CHAPTER 6

NATURE, EXTENT AND INFLUENCING FACTORS OF RURAL LIVELIHOOD DIVERSIFICATION

In the previous chapter, the impact of oil exploration of ONGC and OIL on the five livelihood capitals has been discussed. On the one hand, the oil industry generates several employment opportunities, both directly and indirectly, for its local rural peoples; on the other hand, several vulnerability contexts have been observed as a result of ONGC and OIL's oil exploration activities in the study area. For example, some major vulnerabilities found in the previous chapter are land acquisition, loss of traditional occupation, seasonality of occupation, environmental pollution, etc. Livelihood diversification is one of the important strategies to cope with the stresses and shocks of livelihood vulnerability. Ellis (1998) defined livelihood diversification as the process by which rural families construct a diverse portfolio of activities and social support capabilities in their struggle for survival and to improve their standards of living. It is an important way by which rural people may work to achieve sustainable livelihoods. (Hussein & Nelson, 1998). Especially, in developing countries, livelihood diversification (LD) is emphasised as a means for economic growth and poverty reduction in rural areas (Loison, 2019).

Amidst such vulnerability contexts and alternative income-earning opportunities, a study on how the local rural people of such extractive industries adopt livelihood diversification as an alternative strategy to achieve sustainability bears significance. So, in this chapter, an attempt has been made to discuss the nature and extent of rural livelihood diversification in the study area. An effort has also been made to examine whether ONGC and OIL influence the livelihood diversification of the local rural households. In addition, to identify the major driving factors of rural livelihood diversification a regression analysis is performed.

6.1 Nature and extent of rural livelihood diversification in the study area

There are several methods to measure livelihood diversification. Some researchers have measured livelihood diversification by counting the number of income sources on which households depend (Ibrahim et. al., 2009; Khatun & Roy, 2018).

Some other researchers estimated livelihood diversification by accounting for the contribution of different income sources to the total household income. There are several indices to measure livelihood diversity. Some of the popular indices used by earlier researchers are the Herfindahl index, Simpson index, Entropy index, Modified Entropy index and Composite Entropy Index (Mandal & Bezbaruah, 2013; Mandal, 2014; Ahmed et. al., 2018). But, the Simpson index of diversification is widely used by researchers to determine livelihood diversification for its robustness, simplicity, and wider acceptance (Mishra, 2009; Khatun & Roy, 2012; Saikia, 2015; Roy & Basu, 2020; Sarker et al., 2020a, Sarker et al., 2020b). So, in the present study, the Simpson index of diversification (SID) is used, where $SID=1-\Sigma (S_i^2)$, $0 \leq SID \leq 1$ and S_i indicate the contribution of i^{th} livelihood source to total income. The value of SID equal to zero indicates complete concentration and one implies complete diversification.

6.1.1 Income source diversity

In the present study, the household income sources are mainly classified into 16 categories based on the field information from the study area which is shown in table 6.1. Then the average number of income sources is estimated in table 6.2 for the different categories of villages. In the case of the operational areas, it is observed that the average number of sources is 5.04 in the sample households of oil villages as against 4.01 in the sample households of the control villages. On the other hand, in the case of nearby villages of the operational headquarters, the average number of income sources of the sample households is estimated to be 5.16, while it is 4.48 in the case of the sample households of the control villages. Such findings imply that the operational areas and the operational headquarters of ONGC and OIL provide more opportunities to the neighbouring rural households to earn from different sources as compared to the control villages. A previous study conducted in Bankura district of West Bengal also found that the mining industry has created many non-farm employment opportunities to the local rural people which resulted an occupational diversification in that area from agriculture to mining sector (Banerjee & Mistri, 2019). However, in contrast to the field observation of the present study, some other research observed that the mining industry

of Orissa have reduced the livelihood sources of the nearby rural community (Das & Mishra, 2015).

Table 6.3 and figure 6.1 also denote that the percentage of households having more income-earning sources (i.e., 5—9 sources) is greater in the oil villages and nearby villages of the oil industry. In contrast, a large percentage of households in the control villages fall in the category of less income earning sources (i.e., 1—4 sources).

Table 6.1

Classification of income sources in the study areas

Sl. No.	Income sources
1.	Paddy cultivation
2	Vegetable cultivation
3	Tea cultivation
4.	Poultry
5.	Livestock
6.	Fishery
7.	Agricultural wage labourers
8.	Business and self-employment
9.	Salaried job in the government sector
10.	Private-sector job
11.	Jobs in public sector undertakings like ONGC and OIL
12.	Casual jobs in private companies having a contractual agreement with ONGC and OIL
13.	Daily wage labourers
14.	Income from handloom
15.	Pension
16.	Benefit transfer from government sources through welfare schemes

Source: Field survey

Table 6.2

The average number of household income sources in the study areas

Study areas	**Village type**	**The average number of income sources**
Operational areas	Oil Villages	5.05
	Control villages	4.01
Operational headquarters	Nearby Villages	5.16
	Control villages	4.48

Source: Researcher's calculation from the field data

Table 6.3

Distribution of sample households according to the number of household income sources

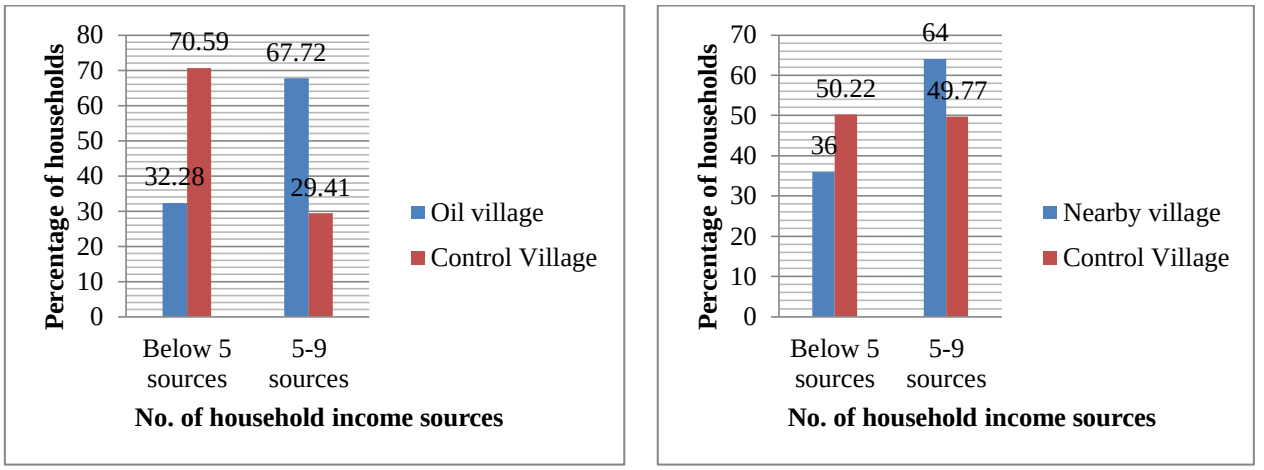
	No. of Income Sources	No. of sample households under different income source groups									**Total sample households**
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	
Operational areas	Oil Village	5 (1.13)	16 (3.61)	46 (10.38)	76 (17.16)	115 (25.96)	124 (27.99)	49 (11.06)	12 (2.71)	0 (0.00)	443 (100)
	Control village	1 (0.53)	8 (4.28)	50 (26.74)	73 (39.04)	44 (23.53)	8 (4.28)	2 (1.07)	1 (0.53)	0 (0.00)	187 (100)
Operational headquarters	Nearby Village	0 (0.00)	2 (1.60)	10 (8.00)	33 (26.40)	33 (26.40)	23 (18.40)	18 (14.40)	4 (3.20)	2 (1.60)	125 (100)
	Control village	0 (0.00)	5 (2.28)	37 (16.89)	68 (31.05)	76 (34.70)	24 (10.96)	8 (3.65)	1 (0.46)	0 (0.00)	219 (100)

Source: Researcher's calculation from the field data

Note: figures in the parentheses indicate percentage to total.

Figure 6.1: Percentage of sample households under different income source groups

(A) Operational Area (B) Operational Headquarter



6.1.2 Income diversity

Since industrialization creates diversified employment opportunities, directly or indirectly, in the neighbouring areas, it helps the neighbouring rural people in diversifying their household incomes. ONGC and OIL also provide direct and indirect employment opportunities for the local people of the study areas. However, the direct employment opportunity in ONGC and OIL for the neighbouring villages is found to be very limited. Earlier they gave direct employment to the local people as compensation for their acquired land, but such a type of compensation policy is now abolished. However, ONGC and OIL make some casual jobs available for the local people indirectly, as they give many of their operational works such as drilling, transportation etc. to some private companies under contractual agreements. These private companies under ONGC and OIL hire workers from the neighbouring areas. Such type of casual employments creates livelihood risk, rather than livelihood security in the long run. By observing a similar situation in Orissa, Mishra (2009) has stated that the casual workers of the mining industries have been living with a livelihood risk as there is a strong probability of losing their jobs after the end of the coal reserves in their locality.

Table 6.4 shows the contribution of different income sources to the total household income in the study area. It is found that only 6.30 per cent of household

income in oil villages comes from the direct ONGC and OIL sector jobs, while no direct jobs have been created by them in other villages. But the private companies who are working with ONGC and OIL under contractual agreement generate more income-earning opportunities for the people of oil villages under operational areas, and the people of nearby villages under operational headquarters, as compared to their respective control villages. Table 6.4 shows that in the oil villages 10.42 per cent of the total household income comes from the casual jobs offered by the private companies under ONGC and OIL, while the same is only 3.10 per cent in the control villages. Similarly, in the nearby villages of operational headquarters 17.13 per cent of household income of the sample households is constituted from the casual jobs of the private companies under ONGC and OIL which is much higher compared to 10.15 per cent of household income deriving from such casual jobs in the control villages.

To get a more specific picture of the impact of oil companies on different sources in the study area, all the income sources of the households are broadly classified as farm income and non-farm income which is shown in figure 6.2. It is observed that in the operational areas, non-farm income-earning opportunities are greater in the oil villages than in the control villages. The percentage contribution of the non-farm sector to the total household income of the sample families is observed to be 73.22 per cent on average in the oil villages as against 63.82 per cent contribution of this sector in the control villages. But, such difference is negligible between the nearby and control villages of the operational headquarters.

Table 6.4

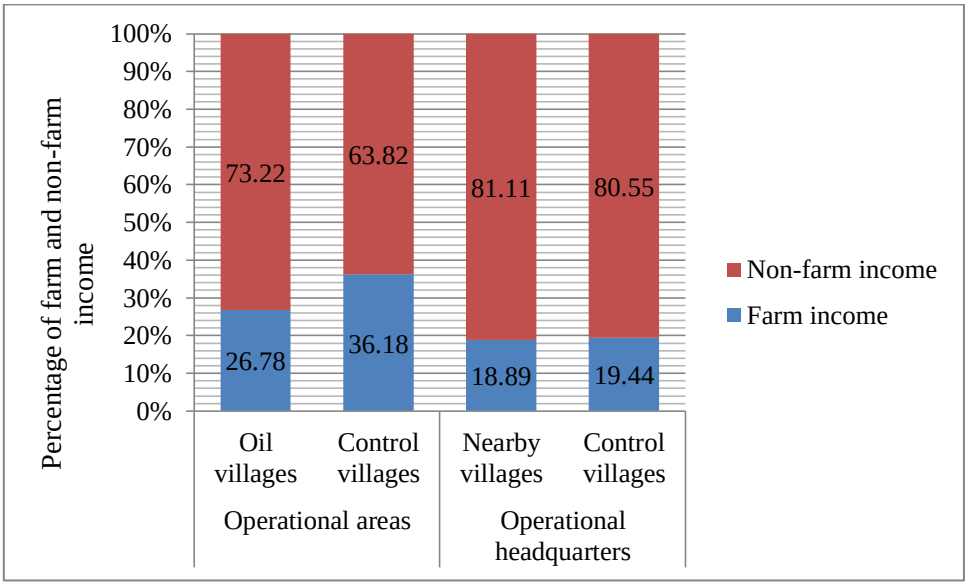
Average earning (in percentage) of sample households from different sources

	Village type	Paddy	Vegetable	Tea	Poultry	Livestock	Fishery	Agricultural wage labourers	Business & self-employment	Govt. job	PSU jobs in ONGC, OIL etc.	Casual job in private companies under ONGC or OIL	Private job	Daily wage labourer	Pension	Handloom	Transfer from government sources	**Household income from all sources**
(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*	*(7)*	*(8)*	*(9)*	*(10)*	*(11)*	*(12)*	*(13)*	*(14)*	*(15)*	*(16)*	*(17)*	*(18)*	*(19)*
Operational areas	Oil villages	3.65	0.97	14.92	1.65	4.73	0.28	0.58	17.71	18.79	6.30	10.42	10.10	1.88	6.21	0.61	1.20	100.00
	Control villages	7.01	0.96	18.15	2.00	7.35	0.49	0.22	19.96	19.04	0.00	3.10	10.01	2.58	6.80	0.57	1.76	100.00
Operational headquarters	Nearby villages	3.87	1.04	10.07	1.01	2.73	0.00	0.17	20.17	19.73	0.00	17.13	12.31	2.32	7.72	0.80	0.93	100.00
	Control villages	7.80	0.91	1.35	1.52	5.50	0.00	2.36	30.34	10.97	0.00	10.15	16.23	6.04	4.13	0.56	2.13	100.00

Source: Researcher's calculation from the field data

Figure 6.2

Percentage of farm and non-farm income in the total household income



To measure the livelihood diversification in the study area, the Simpson index of diversification (SID) is estimated for each household and the average value of SID is presented for oil villages and control villages in table 6.5. It is observed that the average value of SID in the oil villages of operational areas and nearby villages of operational headquarters is greater than that of the control villages.

Table 6.5

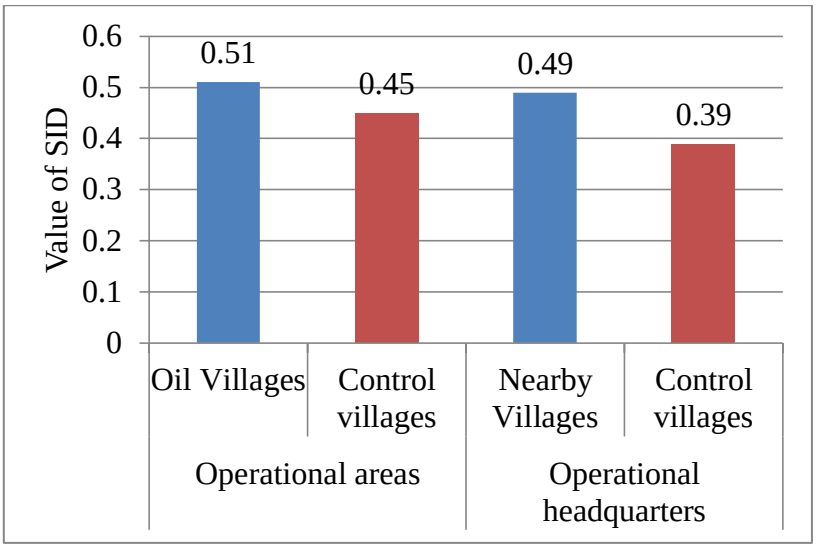
Simpson index of diversification (SID) in the study area

	Village type	Mean SID	N	Std. Deviation
Operational areas	Oil Villages	0.51	443	0.18
	control villages	0.45	187	0.15
Operational headquarters	Nearby Villages	0.49	125	0.21
	control villages	0.39	219	0.17

Source: Researcher's calculation from the field data

Figure 6.3

SID value of the different categories of villages in the study area



Again, in table 6.6, the households are distributed among five categories of diversification according to the values of SID as used by earlier researchers (Roy & Basu, 2020; Sarker et al., 2020b) to examine the extent of diversification among the rural households under their study. It is observed that the percentage of households combing with moderate and high diversification is high in the oil and nearby villages as compared to the control villages. This indicates the availability of opportunities to diversify livelihood is more in the oil villages of operational areas and nearby villages of operational headquarters as compared to the control villages. Such observation indicates that the oil industry has an impact on household livelihood diversification.

Table 6.6

Distribution of sample households according to SID value

Range of SID	**Types**	**Operational areas**		**Operational headquarters**	
		Oil villages	Control villages	Nearby villages	Control villages
0	No diversification	5 (1.13)	2 (1.07)	2 (1.60)	0 (0.00)
0.01 – 0.25	Low diversification	44 (9.93)	23 (12.30)	22 (17.60)	53 (24.20)
0.26 – 0.50	Medium diversification	135 (30.47)	79 (42.25)	37 (29.60)	98 (44.75)
0.51 – 0.75	High diversification	242 (54.63)	81 (43.32)	44 (35.20)	66 (30.14)
0.76 –1.00	Very high diversification	17 (3.84)	2 (1.07)	20 (16.00)	2 (0.91)
	Total	**443 (100)**	**187 (100)**	**125 (100)**	**219 (100)**

Source: Researcher's calculation from the field data

Note: Figures in the parentheses indicate the percentage of the total.

Figure 6.4

Percentage of households under different levels of diversification in the operational area

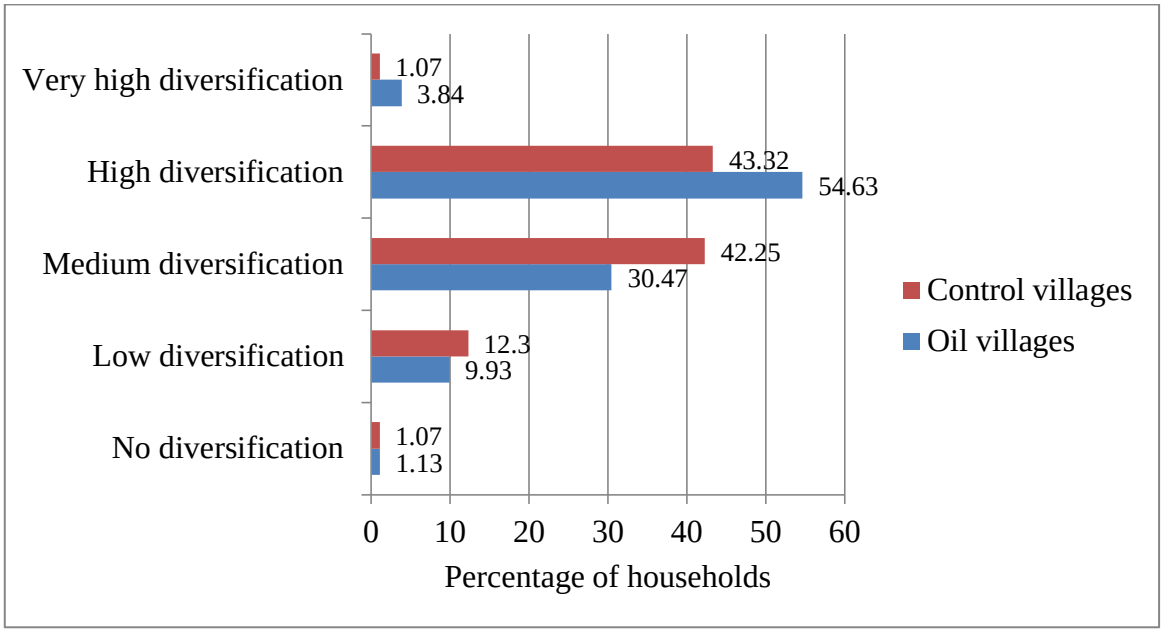
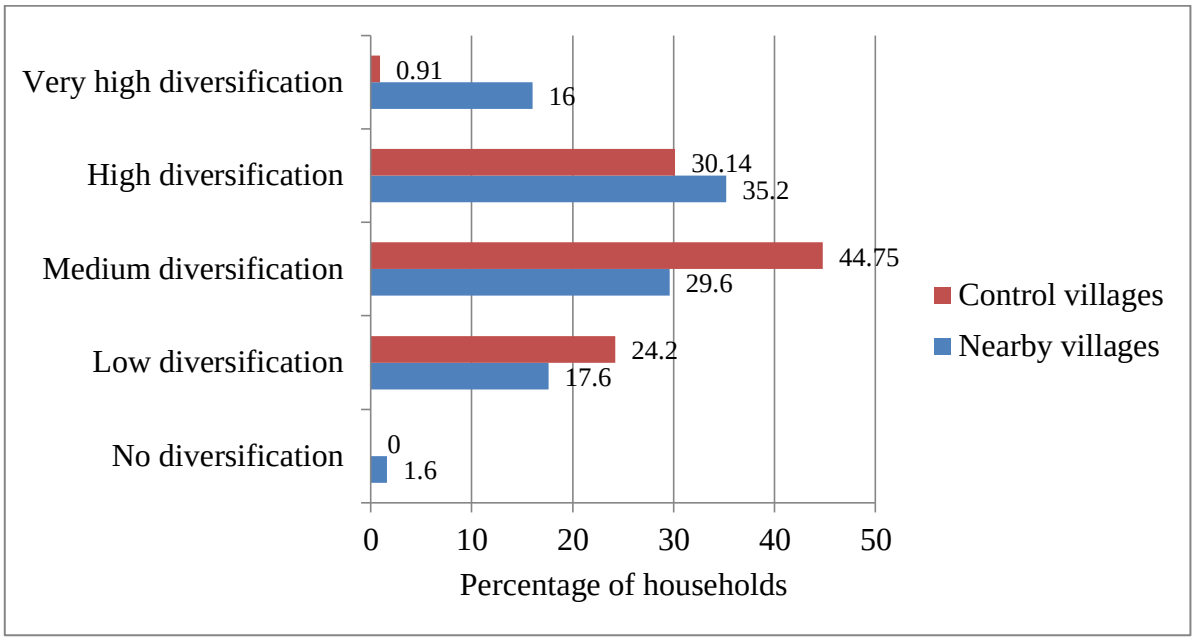


Figure 6.5

Percentage of households under different levels of diversification in operational headquarter



6.1.3 Hypothesis testing

To check whether there is statistical significance in the mean difference of household level livelihood diversification between the oil and control villages of operational areas; and nearby villages and control villages of operational headquarters, an independent sample t-test is conducted. The null (H_0) and alternative (H_1) hypotheses are stated below:

Hypothesis for operational areas

H_0: There is no significant difference in the mean household livelihood diversification between oil villages and control villages of operational areas of ONGC and OIL.

H_1: There is a significant difference in the mean household livelihood diversification between oil villages and control villages of operational areas of ONGC and OIL.

Hypothesis for operational headquarters

H_0: There is no significant difference in the mean household livelihood diversification between oil villages and control villages of the operational headquarters of ONGC and OIL.

H_1: There is a significant difference in the mean household livelihood diversification between oil villages and control villages of the operational headquarters of ONGC and OIL.

Table 6.7

Result of Independent Samples t-test (Operational area)

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Operational area	Equal variances assumed	**5.809**	**.016**	3.63	628	.000	.054	.015	.025	.084
	Equal variances not assumed			**3.85**	**403.13**	**.000**	**.054**	**.014**	**.026**	**.082**
Operational headquarter	Equal variances assumed	**9.811**	**.002**	4.519	342	.000	.096	.021	.054	.138
	Equal variances not assumed			**4.264**	**216.28**	**.000**	**.096**	**.022**	**.051**	**.141**

Source: Researcher's calculation from the field data

Table 6.7 indicates that there is significant difference in scores for oil villages (M= 0.51, SD= 0.18) and control villages (M= 0.45, SD= 0.15). The magnitude of the differences in the means (mean difference=0.054, 95% CI: 0.026 to 0.082) is statistically significant. So, the null hypothesis is rejected and it can be stated that there is a significant difference in the household livelihood diversification between the oil villages and control villages of the study areas. Similarly, in the case of operational headquarters, it is observed that there is a significant difference in the mean SID between nearby villages (M=0.49, SD=0.21) and control villages (M=0.39, SD=0.17). Thus, it can be summarized that the proximity to the operational area or headquarter is one of the factors that influence the household level livelihood diversification in the study area.

6.2 Identifying the influencing factors of livelihood diversification

6.2.1 Specification of the model

Since livelihood is a very complex, diverse and dynamic concept, it can be expected that in addition to the location of the villages, there might be some other factors that influence livelihood diversification at the household level. So, to examine the determinants of livelihood diversification a regression model was done by considering the diversification index (SID) as a dependent variable. Since the value of SID ranges from 0 to 1, the Tobit regression with censoring on both sides is considered as appropriate to regress the dependent variable (Mandal & Bezbaruah, 2013; Roy et. al., 2018; Sarker et al., 2020a; Sarker et al., 2020b).

The Tobit regression model is constructed with a latent variable Y_j^* which can take any possible values which are not always observable. Incorporating the explanatory variables stated in table 6.8, the following model is used for the estimation of the parameters.

$$Y_j^* = \beta_0 + \beta_1(\text{Family size}) + \beta_2(\text{Gender}) + \beta_3(\text{Dependency ratio}) + \beta_4(\text{Education}) + \beta_5(\text{Technical education}) + \beta_6(\text{Physical asset index}) + \beta_7(\text{Distance to the nearest town}) + \beta_8(\text{Distance to the nearest bank}) + \beta_9(\text{CSR benefit}) + \beta_{10}(\text{Membership in formal social organization}) + \beta_{11}(\text{Female work participation}) + \beta_{12}(\text{Land holding}) + \beta_{13}(\text{Land acquisition}) + \beta_{14}(\text{Locational dummy}) + u_j \quad \ldots\ldots(1)$$

The observed dependent variable Y_j (i.e. the value of Simpson index of diversification, SID, for j^{th} households) is linked to the latent variable Y_j^* under the following conditions:

$Y_j = 0$ for $Y_j^* \leq 0$

$Y_j = Y_j^*$ for $0 < Y_j^* \leq 1$

$Y_j = 1$ for $Y_j^* > 1$

The random disturbances u_js are assumed to be independently normally distributed with zero mean. Then, the Maximum likelihood estimates of the parameters have been obtained for the operational area and operational headquarter, separately, using STATA 11.

T able 6.8

Selected variables for regression analysis

Variables	**Definition**	**Expected sign**
Family size (FS)	Number of family members in the household	+
Gender (Gen)	Number of male members in the household	+
Dependency ratio (DR)	Percentage of household members below 18 and above 60 years	+/-
Education (Edu)	No. of family members who completed schooling up to class 12	+
Technical Education	No. of family members who have technical education	+
Physical asset index (Phy)	Value of the physical asset index	+
Distance to the nearest town (urban linkage) (UL)	Distance from the household to the nearest town (in km)	+
Distance to the nearest bank (BL)	Distance from the household to the nearest bank (in km)	+
CSR benefits (CSR)	Does the household receive any kind of CSR benefits from ONGC or OIL? (1=yes, 0=no)	+
Membership in formal social organization (Soc)	Membership in formal social organizations like self-help groups (SHG)/co-operative/ village committees, etc. (1=yes, 0=no)	+
Female work participation (FWP)	Whether the female members participate in the economic activity other than unpaid household work? (1=yes, 0=no)	+
Landholding (LH)	Size of land owned by the household (in hectare)	-
Land acquisition (LA)	Whether the household has confronted land acquisition? (1=yes, 0=no)	+
Locational dummy (LD)	1= if the household belongs to the oil/ nearest villages; 0=if the household belongs to the control villages	+

Source: Field observations and literature review

6.2.2 Rationale of variable selection

The dependent variables of the Tobit model represented by equation (1) are selected based on literature review and field observations. The rationale behind the selection of dependent variables is discussed below:

Family size

Family size, i.e., the number of family members is one of the important determinants of livelihood diversification at the household level. Vatta & Sidhu (2007) and Roy & Basu (2020) have also used this variable in their regression model to identify the probable factors of income and livelihood diversification. The family members are the important component of human capital as they supply labour or manpower required for adopting diversified livelihood options. Abeje et.al. (2019) also stated that a larger household could shift available labour to alternative off- and non-farm livelihood activities. Moreover, the needs of bigger families are larger than the smaller families for which they are bound to go for work. So, it is expected that a bigger family has a higher probability to diversify their livelihoods.

Gender

Gender is another probable determinant of livelihood diversification. There is a difference in workforce participation between males and females. Normally, males score a higher work participation rate than females. So, for that reason, it can be expected that households having more male members have more chances to adopt livelihood diversification strategies. Many researchers have used the gender of the household head as one of the explanatory variables while regressing livelihood diversification (Ayana et. al., 2021). But, in this study, instead of considering the gender of the head of the family only, the number of male members of the family is considered as one of the probable determinants of diversification. It is projected that the higher the number of male members in the family, the higher the value of livelihood diversification.

Dependency ratio

The dependency ratio is a ratio that compares the number of dependents aged 0 to 14 and over 65 to the total population aged 15 to 64. This demographic statistic compares the number of persons who are not working to the number of people who are working. It has long been assumed that as the dependence ratio rises, so does labour force activity; to satisfy the

demands of feeding more children, a larger number of adults, and possibly older children as well, may enter the workforce (Bilsborrow, 1977). By studying the determinants of livelihood diversification in Assosa Wereda, Western Ethiopia; Ayana et al. (2021) also observed a higher probability of livelihood diversification with the increase in dependency ratio. Abeje et al. (2019) also observed that households with more dependents tended to choose off-farm and non-farm livelihood activities. Contrary to such observations, Khatun & Roy (2012) found that the dependency ratio was negatively related to the level of diversification. They pointed out that an increase in dependency ratio means an increase in the number of household members below 18 years and above 60 years who are unable to engage in some activities. Precisely, the shortage of family members under the working age group decreases the opportunity to earn from diversified activities. Thus, the variable dependency ratio may influence the dependent variable positively or negatively under different circumstances.

Education

Educational achievement is one of the most components of human capital which determines peoples' livelihood strategies. Higher education years lead to better skills and are likely to improve employment prospects in the non-farm sector. Many high-paid non-farm jobs require skilled and educated workers. Education helps the household members to diversify their livelihoods from farm to non-farm. So, many researchers in their livelihood research hypothesise that the educational level of the worker increases the probability of getting involved in non-farm employment. To capture the effect of education, some researchers considered the education level or years of schooling of the household head only as an explanatory variable (Musumba et al., 2022). In contrast, some other researchers considered the average education of all the members of a household as the regressor (Khatun & Roy, 2012). But in the present study, the number of family members who completed schooling up to the high school level is considered as the explanatory variable. Roy & Basu (2020) also used 'family member who completed 10 years of schooling as an independent variable in their livelihood diversification regression model. Here, it is expected that with the increase in the number of family members completing high school, the household diversification value will increase.

Technical education

In addition to general schooling, achievement in technical education may also determine the choice of livelihoods. Pasa (2017) found a significant role of capacity/skill

development training in rural livelihoods. Skilled and capable youths are becoming human capital in society and working for transforming social capital. Technical education widens the choice of people to involve in different income-earning activities. So, to examine the effect of technical education on livelihood diversification, the number of family members with technical education is chosen as one of the explanatory variables of the model. It is expected that technical education would affect livelihood diversification positively.

Physical asset index

Physical assets or capital are important components of livelihoods. Along with other capital, physical assets help households to formulate diverse livelihood strategies. In the previous chapter, the physical asset index is estimated for all the households under study based on the physical assets that they have. The value of the physical asset index is incorporated in the regression model to find out its effect on livelihood diversification. It is hypothesised that a higher physical asset index will increase livelihood diversification.

Distance to the nearest town

Spatial effects are considered as very strong determinants of activity choice and market participation (Fafchamps & Shilpi, 2003). So, it is very essential to include the geographic variables in the model for examining the predictors of livelihood diversification. Proximity to a market or town may have a substantial impact on livelihood diversification and boosts the chances of rural households finding non-farm jobs. Khatun & Roy (2012) also hypothesized that there would be a negative relationship between livelihood diversification and distance to the nearest town. Thus, in the present study, it is expected that the lesser the distance to the nearest town, the higher will be the value of livelihood diversification.

Distance to the nearest bank

Access to financial services is one of the important factors that influence the livelihoods of rural households. Proximity to financial institutions such as banks indicates the access to saving as well as credit facilities of the households, which in turn provides an opportunity to choose and invest in better livelihood strategies. It is hypothesised that the lesser the distance from home to the nearest bank, the more access to financial services and the more chance of adopting diversified livelihood options.

CSR benefits

ONGC and OIL spend a considerable amount of money for the development of the local society of their operations following the mandates of the Companies Act, 2013 that every private limited or public limited company, which either has a net worth of Rs. 500 Crore or a turnover of Rs. 1,000 crores or a net profit of Rs. 5 crores are bound to spend at least two per cent of its average net profit of the immediately preceding three financial years for the development of the local area as corporate social responsibility (Ministry of Corporate Affairs, 2019: 87). From the field observations, it is found that they have undertaken several activities under CSR such as road construction, skill development training, grants to local educational institutions for infrastructure development, health camps for the rural people, etc. It is predicted that the inclusion of CSR benefits as an explanatory variable in the model will help to identify its effect on the livelihoods of the local community.

Membership in the formal social organization

Social relations, networks and communications are important components of social capital which help a family in adopting different livelihood strategies. So, the membership of community-based organizations such as self-help Groups (SHG), co-operatives, village committees, panchayats etc. is considered an important determinant of livelihood diversification. Khatun & Roy (2012) opined that membership in SHG promotes social status and increases access to common property resources as well as different government/NGO schemes. So, it is anticipated that membership in the social organization will positively affect the livelihood diversification of the family.

Female work participation

From the field observation, it is found that many female members were engaged in different livelihood enterprises such as agriculture, livestock and poultry rearing, and handloom activities. These enterprises were found to contribute to the total income of the households. So, female work participation is assumed to positively impact the livelihood diversification of rural households.

Landholding

The land is one of the important natural capitals and the rural people use land mainly for agriculture purposes and homes. Many researchers argued that the size of landholding may affect livelihood diversification negatively. The lesser the size of landholding higher the

probability of choosing off-farm and non-farm activities by the households (Khatun & Roy, 2012). So, in the present study, it is hypothesised that there is a negative relationship between landholding and livelihood diversification.

Land acquisition

ONGC and OIL acquire land from rural households in their operational areas for their different operational works. From the field survey, it is observed that due to land acquisition the marginal farmers have been affected the most. Therefore, it is expected that the households who confronted land acquisition have the potential to diversify their livelihoods from the farm to the non-farm sector.

Locational dummy

To capture the effect of the oil industry on the local rural community, a locational dummy (i.e., 1= if the household belongs to the oil/ nearest villages; 0=if the household belongs to the control villages) is included in the regression model. The rationale for selecting the locational dummy is that the extent of diversification in the households of oil villages/nearest villages of the operational area and headquarters of ONGC and OIL may differ from the control villages. It is hypothesised that the livelihood diversification of the households will be more in the oil villages/nearest villages.

6.2.3 Results of the regression analysis

The Tobit regression analysis has been conducted for both operational areas and the operational headquarters of ONGC and OIL. While running the analysis for the operational areas all fourteen explanatory variables listed in table 6.8 have been considered, but in the case of operational headquarters, the variable land acquisition has been excluded from the model as no households have confronted land acquisition in the nearby and control villages of operational headquarters.

Since the data used in the model are cross-sectional it may lead to the presence of heteroscedasticity in the model. So, before estimating the parameters, the Breusch-pagan test of heteroscedasticity is conducted and the result suggested that there is the presence of heteroscedasticity in the regression model of the operational area. To correct this problem White heteroscedasticity consistent robust standard errors have been estimated (Gujarati,

2004). Meanwhile, there is no heteroscedasticity problem in the regression model of operational headquarters.

The diagnosis to detect the presence of multicollinearity among the explanatory variables was done and it is found the value of the variance-inflating factor (VIF) is less than 5 in all cases which suggests that there is no multicollinearity problem in the models (Annexure-D).

Table 6.9

Results of Tobit Regression

	Model I: Operational area	
Breusch-Pagan Test of Heteroscedasticity →	chi2(1) = 7.16 Prob > chi2 = 0.0075 *Heteroscedasticity is present*	
Variables ↓	**Coefficient**	**Robust Standard error**
Intercept	.189***	.038
Family size	.015**	.006
Gender	-.002	.009
Dependency ratio	-.003**	.001
Education	.011**	.004
Technical education	.062***	.011
Physical asset index	.020***	.007
Distance to the nearest town (urban linkage)	.001	.001
Distance to the nearest bank	-.008 **	.003
CSR benefits	.087***	.016
Membership in formal social organization	.010	.015
Female work participation	.069***	.016
Landholding	.044 ***	.006
Land acquisition	.015	.015
Locational dummy	.039 **	.021
Model summary →	Number of observation = 630 F(14, 615) = 12.35 Prob > F = 0.0001 Log pseudolikelihood = 274.99 Pseudo R2 = 0.504	

Note: *** p<0.01; ** p<.05 and * p<0.10

Source: Researcher's calculation from the field data

Table 6.10

Results of Tobit Regression

	Model II: Operational headquarter	
Breusch-Pagan Test of Heteroscedasticity →	chi2(1) = 0.07 Prob > chi2 = 0.7861 *Heteroscedasticity is not present*	
Variables ↓	**Coefficient**	**Standard error**
Intercept	.201***	.051
Family size	.027***	.007
Gender	.007	.011
Dependency ratio	.024	.021
Education	.007	.008
Technical education	.081 ***	.019
Physical asset index	.011	.009
Distance to the nearest town (urban linkage)	-.012**	.006
Distance to the nearest bank	.005	.004
CSR benefits	-.021	.027
Membership in the formal social organisation	.115***	.022
Female work participation	.142***	.021
Landholding	.046 ***	.008
Locational dummy	.086 ***	.029
Model summary →	Number of observation = 344 LR chi2(13) = 241.15 Prob > chi2 = 0.0001 Log-likelihood = 188.63 Pseudo R2 = .771	

Note: *** p<0.01; ** p<.05 and * p<0.10

Source: Researcher's calculation from the field data

The estimated results of Tobit regression analysis for operational areas and operational headquarters are shown in table 6.9 and 6.10, respectively. The coefficient of family size is found to be positive and significant at 5 per cent and 1 per cent levels of significance in the case of operational areas and operational headquarters, respectively. This suggests that the larger family have a greater scope to earn from diversified livelihood sources. While studying the drivers of livelihood diversification in the Upper Blue Nile Basin of Ethiopia, Abeje et al. (2019) also observed a positive significant impact of family size on livelihood diversification. They opined that a larger household could shift available labour to alternative off- and non-farm livelihood activities. A similar finding was also observed by Vatta & Sidhu (2007) while studying income diversification among rural households in Punjab. They concluded that an increase in the family size encouraged the households to diversify their income, for, with the increase of household members, the per capita income of the family declines and that leads the households to diversify their income.

The coefficient of dependency ratio is found to be negative and significant at a 5 per cent level in the Model I (Table 6.9) implying that the greater number of the dependents or fewer working-age members in the family, the smaller would be the value of livelihood diversification. This result resembles the findings of Vatta & Sidhu (2007) who observed that an increase in the working population ratio in the family positively influences income diversification.

Education is also found to be a significant influencing factor of livelihood diversification in the operational area (Table 6.9). This finding indicates that with the increase in the number of family members completing school education up to class 10, the value of livelihood diversification also increases. Education helps in human capital formation by developing skills and productivity of the household members which in turn helps to improve employment prospects in the non-farm sector. This finding is in line with the finding obtained by Khatun & Roy (2012), Gebru et al. (2018), and Sarker et al. (2020) who identified education as one of the factors that have a positive influence on livelihood diversification. They concluded that the educated family members are well endowed with knowledge and skill able to effectively formulate strategies how to earn from diversified sources and make a better living than the less educated households. Likewise, as expected, the coefficient of technical education is found to be positive and statistically significant ($p<0.01$) in both operational areas and operational headquarters. This finding implies that in addition to general education, technical education has also an important role in rural

household diversification. It increases livelihood diversification by increasing employment opportunities in diversified areas (Pasa, 2017).

The possession of physical assets also affects livelihood diversification. As predicted, the result of regression model I (Table 6.9) indicates that the physical asset index ($p<0.01$) has a significant positive influence on livelihood diversification in the operational area. Holding of physical assets such as modern agricultural implements, use of information and communication technology such as televisions, mobile phones, etc., possession of own transport facilities such as cars, motorcycles, etc. can be considered very productive to generate household income from different sources. This finding is like Roy et al. (2018) who studied livelihood diversification in rural West Bengal. They pointed out that a poor asset base is one of the most limiting factors toward livelihood diversification in rural areas.

As expected, the effect of distance from home to the nearest town is found to be negative and statistically significant ($p<0.05$) in the case of operational headquarter (Table 6.10). If the distance to the nearest town increases, urban linkage and market participation by the rural households turn out to be poor. This finding is also in line with the finding of Roy, Khatun and Roy (2018) who stated that more the proximity to the town (or the lesser the distance) higher is the value for livelihood diversification. They opined that proximity to towns or cities provides an opportunity for employment in non-farm sectors. Likewise, Ayana et al. (2021) in their study on livelihood diversification in Assosa Wereda, Western Ethiopia observed that urban linkage is one of the significant positive determinants of livelihood diversification. They stated that proximity to town helped the rural people to get daily wage labour, engage in small business, sell their products in town, purchase what they need, and share ideas that improve their livelihoods.

The effect of distance to the nearest bank on livelihood diversification in operational areas is found negative and significant ($p<0.05$) (Table 6.9). This finding fulfils the hypothesis that the lesser the distance from home to the nearest bank, the more access to financial services which in turn increases the probability of adopting diversified livelihood options. From the nearest banking institutions, the rural households can easily avail of savings and credit facilities which help in the formulation of better livelihood strategies. From their analysis, Agyeman et al. (2014); Khatun & Roy (2012); Ambachew & Ermiyas (2016) opined that credit access increased the degree of livelihood diversification in rural households.

The CSR benefit was found as a significant determinant ($p<0.01$) of livelihood diversification in the operational area (Table 6.9). One of the reasons for this result could be the implementation of several CSR schemes by the oil companies in the localities of the operational area. From a field survey, it was found that the local communities of the operational areas have been enjoying the benefit of good road connectivity, skill development training, grants to local educational institutions for infrastructure development, health camps for the rural people, etc.; which have encouraged the rural households to adopt diversified livelihood options.

The coefficient of membership in formal social organizations is found as positive and statistically significant ($p<0.01$) in the regression model of operational headquarters (Table 6.10). Participation in various social organisations boosts household social capital (associations and networks). It helps to gather information related to the available livelihood options for the household members. This finding is consistent with Roy & Basu's (2020) findings, which looked at the factors of livelihood diversification in several areas of Bangladesh and found that the level of diversification is higher among farmers who participate in social activities often. In the same way, Sarker et al. (2020) also found that organizational participation has a significant impact on livelihood diversification.

As expected, the coefficient of female work participation is found to be positive and significant ($p<0.01$) in both operational areas and operational headquarters. In the study area, many female members, in addition to their unpaid household work, are found participating in economic activities such as livestock and poultry rearing and handloom activities. Moreover, they extend their help in paddy cultivation to the male household members. Participation in such productive works by female members increases livelihood diversification at the household level.

Contrary to the hypothesis, the regression result shows that landholding has a positive and significant ($p<0.01$) impact on the livelihood diversification of the households under both operational areas and operational headquarters. This finding is consistent with the findings of Gebru et al. (2018) and contrary to the findings of Bhaumik (2007) and Khatun & Roy (2012). One of the possible reasons for such a finding could be that rural households with greater landholding have the opportunity to diversify their income within the farm sector.

The locational dummy is found to be statistically significant in both operational areas ($p<.05$) and operational headquarters ($p<.01$). This indicates that the households who inhabit

oil villages of operational areas and nearby villages of operational headquarters have a higher degree of livelihood diversification than the respective control villages. During the field survey, it is observed that the household members of oil villages of operational areas have the opportunity to get employed in different casual jobs in the oil industry. Similarly, the household members of nearby villages of operational headquarters also get many non-farm employment opportunities. Two urban centres, Nazira and Duliajan, have grown based on the operational headquarters of ONGC and OIL, respectively. So, households of the nearby villages can diversify their household income from different sources available in the urban centres.

6.3 Summing Up

From the discussion done in this chapter, it is observed that the oil industries in Assam have a significant role in livelihood diversification. By looking at income source diversification, it was discovered that sample households of oil villages in operational areas and nearby villages of operational headquarters have more diverse income sources than their respective control villages. In comparison to the control villages, the field data suggest that ONGC and OIL's operational areas and operational headquarters provide more opportunities for neighbouring rural households to earn from various sources.

By estimating the Simpson index of diversification for the sample households under study, the average value of SID is found to be higher in oil villages of operational areas and surrounding villages of operational headquarters than in control villages. The result of the independent sample t-test also reveals that there is a significant difference in household livelihood diversification- i) between the oil villages and control villages of the study areas, and ii) between nearby villages and control villages of operational headquarters. Such findings indicate that the proximity to the operational area or headquarters from the place of inheritance of the sample households is one of the factors influencing the household level livelihood diversification.

By estimating the Tobit regression model for both operational area and operational headquarters, several variables have been identified that have a statistically significant influence on rural livelihood diversification. The explanatory variables – family size, dependency ratio, education, technical education, physical asset, distance to the nearest bank, CSR benefit, female work participation, landholding, and locational dummy (i.e., proximity to the operational area) are found to be significant factors of household livelihood

diversification in the operational area. On the other hand, the variables – family size, technical education, distance to the nearest town, membership in formal social organization, female work participation, landholding and locational dummy (i.e., proximity to operational headquarter) are found as significant influencing factors of livelihood diversification in the operational headquarter. The results of the regression models could be used for formulating several policy measures to increase the livelihood diversification of the rural households under study. For example, giving more emphasis on the expansion of school education and technical education among rural households could increase the level of livelihood diversification. Moreover, increasing the bank linkage and accessibility of banking services are also expected to increase livelihood diversification which the government can investigate. The increase of female work participation in economic activities and extension of social organization membership among the rural household members will also be an effective policy to increase the extent of livelihood diversification among the rural households and in this regard, the role of Government organizations and Non-Government Organizations seem to be very essential. Such initiatives are likely to aid in expanding the magnitude of livelihood diversification of the rural households under study beyond the existing level.