate)**,** following observations can be made:

A. **Throughout efficient or inefficient States/UT**

(i) For GCS group, it is observed that the **perfect TEF_{inp} is continuously achieved** by KER, BI, MH, JHAR, UP and ORI during all the years of the study.

(ii) **Throughout inefficiency is observed** for the GCS like, PN, HAR and CHHAT.

(iii) As SCS&UT, **TEF_{inp} is consistently achieved** by DEL, ARU, MAN, AS, MEGH, PUD, D&N and NG during the course of the time.

(iv) In SCS&UT group, **input inefficiency is consistently shown** by TP.

B. **The states /UT for which efficiency has increased**

(i) In GCS group, KAR, GO, GUJ and CHHAT reflect a **rising pattern of TEF_{inp} score.**

(ii) In SCS&UT group, J&K **indicates an improving pattern** of TEF_{inp} in comparison to the TEF_{inp} score at the initial time point. Similarly, at the terminal year TEF_{inp} of TP improved than its initial value.

C. **The states /UT for which efficiency has decreased**

(i) Considering GCS, TN, PN, WB, HAR and MP reflect a **falling pattern of TEF_{inp}** in the view of initial TEF_{inp} score.

(ii) Considering SCS&UT, SIK, D&D and A&N indicate a **reducing pattern of TEF_{inp},** though D&D and SIK exhibit recovery in the midway.

D. **The states /UT which turned efficient to inefficient**

(i) Considering GCS, TN and WB proved **input efficiency at the beginning, but became inefficient afterwards.**

(ii) In the SCS&UT group, A&N, SIK and D&D reflected **input efficiency at the start but have undergone inefficiency later.**

E. **The states /UT which turned inefficient to efficient**

In the GCS group, KAR and GUJ **appeared as inefficient states at the start, but gained perfect efficiency (TEF_{inp}) across-time.**

Comparing TEF_{inp} results of Secondary-level with that of the H.S. level indicates some observations: In the GCS group, throughout the whole period, the states achieved perfect TEF_{inp} at both Secondary and H.S. levels are KER, MH,ORI, BI, JHAR; whereas WB, GO achieved throughout full TEF_{inp} exclusively at Secondary-level, and UP achieved throughout TEF_{inp} exclusively at H.S. level. On the other hand, in the SCS&UT group, perfect TEF_{inp} throughout the span of the years is achieved by DEL, D&N, AS at both Secondary and H.S. levels; while throughout full TEF_{inp} specifically at Secondary-level is achieved by LAKH, TP; and solely at H.S. level the same is achieved by ARU, MAN, MEGH, PUD, NG. Again, the GCS appeared to be inefficient throughout at Secondary-level are MP and RAJ and at H.S. level are PN, CHHAT, HAR. Similarly, the SCS&UT becoming input inefficient throughout at Secondary-level are J&K, PUD and at H.S. level is TP. In addition to this, though starting with perfect TEF_{inp} ,the GCS which transformed over the time interval as inefficient at Secondary-level are CHHAT, AP, PN and at H.S. level are TN,WB. The SCS&UT that transformed to inefficient, from perfect TEF_{inp} during the years under observation only at Secondary level are MAN, MIZO and only at H.S. level are A&N, SIK; while considering both the Secondary and H.S. levels, this deterioration is reflected by D&D. Considering the referenced time interval, inefficient to efficient transforming GCS at H.S. level are KAR and GUJ; though at the Secondary-level such type of transformation is not observed for any GCS. Again, the SCS&UT that are transforming from inefficient to efficient over the referenced years at Secondary-level are NG and ARU, though such a transformation has not been noticed for any SCS&UT concerning the H.S. level.

Considering the determinant analysis of the Secondary education, it is found that the level of TEF_{inp}, for GCS is significantly determined by social indicator, policy variable, the general environment of the state revealing macro indicator, in addition to, infrastructure indicating factors, and for SCS&UT, is significantly affected by infrastructure specifying indicators, social indicator, in addition to, the policy indicator.

Referring to the GCS, it is particularly observed for Secondary-level that in the infrastructural aspect, 'percentage of schools without building' turns into a significant variable reflecting a negative sign while 'proportion of para teachers' turns into a significant variable reflecting a positive sign in determining TEF_{inp}, implying that increase in proportion of para teachers in the school and formation of school building can boost up TEF_{inp}.

Additionally, 'proportion of girls' to boys' enrolment', as a social indicator, affects TEF_{inp} significantly and positively which is an indication of the fact that improving the girls' to boys' proportion at Secondary education system in GCS, will actually improve TEF_{inp}, i.e., more social inclusions of the girls to the formal education system will in turn promote TEF_{inp}. Also, 'government expenditure on education' being a policy indicator and 'per capita net state domestic product' being a macro indicator, positively impacts on TEF_{inp} of Secondary-stage in GCS.

Referring to 'SCS&UT', TEF_{inp} at the Secondary-level is explicated by the prominent roles of poor school infrastructure specifying indicators like, 'percentage of schools with absence of drinking water facility', 'proportion of single teacher schools', 'percentage of bad condition classrooms' and 'percentage of schools without electricity' which are significantly and negatively impacting TEF_{inp} of the Secondary-level, though among these variables 'percentage of bad condition classrooms' is less significant, implying the improvement in drinking water conditions, increase in number of teachers, betterment in the condition of classrooms, provision of electricity in the school can improve the situation of TEF_{inp}.

Also, in 'SCS&UT', a higher value of 'proportion of para teachers' and 'government education expenditure' as school infrastructure variable and policy variable, respectively, improves TEF_{inp} at Secondary-stage. 'Percentage of scheduled tribe enrolment' being a social indicator, has positive and significant impact on TEF_{inp} of Secondary-level in SCS&UT, because of the tribal population dominance in these areas.

In connection with H.S. education, the findings for GCS demonstrates the prominent roles of policy, infrastructural and social factors in determination of TEF_{inp}, and for SCS&UT, essential roles of the policy, infrastructural and social indicators while determining TEF_{inp} are found.

For example, in relation to H.S. education, the results for states in the 'general category' indicate that on the infrastructural ground, 'proportion of para teachers' imparts a positive effect, supporting that the increase in the proportion of para teacher can boost up TEF_{inp}. Additionally, in the GCS, 'proportion of girls' to boys' enrolment' and 'government expenditure on education' referring to the social and policy aspect, respectively, influence TEF_{inp} of H.S. education significantly and positively, implying that improving government education expenditure and girls' enrolment, i.e., more social inclusions of the girls to the formal education system may in turn promote TEF_{inp}.

At the same time, for GCS, 'percentage of schools with absence of computer & internet connection', 'percentage of schools without building', 'percentage of schools without girls' toilet', individually imparts a negative effect on TEF_{inp} of H.S. level, supporting the provision of computer and internet facility, constructing school buildings and girls' toilet in school premises can enhance TEF_{inp}. However, less significance is found for 'percentage of schools without computer and internet connection' in the infrastructural determinant category.

On the other hand, the results of the determinants of TEF_{inp} for H.S. level considering SCS&UT demonstrates that as an infrastructure indicating factor, 'percentage of schools without building' appears in a negative role implying that constructing school building may improve the scenario of TEF_{inp}; while 'proportion of para teachers' appearing in a positively significant role indicating that increasing para-teachers proportion can boost up TEF_{inp}. However, 'percentage of schools without building' is noted as a less significant determinant.

In SCS&UT group, 'proportion of female to male teachers' and 'proportion of girls' to boys' enrolment', in the social factor aspect, are individually depicting a positive effect in the determination of TEF_{inp} of H.S. level, suggesting that increasing proportion of female to male teacher, i,e., increasing employability of female teachers and improving girls enrolment to boys, i.e., bringing more girls to the formal education system may promote TEF_{inp}. On the ground of policy, the coefficient of 'government expenditure on education' being negatively significant and the coefficient of its square term being positively significant, specifies the existing non-linear U-shaped relationship between TEF_{inp} of H.S. level and 'government expenditure on education' in SCS&UT, revealing that after a specific minimum level referred

to as the 'threshold level' of 'education expenditure incurred by government' (for the state), TEF_{inp} increases with increase in government expenditure on education. However, the sample mean of government expenditure on education is less than the minimum value of 'government expenditure on education' required for indicating increasing TEF_{inp} of H.S. i.e., the minimum required level has not been achieved yet for the present sample of SCS&UT. Consequently, for obtaining the positive effect of 'government expenditure on education' on TEF_{inp} of H.S. level, the government should prioritize raising educational expenses in SCS&UT.

The comparison of the findings of determinant analysis of TEF_{inp} between Secondary-level and H.S. level suggests: For the GCS group, it is observed that percentage of schools without building, government expenditure on education, proportion of girls' to boys' enrolment and proportion of para teachers are the common determinants of TEF_{inp} of both Secondary and H.S. levels of education. Among these common determinants, other than the poor-infrastructure variable 'percentage of schools without building', all are positively determining TEF_{inp}. With reference to the SCS&UT group, it is noticed that proportion of para teachers positively determines TEF_{inp} at both Secondary and H.S. levels. Besides, government expenditure on education can also impart a positive impact on TEF_{inp} at both the levels.

Apart from the stated common determinants of TEF_{inp}, in GCS some specific to the level of education determinants have been pointed out; like, 'per capita net state domestic product' with positive sign specifically at Secondary-level and 'percentage of schools without girls' toilet', percentage of schools without computer and internet connection' with negative sign exclusively at H.S. level influences TEF_{inp}. In SCS&UT, percentage of classrooms in bad condition, proportion of single teacher schools, percentage of schools with absence of drinking water facility and percentage of schools without electricity influence TEF_{inp} negatively and 'percentage of scheduled tribe enrolment' influences TEF_{inp} positively specifically at Secondary-level while the negative influence of percentage of schools without building and the positive influences of proportion of female to male teachers and proportion of girls' to boys' enrolment are evident on TEF_{inp} of particularly H.S. level of education.

Relevantly, the extent of inefficient use of various inputs, in the 'Secondary' and 'H.S.' education production should also be brought to attention. Using the combined figures of radial and slack movements, inefficient use of various inputs of Secondary and H.S. level are analyzed for 'GCS' and 'SCS&UT' individually. The result, referring to the 'GCS' group for Secondary-level, reveals that the average inefficiency is found to be greatest for input 1 i.e.

'number of Secondary schools per-lakh-population' (11.87%), followed by input 2 or 'teacher-student ratio' (9.32 %) and input 3 or 'classroom-pupil ratio'(9.21 %) respectively; and it is lowest for the input 4 i.e. **'**percentage of teachers qualifying master's or higher degree' (8.16 %).

On the other hand, referring to 'SCS&UT', assessment of inefficient utilization of various inputs considering Secondary-level reflects that the average inefficiency is greatest for the input 1 (15.16%), followed by input 2 (10.62%) and input 3 (9.12%) respectively; and it is observed as the lowest for input 4 (7.72%). In addition to this, for 'H.S.' stage of education, using again the respective combined estimates, the performances of various inputs are analyzed for 'GCS' as well as 'SCS&UT'; and the result for 'GCS' reveals that the average inefficiency is reflected as the maximum for input 1 i.e. 'number of H.S. schools per-lakh-population' (18.23%), followed by the input 3 (18.09%) and input 2 (14.50%) respectively, and the lowest is noted for input 4 (8.87%); while the result for 'SCS&UT' group confirms that the average inefficiency is greatest for input 2 (19.55%), followed by input 3 (17.59%) and input 1 (15.15%), and is lowest for input 4 (11.99%) respectively. In both the state categories (i.e. GCS and SCS&UT), these observations on input inefficient-utilization reflect that producing the given extent of output, both at the Secondary-level as well as at the H.S. level, is possible utilizing the lesser extent of inputs (corresponding to the specific level of education) with better utilization.

Findings on School-Level Analysis

In order to mitigate the gap in the prevailing literature relating to the school-level analysis of TEF at Secondary and H.S. levels in Indian context, one segment of the present study attempts filling such a void based on the data, collected through primary survey following stratified random sampling method from twenty five Kolkata based government-aided and government schools. Relevantly, the data was collected by conducting (i) school survey and (ii) student survey from each surveyed school. Based on the school survey data, TEF_{out} and TEF_{inp} scores are measured employing DEA whereas utilizing both the school survey data as well as the student survey data, the determinant analysis of TEF_{out} and TEF_{inp} are performed (individually). For Secondary and H.S. levels, as the observations of the sample schools separately suggest that the major proportion of the students availing private tuition may possibly inflate TEF_{out} and TEF_{inp} scores of these schools for the concerned levels of education, thus, in the case of Secondary-stage and also for H.S. stage, the concern is what happens to

TEF_{out} and TEF_{inp} measures in the absence of the contribution of private tuition. In order to address this issue, the present thesis follows several steps, individually for the two stages of school education, where, as a primary step TEF_{out} score (or TEF_{inp} score, in case of the input conservation perspective based analysis) is explained in terms of the 'percentage of students opting for private tuition' and the set of other determining variables. As 'percentage of students taking private tuition' itself can in turn be determined by several other factors of the system, the determinants of this 'private tuition' variable and consequently 'estimated percentage of private tuition taking students' is also obtained for both the school education levels.

Since one of the objectives of the thesis is to find out the variation of TEF_{out} (or TEF_{inp}) not accounted by the students taking private tuition, in case of both Secondary-level and H.S. level analysis, TEF_{out} (or TEF_{inp}) is regressed on 'estimated percentage of private tuition taking students' for obtaining the residual series which reflects that measure of TEF_{out} (or TEF_{inp}) variation which remains unexplained by 'private tuition' variable for the specific level of school-education. Such empirical results are expected to reflect the real scenario of the performances of Secondary and H.S. stages of education at school-level.

Findings on TEF_{out} : School-Level Analysis

The findings on TEF_{out} reveal that 52% sample schools are inefficient considering Secondary-stage while 56% sample schools are inefficient referring to H.S. stage of education, indicating that these schools are capable of producing more output utilizing the same extent of existing inputs. Variation of TEF_{out} scores among different schools is observed for both of the school education levels.

However, for capturing the real scenario of TEF_{out} attainment by the schools at both Secondary-level and H.S. level excluding the upwardly inflating impact of 'private tuition' variable, this segment of the present study obtains the extent of TEF_{out} variation that is not explained by 'percentage of students taking private tuition'. The result reveals that, as 'percentage of students taking private tuition' explains major part of variation in TEF_{out} for Secondary-stage as well as for H.S. stage, therefore, the remaining part of variation, which is not explained by 'private tuition' variable, is very less; for Secondary-level of schools it ranges from 1.5% to 23.8% with the average value 8.28% while for H.S. level of schools it ranges between 0.40% and 8.64% with the average value 3.72%. This result, in absence of the role of private tuition, is in fact an indication of very low TEF_{out} score attainment by the schools at both of the education levels.

Such important findings are implied by the fact that 'percentage of students taking private tuition' (at the respective level of school education) plays a pivotal role in determining TEF_{out} level of schools for the respective stage (i.e. Secondary-stage or H.S. stage), representing high statistical significance with a positive sign. Other than this key determinant, TEF_{out} can be explained in terms of several other affecting factors in case of both Secondary-stage and H.S. stage of school.

The determinants of TEF_{out} considering Secondary-stage of the schools are the following:

(i) HM's school managerial role reflecting variable, 'while taking a decision whether HM interacts with teachers and students' as well as an interaction variable between 'while taking a decision whether HM interacts with teachers and students' and 'interaction frequency of HM with State Education Department' are favourably and significantly impacting TEF_{out} score for Secondary-stage of the schools, representing the favourable school managerial role of HM in promoting TEF_{out} at Secondary-level. The significance of the interaction variable indicates that given the value of one variable, TEF_{out} level of the school is dependent on the other variable and vice versa (implying the crucial roles of both of these factors). (ii) HM's experience adversely influences the TEF_{out} score of the school for Secondary-level, expressing that the schools operated by junior HM will achieve greater TEF_{out} than the schools operated by senior HM. (iii) Full-time teacher's service experience adversely influences TEF_{out}, revealing that the schools functioning with comparatively junior full-time-teachers, attain greater TEF_{out} at Secondary-level. (iv) School infrastructure and administration defining variables, 'number of smart classroom' and 'whether librarian of the school is present on duty' are favourably and significantly affecting TEF_{out} scores of Secondary-level of schools, depicting that (a) the schools with higher number of smart classrooms will obtain greater TEF_{out} and (b) the schools with librarian's presence on duty will obtain more TEF_{out} at Secondary-level in comparison to the schools operating without on duty presence of librarian. (v) Policy variable, 'amount of government fund received by the school, excluding the salary payment of non-teaching and teaching staffs' positively determines TEF_{out} score of the school relating to the Secondary-level, indicating that higher level of government funding improves TEF_{out} score attainment of the school. Another policy variable, 'proportion of students receiving Kanyashree' depicts an inverted U-shaped nonlinear relationship with TEF_{out} of Secondary-level, confirming the initial increase in TEF_{out} score with an increase in 'Kanyashree' variable until reaching a threshold limit which onwards TEF_{out} decreases with the rise in 'proportion of students receiving Kanyashree'. Specifically, the marginal effect of 'proportion of students receiving Kanyashree'

variable turning positive at the average level of this variable for the present sample, reflecting that by raising the proportion of students receiving Kanyashree, TEF_{out} of Secondary-level can be raised for the present case. The average value of 'Kanyashree' variable becoming lesser than the threshold-level value basically ensures such a result of positive marginal effect. (vi) Characteristics of school, composition of students and characteristics of students defining variables: (a) 'Class size' is favourably and significantly influencing TEF_{out} of Secondary-level of schools, supporting TEF_{out} enhancing role of larger class size at Secondary-level education, (b) 'Reserved category student's proportion' positively impacts on TEF_{out} , pointing out the favourable role of government's social inclusion policy practice in enhancing TEF_{out}, (c) 'Percentage of students possessing text books at home' as a 'student characteristics' defining variable, positively determines TEF_{out} of Secondary-stage of school, implying that the school functioning with larger percentage of students possessing textbooks at home, will attain relatively more TEF_{out} level.

Further, the determinants of TEF_{out} of the schools for H.S. level are:

(i) TEF_{out} of H.S. stage of the schools is determined positively and significantly by the interaction term between two variables, 'while taking a decision whether HM interacts with teachers and students' and 'frequency of HM's interaction with State Education Department', suggesting the positive school managerial role of HM in promoting TEF_{out} of the referred stage of the schools. (ii) 'Gender of HM' is positively and significantly affecting TEF_{out}, suggesting that the schools under male headship perform more efficiently at H.S. level in comparison to the female-headed schools; although the significance level of this variable appears as low. (iii) The variable 'number of smart classroom' is positively and significantly affecting TEF_{out} of the H.S. level of the schools, implying that the efficiency level is higher for those schools operating with presence of more smart classrooms. Additionally, the variable 'whether librarian of the school is present on duty' is also turning positively significant, meaning the presence of librarian on duty can lead the TEF_{out} of those schools to the higher level in comparison to the schools where librarian is absent from duty. (iv) 'Amount of government fund received by the school', shows negative significance whereas its square term shows positive significance in determining TEF_{out} of H.S. stage of the school, denoting a non-linear U-shaped relation of this variable with TEF_{out} which basically indicates that only after a certain level of 'amount of government fund received', TEF_{out} will be positively impacted by this variable. The calculated marginal effect at mean value of 'amount of government fund received' being positive is suggesting that for the sample schools relation between these two variables is lying at the rising

part of the curve and hence the result is actually reflecting a positive role of government funding in determination of TEF_{out} of H.S. stage of the schools**.** Additionally, a positive significance of 'proportion of students receiving Kanyashree' in determination of TEF_{out} of H.S. stage is also evident for these schools, implying the positive role of Kanyashree in enhancing TEF_{out} of schools corresponding to H.S. level.

The comparison of TEF_{out} results between Secondary-stage and H.S. stage indicates that 52% sample schools are inefficient referring to Secondary-stage while 56% sample schools are inefficient referring to H.S. stage, indicating relatively greater extent of (output-oriented) inefficiency at H.S. level in comparison to the Secondary-level of schools.

Since the result of the determinant analysis reveals that 'percentage of private tuition taking students' explains the larger segment of variation in TEF_{out} for secondary-stage as well as for H.S. stage, therefore investigating the residual segment of variation in TEF_{out} for both stages, excluding the contribution of 'private tuition' is crucial and it ranges from 1.5% to 23.8% with the average value 8.28% for Secondary-level while for H.S. level of schools it ranges between 0.40% and 8.64% with the average value 3.72%. This result is an indication of very low TEF_{out} score attainment by the schools in absence of the contribution of private tuition; however, it is further lower for H.S. level than Secondary-level.

The comparison between the determinants of TEF_{out} of Secondary-level and H.S. level, reveals that some factors can commonly determine TEF_{out} of both Secondary and H.S. levels like, percentage of private tuition receiving students, frequency of HM's interaction with state-education department, HM's interaction with teachers and students while taking policy decision, proportion of students receiving Kanyashree, amount of funding received by school from government, librarians presence on duty and the number of smart classroom in the school.

However, other than these common determinants, the specific to Secondary-level determinants of TEF_{out} are also evident like, full-time teachers' experience, class size, reserve category students' proportion, HM's experience, proportion of students possessing textbooks at home; though any such specific to level determinants of TEF_{out} are not found for H.S. level.

Findings on TEF_{inp} : School-Level Analysis

With reference to Secondary-level and H.S. level of the schools, the TEF_{inp} results reveal that 56% sample schools are operating inefficiently (at both the levels of school education), indicating the capability of these schools of producing the existing output levels utilizing lesser

inputs. The variations of TEF_{inp} scores amongst the different sample schools concerning both the stages of school education are also observed.

The findings on the extent of variation of TEF_{inp} excluding the role of the guidance received by the students from private tuition convey that as 'private tuition' variable explains the considerable part of variation in TEF_{inp} of the schools for both Secondary and H.S. levels (separately), therefore the residual part of variations, which are remaining unexplained by the 'private tuition' variable at both levels of education, are nominal ; and for Secondary-level it ranges between 0.09 % and 28.61% with the average value 5.71% while for H.S. level it ranges between 0.34% and 19.24% with the mean representation of 6.30%. Such results are the revelation of very less TEF_{inp} score attainment by the schools at these two concerned levels of education, in absence of private tuition's contribution.

The above stated consequences are arising because of the fact that 'percentage of students taking private tuition' (at the respective level of school education) is playing a highly significant favourable role in determining TEF_{inp} of schools at the respective stage of school education (i.e. Secondary-stage or H.S. stage). However, apart from the crucial determinant, 'percentage of students taking private tuition', the TEF_{inp} score can be explained in terms of several other affecting factors at both Secondary-level as well as H.S. level of school.

The TEF_{inp} of schools for Secondary-level is determined by the following factors:

(i) 'While taking a decision whether HM interacts with teachers and students' appears as a positive and significant determinant of TEF_{inp} for the Secondary-stage of the schools, supporting the positive role of HM's interaction with students and teachers of the school while taking any school-related decision, in enhancing TEF_{inp}. (ii) Policy variable, 'proportion of students receiving Kanyashree' validates the existence of non-linear inverted U-shaped relationship with TEF_{inp} of Secondary-level as the coefficient of 'Kanyashree' variable indicates positive significance and the coefficient of its square term indicates negative significance, implying that even though the 'proportion of students receiving Kanyashree' leads to an increase in TEF_{inp} of Secondary-level initially, however, after reaching a threshold level of this variable, TEF_{inp} reduces with the rise in 'Kanyashree' variable. For the present sample of schools, the average representation of 'proportion of students receiving Kanyashree' turns less than the threshold level, therefore the present sample exists on the upward rising portion of the curve, resulting in a positive marginal effect of 'Kanyashree' variable. This finding implies that for the present sample, TEF_{inp} arises following the rise in 'proportion of

students receiving Kanyashree'. Another policy variable, 'amount of government fund received by the school' positively impacts on TEF_{inp} of Secondary-stage of the schools, implying the positive role of receipt of the amount of government fund by the school in fostering TEF_{inp} score relating to Secondary-level. (iii) For Secondary-level at schools, 'whether the HM is present on duty' and 'number of smart classroom' are noted as positively affecting administration and infrastructure variables for determining TEF_{inp}. These findings reflect: (a) the favourable effect of HM's on-duty presence in the school on TEF_{inp} in comparison to the schools where HM's absence is observed during the duty hours; (b) the schools featuring more smart classrooms are associated with higher TEF_{inp} score at Secondary-level (with low significance level). (iv) School characteristic variable 'class size' positively impacts on TEF_{inp} of Secondary-level, revealing the fact that the greater level of TEF_{inp} is gained by those schools where size of the class is greater. (v) Quality of school attribute describing variable, 'student's perception about quality of laboratory' evidences its favourable influence in determining TEF_{inp} of Secondary-level of schools, denoting that the schools featuring a relatively better quality of laboratory, achieve an improved level of TEF_{inp} at Secondary-stage.

In addition, the determinants of TEF_{inp} at H.S. level of schools are identified as:

(i) HM's school managerial role describing variable, 'while taking a decision whether HM interacts with teachers and students' is determining TEF_{inp} of H.S. stage at the school level positively, expressing the favourable role of HM's interaction with students and teachers while reaching any school-related decision in fostering TEF_{inp} relating to H.S. stage. (ii) Again, 'amount of government fund received by the school' exerts a positive impact in determination of TEF_{inp} of H.S. stage of the schools, indicating the favouring role of government funds allocated to the school in enhancing its H.S. level's TEF_{inp} score. (iii) Infrastructure variable, 'number of smart classroom' positively impacts on TEF_{inp} of H.S. stage which basically expresses that the schools with greater count of smart classrooms, attain a greater level of TEF_{inp}. (iv) 'Class size' as a school-characteristic variable, reflects positive effect in determining TEF_{inp} of H.S. level of the schools, implying the importance of the 'size of the class' in fostering TEF_{inp} of H.S. level (with low significance level). (v) 'Student's perception about quality of teaching' appears as a favourably influencing factor of TEF_{inp} at H.S. stage, declaring that the schools with better teaching quality, attain higher TEF_{inp} at H.S. level. (vi) 'Student's characteristics' reflecting variable, 'study hours at home' imparts a positive effect on TEF_{inp} at H.S. level, reflecting that the schools, educating the students with more study duration at home are capable of achieving higher TEF_{inp} score. (vii) 'Gender of HM' as a HM's

characteristic defining variable, reveals the evidence of the male-headed schools attaining a greater level of TEF_{inp} in comparison to those schools, not under male headship.

In the act of comparing TEF_{inp} results between Secondary-level and H.S. level it is noted that 56% sample schools are operating inefficiently at both Secondary and H.S. levels. Nevertheless, for capturing the true situation of TEF_{inp} of the schools excluding the contribution of 'private tuition' (as considerable proportion of students avail private tuition at both levels), the residual part of variations in TEF_{inp} which is remaining unexplained by the 'percentage of students receiving private tuition' are obtained for both secondary and H.S. levels. For secondary-level it ranges between 0.09 % and 28.61% with the average figure 5.71% while for H.S. level it ranges between 0.34% and 19.24% with the average representation of 6.30%. These outcomes are the reflections of very less TEF_{inp} score attainment by the schools at both of these levels of education in exclusion of the contribution of private tuition, although it is noted as even little less for Secondary-level.

Simultaneously comparing the determinants of TEF_{inp} between Secondary-stage and H.S. stage at school-level, it is observed that some determinants of TEF_{inp} are common in both Secondary and H.S. contexts; for example, HM's interaction with student and teacher in developing school-related policies, percentage of private tuition receiving students, the amount of government fund received by the schools, number of smart classroom and class size.

However, besides such commonly affecting determinants, there are some factors which solely determine TEF_{inp} of Secondary-level of school, such as Kanyashree receiving students' proportion, HM's presence on duty and students' opinion regarding quality of laboratory. Similarly, TEF_{inp} of H.S. level is exclusively impacted by students' opinion regarding teaching quality, gender of HM and study duration of the students at home.

Relevantly, the degree of inefficient utilization of inputs, indicated by each input in the respective process of education production is crucial to obtain based on the combined values of radial & slack movements added together for each of the inputs focusing on Secondary-stage and H.S. stage of the schools separately. The result relating to the Secondary-level of schools, on combined movement for the four inputs expresses that the average inefficiency is noted to be greatest for the input **'**teachers-student ratio' (17.62%), followed by the inputs, classrooms-pupil ratio (15.90%) and per student expenses of school on a monthly basis (12.21%) respectively; and lowest for the input, percentage of teachers with master's degree and above academic qualification (6.61%). In addition to this, referring to the H.S. level of the schools

and analyzing the respective combined estimates of inputs, the average inefficiency level is found to be greatest for **'**teachers-student ratio' (34.63%), followed by 'classroom-pupil ratio' (34.54%) and 'per student expenses of school on a monthly basis' (23.01%) respectively; and lowest for **'**percentage of teachers with master's degree and above academic qualification' (8.38%). The estimate of average inefficiency level corresponding to each input in education production is useful for recognizing the inputs with different extent of inefficient utilization.

The determinant analysis of TEF (from both perspectives: output and input oriented) for Secondary and H.S. levels are the essential aspects of this entire analysis as such findings can help in identifying the determining factors of TEF at the concerned levels of education and thereby in accordance with such empirical evidences accurate TEF improving policies are suggested.

Policy Suggestion

Policies for improving TEF_{out} at State-Level

While designing the policy with the objective of improving TEF_{out} it should be taken into consideration that some policy variables are such that change in which in the proper direction may create a greater impact on the aspect of TEF_{out} in the sense of improving TEF_{out} in each state category (i.e. GCS and SCS&UT) corresponding to the Secondary and H.S. education system. Contextually, raising 'education expenditure' by the government can act as a common policy for boosting TEF_{out} at both Secondary and H.S. education levels in GCS as well as in SCS&UT. A crucial finding reveals for SCS&UT group and for H.S level that because of the non-linear 'U' shaped relation as exist between 'government education expenditure' and TEF_{out} of H.S. education in SCS&UT, there exists a threshold level after which the positive effect of Government expenditure on $TEF_{out.}$ is felt and the sample value of the government expenditure on education is below that of the threshold level. Thus, the government should prioritize more on increasing government education expenditure for experiencing the favourable influence of 'government education expenditure' on TEF_{out} score corresponding to H.S level in such a way to overshoot the threshold point. Additionally, government policy of appointing teachers to a sufficient extent and a policy of encouraging the girls students for enrolling at Secondary-level can enhance TEF_{out} of Secondary-stage of education in GCS and SCS&UT.

Apart from these common policies, there exists some specific policies for fostering TEF_{out} scores of a particular level of education in a specific state group. In particular, for GCS, construction of the buildings in the school premises and the policy for growing 'per capita net state domestic product' can enhance TEF_{out} of Secondary education. On the other hand, in SCS&UT, TEF_{out} of Secondary education can be improved by the policies of incentivizing tribal community for enrolling their children in formal Secondary education, reconstructing those classrooms remaining in bad condition, offering the facility of drinking water and providing the electric power inside the school. Since more number of lack of infrastructure defining variables influence TEF_{out} of Secondary education in SCS&UT as compared to GCS, therefore for improving infrastructural conditions, SCS&UT seeks more attention from government. Further, concerning the H.S. education, fostering TEF_{out} in GCS can be performed through adopting several policies like, construction of the buildings along with toilets for the girl students in the school, encouraging girls for enrolling at H.S. level of formal education and appointing sufficient quantities of the teachers. However, for enhancing TEF_{out} level of H.S. education in SCS&UT, the polices like, incentivizing ST, SC community for enrolling their children in formal H.S. education, building more classrooms and appointing greater number of female teachers in comparison to the male teachers can be suggested.

Policies for improving TEF_{inp} at State-Level

It should be noted that a number of policy prescriptions are specific to 'GCS' and a few are to 'SCS&UT' for enhancing TEF_{inp} at the concerned level of education and also some policies are advised for both the levels of education at a particular state group. However, a few policies, common to both 'GCS' and 'SCS&UT' are also evident. As the common policies, for both the groups of states, raising government education expenditure and appointing full-time teachers (for mitigating the deficit of teaching-staffs) by the authority at both Secondary and H.S. education levels can raise TEF_{inp}. Moreover, a 'U' shaped relation between 'government education expenditure' and TEF_{inp} of H.S. education in SCS&UT, indicates the priority of raising education expenditure by government in such states, as argued in case of TEF_{out}. Besides, the existence of school building must be ensured in the school premises by establishing building, specially, in those schools, functioning without any building in both 'GCS' and 'SCS&UT' for improving TEF_{inp} at H.S. education; and also such a policy is capable of enhancing TEF_{inp} of Secondary education in GCS. In addition to this, implementation of incentivizing policy, targeting the girls at the appropriate age cohort for leading them in formal education, by the government may elevate TEF_{inp} of H.S. level in both

the groups of states and this policy also remains beneficial for improving TEF_{inp} of Secondary-level in GCS. Coming to the specific policy, any government initiative aiming at stimulating the per capita net state domestic product will lead to an increase in TEF_{inp} of Secondary-level in GCS. In contrast, referring to the Secondary education system in SCS&UT, the policy of reconstructing the classrooms remaining in bad condition, providing the availability of electric power, offering the facility of drinking water inside the school and incentivizing tribal people for enrolling their children in formal Secondary education will elevate TEF_{inp}. Further, for H.S. stage of education, the policy of building toilet exclusively for girl students inside the school property, offering the internet and computer using facility in the school will raise TEF_{inp} in GCS whereas an enhancement of TEF_{inp} at this stage of education in SCS&UT will be achieved through the policy of appointing more number of female teachers in comparison to the male teachers at H.S. education system.

Policies for improving TEF_{out} at Schools

Based on the school-level analysis, the following policies are prescribed for promoting TEF_{out} of schools at Secondary-stage and H.S. stage:

Some policies are common for fostering TEF_{out} at both Secondary and H.S. levels: (i) Since more funding from the government can increase TEF_{out} of the Secondary-level of the school and the positive marginal effect of government funds is evident at its sample average value (on TEF_{out}) for H.S. level, it is therefore recommended that the government should increase the amount of funding for the schools for fostering TEF_{out} at both Secondary and H.S. levels. (ii) As TEF_{out} of Secondary-level may increase as a result of an increase in Kanyashree because of the empirical findings suggesting, Kanyashree having a positive marginal effect at its sample average value and for H.S. level, Kanyashree being identified as a favourably TEF_{out} determining variable, therefore, outreach of Kanyashree should be improved for improving TEF_{out} of the schools at both the education levels. (iii) Since interaction of HM with teachers and students while taking any policy decision for the school and also interaction frequency with state education department are influencing TEF_{out} of both Secondary-level and H.S. level positively, it is therefore recommended that while framing policies for school, HM should always interact with teachers & students and should also interact frequently with education department of the state in order to promote TEF_{out} at both the education levels of school. (iv) As the school where the librarian is on duty reflects relatively higher TEF_{out} at Secondary-level and H.S. level than that of the school running without librarian's presence, therefore the schools

should make arrangements of part-time or temporary librarians in absence of the full-time librarian from duty to promote TEF_{out} at both the levels. (v) Since the empirical finding indicates that more smart classrooms in the school can lead to higher TEF_{out} at Secondary and H.S. levels of the school, it is thereby advised that the schools should take initiative for making arrangements of smart classrooms in the school premises in order to increase TEF_{out} at both the levels. (vi) Since the percentage of students opting for private tuition is determining TEF_{out} of Secondary-level and H.S. level of the school positively, it is therefore implying that schools cannot meet the students' requirements of deriving academic benefits from their schools which is supported by very less extent of TEF_{out} variation at both the mentioned education levels, in absence of the role of private tuition. It is therefore suggested that school authorities should arrange some interactive sessions between teachers and students for discussing the problems of the students followed by possible solutions so that the students can eventually stop taking private tuition.

Further, some policies which can exclusively enhance TEF_{out} of Secondary-level, are discussed below:

(i) As full time teacher's service experience and also HM's service experience are adversely affecting TEF_{out} of Secondary-level of the school, it is suggested that new appointments of full-time teachers as well as of HM should be offered by the Government for enhancing TEF_{out} at Secondary-level. (ii) Since a positive relation is found between the reserve category students' proportion in class and TEF_{out} level of the school relating to Secondary-stage, the government is suggested to carry out social inclusion policy continuously in case of formal education. (iii) As the student's percentage, possessing textbooks at home is positively influencing TEF_{out} score at Secondary-level, it is therefore prescribed that school should pay attention to provide textbooks to those Secondary-level students who do not possess it.

The study of the school-level TEF_{out} analysis contains interesting findings that : (a) for Secondary-level of schools, (i) the interaction variable between the student's opinion regarding the regularity of class and the proportion of vacant teaching-position, (ii) educational qualification of mother; and (b) for H.S. level of schools, (i) proportion of vacant teaching-position, (ii) teaching experience of part-time teachers, and (iii) percentage of students possessing textbook at home are determining 'percentage of students taking private tuition' significantly and consequently also determining TEF_{out} of the corresponding education level of school. At Secondary-level, more number of teaching-position remaining vacant or class

irregularities induce the students to opt for private tuition and hence schools are advised to pay attention to recruit in the vacancy for teaching-positions and also to improve class regularities. Specifically, for monitoring and ensuring class regularities, school authorities can arrange student feedback systems. Again, as higher academic qualifications of mother's lead to a decline in percentage of private tuition taking students at Secondary-level of the school, the government is advised to take some favourable measures for further improving the scenario of female education. Referring to H.S. level of school as well, more vacancy in teaching-position causes more number of students opting for private tuition, thus it is important for the school to fill the vacancy by aiming to improve such scenario. Additionally, since more teaching experience of part-time teachers causes less taking of private tuition by the H.S. level students, therefore for retention of experienced part-time teachers in the school, designing a better salary structure for them is recommended. Likewise, as the schools with higher percentages of H.S. level students possessing textbooks can lead to a lesser percentage of private tuition taking students, the government should monitor and assure the reception of the textbooks by all the students at the beginning of the session.

Policies for improving TEF_{inp} at Schools

The TEF_{inp} analysis at school-level sets the ground for suggesting some (input oriented) efficiency-enhancing policies at both Secondary and H.S. levels. However, some policy prescriptions are common to these two levels while some are specific to the particular level of school-education.

The common policies for increasing TEF_{inp} at both Secondary-level and H.S. level of the schools are : (i) As the 'amount of government fund received by the school' impacts positively on TEF_{inp} at both the levels of the schools, hence it is advised to increase the amount of government fund at schools for improving TEF_{inp}. (ii) 'HM's interaction with teachers & students for taking school-related decisions', positively influences TEF_{inp} scores of schools for Secondary & H.S. levels. Hence, the recommendation of carrying out interaction with teacher & student is given to HM while taking any policy decision, for elevating TEF_{inp} at both the levels. (iii) As the schools featuring greater number of smart classrooms have been able to gain higher TEF_{inp} scores at both Secondary & H.S. levels, it is hence advised that the schools should extend the number of smart classrooms (to possible extent) in order to enhance TEF_{inp} at both the levels of the schools. (iv) Since the schools operating with larger class size can attain higher

TEF_{inp} at both the levels, it is therefore recommended that schools should arrange for more sections in the class, for improving TEF_{inp} scores at both the levels.

Suggested specific policies for improving TEF_{inp} at Secondary-level of schools are:

(i) For the present sample 'proportion of students receiving Kanyashree' imparts a positive effect on the level of TEF_{inp} corresponding to the Secondary-stage and thus a rise in the proportion of Kanyashree will lead to an improvement in TEF_{inp} at Secondary-level of school. (ii) The school where the HM is present on duty is able to attain higher TEF_{inp} at Secondary-level, hence it is advised that if HM is absent from duty at any school then HM must nominate an alternative teacher for performing his responsibilities in his absence. (iii) Since 'quality of laboratory' (based on student's opinion) is favourably impacting on TEF_{inp} score of schools for Secondary-level, therefore the school authority is advised to offer improved laboratory quality at school premises.

Again, the recommended specific policies for enhancing TEF_{inp} at H.S. level of schools are:

(i) As student's study duration at home positively impacts on TEF_{inp} of schools for H.S. level, thus the schools are suggested to engage students more in studying at home by giving them assignments or conducting continuous assessments, in order to elevate TEF_{inp} at H.S. level. (ii) As 'quality of teaching' (based on student's opinion) is favourably influencing TEF_{inp} score of schools at H.S. level, hence the schools are advised to ensure good quality of teaching by monitoring the teaching hours through students' feedback, for enhancing TEF_{inp} at H.S. level of schools.

As significantly influencing factors of 'percentage of students taking private tuition' also indirectly affects $TEF_{inp,}$ thus based on such results several policies can also be suggested: at (a) Secondary-level (i) schools need to arrange classes regularly, (ii) recruit for a vacancy in the teaching-position and (iii) the government should formulate more policies to rectify the scenario of female education for enhancing the academic qualification of the mother of the student; similarly, for (b) H.S. level, it is advised to (i) design a better salary structure for retaining experienced part-time teachers in the school, (ii) recruit for a teaching-position vacancy, and (iii) schools must offer textbooks to H.S. level students, in case they do not possess any of the textbooks.

Common Policy Prescriptions based on the Overall Study

On the ground of the overall State-level analysis (of TEF) segment of the present thesis, several common policies for upgrading the level of TEF of the concerned stages of education may be formulated.

Precisely, the common policies for enhancing TEF_{out} as well as TEF_{inp} at both Secondary and H.S. levels in GCS would be (i) Promoting government education expenditure, (ii) Encouraging girl student's enrolment, (iii) Appointing sufficient teachers (in terms of the numbers) and (iv) Constructing more buildings in the school premises.

Similarly, the common policies for improving TEF_{out} at Secondary and H.S. levels in SCS&UT are: (i) Raising government education expenditure and (ii) Encouraging ST population for enrolling their children in formal education; additionally, for promoting TEF_{inp} at Secondary and H.S. levels in SCS&UT, a few common policies can be suggested like, (i) Escalating government education expenditure and (ii) Appointing sufficient number of the teachers.

Therefore, summarizing the policies, designed for enhancing efficiency of Secondary and H.S. education at the state-level, a single common policy can be prescribed with the objective of simultaneously improving TEF_{out} as well as TEF_{inp} at both Secondary and H.S. levels, in both GCS and SCS&UT; and such a policy suggestion is 'raising government education expenditure'.

Moving towards the school-level analysis (of TEF) segment of the present thesis, several common policies can possibly be prescribed for simultaneously promoting TEF_{out} as well as TEF_{inp} of the schools both at Secondary & H.S. Levels; and such policies would be (i) Allocating more government funds to the schools, (ii) Increasing HM's interaction with teachers and students while formulating school-related policies, (iii) Providing more smart classrooms (to a possible extent) and (iv) Arranging teachers-students discussion (by school) regarding the problems of the students and suggesting possible solutions.

Although the present thesis intended to shed light on the substantial aspects of TEF particularly focusing on Secondary and H.S. levels of education, however, it is not completely free from the limitations. In accordance with the literature, the estimation of TEF rests on the production relation between output and input variables. Relevantly, it is essential to point out an important deviation of education production function from the conventional micro-economic idea. The

output of education sector is intangible. Therefore, representation of output by appropriate measures is essentially required. Thus the analysis is contingent upon the assumed measures of output variable. The obtained results may be sensitive to the assumed measures of output.

Signature of Supervisor

Signature of Candidate