Chapter V

Empirical Study

Table 1: General distribution of variables in terms of Mean, S.D, and C.V

	variables	Mean	SD	Coefficient of variation (Percentage)
X_1	Age	44.0566	8.155135	18.51059
X_2	Education	8.245283	3.720954	45.12827
X_3	Family size	9.283019	2.88377	31.065
X_4	Family statement adult person (%)	49.56604	11.0103	22.2134
X_5	Functional education strata	2.150943	1.257374	58.45687
X_6	Cropping intensity (%)	295.3962	17.79478	6.024039
X_7	Irrigated land (cottah)	76.88679	32.7464	42.59041
X_8	Animal/bird number	5.924528	3.52805	59.54988
X_9	Holding size	11.11321	3.904909	35.13755
X_{10}	Income(Rs) per cottah	608.4906	78.74957	12.94179
X_{11}	Spacing (%)	81.58491	8.8668	10.86819
X_{12}	Fertilizer (%)	96.88679	8.924548	9.211316
X_{13}	Irrigation (%)	81.4717	7.152263	8.778831
X_{14}	Applied Pesticide (%)	91.56604	8.219878	8.976994
X_{15}	Yield (%)	73.09434	7.915269	10.82884
Y_1	Livelihood security	4.584906	0.756954	16.5097

Y_2	Food intake value /g /day/head	103.4528	19.70975	19.05192
Y_3	Health status	24.62264	33.11058	134.4721
Y_4	Wage	70.39623	5.447311	7.738072

Table-1 Present the descriptive distribution of both independent and dependent variables.

In case of age(x_1), mean age of respondents of the study was 44.056 with a standard deviation of 8.155 for total distribution. The coefficient of variation of this age distribution of respondents was 18.510, which explained the higher level of consistency of the total distribution.

The mean value of education (x_2) of respondents was 8.245 that were in primary and secondary school level. The S.D of distribution was 3.720 with a coefficient of variation 45.128 Percentage which in turn reflected the medium level of consistency.

In case of Holding size(x_9) and irrigated land (x_7) cottah, mean value of this two variables of respondents of the study was 11.113 and 76.886 with a standard deviation 3.904 and 32.746 for total distribution. The coefficient of variation of this Holding size and irrigated land (cottah) distribution of respondents was 35.137 and 42.590 which explained the medium level of consistency of the total distribution.

The mean value of Wage (y_4), Cropping Intensity(x_6) and Income (Rs) per cottah (x_{10}) was 70.396, 295.396 and 608.490, with standard deviation 5.447, 17.794 and 78.749 respectively. The coefficient of variation was 7.738, 6.024 and 12.941 respectively, which depicted the high level of consistency.

In case of Spacing (%)(x_{11}),Fertilizer (%)(x_{12}),Irrigation (%)(x_{13}), Applied Pesticide (%)(x_{14}) and Yield (%)(x_{15}) mean value of these variables of respondents of the study was 81.584, 96.886, 91.566, 81.47, 91.566, and 73.094 with a standard deviation 8.866, 8.924, 7.152, 8.219 and 7.915 for total distribution. The coefficient of variation of these variables distribution of respondents was 10.868, 9.211, 8.778, 8.976, and 10.82which explained the high level of consistency of the total distribution.

The mean value of Health status (y_3) of respondents was 24.622 that were in very low level. The S.D of distribution was 33.110 with a coefficient of variation 134.472% which in turn reflected the very low level of consistency.

The mean value of Functional education strata(x_5) and Animal/bird number(x_8) of respondents was 2.150943 and 5.924528 that were in low level. The S.D of distribution was 1.257 and 3.528 with a coefficient of variation 58.456 and 59.549 which in turn reflected the low level of consistency.

In case of Livelihood security (y_1) and Food intake value /g /day/head (y_2) mean value of these two variables of respondents of the study was 4.584 and 103.452 with a standard deviation 0.756 and 19.709 for total distribution. The coefficient of variation of Livelihood security and Food intake value /g /day/head distribution of respondents was 16.509 and 19.051 which explained the medium level of consistency of the total distribution.

Table 2: Coefficient of correlation between livelihood security (Y_1) and 15 independent variables

	Variables	Correlation coefficient
X_1	Age	0.151
X_2	Education	0.083
X_3	Family size	0.084
X_4	Family statement adult person (%)	-0.071
X_5	Functional education strata	0.051
X_6	Cropping intensity (%)	0.451**
X_7	Irrigated land (cottah)	0.068
X_8	Animal/bird number	0.179
X_9	Holding size	0.146
X_{10}	Income(Rs) per cottah	0.558**
X_{11}	Spacing (%)	0.506**
X_{12}	Fertilizer (%)	-0.221
X_{13}	Irrigation (%)	-0.107
X_{14}	Applied Pesticide (%)	0.088
X_{15}	Yield (%)	0.647**

*Significant at 0.05 level

** Significant at 0.01 level

Table-2 Presents the Coefficient of correlation between livelihood security (y_1) and 15 independent variables. It has been found that the variable cropping intensity has recorded a positive and prevalent impact on livelihood security (y_1). Cropping intensity(x_6) is related with intensive utilization of plant water and plant resources and it enriches a farming enterprise by ensuring crop diversification and yield as well. So with higher crop diversification and better yield, livelihood has been profusely secure.

The other variables Income (Rs) per cottah(x_{10}) and crop yield(x_{15}) have also recorded significant correlation with the livelihood security. The higher

income of the respondent and better yield of his farm conjointly with ensures livelihood security.

It is interesting note that spacing(x_{11}) is recorded a positive and significant correlation with livelihood higher spacing and in sowing or transplantation means less of troubling in interculture operation. That is why it would amount to increased security and livelihood.

Table 3 Regression analysis for selecting most significant variables having prominent regression impact on consequent variables Livelihood security (y_1)

Variables			β	T	R^2
Livelihood security (y_1)	X_{15}	Yield (%)	0.53	4.65	R^2=0.48
	X_{11}	Spacing (%)	0.28	2.43	

Factor value for R^2=0.48 with 37 df

*Significant at 0.05 level

** Significant at 0.01 level

Table-3 Presents the regression analysis for selecting most significant variables out of the total score of causal variables by following step down regression approaches.

The Coefficient of correlation estimates the degree of influence of one variable to others, the regression analysis estimates the efficacy the causal variables on the consequent variables.

Through step down regression it has been found that only two variables yield and spacing have exhorted regression analysis is strong, discretionary impact on the livelihood security and these two variable together have explained as highest 48% of variance embedded with livelihood security.

Table 4 Path analysis for deriving direct, indirect and residual effect of exogenous variables on consequent variables (Livelihood security vs 15 antecedent variables)

Variables		Total effect (r)	Direct effect (d)	Indirect effect (r-d)	Substantial Indirect effect		
					i	ii	iii
X_1	Age	0.151	0.079	0.072	0.475(x_3)	-0.268(x_9)	-0.196(x_7)
X_2	Education	0.083	0.180	-0.097	-0.290(x_3)	0.190(x_9)	0.096 (x_7)
X_3	Family size	0.084	0.661	-0.577	-0.565(x_7)	-0.135(x_9)	-0.079(x_2)
X_4	Family statement adult person (%)	-0.071	0.193	-0.264	-0.122(x_{11})	-0.108(x_{15})	-0.086(x_3)
X_5	Functional education strata	0.051	-0.109	0.16	-0.204(x_3)	0.198(x_9)	0.165(x_{15})
X_6	Cropping intensity (%)	0.451	0.045	0.406	0.406 (x_{15})	-0.304(x_7)	0.261(x_9)
X_7	Irrigated land (cottah)	0.068	-0.971	1.039	0.505(x_8)	0.385(x_3)	0.047(x_{15})
X_8	Animal/bird number	0.179	0.023	0.156	-0.203 (x_7)	0.194(x_3)	0.053(x_{14})
X_9	Holding size	0.146	0.783	-0.637	-0.626 (x_7)	-0.144(x_3)	0.095(x_{15})
X_{10}	Income(Rs) per cottah	0.558	-0.144	0.702	0.486 (x_{15})	0.131(x_{11})	0.095 (x_9)
X_{11}	Spacing (%)	0.506	0.328	0.178	0.233 (x_{15})	-0.083(x_7)	-0.072(x_4)
X_{12}	Fertilizer (%)	-0.221	-0.125	-0.096	0.180 (x_7)	-0.135(x_9)	-0.090(x_{11})
X_{13}	Irrigation (%)	-0.107	-0.091	-0.016	0.130 (x_9)	-0.093(x_{11})	-0.072 (x_3)

X_{14}	**Applied Pesticide (%)**	**0.088**	**0.151**	**-0.063**	**-0.276** (x_7)	**0.244**(x_3)	**-0.050** (x_2)
X_{15}	**Yield (%)**	**0.647**	**0.534**	**0.113**	**0.143** (x_{11})	**0.139**(x_9)	**-0.131**(x_{10})

Residual effect: 0.619

Table-4 Present the path analysis to decompose the total effect into direct, indirect and residual effect of the exogenous variables on the variable **Livelihood security (y_1)**. It has been found from the table that variable irrigated land has recorded the highest direct impact on livelihood security. The highest size of the land under irrigation, the higher would be the livelihood security because of the assume yield and subsequent income. The other variables holding size(x_9) and family size(x_3) the provider of land resources and family labour have recorded and substantive on livelihood security.

The same variable irrigated land has also recorded higher indirect impact in accentuating livelihood and astoundingly the combination of this variation has been proved less significant while total effect is in concern. It has been noted that the variable Holding size (x_9) has routed that the higher indirect effect of as many as five antecedent variables through it. So this variable has got higher security for creating close association with other variables. The residual effect being 0.619. It is concluded that 61.9% of the variability embedded with the consequent variable livelihood would not be explained.

Table-5 Coefficient of correlation between Food intake value (y_2) and 15 independent variables

Variables		Correlation coefficient
X_1	**Age**	**-0.064**
X_2	**Education**	**0.063**

X_3	**Family size**	**-0.076**
X_4	**Family statement adult person (%)**	**-0.217**
X_5	**Functional education strata**	**0.024**
X_6	**Cropping intensity (%)**	**0.333***
X_7	**Irrigated land (cottah)**	**0.415****
X_8	**Animal/bird number**	**-0.122**
X_9	**Holding size**	**0.636****
X_{10}	**Income(Rs) per cottah**	**0.276***
X_{11}	**Spacing (%)**	**0.328***
X_{12}	**Fertilizer (%)**	**-0.154**
X_{13}	**Irrigation (%)**	**-0.044**
X_{14}	**Applied Pesticide (%)**	**-0.008**
X_{15}	**Yield (%)**	**0.234**

*Significant at 0.05 level
** Significant at 0.01 level

Table-5 Present the correlation coefficient between **food intake value (y_2)** Vs fifteen independent variables.

It has been found that the following variables Cropping intensity % (x_6), Irrigated land (cottah)(x_7), Income (x_{10}), Spacing (x_{11}), have recorded significant and positive correlation food intake value (y_2) of the respondent. The access to availability of food depends on yield performance, cropping intensity followed, holding size possess by the farmer. These all agro economic variables have cumulatively amounted to higher access to food by the respondents.

Table 6 Regression analysis for selecting most significant variables having prominent regression impact on consequent variables Food intake value (y_2)

Variables			β	T	R^2
Food intake value(y_2)	X_9	Holding size	0.63	6.34	R^2=0.51
	X_{11}	Spacing (%)	0.32	3.21	

Factor value for R^2=0.51 with 37 df
*Significant at 0.05 level
** Significant at 0.01 level

Table-6 Multiple regression analysis presents the magnitude of regressional impact on the consequent factor i.e. **Food intake value (y$_2$)**. It has been found that two variables holding size (x_9) and Spacing (x_{11}) have recorded a significant on regression impact on food intake value higher holding size means higher economic security and better purchase capability.

Spacing helps a critical intercultural operation through engagement of optimum labour utilization and these two casual variables have explained 51% variable of the consequent variable.

Table 7 Path analysis for deriving direct, indirect and residual effect of exogenous variables on consequent variables (Food intake value (y$_2$) vs 15 antecedent variables

Variables		Total effect (r)	Direct effect (d)	Indirect effect (r-d)	Substantial Indirect effect		
					i	ii	iii
X$_1$	Age	-0.064	0.071	-0.135	-0.355(x$_9$)	0.221(x$_3$)	0.072(x$_{11}$)
X$_2$	Education	0.063	0.061	0.002	0.253(x$_9$)	-0.135(x$_3$)	-0.093(x$_{15}$)
X$_3$	Family size	-0.076	0.307	-0.383	-0.276(x$_7$)	-0.180(x$_9$)	0.051(x$_1$)
X$_4$	Family statement adult person (%)	-0.217	-0.152	-0.065	0.144(x$_{15}$)	-0.108(x$_{11}$)	-0.076(x$_{10}$)
X$_5$	Functional education strata	0.024	-0.108	0.132	0.263(x$_9$)	-0.174(x$_{15}$)	0.100(x$_{10}$)

X_6	Cropping intensity (%)	0.333	0.245	0.088	-0.428(x_{15})	0.346(x_9)	0.240(x_{10})
X_7	Irrigated land (cottah)	0.415	-0.474	0.889	0.670(x_9)	0.179(x_3)	0.077(x_6)
X_8	Animal/bird number	-0.122	-0.168	0.046	-0.099(x_7)	0.090(x_3)	0.055(x_9)
X_9	Holding size	0.636	1.039	-0.403	-0.306(x_7)	-0.100(x_{15})	0.082(x_6)
X_{10}	Income(Rs) per cottah	0.276	0.360	-0.084	-0.513(x_{15})	0.163(x_6)	0.126(x_9)
X_{11}	Spacing (%)	0.328	0.288	0.04	-0.246(x_{15})	0.144(x_{10})	0.072(x_6)
X_{12}	Fertilizer (%)	-0.154	0.042	-0.196	-0.179(x_9)	0.088(x_7)	-0.080(x_{11})
X_{13}	Irrigation (%)	-0.044	-0.043	-0.001	0.173(x_9)	-0.082(x_{11})	-0.033(x_3)
X_{14}	Applied Pesticide (%)	-0.008	0.097	-0.105	-0.135(x_7)	0.113(x_3)	-0.059(x_8)
X_{15}	Yield (%)	0.234	-0.563	0.797	0.326(x_{10})	0.186(x_6)	0.185(x_9)

Residual effect: 0.608

Table-7 Present the path analysis to decompose the total effect into direct, indirect and residual effect of the exogenous variables on the variable **food intake value (y_2)**

It has been found that the variable holding size (x_9) has recorded the highest direct effect on food intake value (y_2).In the domain of food security, income generation and livelihood security, holding size is still a strong provider. The other way we can say that land is still uncontrolled factor in rural economy.

Table 8 Coefficient of correlation between Health status (y_3) and 15 independent variables

Variables		Correlation coefficient
X_1	Age	0.049
X_2	Education	0.106
X_3	Family size	0.119
X_4	Family statement adult person (%)	-0.227
X_5	Functional education strata	0.286*
X_6	Cropping intensity (%)	0.195
X_7	Irrigated land (cottah)	0.009
X_8	Animal/bird number	0.106
X_9	Holding size	-0.019
X_{10}	Income(Rs) per cottah	0.224
X_{11}	Spacing (%)	0.141
X_{12}	Fertilizer (%)	0.036
X_{13}	Irrigation (%)	0.036
X_{14}	Applied Pesticide (%)	-0.173
X_{15}	Yield (%)	0.254

*Significant at 0.05 level
** Significant at 0.01 level

Table-8 Present the correlation coefficient between **Health status (y_3)** Vs fifteen independent variables.

It has been elicited that the variables functional education status(x_5), only one in this case, has recorded strong correlation value with health status. No other variable in this table has been followed to record significant correlation with the dependent variables health status.

This is really an interesting result to conclude that functional education level has got direct prevalent and decisive impact to ensure better health status. It is also observable that the families having higher functional

education are free of primary health hazards in comparison to those having poor functional education.

Table 9 Regression analysis for selecting most significant variables having prominent regression impact on consequent variables Health status (y_3)

Variables			β	T	R^2
Health status(y_3)	X_5	Functional education strata	0.29	2.13	R^2=0.08

Factor value for R^2=0.08 with 37 df

*Significant at 0.05 level

** Significant at 0.01 level

Table-9 Presents the regression analysis for selecting most significant variables having prominent regression impact on consequent variables **Health status (y_3)**

The step down regression analysis has isolated at the last step and quite logically the some variable for having a decisive impact on health status. This solitary variable has contributed to 8 percent variance embedded with consequent variable health status.

Table 10 Path analysis for deriving direct, indirect and residual effect of exogenous variables on consequent variables Health status (y_3) vs 15 antecedent variables

	Variables	Total effect (r)	Direct effect (d)	Indirect effect (r-d)	Substantial Indirect effect		
					i	ii	iii
X_1	Age	0.049	0.278	-0.229	0.484(x_3)	-0.236(x_5)	-0.154(x_9)

X_2	Education	0.106	0.160	-0.054	-0.296(x_3)	-0.209(x_1)	0.191(x_5)
X_3	Family size	0.119	0.674	-0.555	-0.401(x_7)	0.200(x_1)	-0.156(x_5)
X_4	Family statement adult person (%)	-0.227	-0.297	0.07	-0.088(x_3)	0.055(x_5)	0.037(x_{13})
X_5	Functional education strata	0.286	0.507	-0.221	-0.207(x_3)	-0.130(x_1)	0.114(x_9)
X_6	Cropping intensity (%)	0.195	0.129	0.066	-0.215(x_7)	0.150(x_9)	0.143(x_5)
X_7	Irrigated land (cottah)	0.009	-0.688	0.697	0.392(x_3)	0.290(x_9)	-0.083(x_{14})
X_8	Animal/bird number	0.106	0.098	0.008	0.197(x_3)	-0.144(x_7)	-0.103(x_{14})
X_9	Holding size	-0.019	0.450	-0.469	-0.444(x_7)	0.128(x_5)	-0.117(x_3)
X_{10}	Income(Rs) per cottah	0.224	-0.035	0.259	0.141(x_5)	-0.114(x_{15})	0.086(x_6)
X_{11}	Spacing (%)	0.141	0.097	0.044	0.111(x_4)	0.063(x_3)	0.070(x_1)
X_{12}	Fertilizer (%)	0.036	0.121	-0.085	0.127(x_7)	-0.077(x_9)	-0.055(x_{14})
X_{13}	Irrigation (%)	0.036	0.182	-0.146	0.075(x_9)	-0.073(x_3)	-0.061(x_4)
X_{14}	Applied Pesticide (%)	-0.173	-0.293	0.12	0.249(x_3)	-0.195(x_7)	0.101(x_1)
X_{15}	Yield (%)	0.254	-0.126	0.38	0.157(x_5)	0.098(x_9)	0.080(x_9)

Residual effect: 0.788

Table-10 Path analysis for deriving direct, indirect and residual effect of exogenous variables on consequent variables **Health status (y_3)** vs 15 antecedent variables

It has been found that the variable irrigated land has recorded a decisive impact on health status.

An irrigation status implies an enhanced capacity to yield crop and at the sometime invites intense application of fertilizer, pesticides, has recorded substantive impact on health status, the unplanned, inert and discriminate use of pesticides prompt the process of water contamination and invasion into food chain.

The other variable family size(x_3) has also recorded a substantive impact on health status to prove its logical inclusion into this well of intervention. The other variable family size has routed the highest indirect effect as many as sever variables to characterize the behavior of consequent variable, health status.

The value of residual effect (R=78.81%) suggests that even with the combination of 15 exogenous variables, 78.8% of variance.

Table 11 Coefficient of correlation between Wage (y_4) and 15 independent variables

	Variables	Correlation coefficient
X_1	Age	-0.067
X_2	Education	0.011
X_3	Family size	-0.044
X_4	Family statement adult person (%)	0.057
X_5	Functional education strata	0.017
X_6	Cropping intensity (%)	0.138
X_7	Irrigated land (cottah)	-0.066

X_8	**Animal/bird number**	**-0.232**
X_9	**Holding size**	**-0.092**
X_{10}	**Income(Rs) per cottah**	**0.111**
X_{11}	**Spacing (%)**	**-0.013**
X_{12}	**Fertilizer (%)**	**-0.164**
X_{13}	**Irrigation (%)**	**-0.079**
X_{14}	**Applied Pesticide (%)**	**-0.198**
X_{15}	**Yield (%)**	**0.028**

*Significant at 0.05 level
** Significant at 0.01 level

Table-11 Presents the Coefficient of correlation between **Wage (y_4)** and 15 independent variables.

It has been found that none of the 15 variables has recorded any significant correlation with health status. Although the variable animal/bird number has come up with near significant status of correlation to imply that animal and bird enterprise has got immediate impact on the wage of the respondent.

Table 12 Regression analysis for selecting most significant variables having prominent regression impact on consequent variables Wage (y_4)

Variables			β	T	R^2
Wage (y_4)	X_1	Age	-0.16	-1.10	R^2=0.16
	X_6	Cropping intensity (%)	0.37	1.71	
	X_9	Holding size	-0.24	-1.55	
	X_{10}	Income(Rs) per cottah	0.60	1.81	
	X_{12}	Fertilizer (%)	-0.21	-1.53	
	X_{15}	Yield (%)	-0.78	-2.06	

Factor value for R^2=0.16 with 37 df
*Significant at 0.05 level
** Significant at 0.01 level

Table-12 Presents the regression analysis for selecting most significant variables having prominent regression impact on consequent variables **Wage (y_4)**

It has been found that the causal variables age(x_2), cropping intensity(x_6), holding size(x_9), income(x_{10}), fertilizer(x_{12}) and yield(x_{15}) have recorded substantive impact on wage.

Wage is basically a socio-economic character that gets culturally turned to livelihood, community, family and farm as well. That's why cropping intensity has rightly gone direct failed to wage .so, also has happened to other variables as well. Holding size is a strong determinant of wage quantity and variability with higher cropping intensity, the generation of wages is ensured, keeps on imbibing other consequent impacts like generation of income, application of fertilizer and yield of crop.

The R^2 value being 0.16, it is to infer that with the combination of 15 causal variables embedded with consequent factor has been rendered explicable.

Table 13 Path analysis for deriving direct, indirect and residual effect of exogenous variables on consequent variables Wage (y_4) vs 15 antecedent variables

	Variables	Total effect (r)	Direct effect (d)	Indirect effect (r-d)	Substantial Indirect effect		
					i	ii	iii
X_1	Age	-0.067	-0.391	0.324	0.178(x_9)	0.139(x_2)	0.085(x_7)
X_2	Education	0.011	-0.185	0.196	0.293(x_1)	-0.127(x_9)	-0.094(x_{15})
X_3	Family size	-0.044	-0.112	0.068	-0.281(x_1)	0.244(x_7)	0.090(x_9)

X_4	Family statement adult person (%)	0.057	0.100	-0.043	-0.144(x_{10})	0.115(x_{15})	0.044(x_1)
X_5	Functional education strata	0.017	-0.112	0.129	0.191(x_{10})	0.182(x_1)	-0.176(x_{15})
X_6	Cropping intensity (%)	0.138	0.221	-0.083	0.457(x_{10})	-0.432(x_{15})	-0.174(x_9)
X_7	Irrigated land (cottah)	-0.066	0.420	-0.486	-0.337(x_9)	-0.079(x_1)	0.069(x_6)
X_8	Animal/bird number	-0.232	-0.013	-0.219	0.088(x_7)	-0.080(x_1)	-0.057(x_{10})
X_9	Holding size	-0.092	-0.522	0.43	0.271(x_7)	0.134(x_1)	-0.101(x_{15})
X_{10}	Income(Rs) per cottah	0.111	0.686	-0.575	-0.517(x_{15})	0.148(x_6)	-0.063(x_9)
X_{11}	Spacing (%)	-0.013	-0.096	0.083	0.275(x_{10})	-0.248(x_{15})	-0.098(x_1)
X_{12}	Fertilizer (%)	-0.164	-0.196	0.032	0.090(x_9)	-0.078(x_7)	0.074(x_{15})
X_{13}	Irrigation (%)	-0.079	-0.119	0.04	-0.087(x_9)	0.043(x_1)	0.027(x_{11})
X_{14}	Applied Pesticide (%)	-0.198	-0.153	-0.045	-0.142(x_1)	0.119(x_7)	0.051(x_2)
X_{15}	Yield (%)	0.028	-0.568	0.596	0.625(x_{10})	0.168(x_6)	-0.093(x_9)

Residual effect: 0.883

Table-13 Presents the Path analysis for deriving direct, indirect and residual effect of exogenous variables on consequent variables **Wage (y_4)** vs 15 antecedent variables

This table shows that the variable income has recorded the highest direct effect. Better wage means higher income and higher income implies better wage. That's why; a kind of covalence of interaction has been created between wage and income.

Yield(x_{15}) has recorded the highest indirect effect to imply that this variable has got immense coherency to include other variables for routing their associational effect for characterize the consequent variables.

The high residual effect (0.883) suggests that even with the combination of 15 variables **88.30** percent of variance left in explained.

Table 14 Factor analysis for clubbing of variables into factor based on factor loading.

Factor	Variability		Factor loading	Eigen value	Variance (%)	Cumulative (%)	Factor rename
Factor - 1	X_6	Cropping intensity (%)	0.77	3.98	20.93	20.93	Livelihood Status
	X_{10}	Income(Rs) per cottah	0.91				
	X_{15}	Yield (%)	0.95				
	X_{16}	Livelihood security	0.77				
Factor -2	X_1	Age	0.91	3.16	16.65	37.58	Bio-Social factor
	X_2	Education	-0.75				
	X_3	Family size	0.87				
Factor -3	X_7	Irrigated land (cottah)	0.88	2.06	10.86	48.44	Agro-Nutritional

	X_9	Holding size	0.87				status
	X_{17}	Food intake value /g /day/head	0.67				
Factor -4	X_4	Family statement adult person (%)	0.70	1.70	8.96	57.40	Farmers Capability
	X_{11}	Spacing (%)	-0.58				
	X_{13}	Irrigation (%)	0.75				
Factor -5	X_8	Animal/bird number	0.59	1.33	7.02	64.42	Ancillary Status
	X_{19}	Wage	-0.80				
Factor -6	X_5	Functional education strata	0.55	1.14	5097	70.40	Psycho-Physical factor
	X_{18}	Health status	0.79				
Factor -7	X_{12}	Fertilizer (%)	0.63	1.06	5.58	75.98	Input factor
	X_{14}	Applied Pesticide (%)	0.68				

Table-14 Factor analysis has been carried out for the static conglomeration of variables based on Eigen roots that is derived from coefficient of correlation. So, a recombination types of agglomeration results which can be trenched as factor.

The Factor-1 has accommodated the following variables X_6 (Cropping Intensity), X_{10} (Income), X_{15} (yield), X_{16} (Livelihood security), and has been renamed as **Livelihood Status**. The factor has contributed **20.93** percent of variance of the predictable character.

The Factor-2 has accommodated the following variables X_1 (Age), X_2 (Education), X_3(Family size), and has been renamed as **Bio-Social Factor** contributing variance percentage was **16.65.**

It has been found factor-3 has accumulated X_7(Irrigated Land), X_9(Holding Size), X_{17}(Food intake value), and could be renamed as **Agro-Nutritional Status**, contributing variance percentage was **10.86.**The Factor-4 has accommodated the following variables X_4(Family statement adult person), X_{11}(Spacing), X_{13}(Irrigation), and has been renamed as **Farmers Capability** contributing variance was **8.96** percent**.**

It has found that factor-5 accumulated X_8(Animal/bird number), X_{19}(Wage), and with **64.42** percent Cumulative Variance and has been renamed as **Ancillary factor** .

The Factor-6 has accommodated the following variables X_5 (Functional education strata), X_{18}(Health status), and has been renamed as **Psycho-physical factor** contributing variance was **5.097** percent.

The Factor-7 has accommodated the following variables X_{12}(Fertilizer), X_{14} (Applied Pesticide), and has been renamed as **Input factor**. The factor has contributed **5.58** percent of variance

Table 15 Presents the Coefficient of correlation between Sustainable livelihood (y_5) and 15 independent variables

	Variables	Correlation coefficient
X_1	Age	0.0486
X_2	Education	0.1297
X_3	Family size	0.1223
X_4	Family statement adult person (%)	-0.2524
X_5	Functional education strata	0.302*
X_6	Cropping intensity (%)	0.304*
X_7	Irrigated land (cottah)	0.075
X_8	Animal/bird number	0.103
X_9	Holding size	0.0783
X_{10}	Income(Rs) per cottah	0.332**
X_{11}	Spacing (%)	0.230
X_{12}	Fertilizer (%)	0.002
X_{13}	Irrigation (%)	0.003
X_{14}	Applied Pesticide (%)	-0.160
X_{15}	Yield (%)	0.360**

*Significant at 0.05 level
** Significant at 0.01 level

Table-15 Presents the Coefficient of correlation between **Sustainable livelihood (y_5)** and 15 independent variables.

It has been found that the coefficient correlation between sustainable livelihood and 15 independent variables. It has been found the Functional education strata(x_5), Cropping intensity % (x_6), Income (x_{10}), Yield(x_{15}), all have gone significantly correlated with sustainable livelihood. So, ample attention needs to be focus on these variables.

For attaining sustainable livelihood, the role of functional education strata possessing irrigated land at higher scale, and better yield. Cropping

intensity %, Income, Yield these variables are considered crucial and important.

Table 16 Regression analysis for selecting most significant variables having prominent regression impact on consequent variables sustainable livelihood (y_5)

Variables		Beta	β x R	Reg-Coef-β	SE of β	T value of β
X_3	Family size	0.909	37.741	77480.570	27948.841	2.77
X_4	Family statement adult person (%)	-0.270	23.110	-6019.424	2768.773	2.174
X_5	Functional education strata	0.421	43.205	82328.914	25981.520	3.169
X_7	Irrigated land (cottah)	-0.960	-24.468	-7211.595	3118.815	2.312
X_9	Holding size	0.768	20.412	48326.273	21466.531	2.251

Multiple R-sq=0.2944
Multiple R =0.5426
F value for R = 3.92 with 5 and 47 dfs

Table-16 Regression analysis for selecting most significant variables having prominent regression impact on consequent variables **sustainable livelihood (y_5)**

Step down regression analysis (T-16) depicted these five causal variables (Family size- X_3, Family statement adult person (%)-X_4, Functional education strata- X_5, Irrigated land (cottah)- X_7, Holding size- X_9) have

been retained at the last step for their critical and crucial contribution in assuming the sustainable livelihood for the farmers.

Table-17 Path analysis for deriving direct, indirect and residual effect of exogenous variables on consequent variables sustainable livelihood (y_5)vs 15 antecedent variables

Variables		Total effect (r)	Direct effect (d)	Indirect effect (r-d)	Substantial Indirect effect		
					i	ii	iii
X_1	Age	0.0486	0.2503	-0.201	-0.187(x_2)	0.180(x_3)	-0.116(x_5)
X_2	Education	0.1297	-0.1347	0.264	0.1797(x_2)	-0.078(x_3)	0.067(x_5)
X_3	Family size	0.1223	0.5758	-0.453	0.8009(x_3)	0.466(x_7)	-0.351(x_2)
X_4	Family statement adult person (%)	-0.2524	0.0315	-0.283	-0.280(x_4)	0.104(x_{11})	0.058(x_{10})
X_5	Functional education strata	0.302	-0.2181	0.520	0.467(x_5)	0.176(x_2)	0.144(x_{15})
X_6	Cropping intensity (%)	0.304	-0.0057	0.309	0.193(x_6)	0.147(x_{15})	0.129(x_{10})
X_7	Irrigated land (cottah)	0.075	-0.1694	0.244	0.837(x_7)	-0.540(x_9)	-0.487(x_3)
X_8	Animal/bird number	0.103	0.0169	0.086	0.082(x_8)	0.029(x_{14})	0.024(x_3)
X_9	Holding size	0.0783	-0.2209	0.299	0.645(x_9)	0.416(x_7)	0.214(x_6)
X_{10}	Income(Rs) per cottah	0.332	0.0048	0.327	0.056(x_{10})	0.051(x_{15})	0.037(x_6)

X_{11}	Spacing (%)	0.230	0.0401	0.189	0.159(x_{11})	0.069(x_{15})	-0.059(x_4)
X_{12}	Fertilizer (%)	0.002	-0.003	0.005	0.115(x_{12})	-0.032(x_{11})	0.021(x_{14})
X_{13}	Irrigation (%)	0.003	-0.0158	0.018	0.142(x_{13})	-0.040(x_{11})	0.029(x_4)
X_{14}	Applied Pesticide (%)	-0.160	-0.0940	-0.066	-0.258(x_{14})	-0.095(x_3)	-0.091(x_8)
X_{15}	Yield (%)	0.360	-0.0088	0.368	-0.193(x_{15})	-0.175(x_{10})	-0.146(x_6)

Residual effect: 0.5715

Table-17 Present the path analysis to decompose the total effect into direct, indirect and residual effect of the exogenous variables on the variable **sustainable livelihood (y_5)**

The variable Family status- (X_3) was exhausted the high and direct effect on the sustainable livelihood. Size of the family have as determined the sustainable livelihood by level of sharing and assessing both risk and resources. The variable Functional education strata- X_5 rightly as routed the highest indirect effect on the sustainable livelihood. It indicated that functional education itself has got multifaceted and polyhedral impact on sustainable livelihood. It has also been found that the variable education exhausted the highest indirect effect of to predictor variables ultimately to characterize.

The residual effect being 0.5715, it is to conclude that even with the combination of 15 exogenous variables could not be explained.

Table 18 Factor analysis for clubbing of variables into factor based on factor loading

Factor	Variability		Factor loading	Variance (%)	Cumulative (%)	Factor rename
Factor-1	X_{11}	Spacing (%)	0.135	21.22	21.22	Livelihood
	X_{16}	Livelihood Security	0.167			
Factor-2	X_1	Age	0.288	15.81	37.03	Family
	X_3	Family size	0.262			
Factor-3	X_7	Irrigated land (cottah)	0.273	11.09	48.13	Agro-Eco system
	X_9	Holding size	0.298			
	X_{17}	Food intake value /g /day/head	0.266			
Factor-4	X_2	Education	0.085	9.71	57.84	Health Awareness
	X_8	Animal/bird number	0.237			
	X_{18}	Health Status	0.221			
	X_{20}	Sustainable Livelihood	0.197			
Factor-5	X_4	Family statement adult person (%)	0.329	7.35	65.19	Agro-Technology
	X_{10}	Income(Rs) per cottah	0.230			
	X_{12}	Fertilizer (%)	0.268			
	X_{14}	Applied Pesticide (%)	0.275			
	X_{15}	Yield (%)	0.244			

Factor	X					
Factor -6	X_6	Cropping intensity (%)	0.202	6.12	71.32	Agro-Economic
	X_{13}	Irrigation (%)	0.361			
	X_{19}	Wage	0.354			
Factor -7	X_5	Functional education strata	0.481	5.35	76.67	Agro-Activity

Table-18 Factor analysis for clubbing of variables into factor based on factor loading

The Factor-1 has accommodated the following variables X_{11}(Spacing), X_{16} (Livelihood security), and has been renamed as **Livelihood**. The factor has contributed **21.22**percent of variance of the predictable character.

The Factor-2 has accommodated the following variables X_1 (Age), X_3(Family size), and has been renamed as **Family** contributing variance percentage was **15.81** percent.

It has been found factor-3 has accumulated X_7(Irrigated Land), X_9(Holding Size), X_{17}(Food intake value), and could be renamed as **Agro-Eco system**, contributing variance percentage was **11.09**

The Factor-4 has accommodated the following variables X_2 (Education), X_{18}(Health status), X_8(Animal/bird number), sustainable livelihood(X_{20}), and has been renamed as **Health awareness** contributing variance was **9.71** percent.

It has found that factor-5 accumulated X_4(Family statement adult person), X_{10} (Income), X_{12}(Fertilizer), X_{14} (Applied Pesticide), X_{15} (yield), and with **65.19** percent Cumulative Variance and has been renamed as **Agro-Technology** .

The Factor-6 has accommodated the following variables X_6 (Cropping Intensity), X_{13}(Irrigation), X_{19}(Wage), and has been renamed as **Agro-Economic** contributing variance was **6.12** percent.

The Factor-7 has accommodated the following variables X_5 (Functional education strata), and has been renamed as **Agro-Activities**. The factor has contributed **5.35** percent of variance.

Summary and Conclusion

The present investigation had been conducted at Goragachha village in Nadia, West Bengal. State Block and village were selected purposively due to unique nature of the locations in terms of subject area of study. A pilot study was conducted to understand the area, its people, institution, communication, extension system and attitude of people towards sustainable livelihood process.

The 15 independent variables and 5 dependent variables were selected and measured with the help of exact scales developed by previous social science researcher or by modifying the developed scale by structured schedule for requirement of the investigation.

Around 134 families live in village. An exhaustive list of respondents was prepared critically with the help of same villagers. From the list 53 respondents were randomly selected for the study. The final primary data were collected with the help of structured interview schedule by following the personal interview method after pre-testing of schedule. The Secondary data were collected from our library, Cab, internet etc, for establishing the conceptual frame work of the present study.

The statistical tools like standard deviation, coefficient of variance, multiple regression analysis, path analysis, factor analysis.

Findings-

1) **Livelihood Security(Y_1)**—Findings of related analysis-

- **Coefficient of correlation**- It has been found that the variable cropping intensity has recorded a positive and prevalent impact on livelihood security (y1). Cropping intensity is related with intensive utilization of plant water and plant resources and it enriches a farming enterprise by ensuring crop diversification and yield as well. So with higher crop diversification and better yield, livelihood has been profusely secure.

- **Multiple regression analysis**- Through step down regression it has been found that only two variables yield and spacing have exhorted regression analysis is strong, discretionary impact on the livelihood security and these two variable together have explained as highest 48% of variance embedded with livelihood security.

- **Path analysis**- The other variables holding size and family size the provider of land resources and family labour have recorded and substantive on livelihood security. It has been noted that the variable Holding size (x_9) has routed that the higher indirect effect of as many as five antecedent variables through it. So this variable has got higher security for creating close association with other variables. The residual effect being 0.619, it is concluded that 61.9%

of   the variability embedded with the consequent variable livelihood would not be explained

2) **Food intake value(Y_2)**- Findings of related analysis-

- **Coefficient of correlation**- The access to availability of food depends on yield performance, cropping intensity followed, holding size possess by the farmer. These all agro economic variables have cumulatively amounted to higher access to food by the respondents.

- **Multiple regression analysis**- It has been found that two variables holding size (x_9) and Spacing (x_{11}) have recorded a significant on regression impact on food intake value higher holding size means higher economic security and better purchase capability.

Spacing helps a critical interculture operation through engagement of optimum   labour utilization and these two casual variables have explained 51% variable of the consequent variable.

- **Path analysis**- It has been found that the variable holding size (x_9) has recorded the highest direct effect on food intake value (y_2).In the domain of food security, income generation and livelihood security, holding size is still a strong provider. The other way we can say that land is still uncontrolled factor in rural economy.

3) **Health Status(Y_3)**- Findings of related analysis-

- **Coefficient of correlation**- It has been elicited that the variables functional education status, only one in this case, has recorded strong correlation value with health status. No other variable in this table has been followed to record significant correlation with the dependent variables health status.

- **Multiple regression analysis**- The step down regression analysis has isolated at the last step and quite logically the some variable for having a decisive impact on health status. This solitary variable has contributed to 8 percent variance embedded with consequent variable health status.

- **Path analysis**- The other variable family size has routed the highest indirect effect as many as sever variables to characterize the behavior of consequent variable, health status. The value of residual effect (R=78.81%) suggests that even with the combination of 15 exogenous variables, 78.8% of variance.

4) **Wage (Y$_4$)** - Findings of related analysis-

- **Coefficient of correlation**- It has been found that none of the 15 variables has recorded any significant correlation with health status. Although the variable animal/bird number has come up with near significant status of correlation to imply that animal and bird enterprise has got immediate impact on the wage of the respondent.

- **Multiple regression analysis**- Holding size is a strong determinant of wage quantity and variability with higher cropping intensity, the generation of wages is ensured, keeps on imbibing other consequent impacts like generation of income, application of fertilizer and yield of crop.

The R^2 value being 0.16, it is to infer that with the combination of 15 causal variables embedded with consequent factor has been rendered explicable.

- **Path analysis**- Yield has recorded the highest indirect effect to imply that this variable has got immense coherency to include other variables for routing their associational effect for characterize the consequent variables.

The high residual effect (0.883) suggests that even with the combination of 15 variables.88.30 percent of variance left in explained.

5) **Sustainable Livelihood (Y_5)** - Findings of related analysis-

- **Coefficient of correlation**-. It has been found the Functional education strata(x_5), Cropping intensity % (x_6), Income (x_{10}), Yield(x_{15}), all have gone significantly correlated with sustainable livelihood. So, ample attention needs to be focus on these variables.

- **Multiple regression analysis**- Step down regression analysis (T-16) depicted these five causal variables (Family size- x_3, Family statement adult person (%)-X_4, Functional education strata- X_5, Irrigated land (cottah)- X_7, Holding size- X_9) have been retained at the last step for their critical and crucial contribution in assuming the sustainable livelihood for the farmers.

- **Path analysis**- The variable Functional education strata- X_5 rightly as routed the highest indirect effect on the sustainable livelihood. It indicated that functional education itself has got multifaceted and polyhedral impact on sustainable livelihood. It has also been found that the variable education exhausted the highest indirect effect of to predictor variables ultimately to characterize.

The residual effect being 0.5715, it is to conclude that even with the combination of 15 exogenous variables could not be explained.