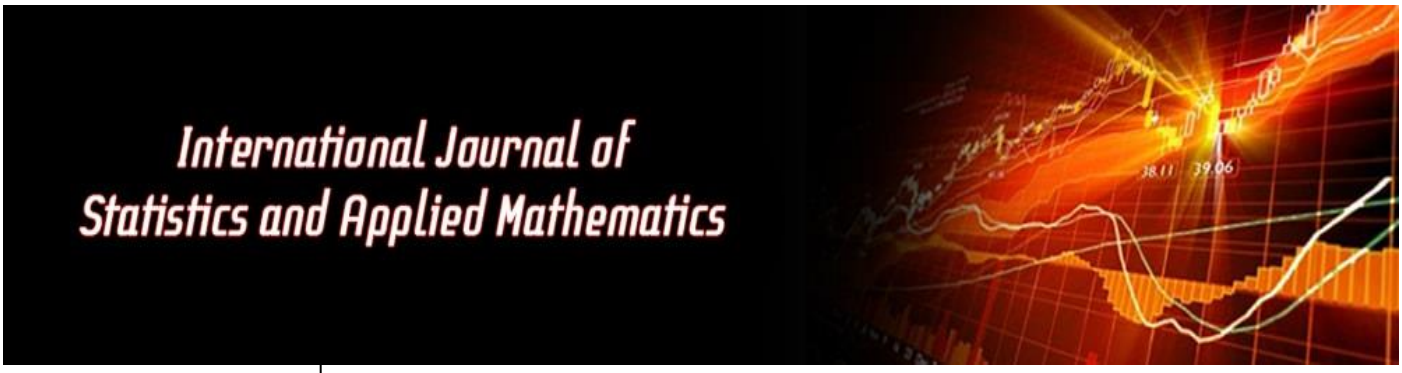

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Regression analysis of management efficiency of cotton seed producer farmers

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Abstract
The study was carried out in Sabarkantha district of Gujarat state. An Ex-post facto research design was followed to select the cotton seed producer farmers. Thus, a total of 240 cotton seed producer farmers were selected as sample size. The main objective of this study is to study the regression analysis of the Management efficiency of cotton seed producer farmers. It is revealed that the coefficient of determination (R^2) of the independent variables was 0.620. It means that 62.00% of the total variation in Management efficiency of cotton seed producer farmers was explained by the selected 14 independent variables i.e. Age, education, experience, land holding, annual income, social participation, participation in a training programme, extension contacts, mass media exposure, economic motivation, risk orientation, scientific orientation Market Orientation, and self-confidence. The present study was used as a multistage sampling procedure. Collected data were classified, tabulated, and analyzed by using multiple regression.

Keywords: Cotton seed, regression, farmers

Introduction
The management efficiency of agricultural producers plays a crucial role in the overall productivity and sustainability of the agricultural sector. Within this context, the management efficiency of cotton seed producer farmers is of paramount importance, as cotton holds a significant position in the agricultural economy, particularly in regions like the Sabarkantha district of Gujarat state. Management efficiency refers to the ability of farmers to effectively allocate resources, make informed decisions, and optimize their farming practices to achieve desirable outcomes. Factors such as education, experience, land holding, income, social participation, and various other variables can influence the management efficiency of cotton seed producer farmers. Understanding the determinants of management efficiency in this context is vital for enhancing cotton production, ensuring economic viability for farmers, and contributing to the broader agricultural landscape.

Objective
To study the regression analysis of the management efficiency of cotton seed producer farmers

Methodology
The present investigation was carried out in the Sabarkantha district of Gujarat. Out of eight talukas of Sabarkantha district, four talukas *viz*., Vadali, Khedbrahma, Poshina and Idar having the highest number of seed plots of the cotton crop were selected purposively for the study. From each selected taluka, five cotton seed-producing villages, and from each village twelve cotton seed-producing farmers were selected randomly. Thus, a total of 240 cotton seed producer farmers were selected as sample size. Ex-post facto research design Kerlinger (1976) [8] was used. In line with the objective, the structured interview schedule was prepared and respondents were interviewed either at their homes or on farms. Fourteen independent variables were considered and measured using appropriate scales available or structured schedules specially developed for the present study. Collected data were classified, tabulated, and analyzed by multiple regression.

Results and Discussion

The extent of variation caused by independent variables on the management efficiency

The multiple regression analysis was performed to study the extent of variation of cotton seed producer farmers by selecting fourteen independent variables towards management efficiency. It was carried out to know the important variables with their predicting ability in explaining the variation in management efficiency by the cotton seed producer farmers. In multiple regression analysis, fourteen independent variables were fitted to explain the variation in management efficiency of the cotton seed producer farmers.

These selected fourteen variables were used for multiple regression analysis using the following multiple regression model:

$$Y = a + b_1 X_1 + b_2 X_2 + b_3 X_3 + b_4 X_4 + b_5 X_5 + b_6 X_6 + b_7 X_7 + b_8 X_8 + b_9 X_9 + b_{10} X_{10} + b_{11} X_{11} + b_{12} X_{12} + b_{13} X_{13} + b_{14} X_{14}$$

Where, Y = Management Efficiency

a = intercept value
b_1 = partial regression coefficient of Y on X_1
b_2 = partial regression coefficient of Y on X_2
b_3 = partial regression coefficient of Y on X_3
b_4 = partial regression coefficient of Y on X_4
b_5 = partial regression coefficient of Y on X_5
b_6 = partial regression coefficient of Y on X_6
b_7 = partial regression coefficient of Y on X_7
b_8 = partial regression coefficient of Y on X_8
b_9 = partial regression coefficient of Y on X_9
b_{10} = partial regression coefficient of Y on X_{10}
b_{11} = partial regression coefficient of Y on X_{11}
b_{12} = partial regression coefficient of Y on X_{12}
b_{13} = partial regression coefficient of Y on X_{13}
b_{14} = partial regression coefficient of Y on X_{14}

Table 1: Multiple regression analysis of the selected independent variables with management efficiency of cotton seed producer farmers (n=240)

Sr. No.	Independent variables	Regression Coefficient (b)	't' value	Sig.
1	a (Constant)	49.209	23.074	0.000
2	X_1 (Age)	0.018	0.383	0.702
3	X_2 (Education)	-0.001	-0.005	0.996
4	X_3 (Experience in cotton seed production)	-0.028	-0.300	0.764
5	X_4 (Land holding)	1.416**	4.375	0.000
6	X_5 (Annual income)	0.088	0.335	0.738
7	X_6 (Social participation)	0.387	1.529	0.128
8	X_7 (Participation in training programme)	4.105**	7.364	0.000
9	X_8 (Extension contacts)	0.046**	2.629	0.009
10	X_9 (Mass media exposure)	-0.221*	-2.318	0.021
11	X_{10} (Economic motivation)	0.271**	5.016	0.000
12	X_{11} (Risk orientation)	0.059	1.551	0.122
13	X_{12} (Scientific orientation)	0.066	1.777	0.077
14	X_{13} (Market orientation)	0.013	0.357	0.721
15	X_{14} (Self-confidence)	0.020	0.640	0.523

Multiple R = 0.787, R^2 = 0.620
* Significant at 0.05 level of significance, ** Significant at 0.01 level of significance

It is concluded from Table 1 that 62.00% of the total variation in the level of management efficiency was explained through the variables considered as the regression equation. The unexplained variation was 38.00%, which may be due to extraneous factors.

The calculated 't' values of the partial regression coefficient were significant in the case of land holding (X_4), participation in training programme (X_7), extension contacts (X_8), mass media exposure (X_9) and economic motivation (X_{10}).

From the regression analysis, it is concluded that out of fourteen variables, five variables *viz.*, land holding, participation in training programme, extension contacts, mass media exposure and economic motivation had a significant effect on the management efficiency of the cotton seed producer farmers. The regression coefficient indicates that a one-unit change in land holding, participation in training programme, extension contacts, mass media exposure and economic motivation would affect 1.416 units, 4.105 units, 0.046 units, -0.221 units and 0.271 units change in management efficiency of the cotton seed producer farmers, respectively.

The relative importance of independent variables in explaining management efficiency: In the previous sub-section, the relationship between the independent and dependent variables was expressed in terms of correlation co-efficient ('r'). However, generally, in behavioural sciences, no dependent variable can be influenced singly by one independent variable. As such, the management efficiency is in reality not influenced by any independent variable alone. It is found to be influenced by more than one of these independent attributes jointly through their reciprocal and interactive relationship. To assess the contribution (influence) of each independent variable to the dependent variable, the effect of others was held constant. The stepwise regression is one such method which has been widely adopted in multiple regression analysis. It has the added advantage that at each stage of analysis, every variable is subjected to an examination of its predictive value. The results pertained to step-wise regression are reported in Table 2.

The variables were introduced step-wise in succession depending upon the contribution of each of the independent variables in explaining the variation in the dependent variable. The multiple regression co-efficient (R) represents the correlation between the dependent variable's actual score and the predicted score obtained from the multiple regression equation. The co-efficient of multiple determinations (R^2) gives the average amount of change in the dependent variable when all independent variables were taken together and were tested with the 'F' test as their significance. Partial regression co-efficient (b) represents the change in the dependent

variable as a unit change in the independent variable and it was tested with 't' test for its significance.

The various independent variables had their units of measurement which did not permit a comparison of the partial 'b' values. To facilitate the comparison, the partial 'b' values were converted into standard partial 'b' values which were free from the units of measurement. The independent variables were then ranked based on standard partial 'b' values to find out their relative importance in predicting the dependent variable.

Table 2: Step-wise regression analysis of the selected independent variables with management efficiency of cotton seed producer farmers (n=240)

Sr. No.	Independent variables	Partial regression coefficient (b)	Std. Error	Standardized partial regression coefficient (SPRC)	Rank
1	X_4	1.538	0.295	0.261	III
2	X_7	4.082	0.547	0.343	I
3	X_{10}	0.279	0.052	0.302	II
4	X_8	0.045	0.017	0.135	IV
5	X_9	-0.207	0.085	-0.111	VI
6	X_{12}	0.076	0.036	0.089	V

X_4 = Land holding, X_7 = Participation in training programme,
X_{10} = Economic motivation, X_8 = Extension contacts, X_9 = Mass media exposure,
X_{12} = Scientific orientation

From Table 2, it can be observed that out of fourteen independent variables, five variables have acquainting influence on management efficiency. All the independent variables together contributed 62.00% variation as indicated by the R^2 value.

According to standard partial 'b' values, ranks were assigned to variables. Thus, the first rank was assigned to participation in training programme (X_7) followed by economic motivation (X_{10}), land holding (X_4), extension contacts (X_8), scientific orientation (X_{12}) and mass media exposure (X_9) with Standard Partial Regression Coefficient (SPRC) 0.343, 0.302, 0.261, 0.135, 0.089 and -0.111.

Table 3: Step-wise variation accounted by selected independent variables in management efficiency of cotton seed producer farmers (n=240)

Model	Independent variables	Multiple "R"	Total variation accounted (R^2)	Variation between step
1.	X_4	0.599	0.358 (35.80%)	35.76
2.	$X_4 + X_7$	0.716	0.513 (51.30%)	15.48
3.	$X_4 + X_7 + X_{10}$	0.762	0.581 (58.10%)	6.76
4.	$X_4 + X_7 + X_{10} + X_8$	0.769	0.591 (59.10%)	1.00
5.	$X_4 + X_7 + X_{10} + X_8 + X_9$	0.776	0.602 (60.20%)	1.10
6.	$X_4 + X_7 + X_{10} + X_8 + X_9 + X_{12}$	0.781	0.609 (60.90%)	0.80
Total				60.90

X_4 = Land holding, X_7 = Participation in training programme,
X_{10} = Economic motivation, X_8 = Extension contacts, X_9 = Mass media exposure,
X_{12} = Scientific orientation

The data presented in Table 3 indicate that 35.80% variation was explained by land holding. Land holding along with participation in training programme explained 51.30% variation; land holding, participation in training programme and economic motivation accounted for 58.10% variation; land holding, participation in training programme, economic motivation and extension contacts accounted for 59.10% variation; land holding, participation in training programme, economic motivation, extension contacts and mass media exposure accounted for 60.20% variation. Whereas, land holding, participation in training programme, economic motivation, extension contacts, mass media exposure and scientific orientation accounted for 60.90% variation.

Conclusion

From the above data, it is concluded that fourteen indicators that 60.90% of the total variation was accounted by a set of six independent variables *viz*., land holding, participation in training programme, economic motivation, extension contacts, mass media exposure and scientific orientation put together in the management efficiency of the cotton seed producer farmers.

Conflict of interest

This is to declare that there is "No conflict of interest" among researchers.

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