ASSESSING THE INDIAN STATES' PERFORMANCE AS A PROVIDER OF PRIMARY SCHOOL INFRASTRUCTURE USING TOPSIS ALGORITHM

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Abstract

Infrastructure is one of the key elements for the development of primary education system. Primary education is the first entry point of the children for their education .The learning environment depends on proper infrastructure. Government investment to develop the proper primary school infrastructure is very important for learning as well as making human capital also. A good amount of Government spending is needed in this purpose to boost up the infrastructure of schools and hence the human capital formation. In this paper we have tried to judge the performance of Indian states as a provider of primary school infrastructure based on TOPSIS .The study uses the DISE data on primary education for the year 2016. The study concludes that all the Indian states are not doing well as provider of primary school infrastructure.

Key words: Primary education, infrastructure, TOPSIS.

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1. Introduction

The development of education, specifically primary level education depends on large number of factors including the infrastructural facilities available to a school. School infrastructure, such as the site, buildings, furniture and equipment contribute to a learning environment. Classrooms in most of the schools have problems related to proper ventilation, space, insulation from heat. There are also the inadequacy of benches, blackboards, lights, fans etc. These types of problems lead to a physical infrastructural problem.

Schools are social institutions and there exists the social relationships between students and teachers. Strong infrastructure base of a school can attract so many students and a good social relationship is established there. Schools are second home to a child. Schools build the sense of team work and socialization among students. Away from home, children spend their maximum time in schools.

Government of India has launched the Sarva Shiksha Abhiyan (SSA) in 2001-02. It is primarily meant for promoting increase in the infrastructural facilities up to the level of elementary education for development and causing an increase in the literacy rate. Infrastructural facilities are the determinant of literacy rate. The availability of infrastructural facilities within schools is of major significance. When the schools will make provision of adequate infrastructural facilities, the overall learning environmental conditions will improve. Good infrastructure is truly regarded as the base for good-quality education. (Kapoor. R, 2019). Improved school infrastructure can solve the problem of dropout rates, low enrolment rates, low attendance in class, and low quality of education.   (https://www.caf.com/en/currently/news/2016/10/the-importance-of-having-a-good-school-infrastructure/, 2016). Children want a classroom will be colourful, friendly and peaceful. There will be lots of open spaces in the school, plants, flowers, toys, playgrounds. There should have proper benches, blackboards, lights, fans, inside the classroom.

The extent of primary education is quite low in India. The present scenario of primary education in India is not satisfactory. Only 66% of the Indian people are literate (76% of men and 54% of women). Many villages in India have no primary schools. Most of the schools are physically and

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pedagogically weak and unattractive. It is the reason for the poor performance of the basic schooling. Minimum two rooms, two teachers and a student teacher ratio of 40: 1 should be the primary criteria for a primary school as per the policy of Indian Goverement. The location of the school must be within one kilometre walking distance from a child's home.(Ramachandran, Mehrotra, and Jandhalaya, 2007).

The lack of physical infrastructure is one of the major problem of primary education. Majority of the primary schools are facing this problem. The space of the classrooms, teacher's room, and office room is very scanty and of low quality type. Students are not properly accommodated in the classroom due to the lack of adequacy of space. On the other hand in most of the schools in India (especially which are located in rural areas) the toilet facility is very poor. The drinking water facilities as wells as electricity facilities are not up to the mark and close to 90% have functioning toilets (Ramachandran, Mehrotra and Jandhyalay, 2007). There is hardly any playground for the student. Computer education is very important part of learning. But there are some schools which have no computers or some schools have very minimum number of computers. In our globalised world the knowledge about computer is very important. Due to insufficiency of computers the students are facing some problems.

However, it is argued that physical infrastructure is not so important for learning rather it is a secondary need for learning. Student's concentration on learning and merit are the primary factors for educational outcome. But it's proven that apart from student's consciousness, concentration and merit, physical infrastructure of a school is also a very important part of learning. Spacious, well maintained buildings and properly ventilated classrooms are must in schools. Every school should provide a well-organized lab, uninterrupted electricity facility, adequate water supply, hygienic toilet facilities for both girls' and boy's students, sanitized school building (Varshney. G., 2017, Tiexiera. J, Amoroso .J, Gresham. J, 2017). Education is the tool for human capital formation. As primary education is the first stage of education proper investment on primary education will help us to make human capital. So investment in school infrastructure is very important for learning as well as making human capital also. A good amount of Government spending is needed in this purpose to boost up the infrastructure of schools and hence the human capital formation. We also need to know what is meant by school infrastructure. The infrastructure is a wide term and there are so many aspects that are included in it. These include playground,

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library facility, drinking water facility, electricity facility, toilet facility, school building, classrooms, laboratories, computer centres etc. In this backdrop the objective of the paper is to judge the state's performance as provider of primary school infrastructure using TOPSIS method.

2.Data and methodology

To analyse the Indian states' performance as a provider of the infrastructure of the primary education   we collect the data from secondary source DISE for the year 2016. The following indicators are considered to get the states' performance on primary school infrastructure. These indicators will help to judge the infrastructural facilities in primary education. These are:

i.   **Schools with drinking water facility**: Drinking Water is one of the important elements of infrastructures in schools. Proper drinking water facilities for the students are needed for their good health otherwise it cause to spread diseases among students. Schools without drinking water facilities leads to a health threat to the students. So, drinking water is must for schools and it has a positive reflection in infrastructure of the school.

ii.   **Schools with girls' toilet:** Toilet maintains the hygiene and health of the students as well as it gives the positive effect on infrastructure of a particular school. Increase the no of Girls' Toilet in a school helps to attract many Girls' students into the school and can decrease the dropout rate also. So it has a positive effect on learning.

iii.   **Schools with playground facility**: Schools needs a playground too boost up the physical health as well as the mental health of a students. Students can do different physical activities in the playground. So it is a positive factor of school infrastructure.

iv.   **Schools with electricity facility:** It is very difficult to attract students without electricity in the schools. Proper and adequate electricity facility leads to improved infrastructure in the schools and can attract pupils in the schools. Due to lack of electricity facility a school cannot use the audio visual system of learning. Computer learning is also not possible with electricity. The schools cannot use light fans in the classroom with electricity. So it is a very important factor for improvement of learning. So, it has a positive impact on learning.

v.   **Schools with computer facility**: Computer is a very important instrument for the development of a child in globalised world. Increase in Computer facility in the schools shows

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the positive change in infrastructural facility of the school. Students need to operate the computer and it becomes an essential elements for learning.

vi.   **Schools with boys' toilet:** Boys' toilet is also necessary for proper hygiene and health of the students. We can keep school environment clean with the toilet facilities. So if this facility rises infrastructure of schools will improve.

In India NUEPA (2009) proposed a method based on 'Principal Component Analysis'. The Principal component Analysis used to determine the relative individual or group indicator weights is the inter-correlation between them, high weights being assigned to those having high contribution and vice-versa. In case of PCA the weights assign to the variables are based on objective principle. In this approach the meaning of the weights is entirely statistical. In this paper we try to judge the states performance as a provider of primary school infrastructure using TOPSIS.

2.1:TOPSIS

The primary school infrastructure is provided by the respective state governments of India. The states' performance as a provider of better primary school infrastructure depends on (i) Schools with student classroom ratio >= 30. (SC) (ii) Schools with drinking water facility. (W) (iii) Schools with girls' toilet (GT) (iv) Schools with playground facility. (PG) (v) Schools with electricity facility. (E) (vi) Schools with boys' toilet. (BT). Therefore states' performance function may be written as : P_i = f((SC,GT,PG,E,C,BT).

TOPSIS analysis is performed to measure the performance of the states as a provider of primary school infrastructure. The beauty of the TOPSIS is that, for each criterion, it calculates the distance from the positive ideal solution (PIS) and from the negative ideal solution (NIS). The most favourable solution is determined by the relative closeness to the PIS. The most favourable solution is the nearest to the PIS and farthest from NIS.

The steps of TOPSIS analysis is given below:

2.2: The TOPSIS Algorithm

i.   The normalized decision matrix (r_{ij}) is construct by dividing the raw criterion score (x_{ij}) by the sum of the squared scores of all countries of a particular category, i.e., $r_{ij} = \dfrac{x_{ij}}{\sqrt{\Sigma_{i=1}^{n} x_{ij}^2}}$

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ii. The weighted normalized decision matrix (T) is calculated by multiplying each element (r_{ij}) of the normalized decision matrix with its associated weight w_j, i.e., $(T) = \left[(t_{ij})_{n \times 9}\right]$, where $t_{ij} = r_{ij} \times w_j; \sum w_j = 1$

The weights are calculated on the basis of the subjective principle. For each attribute weights are calculated using the concept of "entropy". The steps of weight calculation is as follows:

i) The normalized decision matrix is calculated using the formula $a_{ij} = \frac{y_{ij}}{\sum_{i=1}^{n} y_{ij}}$

ii) Next, the entropy value is calculated by $e_j = -\frac{1}{\ln n} \sum_{i=1}^{n} a_{ij} \ln a_{ij}$, $0 \le e_j \le 1$

iii) The degree of divergence (d_j) of the average inherent information contained in each criterion measured as $(d_j = 1 - e_j)$

iv) The weights for each criterion are calculated by $w_j \left(= \frac{d_j}{\sum_{k=1}^{m} d_k} \right)$

iii. The positive ideal solution (PS) A^+ is determined by maximizing the benefit criteria and minimizing the cost criteria, i.e., $A^+ = \{t_1^+, t_2^+, t_3^+, .., t_m^+\}$,

Where $t_j^+ = \left\{ \max_i t_{ij}, j \in J : \min_i t_{ij}, j \in J' \right\}$; J being the set of benefit attributes and J' the set of cost attributes.

The negative ideal solution (NS) A^- is determined by minimizing the benefit criteria and maximizing the cost criteria, i.e., $A^- = \{t_1^-, t_2^-, t_3^-, .., t_m^-\}$,

Where $t_j^- = \left\{ \max_i t_{ij}, j \in J' : \min_i t_{ij}, j \in J \right\}$; J being the set of benefit attributes and J' the set of cost attributes.

iv. The L^2-distance between the criteria i and the worst condition A^- is calculated by

$d^- = \sqrt{\sum_{j=1}^{n} (t_{ij} - t^-)^2}$

And the distance between the target criteria i and the best condition A^+ is calculated by

$d^+ = \sqrt{\sum_{j=1}^{n} (t_{ij} - t^+)^2}$

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v.   The "relative closeness" to the ideal solution (PS) is calculated as:

$$C_i^+ = \frac{d_i^-}{d_i^+ + d_i^-} \; ; 0 \le C_i^+ \le 1 \, , i = 1(1)n$$

$$\Rightarrow C_i^+ = 1 \text{ If } t_i = A^+ \& C_i^+ = 0 \text{ if } t_i = A^-$$

3. Result and Analysis

The infrastructure of the primary schools across the states of India are not up to the mark. Every state is lacking in providing the full-fledged infrastructural facilities for all the primary schools. Figure 1 depicts the picture of girls' and boys' toilet across the states of India. From the figure

Fig: 1 Percentage of Schools with of Girls' & Boys' Toilet Facility
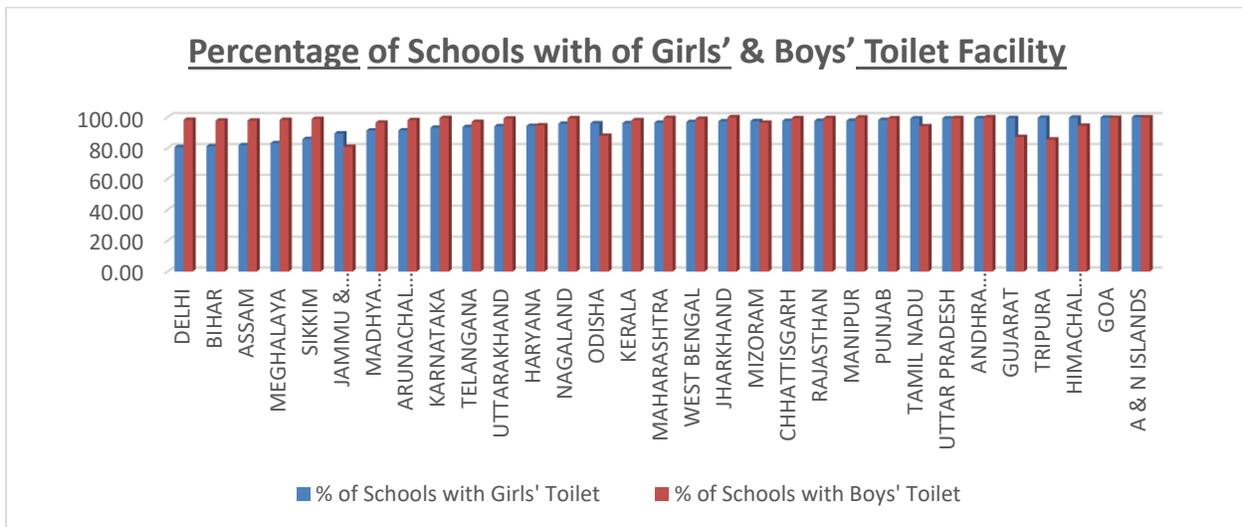
it is clear that majority of the states have school with less number of girls' toilet than the boys' toilet. In the era of 'Swachh Bharat Abhiyan, still in Indian states hundred percent primary schools have not separate girls' toilet.

Playground has the positive impact on infrastructure. From the figure 2 it is cleared that among all the states in India, Punjab has maximum and Jammu & Kashmir has minimum number of schools

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with playground facility. Odisha, Jammu & Kashmir, Bihar, Arunachal Pradesh, Meghalaya, Nagaland and West Bengal have 40% and less schools without playground.

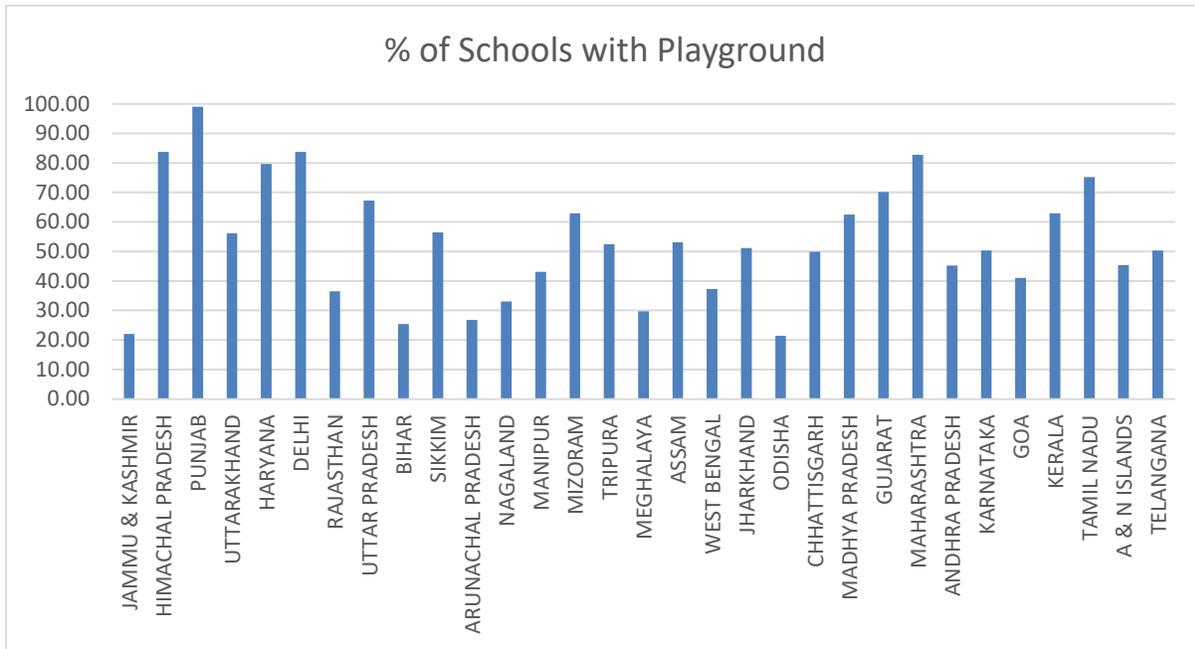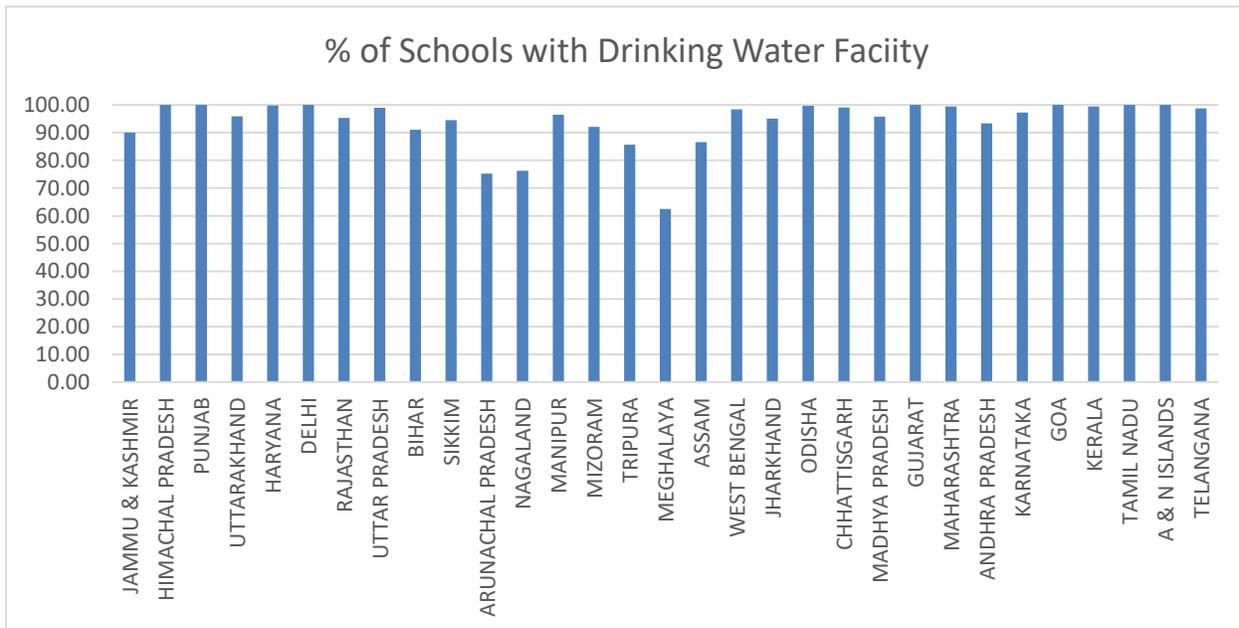**Fig: 2 Percentage of Schools with playground Facility**

% of Schools with Playground

Fig:　3　%　of　Schools　with　Drinking　Water　Facility

% of Schools with Drinking Water Faciity

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According to the figure 3 it is cleared that Himachal Pradesh, Delhi, Goa, A & N Islands have 100% schools with drinking water facility preceded by Punjab. Tamil Nadu, Gujarat, Haryana, Odisha. Meghalaya has the last position having 62.48 % of schools with drinking water facility. It preceded by Arunachal Pradesh, Nagaland, Tripura, Assam.

Fig: 4   Percentage   of   Schools   with   Electricity   Facilities
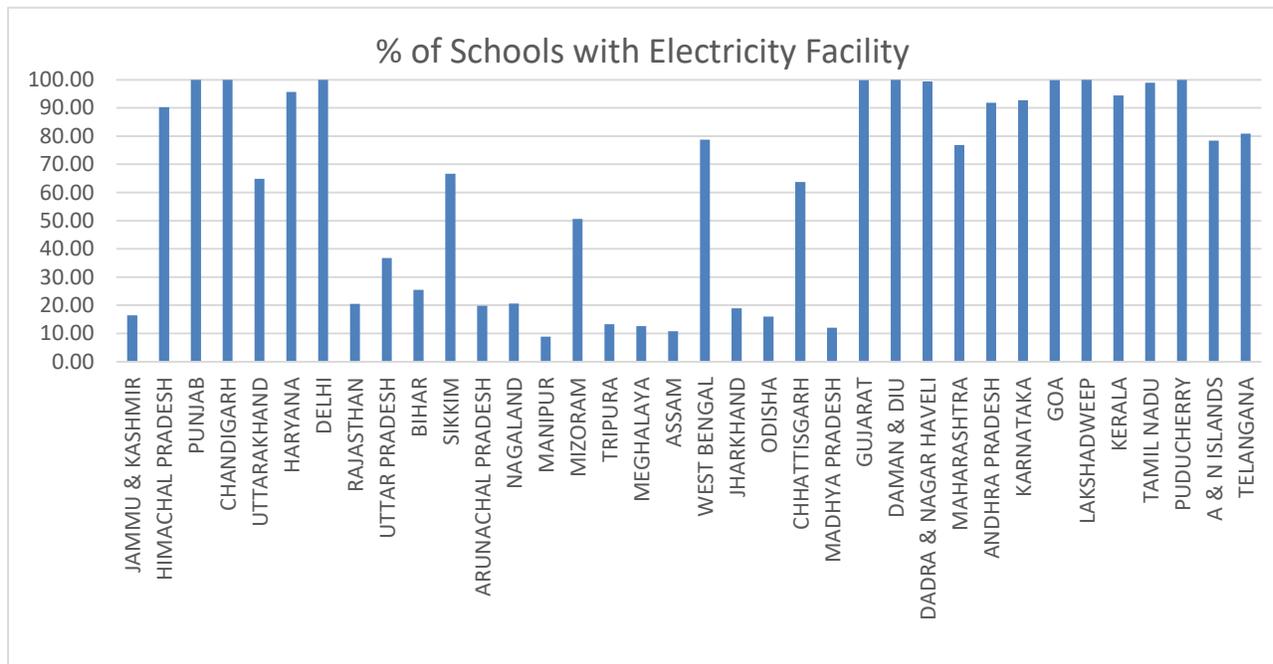

Figure 4 represents the primary schools with electricity across the Indian states. Delhi has maximum primary schools with electricity facility preceded by Punjab, Goa, Gujarat etc. Manipur has the lowest position with 8.83% schools with electricity facility preceded by Assam, Madhya Pradesh, Meghalaya, Tripura, Odisha, Jammu & Kashmir etc. These states are lacking electricity facility in their primary schools. Very minimum amount of schools have electricity facility in these states. These states need much more improvement in this matter.

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Fig: 5 Percentage of schools with Computer Facilities
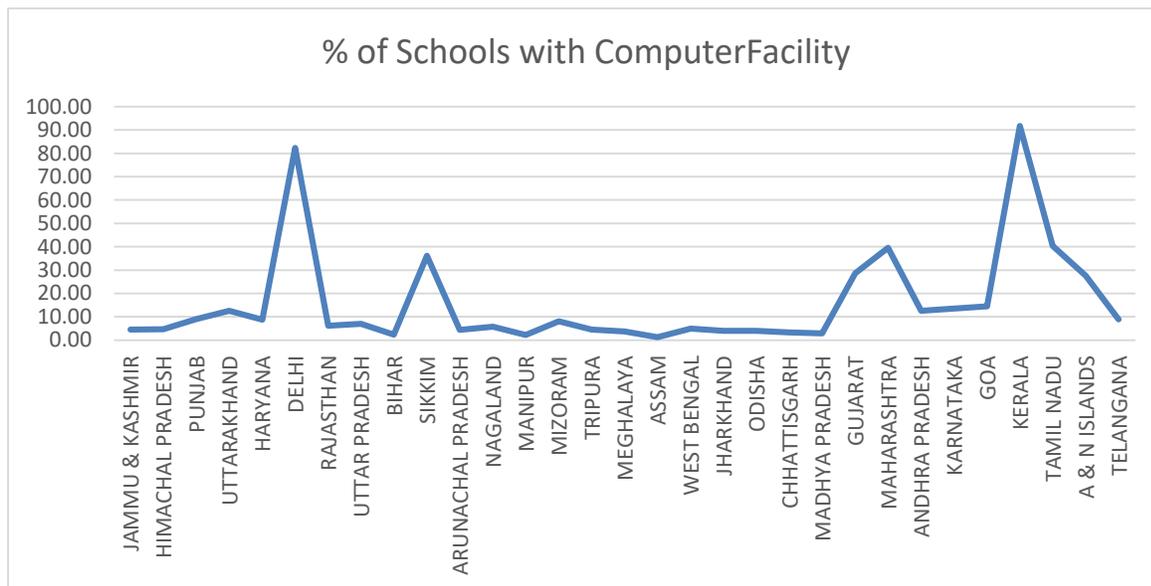
From the figure 5 it is said that Kerala has maximum primary schools with computer facility. There are 24 States in India which have computer facility in schools below 15% which is a very horrible situation in digital India as well as in the era of globalization. Assam has 1.25 % of schools with computer facility. All these states need a huge improvement in this field.

From the above analysis it is clear that Indian states are not performing well in terms of provider of primary school infrastructure facility. The study uses TOPSIS method to rank the Indian states as provider of primary school infrastructure facility. Table 1 depicts the rank of the states in terms of TOPSIS score. In terms of the TOPSIS score Delhi stands first followed by Kerala, Tamil Nadu, and Maharashtra. Bihar, Jammu & Kashmir, Arunachal Pradesh and Meghalaya stand at the bottom of the table. TOPSIS score suggests that maximum states are far away from the positive ideal solution. The North Eastern states are performing poorly. Separate policy should be introduced for the development of the primary school infrastructure for the North Eastern states.

Table 1: State rank in terms of TOPSIS score

State	Rank	score
DELHI	1	0.870261
KERALA	2	0.852203

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TAMIL NADU	3	0.535367
MAHARASHTRA	4	0.514224
GUJARAT	5	0.450935
SIKKIM	6	0.431989
PUNJAB	7	0.395963
A & N ISLANDS	8	0.377977
HARYANA	9	0.359354
HIMACHAL PRADESH	10	0.346015
GOA	11	0.340741
KARNATAKA	12	0.330376
ANDHRA PRADESH	13	0.319029
TELANGANA	14	0.289987
UTTARAKHAND	15	0.280167
WEST BENGAL	16	0.25794
MIZORAM	17	0.248252
UTTAR PRADESH	18	0.238669
CHHATTISGARH	19	0.237692
MADHYA PRADESH	20	0.186301
JHARKHAND	21	0.163437
TRIPURA	22	0.158464
ASSAM	23	0.142737
RAJASTHAN	24	0.137064
MANIPUR	25	0.136433
ODISHA	26	0.11547
NAGALAND	27	0.107032
BIHAR	28	0.097444
JAMMU & KASHMIR	29	0.094092
ARUNACHAL PRADESH	30	0.079393
MEGHALAYA	31	0.050545

4.Conclusion:

The study concludes that all the Indian states are not doing well as provider of primary school infrastructure. TOPSIS score suggests that only Delhi and Kerala have score near to positive ideal solution. All other states are far away from the positive ideal solution. Primary schools are the first entry point of the children for education. This is the starting point for making the human capital

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for future. Therefore, Indian states should initiate right and proper policy to develop the infrastructure of the primary schools for the appropriate build-up of human capital for the future.

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