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Research Article

Enrolment Projection In The Light Of NEP 2020: Statistical Projection For Policy Implications

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ABSTRACT

Projection of unforeseen figures is a critical task in various sectors such as the educational sector, finance, or business planning anticipating potential parameters and choosing an appropriate mathematical model is crucial for achieving maximum accuracy. Although no any prediction algorithms can estimate the future perfectly, certain approaches can improve accuracy and reduce biases in projection. This article provides the estimates and trend of enrolment figures with a 95 per cent confidence interval in India categorized based on gender and social groups until 2036 in the context of the National Education Policy (NEP) 2020, and Sustainable Development Goal 4 (SDG-4). Estimation of school enrolment is a challenging yet captivating task, understanding data and considering the algorithm's complexity is a cornerstone for an effective prediction. Antecedent to choosing a projection algorithm, it is central to identifying features that most influence the outcome. In case of estimating enrolment indicators such as dropout rate, promotion rate, repetition rate and apparent intake rate can significantly affect the enrolment estimates. Enrolment estimation is accomplished using the flow model *i.e.,* the Reconstructive cohort method, one of the crucial educational flow models. Projection of the parameters involved in the flow model is projected using complex machine learning and time series algorithms. Double exponential smoothing and regression algorithms were used after the fulfillment of all the assumptions. Enrolment being a function of population, growth in enrolment is directly proportional to the growth in the child population of that respective age or age group. As the child population is declining, it is significantly impacting enrolment figures in educational institutions. Here, enrolment projection during 2022-2036 has been discussed. The projection reveals that during the period 2022-2036, there will be an estimated decline of 12.7 per cent in enrolment at the primary stage. The middle stage is anticipated to experience a decrease of 9.1 per cent overall. Similarly, the trend continues for the secondary stage, with a 1.3 per cent decline in overall enrolment. The foundational stage (Grades I and II) is expected to undergo a decline of 11.4 per cent in overall enrolment. A similar trend is anticipated for the Preparatory stage (Grades III, IV, and V), with an estimated decline of 12.7 per cent in overall enrolment.

Keywords: Education Planning, Enrolment Projection, Exponential Smoothing, NEP 2020, Reconstructive Cohort Method, School Enrolment.

1. Educational Estimates Aligning to Quality Education:

India has made substantial advancements to provide free and compulsory education to all children in the age group six to fourteen years as a fundamental right through the successful enactment of various initiatives such as Sarva Siksha Abhiyan (SSA) and Right to Education (RTE) (Pandey, 2018). Further, it was supported by the Rashtriya Madhyamik Shiksha Abhiyan (RMSA) for grades 9 to 12 and now Samagra Shiksha Abhiyan (SSA) for grades 1 to 12 in a holistic way. With the current demographic transitions concerning quality

education, innovation, and research, the aim of National Education Policy (NEP) 2020 is to make India a hub of knowledge by preparing students with vocational skills, and upgradation with ICT (Pandey, 2018).
Sustainable Development Goal – 4 (SDG 4) goal which stated that '*Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all*'. The aim of SDG 4 is to cinch quality education to every child and individual by developing national connection and cultural heritage and equality for all citizens (Addey, 2021). This article highlights the importance of projecting enrolment figures which may be used for the devising of policies mainly on quality education. This analysis not only helps in policy formulation but also underpins the socio-economic development of our country. Integration of estimated enrolment figures with the NEP 2020 can have a positive impact on accomplishing quality education. India has experienced a noteworthy advancement in the field of education by essentializing basic education, enhancement in female enrolment, and improvement in completion rate at both secondary and tertiary institutions. (Saxena, 2021).
The NEP 2020 acts as a catalyst for SDG 4 pushing boundaries of traditional learning integrating multidisciplinary critical thinking approaches that involve solving complex, holistic, inquiry-based, discovery-based problems, and analysis-based learning, etc. This encourages students to come across the complex challenges posed by sustainable development (Haripriya and Prema, 2023). The NEP 2020 has given enormous endeavors on ECCE and pre-primary education for which a new pedagogical structure of education is devised encompassing foundational and preparatory stages. This recommendation in the educational structure aligns with the specific targets of SDG 4, ensuring inclusive and equitable quality of education for all. Estimation of future students' enrolment is paramount for achieving every target of SDG 4, stagewise enrolment estimates along with various educational indicators are pivotal in enhancing tailored policies that address challenges to ensure inclusive and equitable quality education for all. Although India has made great progress in expanding inclusive and equitable quality education across all educational levels, there remains substantial scope to fortify quality constraints. Comprehensive and precise student enrolment estimates empower stakeholders to identify gaps and distribute resources more efficiently to children and institutions to ensure progress on the path to achieving quality education for all by 2030.
The demographic shift in India's population significantly impacts student enrolment in the education system. However, estimating unforeseen figures is a challenging as well as captivating task, which uses advanced statistical tools for assessing the enrolment figures with maximum accuracy. In July 2020, India got its NEP 2020 with many transformative recommendations including the introduction of a new school structure of 5+3+3+4, the Foundational stage of 5 years, the preparatory stage of 3 years, the middle stage of 3 years, and secondary stage of 4 years with the inclusion of pre-primary classes of 3 years in the Foundational stage. Now, ECCE or pre-primary classes of 3 years in the age group of 3 – 6 years is a part of the foundational stage as recommended in the new structure of NEP 2020. With this recommendation, after a few years every child will get enrolment at grade one at age 6 after completing the ECCE or Balvatika of 3 years.
It tasks cannot be successfully and effectively conducted unless the government has sufficient and reliable data about the enrolled children, in advance. What is their enrolment, what will be their promotion rate, how many will complete the level, etc. are some indicators of development which are directly or indirectly related to the size and structure of the population. Enrolment projection, which provides information for pro-active thinking and budget planning, is important in many ways to the system. However, obtaining accuracy in planning for future is not an easy task, as many factors have impacts on enrolment numbers. It is, therefore, of paramount importance to know various aspects of the size and structure of enrolments at different points of time. Secondly, educational planning requires enrolment projections, which form the basis for many of the investment decisions. For example, new schools to be opened or upgraded and the number of teachers required are decided on the basis of the number of children to be potentially enrolled in the system (Pajankar and Srivastava, 2019).
Enrolment projection figures and their trend for India and its states up to 2036 classified by gender as well as marginalized groups such as SCs (Scheduled castes) and STs (Scheduled Tribes). These projections are essential for planning educational infrastructure, allocating resources effectively, and ensuring equitable access to quality education across diverse demographics. By forecasting enrolment figures according to the new pedagogical structure, which includes the Foundational, Preparatory, Primary, Middle, and Secondary stages, this article aims to support informed decision-making in education policy and implementation. It underscores the importance of proactive planning and strategic investment in education to meet the evolving needs of India's student population under the transformative framework of NEP 2020.

2. Exploring Correlation between Demographic Shifts and Enrolment Patterns in Developing Nations: Insights from India

Enrolment is a function of the population. Enrolment of children in an age group or grade may depend on the child population of that age group. The growth in enrolment should be directly proportional to the growth in the child population of that respective age or age group. In ideal situation, enrolment should be equal to the child population in respective age or age-group. Practically, it is not equal at any moment. There is always some gap exists between the enrolment figure and child population in respective age or age-groups.

In the census 1991, the proportion of child population in the age group 0-6 years in the total population was about 18% which declined to 13.12% in the census 2011. The proportion of the girl-child population also declined from 18.12% to 12.93% during census 1991 to census 2011.

Table 1: Rate of change in Total and child population (1991 - 2021) (Fig in Millions)

		1991	2001	2011	2021*
Children Age 0-6 Years	Total	150.42	163.84	158.79	114.3
	Boys		85.01	82.95	60.16
	Girls		78.83	75.84	54.13
Total Population	Total	846.3	1028.74	1210.19	1363.01
	Male	439.23	532.2	623.72	700.62
	Female	407.07	496.5	586.47	662.38
Share of Children aged 0-6 years to Total Population	Total	17.94	15.93	13.12	8.39
	Boys	17.77	15.97	13.30	8.59
	Girls	18.12	15.88	12.93	8.17
Rate of Change in Child Population (age 0-6 years)	Total		8.92	-3.08	-28.02
	Boys			-2.42	-27.47
	Girls			-3.79	-28.63
Rate of change in Total Population	Total		21.56	17.64	12.63
	Boys			17.20	12.33
	Girls			18.12	12.94

*Source: Population Census 1991, 2001, 2011, Registrar General of India, Govt. of India, and *NPC (2020)*

It is seen that in the population censuses 1991 to 2021 (see Table 1), the growth rate of the population declined to 21.56 per cent in 1991-2001, 17.64 per cent in 2001-2011, and 12.63 per cent in 2011-2021. A declining trend is also reported in the male and female population. However, the child population in the age group 0-14 years is also declining. The child population in the age group 0-6 years is declining very sharply such that the growth rate is reported as negative as the tremendous decline in the birth rate in the country (NCP, 2020 and IIPS & ICF, 2021). The proportion of child population in the age group 0-6 years in the total population was about 18% which is a decline to 8.59 per cent in census 2021. The proportion of girl child population also declined from 18.12 to 8.17 per cent from 1991 to 2021. IIPS and ICF (2021) reported in NHFS-5 that the total fertility rate (TFR) has declined to 2.0 children per woman compared to NHFS-4 which reported 2.2 children per woman conducted in 2015. Due to the decrease in births, the child population has declined. A smaller number of children get enrolment in the school system. It implies the gap between enrolment and population decreases. As a result, enrolment at each stage will also decline.

As a result, the gap between enrolment and population also decreases. This gap is tailored mainly due to improvements in the rate of decline in the growth of the population (though less than anticipated), a rise in literacy rates, and also the overall sex ratio of the number of women per 1,000 men (John, 2011). The enrolment figure is also declining at each stage. Similar reflections were also seen in the study Pajankar and Srivastava (2022). After 2011, total enrolment at the primary stage starts declining. In projected figures of primary enrolment, this declination is continued. In the middle stage, the enrolment (boys, girls, boys+girls) starts declining from 2016. At the secondary stage, the enrolment (boys, girls, boys+girls) starts declining after 2019.

It has been seen that in the population census of India 2011, the population's growth rate is declining especially in the case of the child population. Changes in the demographic parameters specifically in the fertility rate reflect demographic shifts and that results in the school-age population. Table 1 reveals that child-population of age-group 0-6 is continuously declining. This population decline may be cumulatively reflected sequentially for the upcoming ages in coming years. In the Indian school education system, the primary stage (grade I to V) having age-group 3-11 years, middle stage (grade VI to VIII) having age-group 11-14 and secondary stage (grade IX to XII) having age-group 14-17 years, respectively. In an instant, changes (increases or decreases) in the population of the age group 6-11 years may impact the enrolment at the primary stage (grades I-V) at the same rate. The same is applicable for middle-stage (grade VI-VIII) and secondary-stage (grade IX–X) enrolment (Bilsborrow, 1978). It also supports the intrinsic relation between population and school enrolment figures. Pajankar and Srivastava (2019) concluded the inherent relationship between population and school enrolment figures coexists with the decline in enrolment figures at each educational coupled with increasing in the share of girl's enrolment similarly, social groups Scheduled Castes (SCs) and Scheduled Tribes (STs) enrolment declined at each educational stage.

3. Utilizing enrolment projections to achieve NEP 2020: Vision of quality education

A jewel in the crown of this ambitious policy is the deliberate use of enrolment projection figures which gives key insights into the unforeseen educational demands. Access to quality education is ensured through these projections as it helps policymakers, institutions, and educators to antedate any changes in the system. These

estimates ensure the tailoring of an inclusive and dynamic educational environment by emphasizing data-driven decision-making. Various educational challenges such as infrastructure discrepancies, teacher shortages, droppers, and many other educational incongruities can be capitalized by these enrolment projection figures to achieve NEP 2020 vision of quality education. Below are some potential outcomes of projected figures that can be utilized to achieve the vision for quality education.

(i) The NEP 2020 recommendation of the new pedagogical structure 5+3+3+4 covering ages 3-18 that includes 5 years of foundational stage, 3 years of preparatory stage, 3 years of middle stage, and 4 years of secondary stage. This pedagogical restructuring requires precise upcoming enrolment figures to ensure educational resources and infrastructure are meticulously planned for young learners' cognitive and holistic development.

(ii) The projected enrolment will recognize possible bottlenecks and disparities in the educational sector that are curtailing the dropout rate. Though, there are various schemes and initiatives taken by stakeholders such as Samagra Shiksha Abhiyan (SSA) and the Right to Education Act (RTE Act) 2009, have made remarkable strides to curb the dropout rate and ensure universal access to education but to achieve a rock-bottom dropout rate requires precise enrolment figures. In fact, programs such as SSA and the RTE Act depend on enrolment figures for their successful implementation.

(iii) The semblance of NEP 2020 is prioritizing linguistic diversity and the power of language which are mentioned in the Eighth schedule of the Constitution of India among young learners. Enrolment figures of each state accentuate the need for language teachers in a specific region. For instance, emphasizing Telugu, Bengali, or Marathi enrolment figures can determine the number of language teachers/instructors required for these languages allowing targeted recruitment hence delivering quality education in students' their own mother tongues and also in local dialects. Additionally, enrolment figures will help in the development and distribution of educational resources such as textbooks and e-resources in multiple languages.

(iv) By leveraging the precise enrolment figures and educational indicators effective allocation of educational resources, teacher recruitment, resource distribution, and infrastructure development can form an inclusive and equitable education system. For instance, educational indicators such as the teacher-student ratio are estimated based on enrolment figures, and teacher requirements are determined based on the number of students enrolled.

(v) An uphill task of the educational system is the distance from home to school as it impacts on attendance and quality education of young learners. Schools adopt a proactive approach of data-driven decision-making by analysing the demand of students through projected enrolment figures and then optimizing the school which enhances accessibility contributing to minimum travel distance thereby improving attendance rate and quality education.

The projected enrolment figures are crucial not only for the government organization but also for the researchers who are aiming to develop new indicators in aligned to NEP 2020 for effective and smooth implementation. Enrolment figures are fundamental for ensuring quality education and estimating new indicators. The precise projected enrolment figures permit data-driven proactive decision-making for the effective allocation of educational resources that meet the requirements of students thereby ensuring quality education. These figures can be cornerstone for educational planners and researchers under NEP-2020 fostering continuous enhancement in India’s educational system.

4. Projection Model Accuracy and Reliability in Educational Projection:

Projection of school students’ enrolment is a challenging as well as captivating task for statisticians and researchers. Selection of an appropriate mathematical-statistical model is very crucial for achieving maximum accuracy. Although no prediction algorithm can estimate the future cent-to-cent perfectly. Certain approaches can improve accuracy and reduce biases in projection i.e., tendencies to under predict and over predict. (Xiang, Raymer, & Gray, 2023). Understanding data and considering the algorithm's complexity is a cornerstone for an effective projection process. The aim of the projection should perfectly line up with the complexity of an algorithm and the amount of existing source data. Antecedent to choosing a projection algorithm, it is central to identifying features that most influence the outcome. For example, in the case of estimating students' enrolment indicators such as dropout rate, promotion rate, repetition rate can significantly affect the enrolment estimates. Fulfilling the model assumptions and thereby assessing model performance by getting accurate predictions is the ultimate goal of prediction modeling (Roberts, 2023). The process of school students’ enrolment projection has two important phases.

(i) Identification and collection of reliable data:

- Either primary or secondary data should be collected from reliable trusted sources. In case of secondary data, its authentication needs to be verified.
- If available then data should be collected from Government sources.
- Complete data on a parameter(s) should be from a single source. Data gathered from different sources may effect on results and reliability of the study.

- If any case, data on some required parameters is not available in the main source, then take it from another authentic source and mention its source and the reason for its selection.
- Before use of data (primary or secondary), check the consistency in the data. If data has noised or ups and downs, it may affect on final result of the study. It should be smoothened before the process.
- If case of primary data, clean the data. Check missing values, outliers, range of information, codes used for conversion from text of numerals, etc. Sometimes, it may also be applicable for secondary data.

(ii) Appropriate statistical procedure to estimate accurate enrolment for next year.

This study explores the forecasting models to project school enrolment. It is an extension of an earlier study conducted by Pajankar and Srivastava (2022) during 2017-18 at NCERT, New Delhi. Reconstructive Cohort Method, one of the flow models used for estimating future enrolments, is being utilized to compute the enrolment for grades 1 to 10 by 2036. The Reconstructive Cohort approach is often referred as the true cohort. It is the most reliable way of studying the progress of a group of pupils through a cycle of education. During the construction of cohort, it is easy to work with relative than with absolute number. For example, instead of starting with enrolment in class i (i=1,2,3,...,) in time t and calculating how many pupils will repeat this class in time t+1, be promote to class II, or drop out from the system, it is much easier to base the calculations on the promotion, repetition and dropout rates for class i.

A flow model for projecting student progression through the educational system considers three possible conditions: promoters of a grade; repeaters of a grade; and droppers of a grade, thereby granting advantage of enrolment analysis by examining how fluctuations in promotion, repetition, and dropout rates interactively effect enrolment. (Castillo, Alvarez, Equigua, & Mejia, 2013). The flow method for educational analysis demands an assumption about three different flow rates: the promotion rate (p), repetition rate(r) and dropout rate(d) are expressed as a percentage.

$$p + r + d = 100\ \%$$

Certain basic parameters are essential for computations using the Reconstructive Cohort Method. These parameters include child population age 6 at time t, apparent intake rate at time t, class I enrolment at time t, the repetition rate of class i (i = 1,2, 3...9) at time t, promotion rate of class i (i = 1, 2, ..., 9) at time t.

The child population aged 6 years during the period 2022 to 2036 is required for estimating the flow of student enrolment in the educational system. This projected population may also be useful to calculate the Gross Enrolment Ratio (GER) for respective years. The projected population data is required in two formats. One, child population of age 6 for the estimation of class I enrolment for next year up to 2036 and second, population of different age groups (6 – 9 years, 9 – 11 years, 6 – 11 years, 11 – 14 years, and 14 – 16 years) to calculate gross enrolment ratio at different stages; foundational stage, preparatory stage, primary stage, middle stage and secondary stage for years 2022 to 2036.

The study employed two statistical algorithms to estimate the necessary parameters for the flow model, which is used to project student progression in the school educational system. First, Double Exponential Smoothing or Holt's trend method one of the complex time series algorithms is used to estimate the apparent intake rate repetition rate and dropout rate for years 2022 to 2036, considering data from 2016 to 2021 as input data. This method gives a perfect prediction, by assigning exponentially decreasing weight to the historical data points. In other words, as we move closer to the present, the influence of recent observations becomes stronger, while older observations have less influence on the prediction. For instance, if we are predicting AIR for time t+1 and we have data for time t, t-1, t-2, and t-3 then the maximum weightage will be given to the most recent data, i.e., t and t-1. The model assumes that the future will be somewhat similar to the recent past. Forecasting is based on prior assumptions such as seasonality and trends of available data. Exponential smoothing can be most effective when the time series parameters vary slowly over time. Double Exponential Smoothing has two parameters namely alpha (α) and beta (β). Alpha (α) is a smoothing factor and Beta (β) is a trend smoothing factor. This method supports trends that change in additive ways (smoothing with linear trend) and trends that change in multiplicative ways (smoothing with exponential trend). Second, Multiple Linear Regression is used to predict the dependent variable when we have two or more than two independent variables. This technique is used when we have a strong relation between dependent and independent variables. Multiple linear regression is the extension of simple linear regression. This algorithm of machine learning is utilized for estimating promotion rates based on enumerated factors for the years 2022 to 2036, considering 2016 to 2021 as input data.

Achieving maximum accuracy and quality in prediction requires the optimization of certain parameter values to ensure sustainability. Optimization involves tuning the parameters to boost the reliability of the algorithm, through this enhancement of parameter value, the model accuracy and quality of the prediction model can be sustained thereby estimating outcomes of maximum accuracy and positive decision-making. The enrolment estimate conducted in this study utilized advanced statistical tools and yielded results of maximum accuracy with a minimal margin of error. The margin of error in the enrolment estimates falls within the range of 0-10 percent, while each estimate is accompanied by a 95 percent confidence interval so as to reduce uncertainty, make informed decision-making, and provide a measure of the reliability of the prediction.

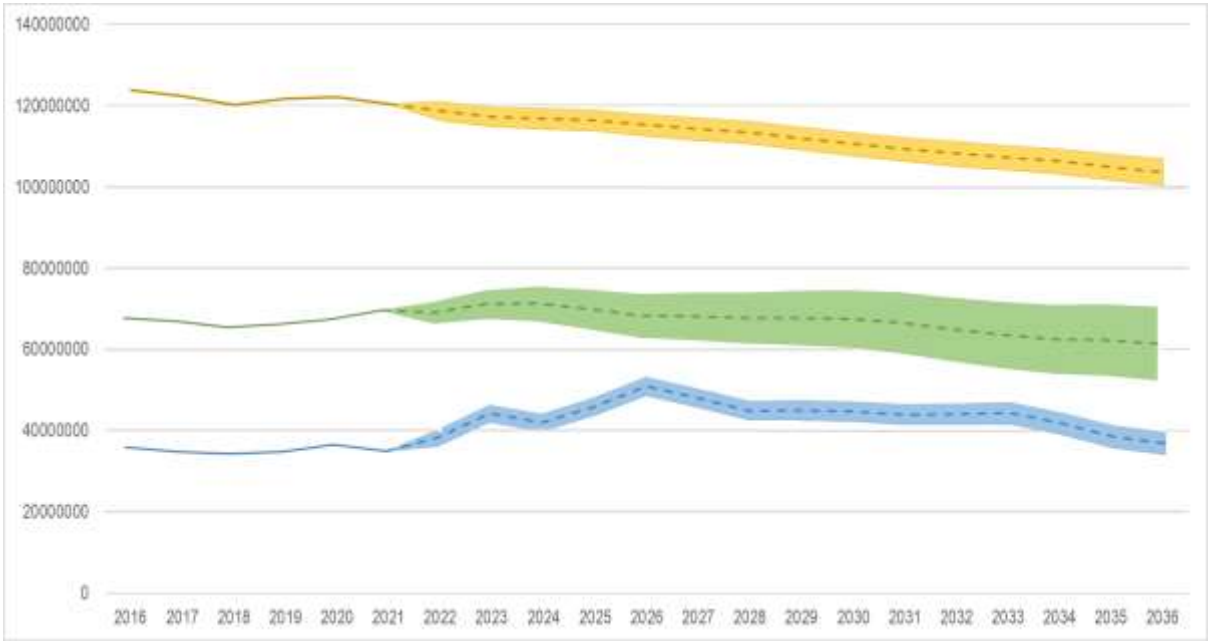
5. Projecting Enrolment Trends Through 2036

Enrolment figures for the years 2022-23 to 2036 has been estimated with the Reconstructive Cohort method, one of the most popular and reliable methods for estimating future enrolment based on different parameters. Sometimes, it may be difficult to estimate and project a single target point. With the statistical procedure, it is not feasible to calculate a point estimate for a single point of enrolment. Since, change in enrolment may depend on different indicators, namely promotion, repetition, and dropout rates. The change in rates is also improving with respect to time such that the repetition rate and dropout rate are declining whereas the promotion rate is increasing. At the same time, due to noises in the prior year's enrolment data (secondary data), it was difficult to estimate an accurate estimation of the enrolment. However, estimation with the confidence interval (upper bound and lower bound) displayed the possible variations in the point estimation of the enrolment at a time.

The enrolment has been estimated for years 2022 to 2036 for stages primary, middle and secondary including foundational stage (grade I and II) and preparatory stage (Grade III to V) separately. It is found that there is decline in enrolment at each stage. At primary, students' enrolment declined by 12.7 per cent, at middle stage it is declined by 9.1 cent, and at secondary, it is declined by 1.3 per cent. As stated earlier, the birth rate is declined the child population is also declined and less child population implies less enrolment in the system. Population census 2011 reported negative growth in the population. UDISE+ statistics reveals that during 2016 to 2022, growth in enrolment of boys, girls, and total (boys and girls) continued in the negative direction (-7.23, -6.19, and -5.63, respectively). This scenario in enrolment will continue at the same pace till 2036. For total (boys and girls), the rate of change in enrolment during the period 2016 to 2036 will be -16.23 and for the period 2022 to 2036, it will be -14.86. The girls enrolment will be -16.09 (2015 to 2036) and -13.14 (2022 to 2036) and for boys, it will be -16.09 (2015 to 2036) and -13.14 (2022 to 2036). According to Population Division(2022) stated that India's population is towards the stabilisation in coming 30 years. The negative growth is going down with time. It is estimated that during the period 2025 to 2036, there is an estimated decline of 7.93 per cent in enrolment. However, from 2030 to 2036, there will be a decline of 4.88 per cent. This indicates a slow pace of decline in enrolment.

At the middle stage, it has been estimated that the growth rate of enrolment during period 2015 - 2036 will be -9.59 and during 2022 - 2036, it will be -10.55. For girls, it will be -8.89 (2015 to 2036) whereas -9.45 (2022 to 2036) and for boys, it will be -6.37 (2015 to 2036) and -10.08 (2022 to 2036). At the secondary stage, the enrolment growth during 2015 to 2036 will be -5.49 and for period 2022 to 2036, it will be -4.76. In case of girls enrolment, it will move towards stabilisation as it will be -0.88 (2015 to 2036) and -0.95 (2022 to 2036), whereas, for boys, it will be -3.37 (2015 to 2036) and -1.89 (2022 to 2036).

Figure 1: Enrolment of Students at Primary, Middle and Secondary Stage with Confidence Interval from 2016 to 2036

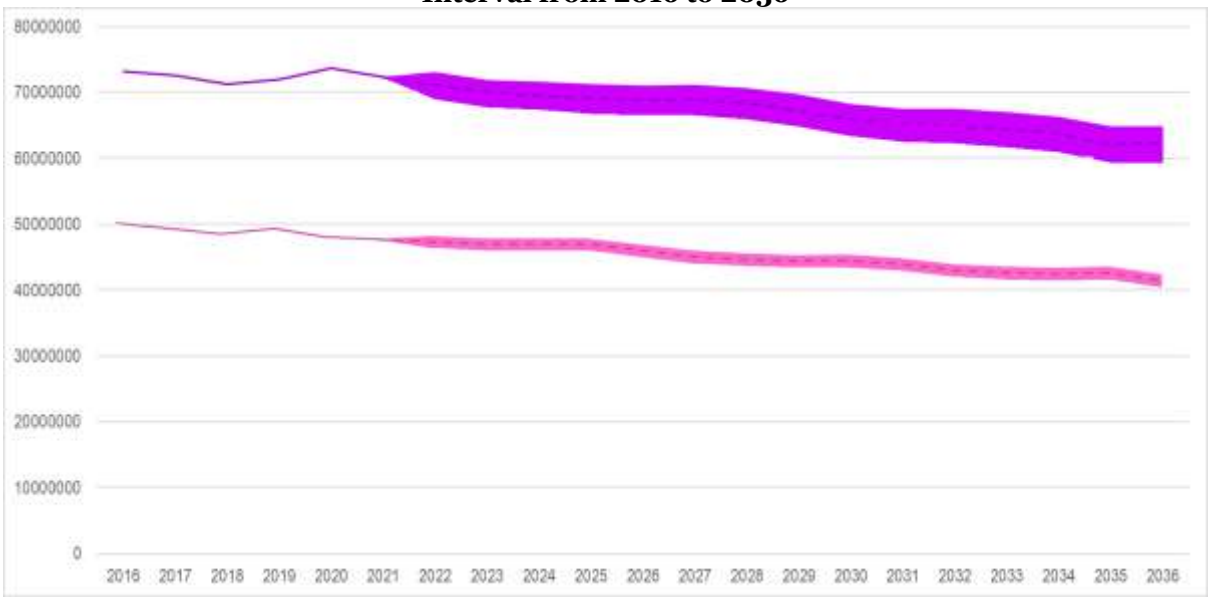


Source: UDISE+ (2023)

As recommended by the NEP 2020, four stages of school system now termed as foundational stage, preparatory stage, middle stage, and secondary stage, where the foundational stage is a combination of two stages Early Childhood Care Education (ECCE)/Balvatika of 3 years (from age 3 to 6 years) and early two grades of primary stage, grade 1 and grade 2, and preparatory stage has grade 3 to 5. Accordingly, the enrolment for period 2022-36 is also estimated for the foundational stage and the preparatory stage. During

2022-36, the Foundational stage (Grade I and II) is expected to undergo a decline of 11.4 per cent, with a subsequent decrease of 12.9 per cent in boys' enrolment and 12.3 per cent in girls' enrolment. Similar trend is anticipated for the Preparatory stage (Grade III, IV and V), with an estimated decline of 12.7 per cent in total enrolment, accompanied by 11.00 per cent decrease in boys' enrolment and a 14.4 per cent decrease in girls' enrolment.

Figure 2: Enrolment of Students at Foundational and Preparatory Stage with Confidence Interval from 2016 to 2036



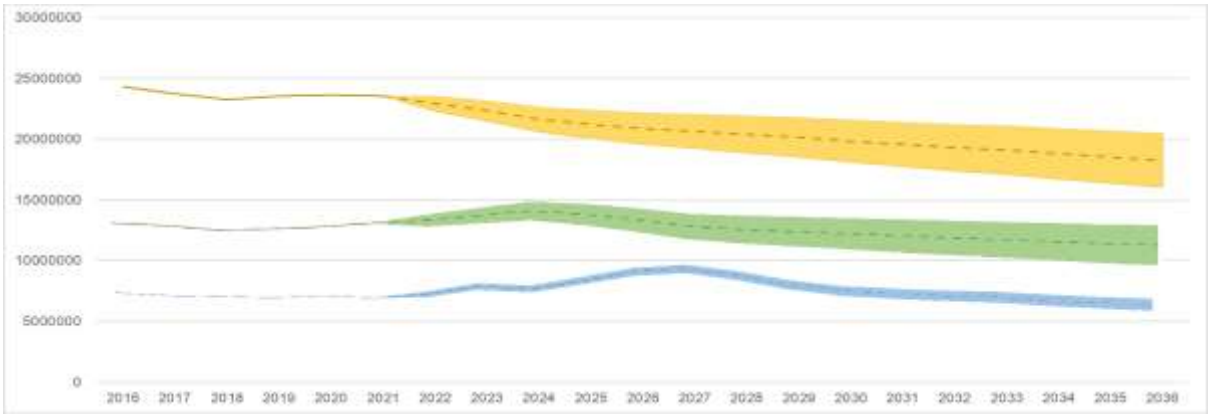
Source: UDISE+ (2023)

Based on the school enrolment figures, it can be inferred that school enrolment in the country is declining uniformly across the stages. However, there will be a slight increase in enrolment at the secondary stage in the upcoming year and then enrolment will also start declining in a slow pace. This decline is due to decreasing fertility rate in the country which leads to a decline in the child population (IIPS and ICF, 2021). As a result, fewer students are being enrolled in the system, which affects the population at each stage and ultimately results in a decline in enrolment figures at each stage. The GER for the foundational, preparatory, and primary stages fluctuates around 100 per cent. However, the GER for the middle stage and secondary stages will remain below 100 per cent. It is also estimated that these figures will improve gradually each year and will eventually reach close to 100 per cent.

6. Enrolment of marginalized groups: Addressing SDG Target 4.5

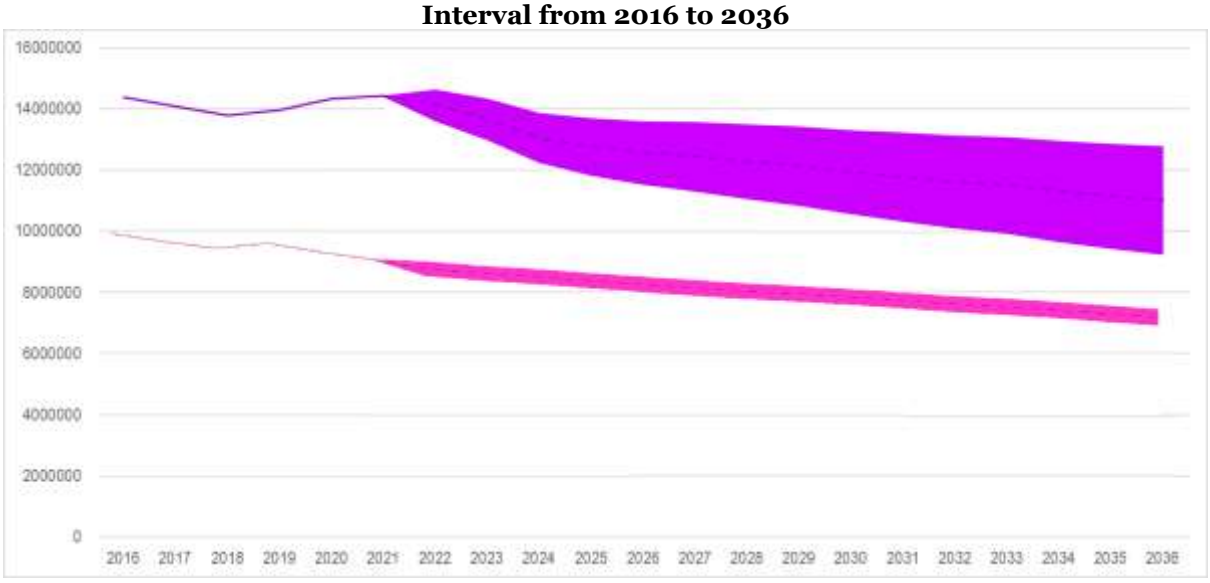
According to SDG 4, target 4.5 states *eliminate all discrimination in education by 2030 whether it is gender disparities or disparities among social groups*. This resolute goal emphasizes the need for a comprehensive and inclusive policy that ensures quality education for all marginalized and social groups. Achieving this target requires exhaustive and reliable estimates of enrolment statistics as well as other related educational indicators such as promotion rate, dropout rate, repetition rate, gross enrolment ratio, and gender parity index. These estimates are crucial for marginalized groups such as Scheduled Castes (SCs) and Scheduled Tribes (STs). Projected enrolment in consort with apparent intake rate will help the government better understand their enrolment trend at the educational institutions. Education indicators such as the gender parity index will be important to understand how class composition can help draft encouragement schemes and policies for marginalized groups. At the Center and State levels, estimated enrolment figures and their trend can assist in better-allocating funds for marginalized groups. At the school level estimated promotion rate, dropout rate, and repetition rate are of crucial importance as these estimates can aid in tracking the performance of marginalized groups and can assist teachers and other academic staff in adopting innovative pedagogies to ensure a motivated and creative learning environment.

Figure 3: Enrolment of Students at Primary, Middle and Secondary Stage with Confidence Interval from 2016 to 2036



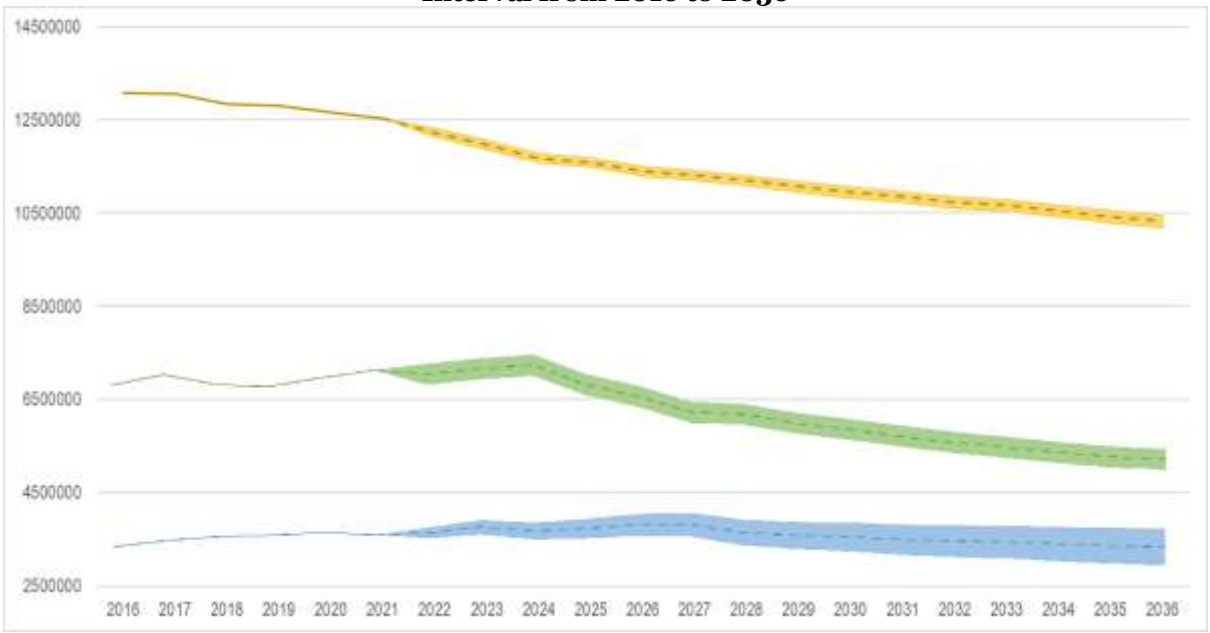
Source: UDISE+ (2023)

Figure 4: Enrolment of Students at Foundational and Preparatory Stage with Confidence Interval from 2016 to 2036



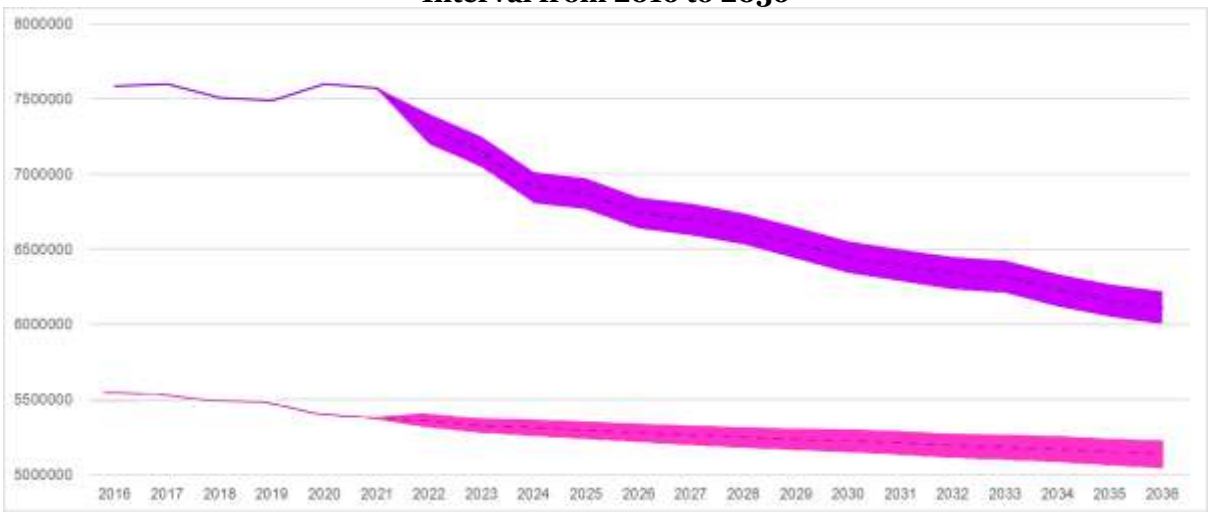
Source: UDISE+ (2023)

Figure 5: Enrolment of Students at Primary, Middle and Secondary Stage with Confidence Interval from 2016 to 2036



Source: UDISE+ (2023)

Figure 6: Enrolment of Students at Foundational and Preparatory Stage with Confidence Interval from 2016 to 2036



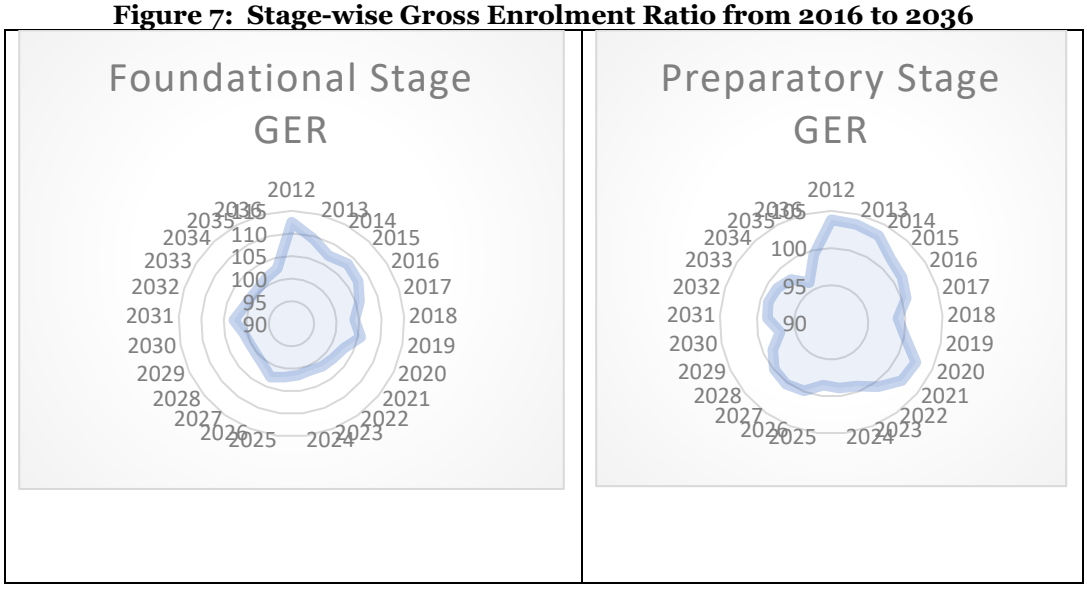
Source: UDISE+ (2023)

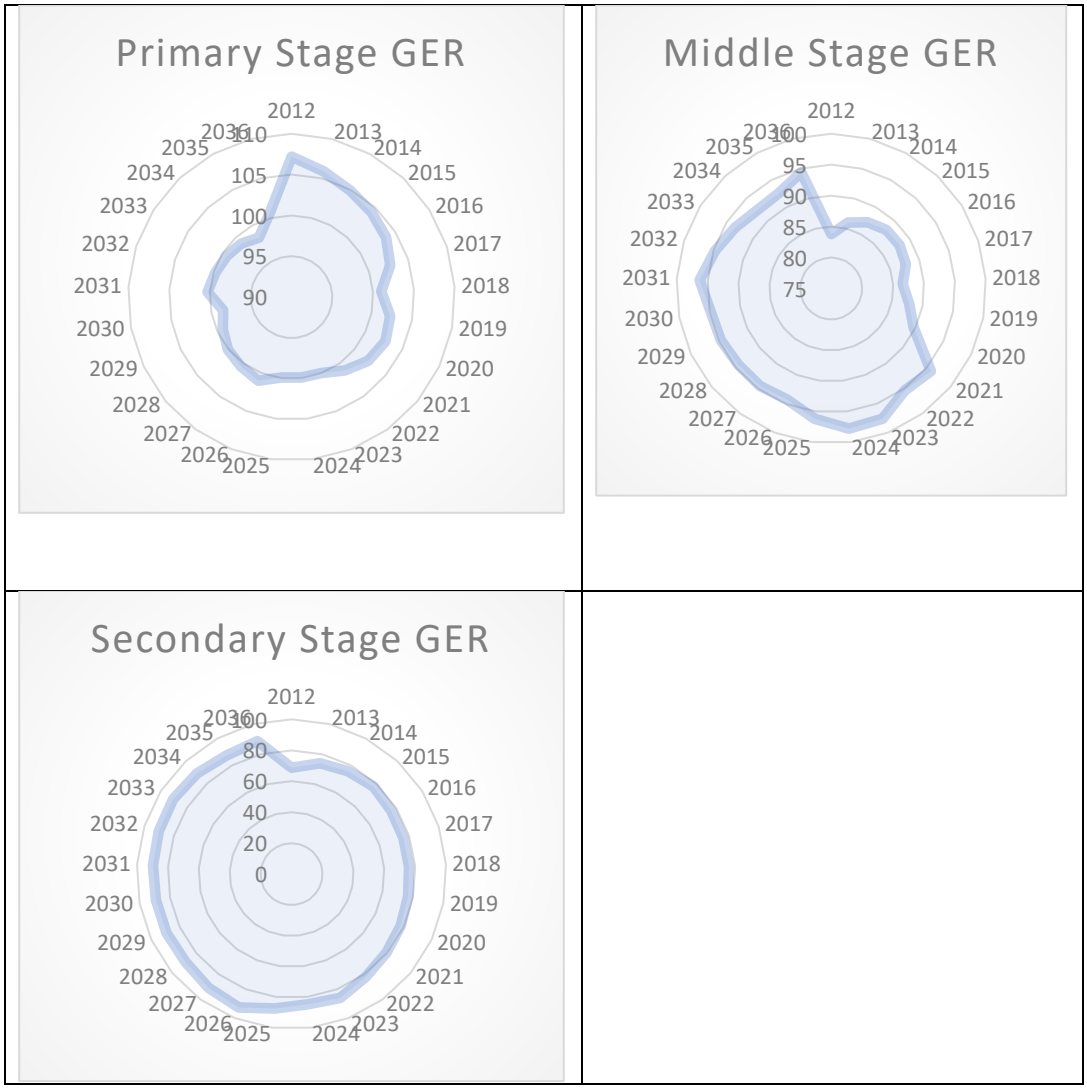
It has been estimated that the number of SC/ST students enrolling in schools is decreasing consistently. This uniform declination can be observed at each stage as SC and ST students population is decreasing uniformly. Analysis reported that SC and ST students' enrolment is consistently declining across all the stages. From 2024, foundational and preparatory stage (primary stage) enrolment will start declining whereas from 2027 onwards, enrolment in middle and secondary stage will starts declining. Same trend of enrolment can be seen for boys and girls in both social categories.

7. Analysing Trends of Gross Enrolment Ratio: Insights from Projection

The analysis concluded that Gross Enrolment Ratio (GER) is expected to stabilize at 100 per cent for both stages of primary by 2036. In 2012, the GER for the foundational stage stood at 113 per cent, and it is projected to decrease to 103 per cent by 2036. Similarly, GER of preparatory is estimated to decline from 104 per cent in 2012 to around 100 per cent in 2036. Likewise, for the primary stage GER is estimated to decrease from 107 per cent in 2012 to 100 per cent by 2036. The GER is expected to see increased at the middle and secondary stages. It may increase from 84 per cent in 2012 to 94 per cent by 2036 and 69 per cent in 2012 to 88.69 per cent by 2036, respectively. This upward trend suggests a move towards achieving a stable GER of 100 per cent at these stages. The GER for the foundational, preparatory, and primary stages fluctuates around 100 per cent. However, the GER for the middle stage and secondary stages will remains below 100 per cent. During the period, GER will improve gradually each year and will eventually reach close to 100 per cent.

Figure 7: Stage-wise Gross Enrolment Ratio from 2016 to 2036





Source: UDISE+ (2023)

8. Conclusion:

With the implementation of NEP, 2020 India is making unprecedented progress towards accomplishing SDG-4 which aims to ensure quality education until 2030. For achieving these endeavours precise enrolment figures are decisive as enrolment is significantly associated with demographic changes. India is going through a decline in child population which is significantly impacting school enrolment figures all over the country. Likewise, enrolment figures for marginalized groups such as Scheduled Castes (SCs) and Scheduled Tribes (STs) follow a similar downward trend.

As reported, decrease in the child-population results in a decrease in the enrolment of students in school institutions. Due to this, educational institutions are closing down which result reduces the number of educational institutions. As a result, educational institutions/schools are struggling to maintain their resources and infrastructure. Many schools consolidate or merge to remain viable rather than invest in new infrastructure. However, shutdown schools have a question of effective allocation of educational resources to reach their full potential. It is suggested to utilise these closing educational complexes and available learning-teaching resources in the complexes for the benefit of society, especially for the teachers, teacher educators, and for students. Schools or educational institutions at each district/block should be dedicated as a center for capacity development (CD) and training programmes for in-service teachers, teacher educators, school heads, education bureaucrats/officials and school management members. The center will also provide the Continuous Professional Development (CPD) programme of 50 hours. It may helps to successfully implementation the recommendation of NEP 2020.

Also, downward trend requires proactive data-driven decision-making to ensure sustainability in quality education. By leveraging unforeseen enrolment figures policymakers and stakeholders can adapt proactive approaches to meet the goals of NEP, 2020, and SDG-4 to maintain quality education for India's education

system. Researchers can utilize these projection figures to explore uncharted areas of the subject and delve deep into the multidimensional aspects associated with these figures.

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