A Logit Analysis on Crop Diversification and Cultivation of Medicinal Plants: A case study of Bihar State

Parijat Saurabh,
JRF at Centre for the Study of Nepal,
Faculty of Social Sciences,
BHU, Varanasi – 221005.
parijat.bhu03@gmail.com

ABSTRACT

"The medicinal traditions of ancient civilizations such as those of India, Nepal and China have a large armamentaria of plants in their pharmacopoeias which are used throughout South-East Asia. A similar situation exists in Africa and South America. Thus, a very high percentage ofthe World's population relies on medicinal and aromatic plants for their medicine. Western medicine is also responding. South Asia is gradually diversifying it's crop sector in favour of high value commodities, especially fruits, vegetables and spices. If carried out diversification can be used as a tool to augment farm income, generate employment, alleviate poverty and conserve precious soil and water resources".

Keywords : *Diversification, Cultivation, Medicinal Plants.*

Introduction

Agriculture means field cultivation. Diversification aims to contain unsystematic risk events in a portfolio so that the positive performance of some investments will neutralize the negative performance of others. Diversification of agriculture refers to the shift from the regional dominance of one crop to regional production of a number of crops, to meet ever increasing demand for cereals, pulses, vegetables, fruits, MAPs. It aims to improve soil health and a dynamic equilibrium of the agro-ecosystem. It takes into account the economic returns from different value-added crops.

The use of plants as medicine is older than recorded history. As mute witness to this fact marshmallow root, hyacinth, and yarrow have been found carefully tucked around the bones of a Stone Age man in Iraq. In 2735 B.C., the Chinese emperor ShenNong wrote an authoritative treatise on herbs that is still in use today. ShenNong recommended the use of Ma Huang (known as ephedra in the Western world), for example, against respiratory distress. Ephedrine, extracted from ephedra, is widely used as a decongestant. We find it in its synthetic form, pseudoephedrine, in many allergy, sinus, and cold-relief medications produced by large pharmaceutical companies.

Known, minor agricultural plants into crops that many farmers consider producing as an alternative to usual plantings of food and feed crops. The attraction of medicinal and aromatic plants as worthy farm crops has grown due to the demand created by consumer interest in these plants for culinary, medicinal, and other anthropogenic applications. As racial diversity in the US has expanded, immigrants from countries in which herbs and herbal medicines are commonly used to flavor foods and treat illnesses have introduced other Americans to a diverse range of plant materials. Indeed, market trend surveys indicate that mainstream American consumers will purchase 75% of the ethnic foods during the next decade (Packaged Facts 2004a).

Historical Perspectives

The initiation of medicinal plant and aromatic production, as a gathering or cultivation of plant materials, is lost to history, but most likely began at or near the time of the first afflictions and the recognition that smelling, chewing, and/or eating some plant materials could provide relief from nausea, pain, and/or other infirmities. Those plants containing the unique chemical profiles that offered pain relief, pleasant aromas, and enhanced food flavors would soon be renowned and much valued by early humans, leading to associations among certain aliments, plants, and "feeling better" (Friedman and Adler 2001). Thus, these plants, now known as medicinal and aromatic plants, and their extracts became the main source for medicines, seasonings, colorings, preservatives, and other similar items used in societies, sustained by myths and traditions developed to explain the almost "magical" powers of selected species and to transmit the accumulation of acquired knowledge about these species before the era of written records.

As continued experimentation with various plant materials demonstrated the benefits of having specific plants immediately available for use in medical treatment and food flavoring, husbandry of these plant species undoubtedly started. Although the collection of plants probably remained the primary source of medicinal and aromatic plant material for a considerable period of time, cultivation and growth of plants could be expected to have begun in small garden plots and botanical collections. As human migration led to settlements within various ecosystems, species having medicinal and aromatic properties specific to those regions would be discovered, leading to a collection of plant materials with a variety of uses and the initiation of trade among neighboring groups for unavailable plant materials. This initial exchange of plant material could be expected to spread and with the passage of time lead to overland and sea trade routes, including those that brought plant materials from Asia to Europe to meet the demand for spices as seasonings and medicines. New insights into the causal agents of poor health were acquired during the 18th and 19th centuries (such as the germ theory developed by Pasteur and Koch, use of disinfectants by Lister, plus the work of many others), but medicinal and aromatic plants remained the primary pharmaceutical agents into the early 1900s (Craker et al. 2003; Craker and Gardner 2006).

Econometric approach

Positivism assumes an objective world which scientific methods can more or less readily represent and measure, and it seeks to predict and explain causal relations among key variables (Gephart, 1999). Here the role of Econometrics becomes important, since it is, at a broad level, the science and art of using economic theory and statistical techniques to analyze economic data (Stock and Watson, 2003). It helps in decision making process in economics, when it involves understanding relationships among variables in the world around us, just as in the case of this study. Here the decision problem is whether the diversification scheme can be considered as an alternative, to the other credit sources, in the sense that can be used in coordination to overcoming its market failure problems.

Specifically the econometric instruments to be used here are characterized as follows. In terms of the econometric model, the maximum likelihood Probit and Logit models are the ones mostly relied on to assess the type of decision problem stated. Probit regression is nonlinear regression model specifically designed for binary dependent variables. It uses the standard normal cumulative probability distribution function. Logit regression is, also as Probit, a nonlinear regression model specifically designed for binary dependent variables, with the difference of using the logistic cumulative probability distribution function (Stock and Watson, 2003). The previous one, Logit, is the one that will be used as the main econometric tool for the assessment of the main hypothesis. The use of probabilistic models is justified by the main idea to be tested, whether higher is the probability of the adoption behavior of the diversification, for Providing Better income & employability and reducing their poverty to other sources.

Data collection

Fieldwork was carried out during the period from March to May 2014 for the survey. Data were collected through informal interviews and informal meetings with head of the family who are the farmers of the crop Diversification through the Cultivation of Medicinal plant and the farmers who are not adopting the crop Diversification through the Cultivation of Medicinal plants. The interviews or conversations were informal and semi-structured, due to the fact of being located in rural areas, using the modern input tools, near to the smallholders, and continuously working. In addition, several informal conversations and discussions also took place with senior staff at the administrative and operational levels.

The present study aims at analyzing the Institutional changes in agriculture the impact of such change on the state economy. As the study focuses on Bihar economy the entire state forms as the study area. Purposive sampling was used to select an area with a number of contractor's growers. Snowball sampling was later employed in the process of selecting a sample using networks. A blend of qualitative and quantitative data was collected. To understand behavior, attitudes, opinions and perceptions, this design was flexible and allowed respondents to freely express their views and opinions.

- Through the multistage Random Sampling, We selected one district all of four regions where must be near about 50% Farmers should be Adopted the crop Diversification through the Cultivation of Medicinal plants.
- Then listed the block where the crop Diversification through the Cultivation of Medicinal plantsheld. We study 3 or 4 villages if it is required for the study.
- In the Villages we categories the farmers in to two groups-
    - The Farmers Who adopted the crop Diversification through the Cultivation of Medicinal plants.
    - The Farmers Who do not adopted the crop Diversification through the Cultivation of Medicinal plants. (Control Groups).
- We selected the crops for the study which are growing by both Districts of the States.

This study will be based on the primary and secondary data sources, primary data will be collected through the personal interview by structure questionnaire from formers. The Farmers will be randomly with purposive sampling selected from chosen villages.

Data analysis

All the data was captured in Microsoft Excel, SPSS 16 for Windows 7, 8.0 & 8.1. The analysis of the data was aided, also, by the Microsoft Excel, SPSS 16 for Windows 7, 8.0 & 8.1. The assessment of whether the adoption behavior of the crop Diversification through the Cultivation of Medicinal plants, for Providing Better income & employability and reducing their poverty as an alternative approach relatively to other farming method, in order to get a higher outreach and *real* effects on the real economy, was realized with the use of econometric analysis tools, specifically the Logit model.

Logit Analysis

Output is for a model that includes only the intercept (which SPSS calls the constant). Given the base rates of the two decision options (00/100 = 00 % decided to Not working with Crop diversification in medicinal plants, and 76/100 = 100 % decided to Work with Crop diversification in medicinal plants and no other information, the best strategy is to predict, for every case, that the subject will decide to Work with Crop diversification in medicinal plants. Using that strategy, you would be correct 76 % of the time.

Table 01

Classification Table[a,b]

Observed			Predicted		
			Adopting Crop Diversification		Percentage Correct
			No	Yes	
Step 0	Adopting Crop Diversification	No	0	24	.0
		Yes	0	76	100.0
	Overall Percentage				76.0

a. Constant is included in the model.

b. The cut value is .500

Under **Variables in the Equation** you see that the intercept-only model is **ln (odds) = 1.418**. If we exponentiate both sides of this expression we find that our predicted odds [Exp (B)] = 3.167. That is, the predicted odds of deciding to continue to engage in crop diversification in medicinal plants are 3.167. Since 76 of our subjects decided to continue with crop diversification and 00 decided to not work with crop diversification system, our **observed odds are = 1.153**.

Table 02

Variables in the Equation

		B	S.E.	Wald	df	Sig.	Exp(B)
Step 0	Constant	1.153	.234	24.235	1	.000	3.167

Now look at the **Block 1** output. Here SPSS has added the gender variable as a predictor. **Omnibus Tests of Model Coefficients** gives us a Chi-Square of 18.714 on 1 *df*, significant beyond .000. This is a test of the null hypothesis that adding the gender variable to the model has not significantly increased our ability to predict the decisions made by our subjects.

Table 03

Variables not in the Equation

			Score	df	Sig.
Step 0	Variables	Q2	17.719	1	.000
	Overall Statistics		17.719	1	.000

Under **Model Summary** we see that the **-2 Log Likelihood** statistics is 91.502. This statistic **measures how srong the model predicts the decisions** -- the smaller the statistic the better the model. Although SPSS does not give us this statistic for the model that had only the intercept, I know it to be 425.666. The **Cox & Snell *R2*** can be interpreted like *R2* in a multiple regression, but cannot reach a maximum value of 1. The **Nagelkerke*R2*** can reach a maximum of 1.

Table 04
Omnibus Tests of Model Coefficients

		Chi-square	df	Sig.
Step 1	Step	18.714	1	.000
	Block	18.714	1	.000
	Model	18.714	1	.000

Table 05
Model Summary

Step	-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
1	91.502[a]	.171	.256

a. Estimation terminated at iteration number 5 because parameter estimates changed by less than .001.

Table 06
Variables in the Equation

		B	S.E.	Wald	df	Sig.	Exp(B)	95.0% C.I.for EXP(B)	
								Lower	Upper
Step 1[a]	Q2	2.263	.599	14.291	1	.000	9.615	2.974	31.088
	Constant	.262	.297	.778	1	.378	1.300		

a. Variable(s) entered on step 1: Q2.

The **Variables in the Equation** output shows us that the regression equation is

ODDS=a + b x ODDs= 0.262 + 2.263 Ages of the Farmer's

We can now use this model to **predict the odds** that a subject of a given gender will decide to accept the crop diversification in medicinal plants. The odds prediction equation is ODDS = e^{a+bx}

If our subject is Farmers age More than forty years (More than forty years = 0), then the **ODDS = $e^{0.262 + 2.263 (0)}$=$e^{0.262}$** = 0.7711 That is, older age farmers is only .7711 as likely to decide to continue with crop diversification in medicinal plants as They are to decide Not working the crop diversification in medicinal plants.

If our subject is Younger age farmers (Less than forty years = 1) then the **ODDS = $e^{0.262 + 2.263 (1)}$ = $e^{2.535}$**=

0.9064 that is , Younger age farmer 0.9064 as likely to decide to continue work with crop diversification in medicinal plants as they are to decide not working with crop diversification in medicinal plants.

We can easily **convert odds to probabilities**. For our Older age farmers

Y=ODDS/1+ODDS

The **Variables in the Equation** output also gives us the **Exp (B)**. This is better known as **the odds ratio** predicted by the model. This odds ratio can be computed by **raising the base of the natural log to the b^{th} *power*, where *b* is the slope from our logistic regression equation**. For our model $e^{2.535}$**= 0.9064** That tells us that the model predicts that the odds of deciding to continue with crop diversification in medicinal plants are 0.9064 times higher for Younger age farmers than they are for Older age farmers. For the Younger age farmers.

The results of our logistic regression can be used to **classify subjects** with respect to what decision we think they will make. As noted earlier, our model leads to the prediction that the probability of deciding to continue with contract farming system is 43 % for Older age farmers and 47 % for Younger age farmers. Before we can use this information to classify subjects, we need to have a decision rule. Our **decision rule** will take the following form: If the probability of the event is greater than or equal to some threshold, we shall predict that the event will take place. By default, SPSS sets this threshold to .5. While that seems reasonable, in many cases we may want to set it higher or lower than .5. More on this later. Using the default threshold, SPSS will classify a subject into the "Continue with the contract farming" category if the estimated probability is .5 or more, which it is for every Younger age farmers subject. SPSS will classify a subject into the "Stop Work with contract farming system" category if the estimated probability is less than .5, which it is for every older age farmer's subject.

Adopting the Crop diversification by the Farmers

For estimating the Adopting the Crop diversification by the Farmers we generate a multiple regression model

$$Y=\beta_0 + \beta_1X_1+\beta_2X_2 + \beta_3X_3 + \beta_4X_4 + \beta_5X_5 + \beta_6X_6 + \varepsilon$$

Y= Adopting the Crop diversification by the Farmers (Dependent Variable)

X_1 = Big farmers mostly Accepted the Crop Diversification in Medicinal plants (Independent variable)

B_1=Parameters attached to the variable X_1

X_2= Crop diversification Provide better Income Satisfaction

B_2=Parameters attached to the variable X_2

X_3= Crop diversification having better Employability

B_3=Parameters attached to the variable X_3

X_4= Farmers having enough skill of Entrepreneurship Accepting the Crop Diversification

B_4= Parameters attached to the variable X_4

X_5 = Crop diversification Needs minimum input

B_5=Parameters attached to the variable X_5

X_6= Uncertainty in Agriculture leads to force to accepting the Crop diversification

B_6 =Parameters attached to the variable X_6

Table 07
Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.636[a]	.404	.366	.38412	.404	10.526	6	93	.000

a. Predictors: (Constant), Uncertainty in Agriculture leads to force to accepting the Crop diversification , Big farmers mostly Accepted the Crop Diversification in Medicinal plants, Crop diversification Needs minimum input, Farmers having Enough skill of Entrepreneurship Accepting the Crop Diversification, Crop diversification having better Employability, Crop diversification Provide better Income Satisfaction

b. Dependent Variable: Adopting Crop Diversification

The coefficient of multiple determinations is 0.404; therefore, about 40.40 % of the variation in the Adopting the crop diversification is explained by Uncertainty in Agriculture leads to force to accepting the Crop diversification , Big farmers mostly Accepted the Crop Diversification in Medicinal plants, Crop diversification Needs minimum input, Farmers having Enough skill of Entrepreneurship Accepting the Crop Diversification, Crop diversification having better Employability, Crop diversification Provide better Income Satisfaction; The regression equation appears to be very useful for making predictions since the value of R^2 is close to 1.

Table 08
ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	9.318	6	1.553	10.526	.000[a]
	Residual	13.722	93	.148		
	Total	23.040	99			

a. Predictors: (Constant), Uncertainty in Agriculture leads to force to accepting the Crop diversification , Big farmers mostly Accepted the Crop Diversification in Medicinal plants, Crop diversification Needs minimum input, Farmers having Enough skill of Entrepreneurship Accepting the Crop Diversification, Crop diversification having better Employability, Crop diversification Provide better Income Satisfaction

b. Dependent Variable: Adopting Crop Diversification

Hypotheses

H_0: $\beta_1 = \beta_2 = \ldots\ldots\beta_n = 0$

H_a: at least one $\beta_i \neq 0$

- **Significance Level**

$\alpha = 0.05$

- **Rejection Region**

Reject the null hypothesis if p-value ≤ 0.05

- **ANOVA Table (Test Statistic and *p*-value)**

(See above) $F = 10.52$, p-value < 0.000

- **Conclusion**

Since p-value < 0.000≤ 0.05, we shall reject the null hypothesis.

- **State conclusion in words**

At the α = 0.05 level of significance, there exists enough evidence to conclude that at least one of the predictors is useful for predicting Adopting the crop diversification; therefore the model us useful.

Table 09
Coefficients[a]

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
	B	Std. Error	Beta			Tolerance	VIF
1 (Constant)	.222	.206		1.079	.284		
Big farmers mostly Accepted the Crop Diversification in Medicinal plants	.140	.046	.493	3.016	.003	.240	4.171
Crop diversification Provide better Income Satisfaction	.068	.074	.213	.911	.005	.117	8.570
Crop diversification having better Employability	.024	.073	.076	.326	.001	.117	8.566
Farmers having Enough skill of Entrepreneurship Accepting the Crop Diversification	.003	.062	.009	.047	.002	.180	5.550
Crop diversification Needs minimum input	.022	-.037	-.071	-.589	.557	.440	2.271
Uncertainty in Agriculture leads to force to accepting the Crop diversification	.023	.039	.068	.587	.003	.473	2.115

a. Dependent Variable: Adopting Crop Diversification

Hypotheses

H_0: $ß_1 = 0$ (Big farmers mostly Accepted the Crop Diversification in Medicinal plants is not useful for predicting to Adopting the Crop Diversification)
H_a: $ß_1 \neq 0$ (Big farmers mostly Accepted the Crop Diversification in Medicinal plants is useful for predicting to Adopting the Crop Diversification)

- **Significance Level**
  $\alpha = 0.05$
- **Rejection Region**
  Reject the null hypothesis if *p*-value ≤ 0.05.

- **Test Statistic and *p*-value**
- *(see above)* $T = 3.01$, *p*-value = 0.003

- **Conclusion**
  Since *p*-value = 0.003≤ 0.05, we shall reject the null hypothesis.

- **State conclusion in words**

At the α = 0.05 level of significance, there exists enough evidence to conclude that the slope of Big farmers mostly Accepted the Crop Diversification in Medicinal plants is not zero and, hence, that Uncertainty in Agriculture leads to force to accepting the Crop diversification, Crop diversification Needs minimum input, Farmers having Enough skill of Entrepreneurship Accepting the Crop Diversification, Crop diversification having better Employability, Crop diversification Provide better Income Satisfaction.

Hypotheses

H_0: $ß_1$= 0 (Crop diversification Provide better Income Satisfaction is not useful for predicting to Adopting the Crop Diversification)

H_a: $ß_1 \neq$ 0 (Crop diversification Provide better Income Satisfaction not useful for predicting to Adopting the Crop Diversification)

- **Significance Level**
  α= 0.05
- **Rejection Region**
  Reject the null hypothesis if *p*-value ≤ 0.05.

- **Test Statistic and *p*-value**
- *(see above)* *T* = 0.911, *p*-value = 0.005

- **Conclusion**
  Since *p*-value = 0.005≤ 0.05, we shall reject the null hypothesis.

- **State conclusion in words**

At the α = 0.05 level of significance, there exists enough evidence to conclude that the slope of Crop diversification Provide better Income Satisfaction is not zero and, hence, that Uncertainty in Agriculture leads to force to accepting the Crop diversification, Big farmers mostly Accepted the Crop Diversification in Medicinal plants , Crop diversification Needs minimum input, Farmers having Enough skill of Entrepreneurship Accepting the Crop Diversification, Crop diversification having better Employability,

Hypotheses

H_0: $ß_1$= 0 (Crop diversification having better Employability is not useful for predicting to Adopting the Crop Diversification)

H_a: $ß_1 \neq$ 0 (Crop diversification having better Employability is not useful for predicting to Adopting the Crop Diversification)

- **Significance Level**
  α= 0.05
- **Rejection Region**
  Reject the null hypothesis if *p*-value ≤ 0.05.

- **Test Statistic and *p*-value**
- *(see above)* *T* = 0.36, *p*-value = 0.001

- **Conclusion**
  Since *p*-value = 0.001≤ 0.05, we shall reject the null hypothesis.

- **State conclusion in words**

At the α = 0.05 level of significance, there exists enough evidence to conclude that the slope of Crop diversification Provide better Income Satisfaction is not zero and, hence, that Uncertainty in Agriculture leads to force to accepting the Crop diversification, Crop diversification Provide better Income Satisfaction, Big farmers mostly Accepted the Crop Diversification in Medicinal plants , Farmers having Enough skill of Entrepreneurship Accepting the Crop Diversification, Crop diversification having better Employability,

Hypotheses

H_0: $ß_1$= 0 (Crop diversification having better Employability is not useful for predicting to Adopting the Crop Diversification)

H_a: $ß_1 \neq$ 0 (Crop diversification having better Employability is not useful for predicting to Adopting the Crop Diversification)

- **Significance Level**
  α= 0.05
- **Rejection Region**
  Reject the null hypothesis if *p*-value ≤ 0.05.

- **Test Statistic and *p*-value**
- *(see above)* *T* = 0.36, *p*-value = 0.001

- **Conclusion**

Since p-value = 0.001≤ 0.05, we shall reject the null hypothesis.

- **State conclusion in words**

At the α = 0.05 level of significance, there exists enough evidence to conclude that the slope of Crop diversification Provide better Income Satisfaction is not zero and, hence, that Uncertainty in Agriculture leads to force to accepting the Crop diversification, Crop diversification Provide better Income Satisfaction, Big farmers mostly Accepted the Crop Diversification in Medicinal plants , Farmers having Enough skill of Entrepreneurship Accepting the Crop Diversification, Crop diversification having better Employability,

Hypotheses

H_0: $ß_1$= 0 (Farmers having Enough skill of Entrepreneurship Accepting the Crop Diversification is not useful for predicting to Adopting the Crop Diversification)

H_a: $ß_1 \neq$ 0 (Farmers having Enough skill of Entrepreneurship Accepting the Crop Diversification is useful for predicting to Adopting the Crop Diversification)

- **Significance Level**

  α= 0.05
- **Rejection Region**

  Reject the null hypothesis if p-value ≤ 0.05.

- **Test Statistic and *p*-value**
- *(see above)* T = 0.047, p-value = 0.002

- **Conclusion**

Since p-value = 0.002≤ 0.05, we shall reject the null hypothesis.

- **State conclusion in words**

At the α = 0.05 level of significance, there exists enough evidence to conclude that the slope of Big farmers mostly Accepted the Crop Diversification in Medicinal plants is not zero and, hence, that Uncertainty in Agriculture leads to force to accepting the Crop diversification, Big farmers mostly Accepted the Crop Diversification in Medicinal plants, Crop diversification Needs minimum input, Farmers having Enough skill of Entrepreneurship Accepting the Crop Diversification, Crop diversification having better Employability, Crop diversification Provide better Income Satisfaction.

Hypotheses

H_0: $ß_1$= 0 (Crop diversification Needs minimum input is not useful for predicting to Adopting the Crop Diversification)

H_a: $ß_1 \neq$ 0 (Crop diversification Needs minimum input is not useful for predicting to Adopting the Crop Diversification)

- **Significance Level**

  α= 0.05
- **Rejection Region**

  Reject the null hypothesis if p-value ≤ 0.05.

- **Test Statistic and *p*-value**
- *(see above)* T = - 0.589, p-value = 0.559

- **Conclusion**

Since p-value = 0.559 › 0.05, we shall Accept the null hypothesis.

- **State conclusion in words**

At the α = 0.05 level of significance, there exists enough evidence to conclude that the slope of Big farmers mostly Rejected the Crop Diversification in Medicinal plants is not zero and, hence, that Uncertainty in Agriculture leads to force to accepting the Crop diversification, Big farmers mostly Accepted the Crop Diversification in Medicinal plants, Farmers having Enough skill of Entrepreneurship Accepting the Crop Diversification Crop diversification Needs minimum input, Farmers having Enough skill of Entrepreneurship Accepting the Crop Diversification, Crop diversification having better Employability, Crop diversification Provide better Income Satisfaction.

Hypotheses

H_0: $ß_1$= 0 (Uncertainty in Agriculture leads to force to accepting the Crop diversification is not useful for predicting to Adopting the Crop Diversification)

H_a: $ß_1 \neq 0$ (Uncertainty in Agriculture leads to force to accepting the Crop diversification is useful for predicting to Adopting the Crop Diversification)

- **Significance Level**
  α= 0.05
- **Rejection Region**
  Reject the null hypothesis if *p*-value ≤ 0.05.

- **Test Statistic and *p*-value**
- *(see above)* *T* = 0.587, *p*-value = 0.003

- **Conclusion**
  Since *p*-value = 0.003≤ 0.05, we shall reject the null hypothesis.

- **State conclusion in words**

At the α = 0.05 level of significance, there exists enough evidence to conclude that the slope of Big farmers mostly Accepted the Crop Diversification in Medicinal plants is not zero and, hence, that, Farmers having Enough skill of Entrepreneurship Accepting the Crop Diversification Big farmers mostly Accepted the Crop Diversification in Medicinal plants, Crop diversification Needs minimum input, Farmers having Enough skill of Entrepreneurship Accepting the Crop Diversification, Crop diversification having better Employability, Crop diversification Provide better Income Satisfaction.

For estimating the Adopting the crop diversification by the farmers of Bihar, we generate a multiple regression models:-

$$\mathbf{Y = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \beta_4 x_4 + \beta_5 x_5 + \beta_5 x_5}$$

But the accepting the null hypothesis thus we remove it from the Model.

And putting the value of all coefficient, we can get a multiple regression models, thus the model will be:

$$\mathbf{\hat{y} = 0.222 + 0.140x_1 + 0.068x_2 + 0.24x_3 + 0.003x_4 + 0.023x_6}$$

- **Multicollinearity Problems:**

➢ Since neither of the predictor variables has a variance inflation factor (VIF) greater than ten (both VIFs are less than 8.57), there are no apparent multicollinearity problems; in other words, there is no variable in the model that is measuring the same relationship/quantity as is measured by another variable or group of variables.

Obtain and interpret 95% confidence intervals for the slopes, βi, of the population regression line that relates net Income of the contract Growers and number of Resources to maximize their Income. Obtain and interpret 95% confidence intervals for the slopes, βi, of the population regression line that relates Uncertainty in Agriculture leads to force to accepting the Crop diversification , Big farmers mostly Accepted the Crop Diversification in Medicinal plants, Crop diversification Needs minimum input, Farmers having Enough skill of Entrepreneurship Accepting the Crop Diversification, Crop diversification having better Employability, Crop diversification Provide better Income Satisfaction; Benefited to Adaptation of crop diversification by the farmers of Bihar state.

➢ We are 95% confident that the slope for Big farmers mostly Accepted the Crop Diversification in Medicinal plants is somewhere between 0.048 and 0.232. In other words, we are 95% confident that for every single-unit increase in big farmers mostly accepted the Crop Diversification in Medicinal plants, the average Adoptation of crop diversification increases between 0.048 and 0.232.

➢ We are 95% confident that the slope for Crop diversification Provide better Income Satisfaction is somewhere between 0.080 and 0.215. In other words, we are 95% confident that for every single-unit increase in Crop diversification Provide better Income Satisfaction, the average

Adaptation of crop diversification increases between 0.080 and 0.215.

- We are 95% confident that the slope for Crop diversification having better Employability is somewhere between 0.168 and 0.281. In other words, we are 95% confident that for every single-unit increase in Crop diversification having better Employability, the average Adaptation of crop diversification increases between 0.168 and 0.281.
- We are 95% confident that the slope for Farmers having enough skill of Entrepreneurship Accepting the Crop Diversification is somewhere between – 0.120 and 0.126. In other words, we are 95% confident that for every single-unit increase in Farmers having enough skill of Entrepreneurship Accepting the Crop Diversification, the average Adaptation of crop diversification increases between – 0.120 and 0.126.
- We are 95% confident that the slope for Crop diversification Needs minimum input is somewhere between – 0.097 and 0.052. In other words, we are 95% confident that for every single-unit increase in Crop diversification Needs minimum input Accepting the Crop Diversification, the average Adaptation of crop diversification increases between – 0.097 and 0.052.
- We are 95% confident that the slope for Uncertainty in Agriculture leads to force to accepting the Crop diversification is somewhere between 1.00 and 0.054. In other words, we are 95% confident that for every single-unit increase in Uncertainty in Agriculture leads to force to accepting the Crop diversification Accepting the Crop Diversification, the average Adaptation of crop diversification increases between 1.00 and 0.054.

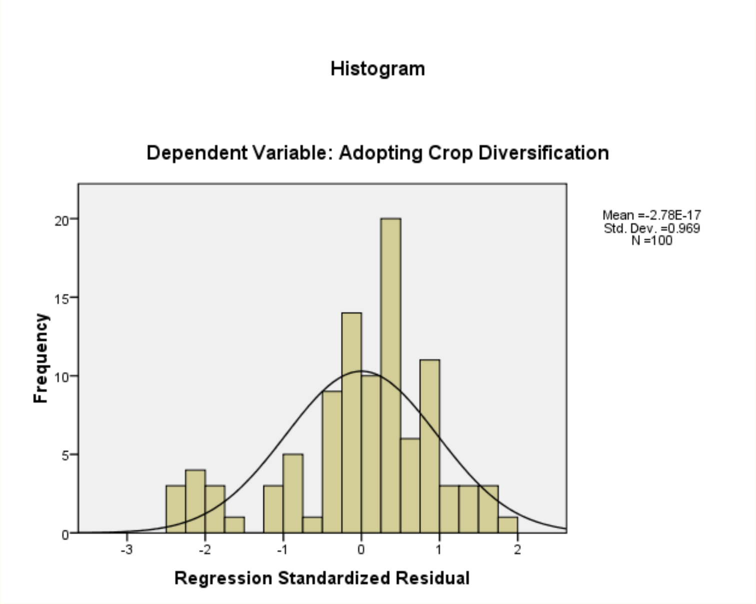
Table 10

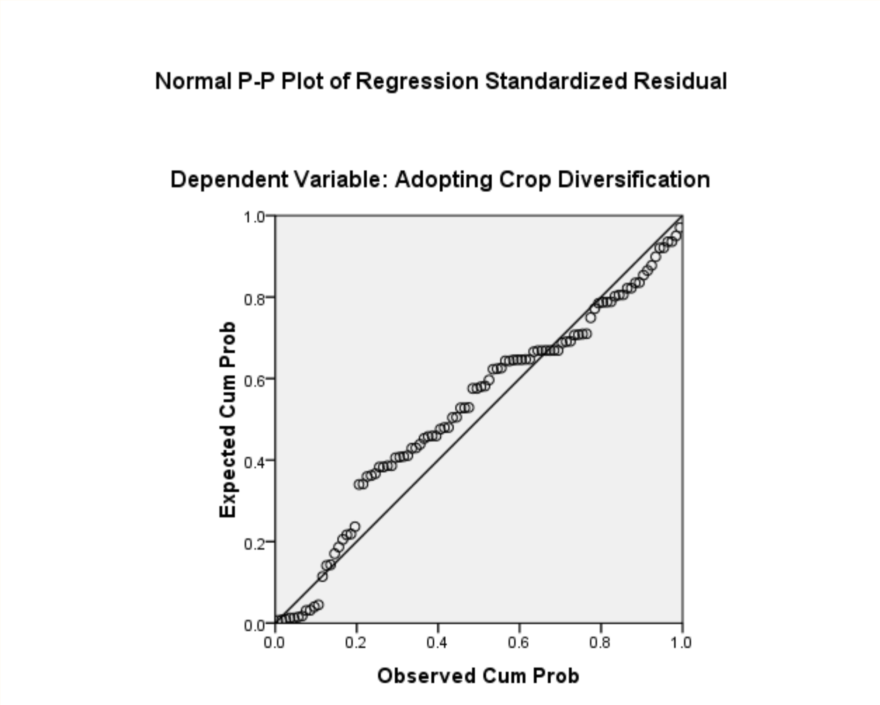
Residuals Statistics[a]

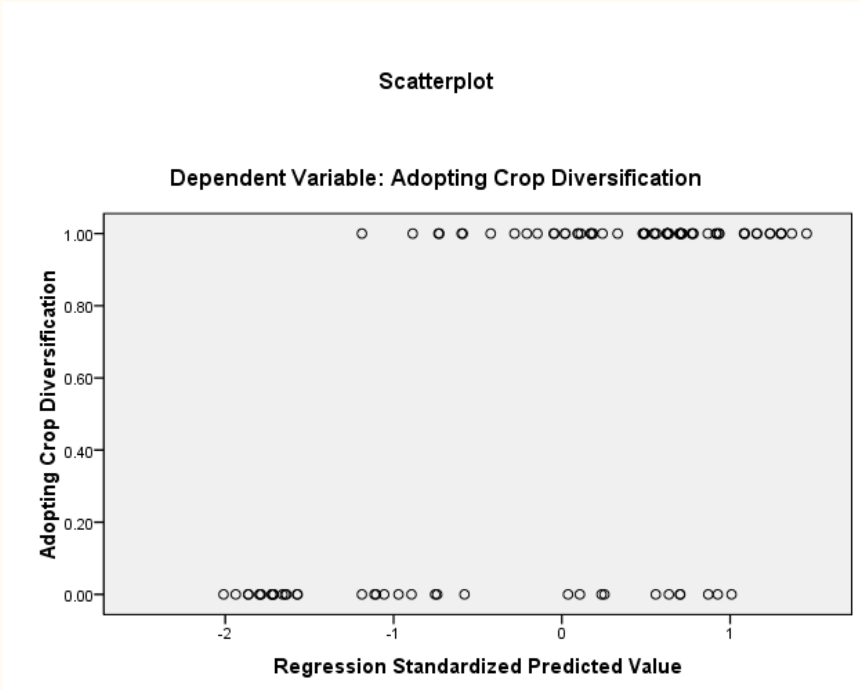
	Minimum	Maximum	Mean	Std. Deviation	N
Predicted Value	.0233	1.0863	.6400	.30679	100
Std. Predicted Value	-2.010	1.455	.000	1.000	100
Standard Error of Predicted Value	.054	.214	.099	.024	100
Adjusted Predicted Value	.0271	1.0913	.6419	.30746	100
Residual	-.94941	.72457	.00000	.37230	100
Std. Residual	-2.472	1.886	.000	.969	100
Stud. Residual	-2.585	1.925	-.002	1.006	100
Deleted Residual	-1.03817	.75433	-.00192	.40124	100
Stud. Deleted Residual	-2.668	1.954	-.007	1.020	100
Mahal. Distance	.937	29.686	5.940	3.747	100
Cook's Distance	.000	.130	.011	.021	100
Centered Leverage Value	.009	.300	.060	.038	100

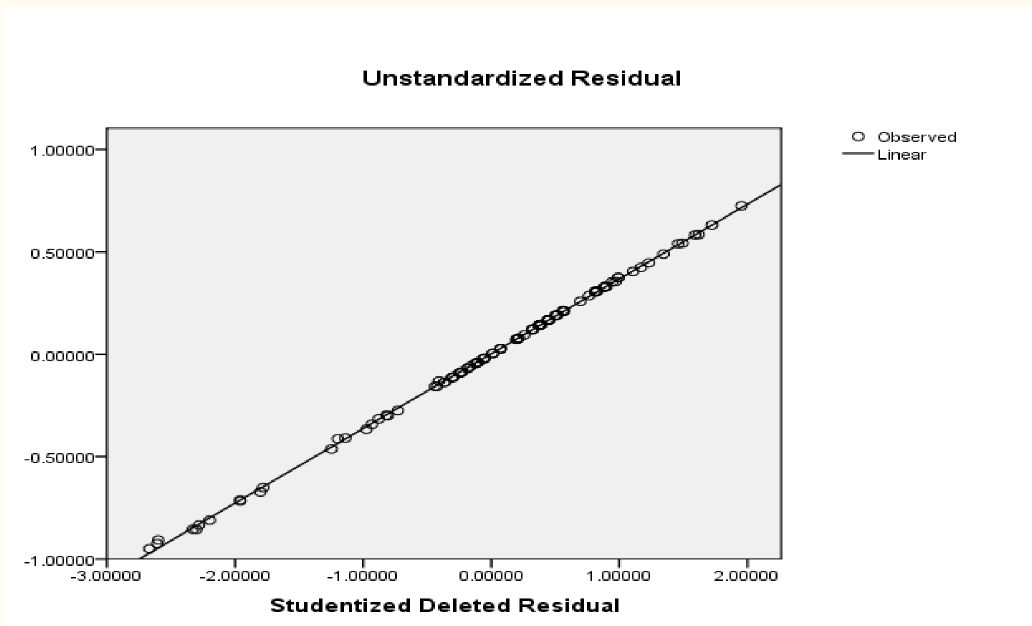
a. Dependent Variable: Adopting Crop Diversification

In the residual statistics we can see that the minimum and the maximum of standardized residual is respectively -2.472 and 1.886 respectively, both are lower than 3. So, that there is no exceptional value in the residual table.









Adopting the crop diversification by the farmers of Bihar appears to be linearly related to each of the predictor variables with no visible potential outliers or influential observations (no points away from the main cluster of points); thus, Assumption 1 appears to be satisfied.

The normal plot of the residuals shows the points close to a diagonal line; thus, Assumption 2 is satisfied. The studentized residual plot shows a random scatter of points with constant variability and no definite outliers (although, there is one very slight potential outlier); thus, Assumption 3 is met.

The normal plot of the residuals shows the points close to a diagonal line; thus, Assumption 2 is satisfied. Each of the studentized residual plots shows a random scatter of points with constant variability; thus, Assumption 3 is met.

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Also, at first glance one might think that the variability is less for the right half of the plots when compared to the left half. This is likely not the case, and any apparent decrease in variability is probably due to the fact that there are far fewer observations in the right half (having fewer values leaves less room for variability).

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