V. Methodology

To accomplish the objectives of the present study a mixed approach i.e. both quantitative and qualitative methods of research will be employed. For quantitative analysis, methods of descriptive statistics, inferential statistics and multivariate statistics would be used. Further to assess the quality of different types of administrative system of primary schools, the following methodology of data analysis will be employed:

1) **Spatial Distribution of Schools**: Descriptive statistics will be used to study the time-trend of establishment of schools.

2) **Demand Analysis of Schools**: To examine the demand of school, a measure of demand will be calculated by taking into account the students-schools ratio (PSR$_{ij}$).

\[
PSR_{ij} = \frac{P_{ij}}{S_{ij}}, \text{Where } P_{ij} \text{ denotes the number of students enrolled at } i^{th} \text{ level (} i=1,2,\ldots,7) \text{ of } j^{th} \text{ management school (} j=1,2,3) \text{ and } S_{ij} \text{ refers to the number of schools of } j^{th} \text{ management having } i^{th} \text{ level.}
\]

3) **Composite Index for Measuring Infrastructure Facilities**: The basic concept is to prepare an index for measuring the quality of education. An index for measuring quality of school by taking infrastructure facilities is formulated with a basic idea to find the input which maximize output i.e. quality of education. The methodology proposed for the purpose is that of Morris (1982) and Unisa (1986) has used this method in finding the quality of life of the people in different states of India. The same approach has been adopted here to find an index for quality of schools as measured through the infrastructure facilities available in the school. For compilation of composite index, all infrastructure facilities available in the school, students-teacher ratio, availability of playground, sports and extracurricular activities, appointment of teacher (permanent/temporary/contract), Education qualification, teachers’ training years of experience will be included. Thus the purpose of including above variables for computing the index is to capture two dimensions namely physical and educational development, to measure the overall quality of a school. The details of computation are given below.

Let $X_{ij}$ represent the size or value of the $i^{th}$ indicator in $j^{th}$ school.
Where (i = 1, 2, ……n, j = 1, 2, ……m).

\[ Y_{ij} = \frac{X_{ij} - \min_j \ X_{ij}}{\max_j \ X_{ij} - \min_j \ X_{ij}} \]

Where \( \min_j X_{ij} \) and \( \max_j X_{ij} \) are respectively the minimum and maximum of \( (X_{ij} = X_{11}, X_{12}, \ldots \ldots \ldots \ldots, X_{1m}) \). The scale value \( Y_{ij} \) varies from zero to one.

From the values of \( Y_{ij} \), the index of the infrastructure of the \( j^{th} \) will be computed as

\[ \text{Mean} Y_{ij} = W_1 Y_{1j} + W_2 Y_{2j} + \ldots \ldots \ldots \ldots + W_n Y_{nj} \]

Where \( W \)'s ((0 < W_i < 1 and sum W_i = 1)) are arbitrary weights reflecting the relative importance of the individual variable. However a more rational view would be to assume that the weights vary inversely as the variation in the respective variable of infrastructure i.e. \( W_i = \frac{1}{s.d.* (1/\sum s.d.)} \). Where s. d. is standard deviation of the \( i^{th} \) variable. If data fluctuates much than the reliability of that indicator becomes less and the importance of that variable decreases proportionately.

The index values have been computed by this method for each of the schools. Also on the basis of the values of the index the overall quality of schools is measured and schools are classified into categories ‘very poor’, ‘poor’, ‘Moderate’, ‘Good’, ‘Very Good’ of quality.

4) Chernoff faces

Graphical methods are well-known for data analysis because of effective means of depiction, exploration, summarization and communication of data. Graphical methods are helpful in suggesting suitable analytical procedures, and in explaining conclusions founded upon them. Chernoff introduced the idea of using faces in 1973 to represent multivariate data graphically. The method consist of vector value data point into geometrically constructed face, features of which are controlled by the values taken for particular variable. The program variables are \( X_1, X_2 \ldots \ldots X_{18} \), for example \( X_6 \), variable may be assigned to the curvature of mouth, the \( X_8 \) to the length of the nose and so on. Thus the facial representation has an advantage over techniques of other graphical methods such as Profile, Stars, Glyphs, Trees and Andrew’s Plots (Saxena, 1985). Flury and Riedwyl (1981) proposed an improved method of construction of faces. The improvement is mainly in the sense that Flury and Riedwyl face gives a more realistic ‘human look’ degenerates less and can accommodate up to 36 variables. With this
programme, it is possible to map paired multivariate measurements. \( X_1 = (x_{11}, x_{12}, \ldots, x_{1k}) \) and \( X_2 = (x_{21}, x_{22}, \ldots, x_{2k}) \) separately to right hand and left hand side of the face. A face half which contains 18 parameters is constructed by an array \( Z = (z_1, z_2, \ldots, z_{18}) \) belongs to \((0,1)^{18}\). \( z_1 \) values are used as construction of face part. The face program allow the user to define for each variable \( x_i \) an interval \((a_i, b_i)\) may either be fixed by user or by programme as multiples of standard deviations.

To assess overall development of primary schools by type of management in Navi Mumbai through Flury and Riedwyl face will be used. For this purpose, the infrastructure facilities available in the schools will be divided into two parts ‘Essential’ (drinking water, power, toilet, library, laboratory, canteen, internet facilities, staff room, bus, firefighting, common room for students, first aid/health, playground, telephone/P.C.O., parking facilities) and ‘Desirable’ (Auditorium, gymnasium, Bank, ATM, Girls Hostel, Boys Hostel etc.) The three type of management will be represented by development in their schools through essential infrastructure facilities. The rationale of using Chernoff type face (Flury and Riedwyl face) – a technique to represent \( k \)-dimensional data graphically (Saxena P. C. and Navneetham K 1993). This technique will be help in assessing and comparing the overall quality of schools by type of management simply by seeing the faces. Also through this technique it is possible to classify schools according to their level of development in each type of management namely NMMC, ZP and private. This means schools can be arranged in hierarchy of development separately under each of the three types of management. This technique will be used to know the hierarchy of development of schools by type of management.

5) School Life Table: ‘Schooling life table is a scheme for expressing the form of schooling in terms of wastage probabilities. It is a population life table model of a cohort which is entering into the school at the same moment and followed through successive stages until they complete schooling. The main concern of school life tables is the study of wastage and school life expectancy during schooling. Using school life table method, it is possible to compare the experience of different schools in terms of wastage, school life expectancy and some important conclusions on quality of schools can be drawn. Let \( R_x \): Number of repeaters and new admission at class \( x \). \( D_x \): Number of dropouts in
class x.       \( F_x \): Number of failure in class x.       \( O_x \): Number of out migrated students in class x.       \( N_x \): Number of students in class x. Then \( N_{x+1} = N_x + R_x - F_x - D_x - O_x \) and the probability of dropout is \( q_{1x} \) and the probability of failure is \( q_{2x} \).

Thus the probability of students who are still continuing in school is \( P_x = 1 - q_{1x} - q_{2x} \).

On the basis of these estimated probabilities life table functions are computed as follows:
Number of students still continuing the schooling at class \( x+1 \) of those enrolled in class 1, is \( 1_{x+1} = 1_x P_x \), where \( 1_1 \) is the total number of students enrolled at class 1.

Number of dropouts in class x is \( D_x = 1_x q_{1x} \) Number of failure in class x is \( F_x = 11_x q_{2x} \).

The probability of wastage in class x is \( F_x = 11_x q_{1x} + q_{2x} \).

The length of schooling at class x is given by \( L_x = \frac{1}{2}(1_x + 1_{x+1}) \). The total number of schooling of those who beyond x class is \( T_x = L_x + L_{x+1} + \ldots + L_7 \).

The expected average number of schooling after x class is given by \( e_x = T_x / 1_x \).

This method of school life table will be used to find compare the expected average number of years of schooling and wastage probabilities in different type of school management.

**6.7 Multivariate Statistical Model**

A multivariate model will be constructed for causal analysis to find the determinants of quality of education controlling the effects of socioeconomic variables pertaining to the background of students of different type of management system. The general multiple regression model is defined as follows:

\[
y = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \ldots + \beta_k x_k + u
\]

Where \( \beta_0 \) is intercept, \( \beta_1 \) measures the change in y with respect to \( x_1 \) holding other factor fixed, \( \beta_2 \) measures the change in y with respect to \( x_2 \) holding other factor fixed and so on.

To determine quality of primary education the explanatory variables will be defined as quality of school measured using infrastructure facilities, teachers profile, student teacher ratio, performance of student etc. Firstly three multivariate model will be constructed for each type of management. Another multivariate model will be constructed using type of management as one of the independent variable to examine significant relationship.