Chapter -III

RESEARCH METHODOLOGY

The following research framework has been chosen conformity to the needs of the problem in respect of the sampling methods, mode of data collection and tools of economics analysis. In view of this, it is tried to sketch out the techniques used to achieve results in order to desire the objectives. For selection of districts and blocks, most scientific approach e.g. – Composite Agricultural Development Index (CADI) has been followed-

CONSTRUCTION OF COMPOSITE AGRICULTURAL DEVELOPMENT INDEX (CADI):

LEVEL OF DEVELOPMENT AND CLASSIFICATION OF DISTRICTS:

This deals with methods of scale transformation and classification. Three methods of scale transformation have been discussed. Also three scales of classification have been found appropriate. There are 13 districts in Central region in Uttar Pradesh. Some of these districts are agriculturally developed. An attempt has been made to classify the districts into following three categories with the help of CADI.

I. Developed districts.
II. Medium developed districts.
III. Low developed districts

SELECTION OF AGRICULTURAL DEVELOPMENT INDICATORS:

Agricultural development is a multidimensional concept that comprises agricultural, infrastructure and socio-economic factors. Hence, development can be measured as a process or as a state or in terms of conditions necessary for development. Since, the spatial pattern of agricultural development at the district level is a dynamic process, this may not be restricted only to some selected variables or parameters. But, it was necessary to recognize the important indicators for quantifying the status of development and to examine the relative importance of the parameters to the developmental process. In view of this, thirteen variables were selected as the agricultural development indicators that could be broadly classified into three groups namely, agricultural, infrastructure and
socio-economic variables. The brief description of the indicators of agricultural development under these categories is given below:

**Agricultural variables/indicators:**

The agricultural variables or indicators are directly related to agricultural mechanism, which are most dominant factors for agricultural progressiveness. The advent of HYVs of Improved seeds, water and Fertilizer management ushered in the era of Green Revolution in agriculture. Hence, the importance of these factors in agricultural development is well documented. In this study, the following indicators are considered as agricultural variables/indicators.

**Table III-1: Variables for Development Indexes of Districts:**

<table>
<thead>
<tr>
<th>Agriculture</th>
<th>Infrastructure</th>
<th>Social</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Gross cropped area</td>
<td>1. Bank Branches</td>
<td>1. Literacy (%)</td>
</tr>
<tr>
<td></td>
<td>(number)</td>
<td></td>
</tr>
<tr>
<td>2. Gross irrigated area (%)</td>
<td>2. Number of Markets</td>
<td>2. Primary health center</td>
</tr>
<tr>
<td></td>
<td>(number)</td>
<td>(number)</td>
</tr>
<tr>
<td>3. Area under food grains</td>
<td>3. Road density</td>
<td>3. Primary school</td>
</tr>
<tr>
<td></td>
<td>(per sq.km)</td>
<td>(number)</td>
</tr>
<tr>
<td>4. Fertilizer consumption</td>
<td>4. Villages electrified</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(number)</td>
<td></td>
</tr>
<tr>
<td>5. Food grain yields/productsivity</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Mechanization (number)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1. **Gross Cropped area:**

Gross cropped area shows much land is available for cultivation purpose. It mainly depends on the topography of area and physical situation of the land. The favorable physical condition is the prime need for any kind of development. Gross cropped area as efficiency of total reported area has been considered as an indicator.
2. Gross Irrigated Area:

Irrigation is one of the major components of Green Revolution packages, which is essentially needed for assuring the effect of other components also and boost up the agricultural crop productivity. So, assured irrigation facilities not only help in increasing crop productivity but also its availability is a precondition for application of other productivity increasing inputs of new agricultural strategy. (The extent-irrigated area as reflected as gross irrigated area as percentage of gross cropped area).

3. Area under food grains:

This includes the total area under food grains i.e. Rice, Maize, Sugarcane, Wheat, Potato, Barely etc. The food grain area in hectare to geographical area of the district was taken as indicator of agricultural development.

4. Fertilizer Consumption:

Fertilizer consumption related to the consumption of the total nutrients \((N+P_2O_5+K_2O)\) that is the critical input for agricultural production and was an integral part of the new agricultural technology. It helps in providing the nutrients needed for plant growth. As a result, productivity of agricultural crops is boosted up even in short period. In this study, fertilizer use in kilogram per hectare of gross cropped area was taken as an indicator.

5. Food grain yield:

The food grain yield is the ultimate result of the use of modern inputs, which, largely varies across the regions and creates the disparities in agricultural development. In spite of this, it ensures the food availability to the people and the self-sufficiency in food in the state that finally promote the agricultural development. It was taken as kilogram of food grain produced per hectare of gross cropped area.

6. Mechanization:

Factor is the major equipment for transforming traditional agriculture into mechanization form. It helps to speed up all types of farm operations and reduce the problems of agriculture such as labor and draft power shortage particularly on large farms and at peak time. If tractor facilities are available at least the percentage of cultivated area could be expected to increase and so the agricultural production.
INFRASTRUCTURE VARIABLES / INDICATORS

1. Electrified Villages:

Electrification is most important to provide the modern amenities at the village level. The modern amenities help to disseminate the present development and knowledge to the rural people. Electrification is essential requirement for using the contemporary tools and equipments in agriculture. So, electrification of villages accelerates of agricultural development. In this regard, villages electrified as percentage of total villages was counted as an indicator of agricultural development.

2. Density of Road:

Road is the key of element for communication at the village level. Without proper communication it may not be possible to get all types information, such as price of the commodity, available of required inputs etc., Moreover, it provides the easy transportation facilities that help to promote marketing of rural produce and add place utility. Densities of roads were measured as the length of road in kilometers of geographical area in the stats.

3. Markets:

The regulated markets play an vital role in the agricultural development by controlling the distribution system, which may be of different kinds and levels. A regulated market functions under law either for a specific commodity or for a group of commodities. Such a market is administered by a market committee, which consists of representatives of the state Government, the local bodies, the traders the commission agents or the dealers and the farmers themselves. The number of regulated markets per ten thousand square kilometer geographical area of the district was taken as indicator of agricultural development.

4. Banks:

The commercial bank branches are playing the main role in lowest level and function to at village based. At the village level, more than person, can establish bank branches advance loans for production purpose only. Since the bank branches play a pivotal role to supply credit to the farmers through the institutional sources, the number of branches in district was taken as an indicator of agricultural development.
Social variable

Socio-economic environment is driving force of the society and it helps in decision-making process and to judge everyday matter. So, the acceptability of any technology and adoption in agriculture is greatly influenced by the socio-economic factors. Hence, it was recognized that the socio-economic factors promote agricultural development.

1. Literacy:

Education plays a pivotal role in development process in district where most of the people are living in rural education because education is the backbone of a nation. The literacy rate in districts has increased steadily, but with great regional variation. As regards the data for rural literacy taken in terms of rural literacy rate as percentage of total population were taken as an indicator.

2. Primary health center:

The health plays in development process in the district, where most of the people are involved in the health. The health rate in districts has increased to affect the work. The numbers of primary health centers in the districts were taken as an indicator of agricultural development.

3. Primary school:

Education plays a pivotal rate in development process as said earlier. Where most of the people are living in rural areas, there is basic need for development of rural education because education is the backbone of a nation. Number of primary schools in the districts was taken as an indicator of agricultural development.

In order to examine the inter-regional disparities in agricultural development CADI has been constructed based on these 13 agricultural development indicators and data of each respective district are considered for the analysis with weighted approach. Because the data were so flexible and large variability is presence that could not be reflecting the authentic agricultural development of the districts instead, for CADI it has considered.

Consequently, the procedure essentially called for selection of appropriate development indicators; conversion of the original values of the indicators into some scaled values; and construction of the composite indices by taking the weighted sum of the scaled
values. The steps involved in the computation of composite index of agricultural development (CADI) are as follows:

Firstly, the selected indicators data have been transformed in the scaled values by the following equation:

\[ Y_{id} = \frac{X_i d_i}{\sum X_i d_i} \]  

Where,

- \( i = \) indicator
- \( d = \) district
- \( i = 1,2,3, \ldots \ldots n \) 13 variables / indicators
- \( d = 1,2,3, \ldots \ldots n = 24 \) districts.
- \( \sum X_i d_i = \) total value / Average of the indication and the districts.
- \( y_{id} = \) Scaled value of the \( i^{th} \) indicators in the \( d^{th} \) district.

Construction of development index of district/block using scaled values, \( Y = (Y_{1d}) \); as a measure for the level or stage of development for different districts / blocks as follows:

\[ Y_d = W_1 Y_{1d} + W_2 Y_{2d} + \ldots \ldots + W_m Y_{md} \ldots \ldots (2) \]

\[ W_1 + W_2 + \ldots \ldots + W_m = 1 \]

Where the \( W \)'s (\( 0 < W_1 < 1 \) and \( W_1 + W_2 + \ldots W_m = 1 \)) are arbitrary weights reflecting the relative importance of the individual indicators in various / respective regions. A special case of this is when the weights are assumed equal.

**SELECTION OF CLUSTERS**

The selection using cluster concepts, which have two dimensions- first dimensions, consists of the relationship components may involve collectively; building trust, open communication and close relationship between the participatory farm firms. The second dimension, which stems from the first and helped in cement relationship components- involves cultivating various forms of clustering activity, namely sharing, collaborating and cooperating.

**WEIGHTS-Scale-VALUE:**

The weight given to each regions were depend on the general levels of agricultural, infrastructure, and social development as a whole and shown as under which are considered during index construction.
Table III-2: Weights: Given level to regions

<table>
<thead>
<tr>
<th>Particulars</th>
<th>Central plain</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agriculture</td>
<td>35</td>
</tr>
<tr>
<td>Infrastructure</td>
<td>35</td>
</tr>
<tr>
<td>Social</td>
<td>30</td>
</tr>
<tr>
<td>Economic development</td>
<td>100</td>
</tr>
</tbody>
</table>

**DEVELOPMENT INDEXES AND MAPPING**

Table III-3: Composite Indices-Central Plain

<table>
<thead>
<tr>
<th>Ranks</th>
<th>District Name</th>
<th>Composite index (%)</th>
<th>Attributes</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Kanpur Dehat</td>
<td>71.72</td>
<td>Developed</td>
</tr>
<tr>
<td>II</td>
<td>Farrukhabad</td>
<td>54.65</td>
<td>Med. Developed</td>
</tr>
<tr>
<td>III</td>
<td>Kanpur Nagar</td>
<td>53.88</td>
<td>Med. Developed</td>
</tr>
<tr>
<td>IV</td>
<td>Allahabad</td>
<td>51.36</td>
<td>Med. Developed</td>
</tr>
<tr>
<td>V</td>
<td>Pratapgarh</td>
<td>50.79</td>
<td>Med. Developed</td>
</tr>
<tr>
<td>VI</td>
<td>Raibareilly</td>
<td>44.82</td>
<td>Low Developed</td>
</tr>
<tr>
<td>VII</td>
<td>Etawah</td>
<td>48.59</td>
<td>Low Developed</td>
</tr>
<tr>
<td>VIII</td>
<td>Lucknow</td>
<td>47.83</td>
<td>Low Developed</td>
</tr>
<tr>
<td>IX</td>
<td>Fatehpur</td>
<td>47.29</td>
<td>Low Developed</td>
</tr>
<tr>
<td>X</td>
<td>Unnao</td>
<td>46.52</td>
<td>Low Developed</td>
</tr>
<tr>
<td>XI</td>
<td>Kheri</td>
<td>44.97</td>
<td>Low Developed</td>
</tr>
<tr>
<td>XII</td>
<td>Sitapur</td>
<td>44.93</td>
<td>Low Developed</td>
</tr>
<tr>
<td>XIII</td>
<td>Hardoi</td>
<td>43.87</td>
<td>Low Developed</td>
</tr>
</tbody>
</table>

Table III-4: Name of Selected District

<table>
<thead>
<tr>
<th>Region</th>
<th>District name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Central Plain</td>
<td>Kanpur Dehat</td>
</tr>
<tr>
<td></td>
<td>Fatehpur</td>
</tr>
</tbody>
</table>
**Blocks:**

**Selection and Ranking:**

The adopted method for selecting of districts from each region, the same procedures have been followed in selecting blocks with the help of CADI.

Table III-5: Kanpur Dehat: Composite Indices

<table>
<thead>
<tr>
<th>Ranks</th>
<th>Blocks name</th>
<th>Composite index (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Rasulabad</td>
<td>33.65</td>
</tr>
<tr>
<td>II</td>
<td>Sandalpur</td>
<td>32.30</td>
</tr>
<tr>
<td>III</td>
<td>Maetha</td>
<td>30.32</td>
</tr>
<tr>
<td>IV</td>
<td>Sarwankera</td>
<td>29.59</td>
</tr>
<tr>
<td>V</td>
<td>Rajpur</td>
<td>29.17</td>
</tr>
<tr>
<td>VI</td>
<td>Derapur</td>
<td>29.04</td>
</tr>
<tr>
<td>VII</td>
<td>Akabarpur</td>
<td>28.81</td>
</tr>
<tr>
<td>VIII</td>
<td>Amroodha</td>
<td>28.33</td>
</tr>
<tr>
<td>IX</td>
<td>Jhijhak</td>
<td>27.01</td>
</tr>
<tr>
<td>X</td>
<td>Malasa</td>
<td>26.98</td>
</tr>
</tbody>
</table>

Table III-6: Name of selected district and Blocks

<table>
<thead>
<tr>
<th>Kanpur Dehat</th>
<th>Metha, Akbarpur</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fatehpur</td>
<td>Malwan, Khajua</td>
</tr>
</tbody>
</table>

**Sampling Method:**

A multi stage random sampling technique was use in the present study. The sampling techniques at the respective stage were made for selection of districts block, villages and cultivators.

**Selection of districts:**

The Central Uttar Pradesh comes under Upper-Gangetic plains of U.P. comprising Allahabad, Fatehpur, Raibarelli, Lucknow, Unnao, Sitapur, Sultanpur, Kheri, Pillibhit, Hardoi, Etawah, Farukhabad and Kanpur. The first selection of districts and blocks, the most scientific approach i.e. Composite Agricultural Development Index has been adopted in selecting district and blocks of central U.P. (CADI) has been constructed by using following variables for agricultural indices given as under:
Selection of block:

For selecting blocks from selected districts the same procedure has been followed for constructing CADI. The composite indices of each block of Kanpur Dehat and Fatehpur showed in table III-5.

Selection of villages:

A list of the cultivator of blocks 1) Maitha and 2) Akbarpur have been prepared from five villages from each blocks (Maitha and Akabarpur) i.e. 10 total village and 10 villagers from two blocks of Fatehpur have been selected randomly with the help of random number.

Selection of cultivators:

A list of all the cultivators along with their cultivated area of each of the selected villages was prepared. Out of these lists, a sample of five cultivators under three size groups (0-1 ha., 1-2 ha and 2 ha. & above) was drawn in respect of all the 20 villages. The number of cultivators under each size group was kept, more or less, prospects as their number falling under each size group in the universe of 20 villages. Thus, in all s sample of 100 cultivators was drawn from 20 selected villages of (1) Maitha (2) Akbarpur blocks of Kanpur Dehat and (1) Malva (2) Khajua Fatehpur.

Table III-7: Distribution of selected cultivators in the sample villages:

<table>
<thead>
<tr>
<th>S.N</th>
<th>Name of selected village</th>
<th>Name of blocks</th>
<th>Number of cultivators selected from different size groups (in hectare)</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>0-1</td>
<td>1-2</td>
</tr>
<tr>
<td>A).</td>
<td>Kanpur Dehat</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>a. Metha</td>
<td>3</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td>4</td>
<td>1</td>
<td>-</td>
</tr>
<tr>
<td>3</td>
<td></td>
<td>4</td>
<td>1</td>
<td>-</td>
</tr>
<tr>
<td>4</td>
<td></td>
<td>2</td>
<td>3</td>
<td>-</td>
</tr>
<tr>
<td>5</td>
<td></td>
<td>2</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>15</td>
<td>7</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>b. Akbarpur</td>
<td>4</td>
<td>-</td>
<td>1</td>
</tr>
<tr>
<td>1</td>
<td></td>
<td>3</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td>3</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td></td>
<td>4</td>
<td>1</td>
<td>-</td>
</tr>
<tr>
<td>5</td>
<td></td>
<td>3</td>
<td>2</td>
<td>-</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>17</td>
<td>5</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grand Total</td>
<td></td>
<td>32</td>
<td>12</td>
<td>6</td>
</tr>
</tbody>
</table>
METHODS OF ENQUIRY

For conducting the present enquiry, survey method was used. The secondary and primary data have been incorporated. The available data from published documents for variables was undertaken to construct CDI. The follow survey on various components needed- for example- blocks and villages and clusters in context to homogenous production system, have been cared have been taken in consideration. The primary data collected from the selected households with suitable and protested schedule and questionnaires have been followed.

ANALYTICAL TOOLS:

a) Average: - The average given in the present study is weighted average, worked out as follows: -

$$\text{Weighted average} = \frac{\sum W_i X_i}{\sum W_i}$$

Where; $X_i$ = variables

$W_i$ = weight of $x$ variables

b) Tabular analysis: The data collected for analysis and interpretation were tabulated in a suitable form.
c) Herfinadal index:

Herfinadal index is an inverse measure of crop diversification. It assumes that very large (infinite) alternatives of production choices are available. Taking the case of crop, Herfinadal index assumed that there exists a very large no of crops, which can be grown by the farmer. If, total area is equally shared among these large number of crop alternatives then it shared of each crop would be near to zero. Then this index uses deviations between actual shares of each crop against equal share of all possible alternatives given by zero. Herfinadal index (H.I.) was used as measures of crop diversification as given blow:

\[ H.I = \sum_{i=1}^{N} P_i^2 \]

Where \( N \) is total number of crop and \( P_i \) represent acreage proportion of the \( i^{th} \) crop is total cropped area. Number of activities: it is simply given by the total number of activities;

Index of maximum proportion: It is a measurer of concentration of most dominant activity and it has a range \( 0 < D_p \leq 1 \).

Where \( K \) is total number of activities and \( P_i \) represent proportion of its activities in total.

1- Ogive index \( (D_h) = \sum_{i=1}^{K} \left( P_i - \frac{1}{k} \right)^2 \sqrt{\frac{1}{k}} \)

d) Cropping Intensity

Intensity of cropping is the ratio between gross cropped area and net cultivated area multiplied by 100. It has been worked out as follows:

\[
\text{Cropping Intensity} = \frac{\text{Total cropped area}}{\text{Net cultivated area}} \times 100
\]