Chapter Three
Methodology and Data

The present study adopts both the econometric regression approach and the non-econometric statistical approach to study inequality and quality of life among Tiwas. Under the first approach the OLS regression method and the binary Logit regression method are separately applied. The non-econometric statistical approach adopts mainly statistical methods of inequality measurement.

3.1 Measurement of Inequality

Cowell defined 'Inequality measure' as "a scalar numerical representation of the interpersonal differences in income within a given population." (Cowell, 2009:7). Here we calculate Mean Logarithmic Deviation, Theil Index, Relative Theil Index, Atkinson Index and Gini Coefficient. Measures of inequality use in this study are as follows:

The Theil Index: The Entropy Class of Inequality Indices

The entropy class of inequality index is based on the concept of entropy that is a measure of disorder in theory of thermodynamics. When it is applied to income distributions, the entropy (disorder) means deviations from perfect equality.

The generalized inequality index is as follows:

$$E(\propto) = \frac{1}{n(\propto^2 - \propto)} \sum_i \left[\left(\frac{y_i}{\bar{y}} \right)^{\propto} - 1 \right]$$

The equation expresses a class as the index E($\propto$) gives different forms depending on the value assigned to $\propto$. $\propto$ is a parameter ranging from minus infinity to infinity.

With $\propto = 0$, the expression becomes

$$\text{E (0)} = -\frac{1}{n} \sum_i \text{In} \left(\frac{y_i}{\bar{y}} \right)$$

With $\propto = 1$, the expression becomes

$$\text{E (1)} = -\frac{1}{n} \sum_i \left(\frac{y_i}{\bar{y}} \right) \text{In} \left(\frac{y_i}{\bar{y}} \right)$$

E(0) index is called the mean logarithmic deviation. E(1) is called the Theil Index, by the name of the author who first proposed it in 1967. Both indexes, however, share an undesirable feature, i.e., not being defined if there are zero incomes. Therefore, in a distribution with all zero incomes except for the last, their maximum value cannot be calculated directly. Rather, it can only be calculated by replacing zero incomes with arbitrary (very small incomes). However, if we replaced zero incomes with very small incomes, while $E(1)$ approaches the maximum value of ln(n), the maximum value of $E(0)$ would depend on how small these incomes are defined. In other words, $E(0)$ is not bound.

For the purpose of an operational approach, a class of Relative Entropy inequality indexes (RE) is defined. For all other numbers, i.e. α and α≠0, it is worth defining relative indexes:

$$RE(1) = \frac{E(1)}{\max E(1)} = \frac{\frac{1}{n}\sum_i \left(\frac{y_i}{\bar{y}}\right) \ln\left(\frac{y_i}{\bar{y}}\right)}{\ln n}$$

Since $E(1)$ is known as the Theil Index, RE(1) can be called the Relative Theil Index

The Atkinson Index

It is one of the most popular welfare-based measures of inequality.

The Atkinson Index may be expressed in following form:

$$A(\varepsilon) = 1 - \frac{y_{EDE}^{*}\sqrt{2}}{\bar{y}^{*}\sqrt{2}} = 1 - \frac{y_{EDE}}{\bar{y}}$$

Here, EDE = Equally Distributed Equivalent

For the EDE, we can get the following expression

$$y_{EDE} = \left[\frac{1}{n}\sum_i {y_i}^{1-\varepsilon}\right]^{\frac{1}{1-\varepsilon}}$$

Atkinson Index gives indication of how much income are disposed to give up in order to have equal incomes. Given any distribution of income, EDE can be calculated easily for different levels of inequality aversion. Different levels of inequality aversion ε provide different values ofy_{EDE} (Atkinson, 1970 and 1983; Bellù and Liberati, 2006).

Gini Coefficient

The Gini coefficient, developed by Gini (1912), is the most common measure of distribution of income, expenditure, wealth and other attribute within a given population. The value of Gini coefficient ranges from 0 to 1. The value 0 represents a situation of perfect equality such

that income (say) is identical across all households, whereas value 1 represents a situation of extreme inequality such that all income is concentrated in a single household. Between 0 and 1, the higher values of Gini coefficient are associated with higher level of inequality. It is strictly linked to the representation of income inequality through the Lorenz Curve (proposed by Lorenz, 1905) that indicates which proportion of total income is in the hands of a given percentage of population. In particular, Gini coefficient is the ratio of the area between the Lorenz Curve and the equi-distribution line (henceforth, the concentration area) to the area of maximum concentration area. In other words, the Gini coefficient is defined as the proportion of the total area under the diagonal that is between the diagonal (equality line) and the Lorenze curve.

Formally, let $x_i$be a point on the x-axis, and y_i a point on the y-axis. Then,

$$\text{Gini}=1-\sum_{i'1}^{N}\cdot(x_i-x_{i-1})(y_i+y_{i-1}).$$

When there are N equal intervals on the x-axis, the equation simplifies to

$$\text{Gini}=1-\frac{1}{N}(y_i+y_{i-1}).$$(Haughton andKhander,2010:104).

Main weakness the Gini coefficient is that it cannot differentiate different kinds of inequalities. Lorenz curves representing different patterns of income distribution may intersect resulting very similar Gini coefficient values (Cowell, 1995).

The above measures of inequality are applied to both per capita household income as well as per capita household consumption expenditure for the related sample of Tiwa households of the two districts of Nagaon and Morigaon. In other words the present study captures inequalities in both income and consumption across occupations.

3.2 Inequality Adjusted Development Index

One of the most serious weaknesses of the human development index (HDI) is that it considers only average achievements and does not take into account the distribution of human development within a country or by population subgroups. The Household-level Development Index (HLDI) measures the average achievements in three basic dimensions of human development: a long and healthy life, knowledge and a decent standard of living. In other words, the HLDI is the geometric mean of the normalized three dimension indices. The Inequality-

adjusted Household-level Development Index (IHLDI) is the geometric mean of the three dimension indices adjusted for inequality.

Step1. *Measuring inequality in the dimensions of the Household-level Development Index (HLDI)*

The IHLDI draws on the Atkinson (1970) family of inequality measures and sets the aversion parameter ε equal to 1. In this case the inequality measure is $A = 1 - g/\mu$, where g is the geometric mean and μ is the arithmetic mean of the distribution.

This can be written as:

$$A_x = 1\text{-}\frac{\sqrt[n]{X_1 \text{-----} X_n}}{\bar{X}}$$

Where, $\{X_1 \ldots, X_n\}$ denotes the underlying distribution in the dimensions of interest. *Ax* is obtained for each variable (health score, education score and per capita income).

Step 2. *Adjusting the dimension indices for inequality*

The mean achievement in an HLDI dimension, $\bar{X}$, is adjusted for inequality as follows:

$$\bar{X}.\ (1\text{-}A_x) = \sqrt[n]{X_1 - - - - X_n}$$

Thus the geometric mean represents the arithmetic mean reduced by the inequality in distribution. Thus, inequality-adjusted dimension indices(I_x^*) are obtained from the household level development dimension indices(I_x) as follows:

$$I_x^* = (1 - A_x) I_x$$

Where,

I_x^*= Household-level Inequality-adjusted dimension indices

I_x= Household-level Development dimension indices

Ax= Atkinson measure of each dimension

The inequality-adjusted income index is based on the unlogged income index, I_{Income}. This enables the IHLDI to account for the full effect of income inequality.

Step 3.*Combining the dimension indices to calculate the Inequality-adjusted Household-level Development Index (IHLDI)*

The IHLDI is the geometric mean of the three dimension indices adjusted for inequality.

First, the IHLDI that includes the unlogged income index (IHLDI*) is calculated:

IHLDI*=$\sqrt[3]{I_{Health} I_{Education} I^*_{Income}}$ =

$$\sqrt[3]{(1-A_{Health}) I_{Health} (1-A_{Education}) I_{Education} (1-A_{Income}) I^*_{Income}}$$

The HLDI based on unlogged income index (*HLDI**) is then calculated:

HLDI*= $\sqrt[3]{I_{Health} I_{Education} I^*_{Income}}$

The percentage loss to the *HLDI** due to inequalities in each dimension is calculated as:

Loss= 1- $\frac{IHLDI^*}{HLDI^*}$ =1- $\sqrt[3]{(1-A_{Health})(1-A_{Education})(1-A_{Income})}$

Assuming that the percentage loss due to inequality in income distribution is the same for both average income and its logarithm, the IHLDI is then calculated as:

IHLDI = $\left(\frac{IHLDI^*}{HLDI^*}\right)$HLDI= $\sqrt[3]{(1-A_{Health})(1-A_{Education})(1-A_{Income})} HLDI$

The co-efficient of human inequality is defined as 'an un-weighted average of inequalities in health, education and income (or consumption)' as follows (UNDP, 2014):

Co-efficient of human inequality = $\frac{A_{Health}+A_{Education}+A_{Income}}{3}$

3.3 Breakup of Quality of Life Indicators

In the present study, household level physical quality of life is given more attention. In this study the household level quality of life is considered as a function of four dimensions such as economic, education, health and housing quality indicators, although each of these dimensions are related to each other and is highly interrelated. From each of the dimension, the present study attempted to calculate a corresponding index. Thus, the present study has constructed four dimensional indices such as economic index, education index, health index and housing quality index at household level. In order to calculate dimension index, human development index (HDI) dimension index formula is utilised in computing all dimensions of household level quality of life index. Thus, dimension index (DI) is calculated as

$$DI = \frac{Xactual - Xminimum}{X\ maximum - Xminimum}$$, where X is any score.

3.3.1 Economic Index: It is calculated from monthly per capita consumption expenditure index (MPCEI) and asset index (AI). In this study, economic index is the average value of MPCEI and AI i.e.

$$Economic\ Index\ (EI) = 1/2\ (MPCEI) + 1/2\ (AI)$$

Consumption Aspect of Households: The present study breaks up consumption expenditure of the household into following five major heads.

I. Expenditure on food and related items: It includes expenditure on food grains, pulses, oil, spices, fish, meat, eggs, vegetables and fruits.
II. Expenditure on children education.
III. Expenditure on health
IV. Expenditure on fuel.
V. Expenditure on travel

To calculate monthly per capita consumption expenditure index (MPCEI) at the household level, it is customary to calculate monthly per capita household consumption expenditure (MPCE). Thus,

$$MPCE = \frac{Total\ Household\ Consumption\ Expenditure}{Number\ of\ Household\ Members}.$$

Measuring Asset Index for Tiwa Households: Another indicator of economic index is asset index. In order to calculate asset index, following 15 point score is calculated for all selected households of the present study.

1. If the household has agricultural land under ownership of head or any member of the household (HOH) at least of the category of small farmer according to agricultural census, India *(i.e. 1 hectare),* the present study assigns '1'and '0' otherwise.
2. If the household has farm animals other than caw/buffalo/bullock, the present study assigns '1'and '0' otherwise.
3. If the household has livestock, '1'and '0' otherwise.
4. If the household has at least one bicycle, '1' and '0' otherwise.
5. If the household has Motorbike, '1' and '0' otherwise.
6. If the household has T V set, '1' and '0' otherwise.

7. If the household has Mobile, '1' and '0' otherwise.

8. If the household has computer/laptop, '1' and '0' otherwise.

9. If the household has at least one LIC, '1' and '0' otherwise.

10. If the household has post office savings bank account, '1' and '0' otherwise.

11. If the household has car, '1' and '0' otherwise.

12. If the household has tractor, '1' and '0' otherwise.

13. If the household has inverter, '1' and '0' otherwise.

14. If the household has Fridge, '1' and '0' otherwise.

15. If the present residence is under the ownership either the head of the household or any other member, give '1' and '0' otherwise.

From asset points for all selected households, asset score is calculated as

$$AS_i = \frac{AS_i}{15} X\ 100$$

From asset score, asset index is calculated.

3.3.2 Health Index: The present study takes two indicators to construct health index. They are health scores and average body mass index (ABMI) at the household level. From health score, health status index (HSI) at the household level is calculated. On the other hand, to calculate ABMI, BMI for every present member of all households during the survey period are recorded and then average BMI for every household of this study is calculated.

Finally, health index at the household level is the average of the health status index (HSI) and average body mass index (ABMI) i.e.

$$Health\ Index\ (HI) = 1/2(HSI) + 1/2\ (ABMI)$$

Measuring Health score for Tiwa Households: The present study assigns '1' for a desirable qualitative character and put '0' otherwise for the undesirable outcome relating to health aspects of the members of the household.

1. If all the children vaccinated/immunised as per schedule '1'and '0' otherwise.

2. If all births of existing below 15 children are in hospital/health centre/nursing home/medical supervision '1' and '0' otherwise.

3. Almost always visit doctor/rural health centre/hospital during sickness or ailment of any family member '1'and '0' otherwise.

4. If regularly using drinking water from a safe source, such as govt. deep tube well ,personal tube well, govt. supply, piped water '1' and '0' otherwise.

5. If the household found to be using dug well, pond or river water when government PHS supply water is actually available in the neighbourhood '0' and '1'otherwise.

6. If the household has safe sanitation facility with proper sanitary chamber (septic tank) '1' and '0' otherwise.

7. If all the children below 15 have a government rural health centre health card '1' and '0' otherwise.

8. Regular consumption of tobacco products by at least one adult in the household '0' and '1' otherwise.

9. Regular consumption of alcohol by at least one adult in the household '0' otherwise and '1' otherwise.

10. Whether pregnant women have taken necessary medical treatment in case of all pregnancies in the household during last five years '1' and '0' otherwise.

11. If household members are chronicle ill due to diarrhoea/gastro-intestinal diseases, the study assigns '0' and '1' otherwise.

12. If household members are chronicle ill due to cough/cold/lung infections, the study assigns '0' and '1' otherwise.

13. Frequent occurrence (every month) of fever, the study assigns '0' and '1' otherwise.

14. If household members suffering from Malaria, the study assigns '0' and '1' otherwise.

15. If household members suffering from T B, the study assigns '0' and '1' otherwise.

From health points for all selected households, health score is calculated as

$$HS_i = \frac{HS_i}{15} X\ 100$$

3.3.3 Education Index (EDUI): In this study, education index (EDUI) of the selected households is constituted from child education index (CEI) and adult education index (AEI). No bias in weightage given for calculating household education index (EDUI). It is calculated as

$$HEI = 1/2\ (CEI) + 1/2\ (AEI)$$

Measuring Education Score for Tiwa Households: This study considered the formal years of education spent by adult members of the household. On the other hand, to capture the child education of the household, expected years of formal education of the children are taken into account in order to find child education score. Thus, following mean years for adults and expected years of children are considered in order to have educational level for all the selected households of the study.

1. Mean years of formal education of all adult males above 21 years.
2. Mean years of formal education of all adult females above 21 years.
3. Expected years of formal education of male members who are still in education.
4. Expected years of formal education of female members who are still in education.

The present study calculates adult education score male (AES_m) and adult education score female (AES_f) for all the selected households of the study. From household level adult education score male (AES_m) and adult education score female (AES_f), adult education index male (AEI_m) and adult education index female (AEI_f) are calculated. In the same way, household level child education index male (CEI_m) and child education index female (CEI_f) are calculated. In order to calculate child education index (CEI), the present study assigns equal weightage to both young age females and males expected years of education. Thus,

$$CEI=1/2\ (CEI_m) + 1/2\ (CEI_f)$$

But for adults, the present study gives more weightage to female education compared to male. Thus, the study assigns weightage 0.66=2/3 to adult education index female (AEI_f) and the remaining 0.33=1/3 to adult education index male (AEI_m). Thus,

$$AEI=2/3\ (AEI_m) + 1/3\ (AEI_f)$$

3.3.4 Housing Quality Index (HQI): In order to capture the housing status and type and plinth area of the household, housing quality index (HQI) of this study is constructed from housing status index (HSI) and plinth area per capita index (PAPI). Thus, it is calculated as

$$HIS = 1/2\ (HQI) + 1/2\ (PAPI)$$

Measuring Housing Score for Tiwa Households: In order to capture housing status and type of all selected households, the present study has considered following basic and important housing facilities to get housing status score at the household level.

1. If the house type is pucca or semi pucca, this study assigns'1'and '0' otherwise
2. If the house has at least two or more rooms, '1'and '0' otherwise.
3. If the house has clean floor, '1'and '0' otherwise.
4. If the kitchen is independent of the living area, '1'and '0' otherwise.
5. Presence of piped water into toilet or washing areas, the study assigns '1' and '0' otherwise

From housing status points at the household level, housing status score is calculated as

$$HQS_i = \frac{HQS_i}{5} X\ 100.$$

From housing status score, housing status index at the household level is calculated. Another component of the housing quality index is the plinth area per capita (PAPC) which is calculated as:

$$PAPC = \frac{Length\ of\ the\ living\ area\ x\ Breadth\ of\ the\ living\ area}{Number\ of\ household\ members}$$

After getting PAPC, plinth area index (PAI) for all Tiwa households is calculated.

Overall Household Level Quality of Life Index (HQLI): Household level quality of life index (HQLI) is the average of all four individual indexes. Thus it the average value of all four dimensional indexes and so it is calculated as

$$HQLI = 1/4(EI+EDUI+HI+HQI).$$

Where, EI = Economic Index

EDUI= Education Index

HI= Health Index

HQI= Housing Quality Index

3.4 Econometric Methods

3.4.1. Ordinary Least Squares Regression

List of Regressors: Following regressors (or explanatory variables) are used to measure different dependent variables relating to different aspects of household level quality of life index (HQLI). Here is the list of regressors.

Table-3.1: Explanatory Variables used in Regression Models			
Variables	Symbol	Definition/Description	Nature
Flood dummy	FD	1= if the household resides in a flood affected area and 0 otherwise	OH
Distance from the nearest urban centre	REMOTENESS	Least or minimum possible time required to reach the nearest urban centre.	OH
Women Workforce Participation	WWP	WWP = 1, if Household have working women'1' and '0' otherwise otherwise.	IH
Family type	FT	1= if joint family and unitary '0' otherwise.	IH
Main road connectivity dummy	MRC	1= If good (at least four/three wheelers can travel) '0' otherwise	OH
Sex ratio	SR	Females per 1000 males total population. It is normalized to 100.	IH
Dependency ratio	DR	Number of dependents divided by number of earning members of the household multiplied by 100.	IH
Indebtedness	INDEBTED	Total amount of debt taken by the household (in Rs.)	IH
Agriculture and allied sector dummy	AGRI	1= if the principal earning member of the household is engaged in the agriculture and allied activities and 0 otherwise	IH
Income earned under MNREGS	MNREGS	Total amount of income earned under MNREGS job card during the last six months.	OH
Electricity Connection Dummy	ELECT	1= if the household has electricity connection and '0' otherwise.	IH
LPG Dummy	LPG	1= if the household used LPG as fuel and '0' otherwise.	IH
Reading habits of Newspaper	NEWS	1= if at least one member of the household read news paper regularly and '0' otherwise.	IH
Note: IH indicates Inside the household and OH indicates Outside the household			

MODEL-I: Dependent variable - Monthly per capita household consumption expenditure (MPCE).

Regressors: Adult education score, children education score, health score, flood dummy, distance from nearest urban centre, women workforce participation, family type, main road connectivity with village ,sex ratio (members), dependency ratio, indebtedness, occupation in agriculture dummy, income earned under MNREGS, electricity connection dummy and LPG dummy.

MODEL-II: Dependent variable - education score (EDUS).

Regressors: Monthly per capita consumption expenditure, health score, housing quality score, flood dummy, distance from nearest urban centre, women workforce participation, family type, main road connectivity with village, sex ratio (members), dependency ratio, indebtedness, occupation in agriculture dummy, MNREGS dummy, electricity connection dummy and LPG dummy.

MODEL-III: Dependent variable - Health Score (HS).

Regressors: Monthly per capita consumption expenditure, education score, housing score, flood dummy, distance from nearest urban centre, women workforce participation, family type, main road connectivity with village, sex ratio (members), dependency ratio, indebtedness, occupation in agriculture dummy, MNREGS dummy, electricity connection dummy and LPG dummy.

MODEL-IV: Dependent variable - housing quality score (HQS).

Regressors: Monthly per capita consumption expenditure, flood dummy, distance from nearest urban centre, women workforce participation, family type, main road connectivity with village, dependency ratio, occupation in agriculture dummy, income earned under MNREGS dummy.

MODEL-V: Dependent variable -Household quality of life index (HQLI).

Regressors: Flood dummy, distance from nearest urban centre, women workforce participation, family type, main road connectivity with village, sex ratio (members), dependency ratio, indebtedness, occupation in agriculture dummy, income earned under MNREGS, electricity connection dummy, LPG dummy, regular reading habits of newspaper.

3.4.2 Limited Dependent Variable Model - Binary Logit Regression

Woman's working status in Tiwa households dependent on a host of socio-economic factors. The present study adopts a limited dependent variable approach to examine the partial impact of selected socio-economic variables on the occupational status of women in Tiwa households. Those variables which are most likely to influence the occupational status (synonymous to work-participation or working status in the present study) of Tiwa women at the household level are only included. In particular, the binary Logit model is used in the present study to estimate how relevant socio-economic variables influence the probability of the

presence of at least one working women in the household, or in other words, the probability of women's work participation at the household level. Thus, for the first model, the Logit regression is estimated on the basis of household level data (N=442). The dependent variable is binary in nature (dependent dummy variable) which assumes value 1, if at least one woman in the household is currently engaged in any income earning activity or is employed (self-employed included), and '0' otherwise.

Model-I: Binary Logit model for examining the socio-economic determinants of women's workforce participation (N=442).

Table 3.2: List of Variables with Symbols and Descriptions for Binary Logit Model

Variables	*Variable name*	*Definition/Description*
Dependent variable: Women workforce participation	WWP	WWP = 1,if at least one female member of the household is currently engaged in any income earning activity or, productive activity that is remunerative (self-employed included), and '0' otherwise.
Explanatory variables		
Monthly Per capita household income	MPCI	Household total monthly divided by size of the household.
Household size	HOUS	Number of members in the household.
Dependency ratio	DR	Number of dependents divided by number of earning members multiplied by 100.
Education of principal earning member	EDUPEM	Number of years spent in formal education
Agriculture and allied sector dummy	AGRI	AGRI'1', if the principal earning member of the household is engaged in the agriculture and allied activities and 0 otherwise
Land holding	LH	Land holding by the household in bigha.
Family Type	FT	FT '1', if joint family and unitary '0' otherwise.
Age of principal earning member	AGEPEM	Age (years) of principal earning member of the household.
Number of children in the household	CHILD	Number of children in the household aged 16 years or less.
Distance from the nearest urban centre	REMOTENESS	Least or minimum possible time required to reach the nearest urban centre.
Flood dummy	FD	FD'1', if the household resides in a flood affected area and 0 otherwise
Indebtedness	INDEBTED	Total amount of debt taken by the household (in Rs.)

Model-II: This model targets the working age-group women in the selected Tiwa households. In other words, all working age group women in all the 442 households were consid-

ered in Model-II. The number of women in the 16-64 years age group stands at 532. Some additional variables are included in this model. The reason behind selecting 16-64 years age range for working woman is that the lowest age for female to be 16 years and the highest age for any working woman in the sample found to be 64 years. There are 215 working women in the entire sample covering all occupations. Working women status is a dependent dummy variable which is binary in nature assuming '1' and '0' otherwise.

Table 3.3 : List of Variables with Symbols and Descriptions for Binary Logit Model

Variables	*Variable name*	*Definition/Description*
Dependent		
Women workforce participation of working age group woman	WWP	WWP = 1 if the working age group woman participate in economic activities and '0' otherwise.
Explanatory		
Monthly per capita household consumption expenditure	MPCE	Household total monthly consumption expenditure divided by size of the household.
Household size	HOUS	Number of members in the household.
Dependency ratio	DR	Number of dependents divided by number of earning members multiplied by 100.
Education of the working age group woman	EDU	Number of years spent in formal education by working age group woman
Agriculture and allied sector dummy	AGRI	AGRI '1', if the principal earning member of the household is engaged in the agriculture and allied activities and 0 otherwise
Land holding	LH	Land holding by the household in bigha.
Family type	FT	FT '1', if joint family and unitary '0' otherwise.
Age(years) of the working age group woman	AGE	Age (years) of the working age group woman.
Number of children in the household	CHILD	Number of children in the household aged 14 years or less.
Distance from the nearest urban centre	REMOTENESS	Least or minimum possible time required to reach the nearest urban centre.
Flood dummy	FD	FD'1', if the household resides in a flood affected area and 0 otherwise
Indebtedness	INDEBTED	Total amount of debt taken by the household (in Rs.)
Marital status of the working age group woman	MARS	MARS'1', if the working age group woman married and 0 otherwise
Years of formal education of husband	EDUH	Years of formal education of the working age group woman's husband

Model-II estimates how relevant socio-economic variables influence the probability that a Tiwa woman in the sample belonging the working age group is currently engaged in economically gainful activities (or currently earning against some work). In other words model-II estimates the partial impacts of relevant socio-economic variables on the probability of work participation by working age group Tiwa woman.

3.4.3 Operational Definitions of Selected Variables

Different demographic, economic and social variables both inside and outside of the household determine household level quality of life of the people. In order to identify important variables that determine the different dimensions of quality of life, this study considered some important variables. The justification for incorporating these variables in OLS regression as well as in logit regression models and their expected signs are discussed below.

Flood Dummy (FD)

Recurrent floods in the region create serious problems for Tiwa households dependent on the farm sector or the agrarian sector. Floods affect the cultivators, and naturally the agricultural labourers who are directly associated with cultivation. Casual workers in the farm sector are also affected. This group comprises of almost 70 per cent of sample households for the present study. Sample households in the non-flood affected zones are not affected. Thus, this dummy variable draws a clear line of distinction between the flood affected households and the others. Expectedly this coefficient must be negative for an economically meaningful regression. Financial loss of the household due to the floods is a difficult exercise, which could be used by the local and state governments for creating a dedicated annual flood relief fund for the flood affected households.

Distance from the nearest Urban Centre (Remoteness)

Remoteness is a vital factor that hinders the development of sections of population residing in rural areas. Remoteness may be measured in several alternative ways. Distance from the nearest urban centre may not be correctly capture remoteness. Rather motorable road connectivity and/or railway connectivity are more important than distance. A more practical way to

measure remoteness is by recording the minimum time required to reach the nearest urban centre.

Women Work Participation (WWP)

Women are vital and productive agents in any country. This is especially so in case of the Indian economy as historically women's work involvement has been predominantly in domestic or household activities. Unfortunately participation of women in different economic activities in India is very low as compared to their m[i]ale counter parts which make their employment status very critical from the point of view of the family or household (the micro-level) and the aggregate economy (the macro-level). In a predominantly tribal society, women have a greater tendency to contribute to family labour (in semi-skilled or low skill jobs) and hence participate in economically gainful work. A great majority of Tiwa women workers work in agriculture and allied occupations. Women work participation helps to raise the level of family income (and expenditure which is an indicator of purchasing power) and so also to take part in taking different family decisions. It is expected to have a positive correlation with women work participation, economic condition and the overall quality of life enjoyed by the household. "Women work participation" in the present study is treated as a dummy variable or categorical variable (assuming 0 and 1 scores). WWP is a regressor in the OLS framework where it assumes score 1 if there is at least one working woman (economically gainful work) at the household level, and 0 otherwise. As a regressor, WWP is expected to have a positive sign.

For the working age group women level regression (logit), the variable WWP has a slightly different meaning in the present study. In this case WWP assumes score 1 if a woman belonging to the working age group is actually found to be working during the time of survey (data collection), and 0 otherwise. For this model, household is not the unit or basis of analysis. Rather for this model working age group woman (16 – 64 years) in the sample is the unit of analysis information. In other words if some female member in the household is present in the age group 16 – 64 years, it is verified whether she is working or not. That is 16 – 64 years female members are isolated for this analysis.

Family Type (FT)

There are two types of family-joint family and nuclear family. (i) Members of a joint family live with their parents and other elders. Such a family refers to a multi generational family with one or more than one married child. More importantly, as per the Indian convention, a joint family must have a single kitchen where cooking of the entire family is done. For such a family, it is given value one (ii) a *nuclear family* is a *family* group consisting of a pair of adults and their children. They live separately as a single family; in this case the variable is given zero as value. However pair of adults, even without their off-springs staying with them, makes a nuclear family. The family type dummy may either have a positive or negative sign in the regression depending on the type of impact it has on the dependent variable. For agricultural households break-up of the joint family system may fragment land holding along with area cultivated, leading to lower per capita income and consumption after the break-up of joint set up. Thus there is a possibility that for farm households or agricultural households, the sign of this dummy variable may be negative. However the present sample consists of non-agricultural households also amounting to almost 65 percent of total sample households. Thus the sign of this dummy cannot be judged *a'priori*.

Main Road Connectivity with Village (MRC)

Rural Road connectivity is a key component of rural development, since it promotes access to economic and social services, thereby generating increased agricultural productivity, non-agriculture employment as well as non-agricultural productivity, which in turn expands rural growth opportunities and real income through which poverty can be reduced and thus quality of rural life can be improved. But many of the rural areas are isolated in terms of distance, bad road conditions, lack of or broken bridges and inadequate transport. These conditions make it difficult for rural people to get their goods to market and themselves to place of work, to handle health emergencies, to send children to school, and to obtain public services. The present study takes rural road connectivity of district head-quarters or nearest town/urban area (as the case may be) with the sample village as an explanatory variable to see its impact on quality of life of Tiwa people. Here we assign value 1, if at least three/four wheelers can travel from the district HQ (or nearest urban location), to the sample village and 0 otherwise.

Thus road connectivity dummy is expected to have a positive influence on development and QOL indicators and the sign is expected to be positive.

Dependency Ratio (DR)

Dependency ratio indicates the potential effects of changes in population age structures for social and economic development, pointing out broad trends in social support needs. A high dependency ratio indicates that the economically active population and the overall economy face a greater burden to support and provide the social services needed by children and by older persons who are more likely to be economically dependent. A high youth dependency ratio (young-age dependency ratio), for instance, implies that higher investments need to be made in schooling and child-care. Expectedly, higher the dependency ratio, lower would be the overall quality of life at the household level, thus implying that the expected sign of this variable (as measured by number of dependents per earning member multiplied by 100) is negative. However there could be exceptions to this.

Interestingly, in traditional peasant households, or cultivator households having limited or uneconomical sized holdings, there is an over-whelming tendency of adult (and physically able) family members to participate in farm activities during the peak cropping seasons. Consequently dependency ratio for such households would be very low although their per capita annual incomes and consumption are also low. Thus for the lower income strata most household members try to contribute to family income as even grown up children (aged 12 years or more) cannot afford to remain idle. For these households the opportunity cost of re-maining idle is high. Naturally the dependency ratio for such households is very low (some-times even zero). One may hence argue that lower the per capita income lower would be the dependency ratio in case of BPL sections. Having said that, rising dependency ratio in such households would be disastrous from the point of view of QOL and overall standards of living.

Sex Ratio (SR)

The sex ratio, the relative number of men and women, is a critical indicator of discrimination against women and it reflects diverse effects including female foeticide, poor access to health

care and lower nutritional status for women and girls. The unfavourable sex ratio reflects very strong and continued favouring of men and boys by family. All these factors have influence on overall quality of life of the people. However in traditional tribal societies of the north east (especially in states like Meghalaya, Mizoram, and Tripura) there is a sufficiently long history of matriarchal way of life and living where the female adult members of the household are the key decision makers with males having a passive role. Unlike that in north, central and western Indian states, sex ratio among north eastern tribes was always at desirable levels since independence. In the present study sex ratio may not play a strong and significant (positive) role in determining household QOL and standards of living among Tiwa households of Assam. However its impact or influence is worth studying as exposure to modern media, urbanisation, globalisation and cultural infiltration might change the way Tiwa society looks at women. Since Tiwas are not living in isolation and are actually trying to assimilate with mainstream Assamese society the influence of sex ratio on household development status, QOL and standards of living may turn out to be positive.

Agriculture and allied activities (AGRI)

Agriculture and its related activities is the mainstay of major proportion of the Tiwa population. The performance of this sector means a lot to the well being of the masses. The present study tries to find out the impact of agriculture and its allied activities on overall quality of life of Tiwa people settled in Morigaon and Nagaon districts of Assam. Since the capacity to earn from this very occupation is limited, so it is expected to have negative impact on quality of life of Tiwa households whose principal earner is engaged in agriculture and allied activities. The dummy variable AGRI captures this aspect. For the present study, AGRI takes the value 1 if the principal earning member (highest earner, and not necessarily head of the household) is engaged in agriculture and allied activities (either owner cultivators or tenants or agricultural daily wage earners) and 0, otherwise. If the coefficient of AGRI turns out to be negative it would imply that the household's attachment to agriculture and allied activities has a negative impact on the household's QOL and standards of living.

Indebtedness (INDEBTED)

In India a majority of rural households are indebted and Assam is no exception. In rural areas loans are mainly taken by people in need, from shop-owners (business owners), and other informal money lenders, for the purpose of treatment, social functions and sometimes to meet consumption expenditures. The study measures indebtedness in terms of total formal (Gramin Bank or other bank loans) and informal loans by all active members of the household as reported on the day of the survey. Indebtedness is expected to have a depressing impact on households' QOL, and standards of living and thus its sign is expected to be negative.

MNREGS

The Mahatma Gandhi National Rural Employment Guarantee Scheme (MNREGS) has become a powerful instrument for economic empowerment and inclusive growth in rural India through its impact on social protection, livelihood security and democratic governance. Mahatma Gandhi NREGS is the first ever law that guarantees wage employment at an unprecedented scale. Most people find it difficult to remember the exact number of days of work under MNREGS, although ideally number of days of work under this scheme by all adult household members during the last one year credibly captures the work participation along with its financial benefits under this scheme. One alternative is to collect data on the income earned from this scheme by all adult members of the household who participated in MNREGS work during the last six months (1 year is too long a period as the interview depends heavily on the respondent's memory). The present study takes the total income earned from MNREGS work participation by all adult members of the household during the last six months (prior to the survey day) as an explanatory variable in order to examine its impact on well-being and quality of life of Tiwa people. It is expected to have a positive sign.

Electricity Connection Dummy (ELECT)

Access to electricity is a very fundamental factor that raises quality of life and living standards in both rural and urban areas. A village or an area may or may not have electricity connection. In a village or area where electricity connection is not provided, the question of household's access to electricity does not arise. Thus due to lack of availability power con-

nection is not possible irrespective of the economic status of the household. On the other hand, the village may have electricity connection although the household cannot access it due to lack of purchasing power. As majority of the villages surveyed in the study have electricity connection, availability is not an issue of concern. This study treats this variable as an explanatory one to measure the quality of life in selected Tiwa households. If the household has electricity connection the variable assumes value '1' and '0'for households with no-electricity connectivity. The expected sign of this variable is positive.

LPG Dummy (LPG)

The pattern of household energy consumption represents the economic condition as well as the quality of life of the household. More dependence on wood and timber implies traditional life style as far cooking is concerned. Greater dependence on fire-wood and timber may also be indicative of lack of purchasing power. More importantly from the ecological or environmental point of view collecting timber from neighbouring forests imply deforestation which needs to be addressed at any cost. As the level of income increases, the household usually moves to cleaner forms of energy like LPG or even electricity. The use of LPG for household cooking is thus indicative of improved standards of living. Rising incomes bring about changes in life styles which necessitate changes in cooking fuel from traditional sources (timber) to gas (LPG). LPG use is hence the result of higher purchasing power leading to better standards of living and QOL. In this study LPG is expected to influence QOL positively, where this dummy variable assumes 1 for LPG users, and 0 for others.

News Paper Reading Habits (NEWS)

News paper reading habits are usually common in educated and literate households where either the head or some adult member has at least completed secondary level of education (10^{th} standard or somewhere close to it). News paper reading may not be that common in households where the head or principal earner has less than 8 years of formal schooling. This dummy variable is taken as a proxy for knowledge and awareness levels of people towards the happenings in their surroundings. The present study gives 1 for Tiwa households with at least one regular newspaper reader and 0 for others. It is expected to have a positive impact

on quality of life of the selected Tiwa people. Arguably newspaper reading habits may be the result of higher income and per capita consumption. Newspaper reading habits can also be the result of higher levels of education achieved by household members. Incidentally educational attainments influence per capita household incomes, and capita household incomes in turn influence educational attainments. Analogously newspaper reading habits can also influence life styles, skill levels (through information, knowledge and awareness) and hence households incomes.

Education of Women belonging to Working Age Group (EDU)

Education is one of the most important factors in increasing the female work force participation. Formal education is one of the key factors that motivate household women to go for economically gainful activities. Education improves skill levels and higher the skill levels higher are the chances of a woman getting a formal sector job. However for traditional peasant families, female work participation is unlikely to be associated with female educational attainments. Traditional farm households require both domestic and hired labour during the cropping season and in case of poor farmers it is natural to expect that active women would participate in agricultural activities in order to save cost of hired labour. This is especially true in case of marginal and uneconomical sized cultivators who have to work with low capital. For landless agricultural labour households, women work participation in farm activities is most common. Thus female education and work force participation are unassociated in case of poor agricultural households where the type of work women do, does not require formal education. However, in order to capture the effect of education on working status of women, this study includes number of years of formal education of working age group women in the sample household. Arguably, the expected relationship between education and woman work force participation is positive.

Age of Women belonging to Working Age Group (AGE)

The age of a woman is very crucial factor for taking decision of work participation. The exact age working age group woman has been included in the model to trace out the effect of age on woman work force participation. Unmarried young women (below 20) with approximate-

ly 15 years of formal education, have greater freedom to choose some formal sector job within the panchayat area. Because of ST quota facility they may get formal sector jobs at an early age. Moreover there are different types of employment women may seek in accordance with the educational attainment. Less educated or illiterate women may attempt to be either self employed by taking up weaving, stitching, embroidery, handicrafts making, etc, or may participate in agricultural activities as either family labour or hired labour. The expected sign of the age of the woman belonging to working age group cannot be predicted a'priori as it may have a positive influence as well as a negative influence.

Education of the Principal Earner (EDUPEM)

Educational attainments of the principal earning member(s) of the household is a key variable that determines the economic status (in terms of purchasing power), living standards and hence the overall quality of life in the household. Formal education raises skill levels and hence raises the chances of shifting to formal sector jobs, preferably in semi-urban pockets (keeping in mind that majority of sample household belong to rural areas). Educational attainment of the principal earner would determine the occupational patterns in the household in the sense that higher the educational attainment higher would be the tendency of entering the formal service sector or being self-employed (or even as unorganised sector worker) in the non-agricultural sector. Furthermore educational attainments of the head of the household determine the educational levels of children or young age members. It can also determine the level of health awareness or consciousness among household members. Education also influences fertility rate negatively implying that more educated households are expected to have smaller family sizes, especially fewer off-springs. In the context of the present study, woman work force participation decision is most likely to be influenced by the educational status of principal earner of the household. It is expected that educational attainments of the principal earner of the household positively influences the decision of a working age group woman to participate in work outside home in the non-agricultural sector. Thus the sign of this variable is expected to be positive.

Number of Children (CHILD)

The number of children mothered by a working age group woman is an important determinant of women's participation in outside home economic activities. The higher the number of children a woman has, greater is her burden of responsibility of child rearing. In other words a working age group woman with no off-springs has greater freedom to participate actively in outside home economic activities. However economically gainful activities may be done inside the home as well, in the form of handicrafts making (baskets and other bamboo/wooden artifacts), weaving and embroidery, etc. Hence number of children hinders outside home jobs but not inside home jobs for a woman. In the logit models, the present study includes the number of children in the household aged 16 years or less. The sign of this coefficient is expected to be negative as more children in the household create social obstacles for the women to actively participate in gainful work.

Household Size (HOUS)

Woman work force participation is also influenced by household size. The larger the household size, the higher would be the dependency ratio (as household size and dependency ratio are expected to have positive correlation), which would raise the distress levels of the household. This is especially true for agricultural households. This could compel the active women of the house to take up economically gainful work either at home or outside. Hence the coefficient of household size is expected to be positive.

Land Holding (LH)

Land holding adds to household fixed assets. Higher the land holding, higher would be the household wealth, and hence the household is expected to be more economically empowered. Interestingly in rural areas higher the size of land holding, higher is the probability of the household being owner cultivators. In this study land holding (in bighas) is included in Model VI and VII in order to assess the impact of household assets on women's working status. Higher the land holding, higher is the level of economic empowerment of the household and lower is the distress level. Sufficient land holding may work as an incentive for women to take up jobs in the non-agricultural sector provided they can remain within the Panchayat area. These may include school teaching, anganwadi work, clerical work, etc. On the other

hand in case of small or uneconomical land holding, women are expected to take part in agricultural sector jobs either as peasant family workers or as hired agricultural labour. Thus, low (or uneconomical) size of holding and high (or commercially viable or satisfactory) size of holding have two different influences on the work participation of women. It is difficult to predict the exact sign of this coefficient in Models VI and VII. Furthermore for educationally forward households, land holding may not determine the work participation of women at all.

Marital Status (MARS)

In this study marital status is included as an independent dummy variable. It assumes 1 in case the woman being interviewed is married and 0 otherwise. This variable is categorized as married and unmarried (single). Married women (irrespective of their age) have to share serious family responsibilities like child rearing, cooking, and other household work. Single women are perhaps less burdened with such responsibilities in most cases. Moreover a married woman's decision to work outside home is conditional upon either the husbands' willingness or her in-law's willingness to allow her to participate in such work and contribute to family income. Hence marital status dummy is likely to have a negative influence on the work participation of a woman belonging to the working age group.

Age of Principal Earning Member (AGEPEM)

The age of principal earner is very crucial factor for labour force participation decision. The exact age of the principal earner of the household is included in the model to trace out the effect of principal earner's age on women's working decision. Higher the age of the principal earner lower could be the probability of women work participation. Older people (especially men) are expected to be orthodox and may possess traditional values, which are not conducive for allowing women (married or unmarried) to take up outside home employment. This may be a severe obstacle for married women. This variable is expected to have a negative sign as it plays a negative influence on the decision of the woman to take up outside home employment.

3.5 Data – Nature and Sources

The present study largely uses primary data based on a sample of 442 Tiwa households collected from two Tiwa dominated districts of Assam-namely Nagaon and Morigaon employing an appropriate sampling methodology. However the overview of the tribal population in Assam in general and the same in Morigaon and Nagaon districts in particular have been analysed on the basis of secondary data. In particular the Census of India, National Sample Survey (NSS) and the National Family Health Survey have been used. The secondary data were also collected from some different sources, such as Central Statistical Organisation (CSO), Planning Commission, UNDP, Different Ministries of India, Department of Statistics and Economics, Gazetteer, Official Records, Block Level Stations, Statistical Abstracts, Journals, Books and the leading libraries and socio-economic research centres of the North-eastern states, and institutions. In addition to these, a few internet data and literatures were also used. These shall be used for the research work after thorough examination of their accuracy.

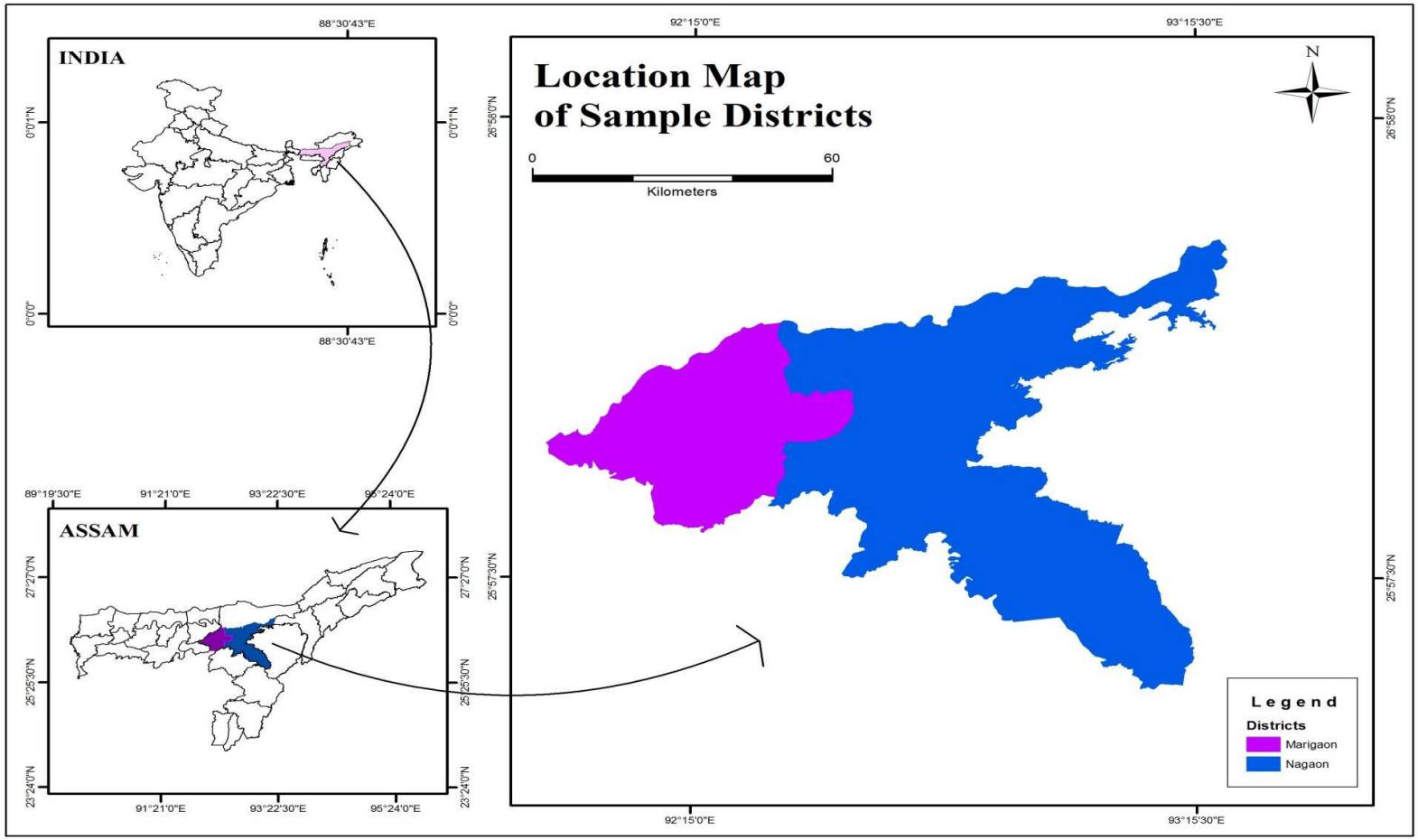
The primary data is collected with the help of a pre-tested structured questionnaire from sample households through personal interview method. This questionnaire consists of questions in view of the objectives of the study. Method of data collection is the standard interview with either head of the household or whichever adult member was present during the visit and was willing to provide information. Height and weight of all members present during the survey were recorded. The overall view of each residence (house) was also taken into account. Details of sanitation type and quality, drinking water source, housing type and quality among many externally visible factors were recorded for statistical analysis and reporting. The collected response has been analyzed with the help of suitable statistical techniques.

3.5.1 Sample Design

Two districts are purposively selected. Morigaon has the highest percentage of Tiwa population among all districts of Assam. Nagaon has the second highest concentration of Tiwas. Both these districts are chosen for the study. For the present study, 4 blocks from Morigaon district and 3 blocks from Nagaon district are purposively selected. The Tiwa Autonomous Council register reveals that blocks have a moderate to high concentration of Tiwa popula-

tion. These 4 blocks are purposively chosen. Out of the 4 blocks of Morigaon, Lahorighat and Mayong are regularly flood affected. Bhurbondha and Kapili are comparatively less flood affected. Those 3 blocks such as Udali, Kathiatoli and Raha are selected from Nagaon district where Tiwa pupation is found in larger proportion as per the Tiwa Autonomous Council register. The sample blocks and villages have been selected purposively, but households are selected randomly. The reason behind purposive selection of bocks and villages is to study variability of data such as, Tiwa population size of the village, nearby urban area, away from urban area, distance to district head quarter, affect from flood, variability in community type of habitants etc that influence the pattern of living, livelihood and quality of life of Tiwa people. The list of Tiwa households of selected villages is taken from the office of Tiwa Autonomous Council which is located in Morigaon town. From each village, 25 per cent households are surveyed and so we have 442 households in our sample. The survey was conducted during January–November 2014.The location map of selected districts is presented in figure 3.1.

Figure 3.1: Location Map of Sample Districts



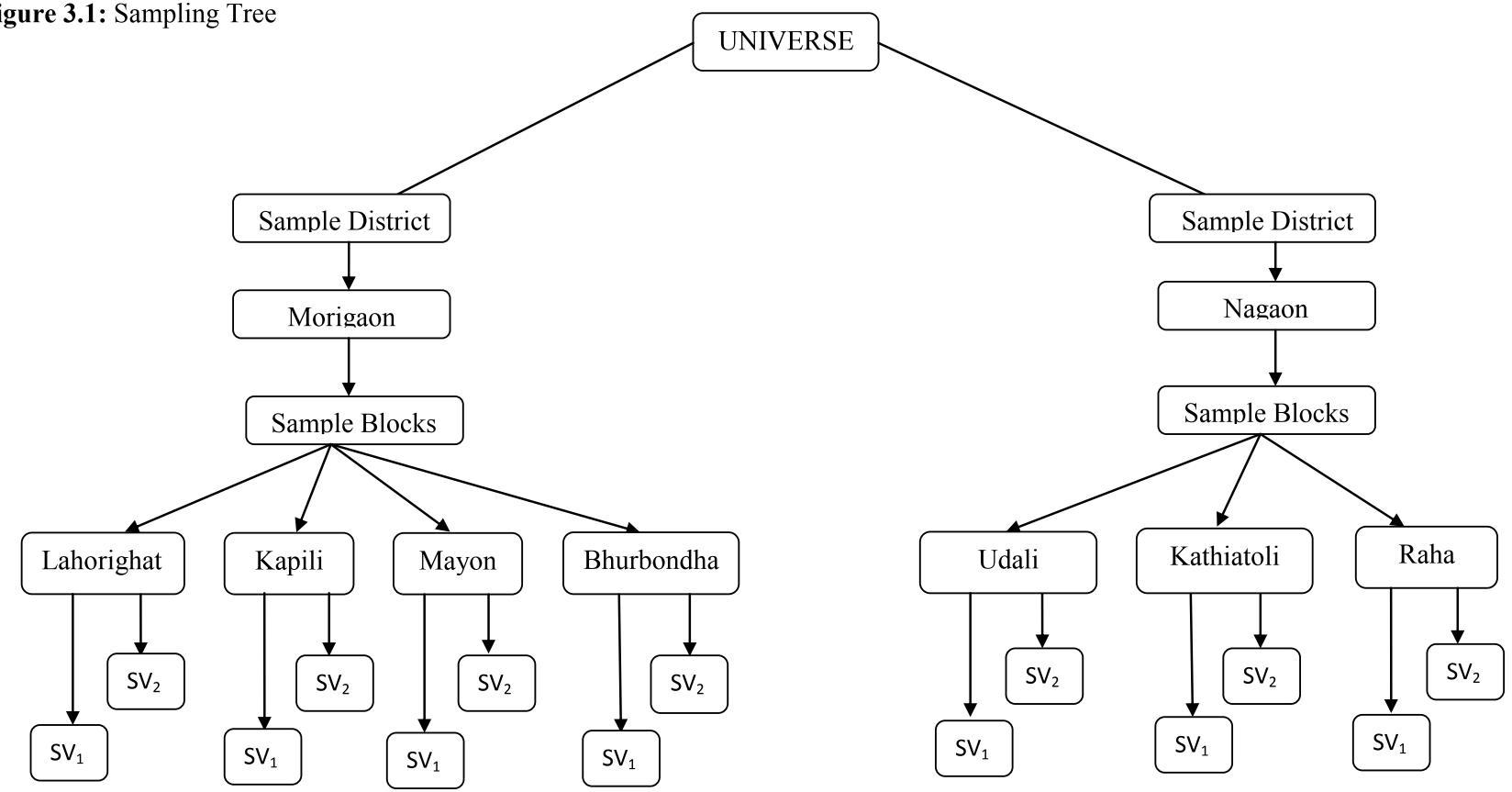
The selection of total sample households is shown in table-3.4.

Table-3.4: Selection of sample Tiwa households of Morigaon and Nagaon districts of Assam

Districts	Blocks	Sample Village	Sample Size Selection Method			
			Total Households	Total Tiwa Households	per cent of Tiwa House-holds	Total Selected Sample
Morigaon	Bhurbondha	Auguri	215	200	25	50
		Patidoya	135	120	25	30
	Lahorighat	Amora ati	210	180	25	45
		Bakorigaon	110	80	25	20
	Mayong	Shilveta	150	120	25	30
		Awatigaon	121	80	25	20
	Kapili	Sohori	225	220	25	55
		Niz Bogori guri	100	100	25	25
	4 Blocks	8 Villages	1266	1100	25 per cent	275
Nagaon	Udali	Kakijan Camp Area	427	106	25	25
		Lalung Gaon	96	84	25	30
	Raha	Bogori guri	145	115	25	29
		Kamgaon	132	95	25	24
	Kathiatoli	Gamari ati	100	100	25	25
		Lalung par	200	175	25	44
	3 Blocks	6 Villages	1100	667	25 per cent	167
Total	7 Blocks	14 Villages	2018	1755	25per cent of Tiwa Household	N=442

Source: Tiwa Autonomous Council Register & Census of India, 2011.

Figure 3.1: Sampling Tree



SV= Sampling Village