Chapter V

Multinomial Logit Analysis for Adoption Level of Rice Production Practices

The analysis was undertaken to assess the factors associated with farmers' level of adoption in three different rice production practices separately. The definitions, labels and codes of variables used in the three models are given in table 3.2. Age of the household head, education level of household head, family labor in agriculture, nature of agricultural decision making, lowland ownership, number of trainings attended by household head, frequency of using mass media by household head are considered as dummy variables. But the variables lowland area cultivated, distance to paddy field from home, distance to extension office from home are considered as continuous variables for logistic regression analysis. Statistical equations used are explained under section 3.9.

5.1. Empirical model for Land Preparation and Planting

Within the 180 sample households, there are 87 (48.3%) non-adopters, 40 (22.2%) partial adopters and 53 (29.4%) adopters in land preparation and planting practice. Table 5.1 summarizes the relative effect of each predictor variable for multinomial logistic model together with SE and Wald statistics for level of adoption of Land Preparation and Planting. The overall model is significant at the <0.001 level according to the model chi-square statistic.

The results reveal that the different levels of adoption are influenced by different factors and at different levels of significance by the same factor. Partial adopters that may have been classified as one group together with adopters or non-adopters in a binary choice model are shown to be influenced by different factors and at different levels of significance by the same factor.

The education level of household head is found to be positive and significant at <0.05 level with adopters and partial adopters. The number of household members involved in agricultural decision-making has positive significant (P<0.05) correlation with adopted category but no significant correlation with regard to partial adopted category. Any way education level of household head contributes less to adopted category than partial adopted category.

The households in which agricultural decisions are taken collectively have positive and significant correlation with adopted category at <0.05 significance level but not significantly correlated with partial adopted category. The number of social organizations involved by household head has positive and significant correlation with adopted and partial adopted categories at <0.01 and <0.05 significance level respectively. Any way social participation contributes more to adopted farmers than partial adopted farmers.

Number of rice production trainings attended by household head is positively and significantly (P<0.05) correlated with adopted category but not correlated with partial adopted category. The number of farm visits by extension officers is positively and significantly correlated with adopted and partial adopted categories at <0.1 and <0.05 level significance respectively. The number of farm visits contributes less to adopted farmers than partial adopted farmers.

Frequency of listening to agricultural radio programs by household head is positively correlated with both adopted and partial adopted categories at <0.01 significance level. Listening contributes less to adopted farmers than partial adopted farmers. Frequency of reading newspaper agriculture articles is positively and significantly related with adopted category at <0.1 level significance. Frequency of viewing agricultural television programs is also positively correlated with adopted category at <0.05 significance level.

Table 5.1: Estimates of Land Preparation and Planting model together with Wald statistics.

| Predictor variable | Adopted | | | | Partially adopted | | | |
	B	SE	Wald	P-value	B	SE	Wald	P-value
Intercept	3.490	4.247	0.675	0.411	-16.032	12.198	1.727	0.189
Age	-0.082	0.947	0.007	0.931	0.006	0.966	0.000	0.995
Education	0.460	0.226	4.152	0.042**	0.574	0.234	5.992	0.014**
Family labor	-1.147	0.770	2.216	0.137	0.302	0.320	0.888	0.346
Decision making	3.556	1.742	4.166	0.041**	1.927	1.763	1.195	0.274
Social organization	3.834	1.256	9.321	0.002***	3.238	1.280	6.403	0.011**
Lowland area	1.246	0.890	1.961	0.161	0.840	0.825	1.035	0.309
Lowland ownership	3.208	2.473	1.682	0.195	3.923	2.684	2.136	0.144
Distance to field	-1.196	0.856	1.953	0.162	-0.197	5.434	0.001	0.971
Distance to office	-0.905	1.834	0.244	0.622	0.597	5.236	0.013	0.909
Easiness to irrigate	0.043	0.566	0.006	0.939	1.336	0.843	2.509	0.113
Training	4.941	2.211	4.996	0.025**	0.300	0.678	0.196	0.658
Demonstration	0.350	0.655	0.286	0.593	0.808	0.770	1.103	0.294
Office visit	-1.069	0.777	1.892	0.169	-0.232	0.746	0.097	0.756
Farm visit	2.846	1.488	3.658	0.056*	3.349	1.515	4.887	0.027**
Listening	6.205	2.067	9.011	0.003***	6.675	2.137	9.757	0.002***
Reading	2.227	1.181	3.552	0.059*	0.453	1.181	0.147	0.701
Viewing	2.875	1.333	4.657	0.031**	1.163	1.264	0.847	0.357

* significant at <0.1, ** significant at <0.05, *** significant at <0.01

[a] The reference category is: Not adopted.

The goodness of fit table presents Pearson Chi-Square statistics showed that the model adequately fit the data (Table 5.2).

Table 5.2: Goodness-of-Fit of LPP model.

	Chi-Square	df	Sig.
Pearson	69.13	60	0.196

Cox & Snell and Nagelkerke Pseudo R-Square values are 0.605 and 0.690 respectively, which is quite substantial in explaining the variation for discrete data.

Table 5.3 showed the correct number of predictions for three different levels of adoption. The LPP model classifies overall 83.9 % cases correctly. In particular, the model excels at identifying non-adopted farmers with correctly identifying 93.1%. It classifies 81.1 adopters and 67.5 partial adopters correctly, hence it does a good job of classifying adopted category and does a moderate job of classifying partially adopted farmers.

Table 5.3: Number of correct predictions in each level of adoption for LPP model.

Observed	Predicted			
	Adopted	Partially adopted	Not adopted	Correct %
Adopted	43	5	5	81.1
Partially adopted	8	27	5	67.5
Not adopted	3	3	81	93.1
Overall %	30.0	19.4	50.6	83.9

5.2. Empirical model for Soil Improvement Methods

There are 103 (57.2%) non-adopters, 46 (25.6%) partial adopters and 31 (17.2%) adopters in soil improvement method practice within the 180 sample households. Table 5.4 summarizes the relative effect of each predictor variable with relevant Wald statistics for multinomial logistic model of soil improvement methods.

The overall model is significant at the <0.001 level according to the model chi-square statistic.

The different levels of adoption are influenced by different factors and at different levels of significance by the same factor. The education level of household head is positively and significantly correlated with adopted and partial adopted categories at <0.01 level significance. The education level contributes more to adopted farmers than partial adopted farmers.

Lowland area cultivated by the households is positively correlated with adopted and non-adopted farmers at <0.05 significance level. The lowland extent contributes more to adopted farmers than partial adopted farmers. Lowland ownership has positive and significant correlation with adopters at <0.1 level significances but it does not show any significant correlation with partial adopted category.

Distance to paddy field from farmhouse shows significant negative correlation with adopted category at <0.05 significant level but no such significant correlation can be seen with partial adopted category. Number of demonstrations attended by household head is positively correlated only with partial adopted category at <0.1 significance level and it is not significantly correlated with adopted category.

Interestingly number of office visits by the household head has negative correlation with adopted and partial adopted category but it is significant only with adopted category. The number of farm visits by extension officers is positively and significantly correlated with adopted and non-adopted categories at <0.05 significance level. The number of farm visits contributes more to adopted category than partial adopted category.

Table 5.4: Estimates of Soil Improvement Method model together with Wald statistics.

Predictor variable	Adoption level [a]							
	Adopted				Partially adopted			
	B	SE	Wald	P-value	B	SE	Wald	P-value
Intercept	-39.921	15.629	6.525	0.011	-6.124	4.172	2.155	0.142
Age	-0.655	1.046	0.392	0.531	-0.324	0.429	0.569	0.451
Education	3.870	0.998	15.023	0.000***	1.082	0.222	23.844	0.000***
Family labor	0.537	0.603	0.796	0.372	-0.265	0.302	0.774	0.379
Decision making	1.839	2.163	0.723	0.395	0.188	0.788	0.057	0.812
Social organization	0.799	1.463	0.299	0.585	-0.078	0.607	0.017	0.898
Lowland area	2.743	1.137	5.822	0.016**	0.971	0.380	6.522	0.011**
Lowland ownership	1.613	0.866	3.465	0.063*	0.455	1.092	0.173	0.677
Distance to field	-0.908	0.476	3.646	0.056*	0.458	1.844	0.062	0.804
Distance to office	-2.032	4.121	0.243	0.622	-0.329	1.720	0.037	0.848
Easiness to irrigate	-0.668	0.784	0.727	0.394	-0.483	0.354	1.856	0.173
Training	1.422	1.551	0.840	0.359	0.467	1.493	0.098	0.754
Demonstration	1.686	1.338	1.587	0.208	0.753	0.436	2.983	0.084*
Office visit	-1.287	1.375	0.876	0.349	-1.926	0.657	8.602	0.003***
Farm visit	3.108	1.324	5.515	0.019**	1.093	0.533	4.211	0.040**
Listening	2.614	1.824	2.055	0.152	0.194	0.580	0.112	0.738
Reading	2.765	2.045	1.829	0.176	-0.502	0.667	0.567	0.452
Viewing	1.734	1.380	1.579	0.209	-0.436	0.495	0.776	0.378

* significant at <0.1, ** significant at <0.05, *** significant at <0.01

[a] The reference category is: Not adopted.

The goodness of fit table presents Pearson Chi-Square statistics. Since the significance value is greater than 0.1, it is concluded that the model adequately fit the data (Table 5.5).

Table 5.5: Goodness-of-Fit of SIM model.

	Chi-Square	df	Sig.
Pearson	4.59	6	0.597

Cox & Snell and Nagelkerke Pseudo R-Square values are 0.633 and 0.739 respectively. This indicates that the substantial amount of the variation is explained by the model.

Table 5.6 presented the correct number of predictions for three different levels of adoption in soil improvement methods and percentages are shown in parenthesis. The SIM model classifies overall 86.1% cases correctly. In particular, the model excels at identifying adopted and non-adopted farmers with correctly identifying 90.3% and 89.3% respectively. However it does a moderate job of classifying partial adopted farmers while classifying only 76.1% correctly.

Table 5.6: Number of correct predictions in each level of adoption for SIM model.

Observed	Predicted			
	Adopted	Partially adopted	Not adopted	Correct %
Adopted	28	3	0	90.3
Partially adopted	2	35	9	76.1
Not adopted	0	11	92	89.3
Overall %	16.7	27.2	56.1	86.1

5.3. Empirical model for Use of Agro Chemicals

There are 72 (40.0%) non-adopters, 53 (29.4%) partial adopters and 55 (30.6%) adopters in soil improvement method practice within the 180 sample households. Table 5.7 summarizes the relative effect of each predictor variable with relevant Wald statistics for logistic model of use of agro chemicals. The overall model is significant at the <0.001 level according to the model Chi-square statistic.

Age of the household head is negatively correlated with adopted and partial adopted categories at <0.001 and <0.1 significance level respectively. Education level of the household head is positively and significantly correlated with adopted and partial adopted categories at <0.05 and <0.01 levels. Education contributes less to adopted category than partial adopted category.

Households which take collective agricultural decisions have positive and significant correlation with adopted category at <0.01 significance level but it is not significantly correlated with partial adopted category. The number of social organizations involved by household head has positive and significant correlation with adopted category at <0.01 significance level and there is no such significant correlation with partial adopted category.

Lowland area cultivated by the households is positively correlated with adopted and non-adopted farmers at <0.01 and <0.05 significance level respectively. The cultivated lowland area contributes more to adopted farmers than partial adopted farmers.

Number of rice production trainings attended by household head is positively and significantly (P<0.1) correlated with adopted and partial adopted category. But rice production training contribute more to adopted farmers than partial adopted farmers. Number of demonstrations participated by household head is also positively correlated with adopted and partial adopted categories at <0.1 significance level. But field demonstrations contribute more to adopted farmers than partial adopted farmers. Number of farm visits by extension officers is shown positive relationship with adopted and partial adopted categories at <0.05 and <0.01 level of significance respectively. Number of farm visits by the extension officers contribute more to adopted farmers than partial adopted farmers.

Table 5.7: Estimates of Use of Agrochemicals model together with Wald statistics.

| Predictor variable | Adoption level [a] | | | | | | | |
| | Adopted | | | | Partially adopted | | | |
	B	SE	Wald	P-value	B	SE	Wald	P-value
Intercept	-42.678	9.285	21.125	0.000	-1.885	6.331	0.089	0.766
Age	-3.042	0.970	9.840	0.002***	-1.484	0.847	3.066	0.080*
Education	0.511	0.222	5.316	0.021**	0.563	0.206	7.495	0.006***
Family labor	0.157	0.531	0.087	0.768	-0.125	0.401	0.097	0.756
Decision making	5.126	1.556	10.848	0.001***	1.423	1.207	1.391	0.238
Social organization	3.893	1.259	9.567	0.002***	-1.198	0.909	1.734	0.188
Lowland area	3.192	0.903	12.507	0.000***	1.624	0.676	5.771	0.016**
Lowland ownership	3.231	2.211	2.137	0.114	2.025	1.613	1.576	0.209
Distance to field	0.053	4.174	0.000	0.990	2.099	2.308	0.827	0.363
Distance to office	-0.657	3.817	0.030	0.863	-1.557	2.188	0.506	0.477
Easiness to irrigate	-0.876	0.703	1.553	0.213	-0.938	0.582	2.599	0.107
Training	0.908	0.476	3.646	0.056*	0.735	0.441	2.777	0.096*
Demonstration	2.396	1.319	3.297	0.069*	1.076	0.560	3.697	0.055*
Office visit	1.350	0.929	2.113	0.146	0.919	0.719	1.635	0.201
Farm visit	1.673	0.844	3.932	0.047**	1.424	0.723	3.885	0.049**
Listening	6.067	1.794	11.438	0.001***	3.041	1.568	3.761	0.052*
Reading	2.714	1.506	3.249	0.071*	1.040	0.726	2.052	0.152
Viewing	1.867	0.841	4.927	0.026**	1.513	0.806	3.520	0.061*

* significant at <0.1, ** significant at <0.05, *** significant at <0.01

[a] The reference category is: Not adopted.

Frequency of listening to agricultural radio programs by household head is positively correlated with both adopted and partial adopted categories at <0.01 and <0.1 significance level respectively. Listening contributes more to adopted farmers than partial adopted farmers. Frequency of reading newspaper agriculture articles is positively and significantly related with adopted category at <0.1 level significance.

But reading is not significantly related with partial adopted category. Frequency of viewing agricultural television programs is positively correlated with adopted and partial adopted categories at <0.05 and <0.1 significance level respectively. It contributes more to adopted farmers than partial adopted farmers.

The goodness of fit table presents Pearson Chi-Square statistics. Since the significance value is greater than 0.1, we can conclude that the model adequately fit the data (Table5.8). Cox & Snell and Nagelkerke Pseudo R-Square values are 0.474 and 0.535 respectively. This is lower than the models of previous two recommended practices but it is substantial in explaining the variation for discrete data.

Table 5.8: Goodness-of-Fit of UAC model.

	Chi-Square	df	Sig.
Pearson	47.21	40	0.202

The correct number of predictions for three different levels of adoption in use of agrochemicals practice is displayed in Table 5.9. The UAC model classifies overall 81.7% cases correctly. In particular, the model excels at identifying adopted and non-adopted farmers with correctly identifying 85.5% and 87.5% respectively. However it classifies only 69.8% adopters correctly. So the model does a moderate job of classifying partially adopted farmers.

Table 5.9: Number of correct predictions in each level of adoption for UAC model.

Observed	Predicted			
	Adopted	Partially adopted	Not adopted	Correct %
Adopted	47	8	0	85.5
Partially adopted	9	37	7	69.8
Not adopted	2	7	63	87.5
Overall %	32.2	28.9	38.9	81.7