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Education infrastructure and enrolment in elementary education in Odisha

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Abstract

Background: Infrastructure is an important tool for facilitating quality education in elementary education system. According to the Right to Education Act (RTE) 2009, every school should have an all indicator: classroom, teacher, toilets for boys and girls, safe and adequate drinking water, and playground, kitchen for the mid-day-meal, boundary wall, electricity and computer.
Objectives: The objective of the present study is to construct a physical infrastructure index at school level across 30 districts of Odisha and the role it plays in improving the enrolment.
Methodology: The study uses secondary data collected for the years 2001 to 2017 for 30 districts of Odisha. Principal Component Analysis is done to construct a composite infrastructural index at school level considering 13 infrastructural variables. On the basis of variations the districts are grouped into four categories and the changes over time is observed. Using panel data regression model the impact of the education infrastructure on enrolment at school level is studied.
Findings: It is found that the infrastructure contributes significantly to the enrolment at elementary education level. The enrolment is increasing over time. The availabilities of basic amenities is encouraging children especially girls to come to the schools. It is also observed that the districts like Balasore, Boudh, Keonjhar and Kalahandi are improving in terms of their infrastructure over time.
Policy Implications: As there is a dearth of studies on the role education infrastructure plays in increasing the enrolment at school level across 30 districts of Odisha. It is suggested that the schools should be well equipped with infrastructure so that it can cater to the need of the present generation. Government should take care of this aspect specially emphasizing the case of the districts still undeveloped in terms of educational infrastructure.
Keyword: Infrastructure, Principal Component Analysis, Education, Development
JEL Classification: H54**,** O15, C43, I21

1. Introduction

Prominent in the Millennium Development Goals (1990-2015) was "Achieve universal primary education: Ensure that boys and girls alike complete primary schooling". The emphasis on universal primary education without gender discrimination needs no elaboration. It is widely realised that the societies with a higher percentage of literates have higher levels of development while primary education takes the lead as the return is highest in primary education followed by secondary and then university education. In India, the social rate of return is 29.3% in primary education as compared to 10.8 per cent in the University level education [1]. Minimum educational attainment has a direct and positive bearing on efficiency in resource allocation leading to higher income and an equitable distribution of such income and reduces inequality [2-4]. The role of education in overall social and economic progress is widely recognized. The right to education has been enshrined as a fundamental right in the Constitution of India which states that: "the State shall provide free and compulsory education to all children aged six to fourteen years in such a manner as the state may, by law, determine." Right of Children to Free and Compulsory Education (RTE) Act, 2009 corroborates this. As a result the literacy rate in India has been constantly rising, improving from 64.8% in 2001 census to 74.04% in 2011 (census data). Both the central and the state governments have been paying increased attention to the need of 'education for all.'

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Infrastructure is an important tool for facilitating quality education in elementary education system. Realizing the importance of infrastructure, both the central and the state government have undertaken several schemes to improve physical infrastructure of government schools. According to the Right to Education Act (RTE) 2009, every school should have an all indicator classroom, teacher, toilets for boys and girls, safe and adequate drinking water, and a playground, a kitchen for the mid-day-meal, boundary wall, electricity and computer. In fact, these are the basic minimum facilities that a school should have. Sarva Shiksha Abhiyan (SSA) is one of the flagship programs of Government of India, which has been implemented in all the 30 districts of Odisha since 2001 in order to achieve universal elementary education of satisfactory quality with a focus on education for life. The cost of the programme is shared by the Centre and the State in the ratio of 65:35. The programme supports infrastructure development, like construction of new school buildings and class rooms, toilets, drinking water facility, free supply of school uniforms for girls and supply of text books [5-7]. With this backdrop, an attempt has been made in this paper to construct a composite infrastructure index for primary education level and also to find out the role infrastructure plays in promoting the enrolment in elementary schools in the state of Odisha. The study is organised in the following manner. Section-II presents data and methodology of the analysis. Results and discussions are given in Section-III. Section-IV highlights the main findings of study and suggestions for policy options are contained in the Concluding Section [8].

2. Data and Methodology

Secondary data relating to population, number of schools, gross enrolment, availability of infrastructural facilities for the year 2001-17across 30 districts of Odisha have been collected from Census Reports, Government of India, Directorate of Elementary Education, Directorate of Mass Education, Government of Odisha and the District Information System for Education data (DISE) published by National University of Educational Planning and Administration, New Delhi.

2.1. Estimation of the composite infrastructure index

The composite education infrastructure index for entire 30 districts of the state of Odisha is constructed using the technique of Principal Component Analysis. The infrastructure indicators considered include Number of School (X_1) comprising of primary school, upper primary school, primary with upper primary school, upper primary with secondary school and primary with secondary and higher secondary school. Pupil Teacher Ratio (X_2), Single Classroom Schools (X_3), Average Teachers Per School (X_4), Single Teacher Schools (X_5), Schools with Girls Toilet (X_6), Schools with Boys Toilet (X_7), School with Drinking Water facilities (X_8), Schools with Kitchen-shed (X_9), Schools with Electricity (X_{10}), Schools with Blackboard (X_{11}), Student Classroom Ratio (X_{12}) and Number of Female Teachers (tch≥2) (X_{13}) [9-10].

Number of Schools is the most important infrastructure for the development of education system so also Pupil Teacher Ratio (PTR) is. For each class there should be a class room so that both teacher and students can carry out the classroom process comfortably. Single teacher handling all the classes, carrying out official works mid -day meal arrangements and many more of work like this is always overburdened and it is difficult to achieve the targeted goals. Therefore the average number of teacher per school is also considered to study the impact on enrolment. Similarly availability of toilet facilities especially for girls and drinking water is highly imperative for promotion of enrolment. The availability of kitchen shed, electricity, blackboards are also necessary as they make the schools more attractive and comfortable. For encouraging girls' education need for female teacher is highly felt and government is trying its best to appoint more female teachers especially at primary school level in Odisha. In the present study, as the first Principal Component absorbs and accounts for maximum possible proportion of the total variation in the set of all variables, the study considers factor loadings that correspond to the first PC. Under this procedure, education development index is computed as a weighted average of various components of educational infrastructure.

2.2. Grouping of the districts as per infrastructure index

After computing the composite index of school infrastructure development, the simple statistical variations tests i.e., computed values of Standard Deviation (σ) and Mean (X) are applied.

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Then by using these two values, all the districts of Odisha are classified into three groups i.e., Highly Developed, Developed, Backward and Highly Backward. This is done by using the following cut off points.

$$HighlyDeveloped \quad (FirstGroup) \geq Mean + S.D$$
$$DevelopedMean + S.D \geq (SecondGroup) \geq Mean$$
$$BackwardMean \geq (ThirdGroup) \geq Mean - S.D$$
$$HighlyBackward \quad (FourthGroup) \leq Mean - S.D$$

2.3. Model specification

Hausman specification test is used for comparing FE model with RE model to study impact of infrastructure index on enrolment. The test result shows the p-value of χ2 as less than 0.05 which suggests that fixed effect model is the appropriate one in this case [11].

The model used is

$$Yit = \beta_1 Xit + \alpha i + uit$$

Where,

α_i (*i*=1….n) is the unknown intercept for each entity (*n* entity-specific intercepts), Y_{it} is the dependent variable (Enrolment) i, where *i* = entity and *t* = time, X_{it} represents independent variable,$\beta_1$is the coefficient, u_{it} is the error term

The present study assumes that infrastructure availability in the education sector of the state determines the level of enrolment across districts. Accordingly, panel data model is applied to find out the impact of educational infrastructure on the gross enrolment in the elementary schools. The statistical packages like SPSS and STATA are being used here.

3. Results and Discussion

3.1. Composite infrastructure index

According to the Right to Education Act (RTE), 2009, "every school should have an all indicator classroom, teacher, toilets for boys and girls, safe and adequate drinking water, a playground, a kitchen shed, boundary wall, electricity, computer, pupil teacher ratio, student classroom ratio, and average teachers per School". In fact, these are the basic minimum facilities that a school should have. An attempt is made here to compute a composite infrastructure index at elementary education level for all the 30 districts of Odisha during 2001 to 2017applying Principal component analysis technique. The districts are classified as highly developed, developed, backward and highly backward on the basis of their infrastructure index. Calculating the semi average of the indices the direction of the change at four points of time is observed and presented in Table 1.The districts are classified into different groups on the basis of their composite education infrastructure index.

Taking four year semi average of infrastructure indices for 2001 to 2004, 2005 to 2008, 2009 to 2012 and 2013 to 2016 all the 30 districts of the state have been grouped as highly developed, developed, backward and highly backward as shown in Table 1. A cursory glance at the table reveals that the district of Ganjam, Mayurbhanj, Balasore are having highly developed infrastructure while Cuttack and Sundargarh are in this group only in two time periods. Last positions are occupied by districts like Boudh, Subampur, Nuapada and Deogarh. In these districts there is lack of education infrastructure facility and these districts are highly economically backward also. Mayurbhanj being the largest and tribal dominated district is having highly developed education infrastructure index as the government policies favour it [12].

The districts like Mayurbhanj, Balasore, Boudh and Keonjhar are experiencing a hike in their infrastructure index values over time while some of them a decline. Though some are with a negative value still there is an improvement. This reflects the fact that the infrastructural facilities are not equitably distributed across the districts. Lack of political interest, inaccessibility of the area and socio economic barriers may be accounted for such backwardness.

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Table 1. Classification of districts on the basis of education infrastructure index

Year	Highly Developed	Developed	Backward	Highly Backward
2001	Mayurbhanj, Ganjam, Sundargarh, Cuttack	Rayagada, Puri, Koraput, Khurda, Keonjhar, Kendrapada, Jajpur, Bolangir, Baragarh,Balasore	Sambalpur, Nayagarh, Nabarangpur, Kandhamal, Kalahandi, Jagatsingpur, Gajapati, Dhenkanal, Boudh, Bhadrak, Anugul	Subampur, Nuapada, Malkangiri, Jharsuguda, Deogarh
2006	Mayurbhanj, Ganjam, Balasore	Rayagada, Puri, Koraput, Khurda, Keonjhar, Kendrapada, Jajpur, Bolangir, Baragarh, Kalahandi, Sundargarh,	Sambalpur, Nayagarh, Nabarangpur, Kandhamal, Kalahandi, Jagatsingpur, Gajapati, Dhenkanal, Bhadrak, Anugul, Subampur	Nuapada, Malkangiri, Jharsuguda, Deogarh, Boudh
2011	Mayurbhanj, Ganjam, Balasore, Cuttack, Sundargarh	Rayagada, Koraput, Khurda, Keonjhar, Kendrapada, Jajpur, Bolangir, Baragarh, Bhadrak, Kalahandi	Sambalpur, Nabarangpur, Kandhamal, Jagatsingpur, Gajapati, Dhenkanal, Boudh, Anugul, Subampur, Malkangiri, Puri, Nuapada,	Jharsuguda, Deogarh, Nayagarh
2016	Mayurbhanj, Ganjam, Balasore, Cuttack, Keonjhar	Sundargarh, Puri, Koraput, Khurda, Kendrapada, Jajpur, Bolangir, Bhadrak, Kalahandi	Sambalpur, Nabarangpur, Kandhamal, Baragarh, Jagatsingpur, Gajapati, Dhenkanal, Nayagarh, Anugul, Malkangiri, Nuapada	Subampur, Nuapada, Jharsuguda, Deogarh, Boudh

Source: Calculated by author

3.2. Impact of infrastructure index on enrolment

The impact of school infrastructure on the enrolment at elementary school level for all the 30 districts of Odisha using time series data is studied by running regression. The education infrastructure index is used as independent variables and the log value of gross enrolment as the dependent variable.

Table 2. Regression result

Model		Coefficient	Std. Err	T	P value
1	Infrastructure Index	0.0066427	0.002267	2.93	0.004
	Constant	5.234615	0.0042946	1218.89	0.000
R Square 0.7016 F Statistic (29,449)=15.92(000***)					
Hausman Test 57.08 (0.000***)Prob(F-Statistic) 0.0036					

Dependent variable: Log Enrolment
Source: Computed by Author using STATA

The regression results as shown that the Table2reveals that 70.16% of the variations in enrolment in schools of Odisha are explained by the education infrastructure index. F statistic 15.92 is significant at 1% level of significance.$\chi 2$ value of Hausman test is 57.08 that is significant 1% level of significance. The P value of FE model that is 0.0036being less than 0.05 that indicates the appropriateness of fixed effect model. T-value of2.93 is significant at 1% level of significance. This indicates that the infrastructure has a significant influence on the gross enrolment.

4. Conclusion

Education imparts knowledge and skills. It shapes values and attitudes thus play a vital role in the progress of a civil society. It is universally recognized as an important investment in building human capital that affects growth in two ways, first human capital levels act as a driver of technological innovation and second human capital stocks determine the speed of absorption of technology. Amongst all types of education, primary education is most important as it is the base of nation building. The Constitution of India, the National Policies on Education and the Five-Year Plans have laid much emphasis on the role of education in development. The 93rd constitutional amendment made education a fundamental right.

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The National Policy on Education, 1986 (modified in 1992) envisaged free and compulsory education for all children up to the age of 14 years before the onset of 21st century. 'Sarva Siksha Abhiyan' has put emphasis on enrolment and attendance (through the mid-day meal scheme).Provision of infrastructure not only improves the quantity but also helps in enhancing quality. Quantity and quality combined together can enrich the human resource of a nation. The Government should not shift the responsibility of primary education to private management. What is needed at the moment is that the central Government must intervene to provide infrastructural facilities to all primary schools with a monitoring mechanism through the Panchayati Raj Institutions so that Quality Education for All can be ensured. The additional resource required for the purpose may be mobilised through additional education cess. Both quality and quantity of the primary education can be improved by implementing existing programme more systematically.

Good infrastructure is truly at the base of quality education. In the face of a dearth of such studies across the districts of Odisha, the present approach may help in framing appropriate micro planning. The policy makers, the executives, NGOs, political leaders and other investing institutions may be encouraged for designing infrastructural facilities in areas having deficiency of such facilities thereby making the elementary education more attractive and interesting in near future. A small step in the direction may achieve huge development in future.

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