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CONSTRAINTS AND STRATEGIC SUGGESTIONS FOR OVERCOMING BARRIERS IN THE ADOPTION OF PROBLEMATIC SOIL RECLAMATION PRACTICES

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ABSTRACT

Agriculture is vital to India's economy, with over 54.60 per cent of its rural population dependent on it. The Bhal region in Gujarat faces significant challenges due to problematic soils, worsened by the Narmada canal project. This study investigates the adoption dynamics of soil reclamation practices among farmers in this region. Using a sample of 160 farmers, the research employs step-wise regression analysis to evaluate the influence of various factors on the adoption of reclamation practices, identifying key constraints and offering actionable suggestions. Findings reveal that irrigation facilities, extension participation, scientific orientation, knowledge, and risk orientation positively impact adoption, while age, education, experience and other socio-economic factors do not. The analysis shows that a combination of knowledge, risk orientation and irrigation facilities explain 37.10 per cent of the variation in adoption. Key constraints include high input costs, lack of organic matter and inadequate knowledge of practices. Suggestions include improving input supply, timely information dissemination and effective irrigation management. This research aims to enhance agricultural productivity and farmer livelihoods through informed policies and sustainable practices.

Keywords: *adoption, soil reclamation practices, irrigation facility/status, step-wise regression*

INTRODUCTION

Agriculture remains a cornerstone of India's economy, employing over 54.60 per cent of its rural population and contributing significantly to national food security and economic stability. Despite its critical role, the sector faces numerous challenges, particularly concerning soil health. Soil degradation, manifested through issues such as salinity, alkalinity and acidity, undermines agricultural productivity and threatens livelihoods. The *Bhal* region of Gujarat, characterized by problematic soils exacerbated by projects like the Narmada canal, serves as a focal point for this study.

The Narmada canal project, while beneficial in many respects, has inadvertently contributed to soil problems in the *Bhal* region. This region's soil issues necessitate effective reclamation practices to restore soil fertility and improve agricultural outcomes. Understanding the dynamics of adoption for these reclamation practices is crucial for devising strategies to enhance productivity and sustainability in the region.

This research aims to explore the constraints and provide strategic suggestions for overcoming barriers in the adoption of problematic soil reclamation practices among farmers in the *Bhal* region. By employing step-wise regression analysis, the study seeks to identify and quantify the factors that hinder the adoption of these practices. By addressing the constraints and suggesting improvements, the study aims to contribute to the development of more effective and sustainable soil management practices. Ultimately, the research aspires to enhance the productivity and socio-economic well-being of farmers in the *Bhal* region.

OBJECTIVES

(1) To identify the constraints faced by the farmers in the adoption of problematic soil reclamation practices

(2) To seek the suggestions from the farmers to overcome various constraints faced in adoption of problematic soil reclamation practices

METHODOLOGY

The study was conducted in the *Bhal* region, focusing on the Ahmedabad and Botad districts due to their prevalent salt-affected soils. An *ex-post-facto* research design (Kerlinger, 1976) and multistage sampling technique

were employed. Three talukas from Ahmedabad (Dholka, Dhandhuka, Dholera) and one from Botad (Barvala) were purposively selected. From these talukas, sixteen villages were chosen and ten farmers from each village were randomly selected, resulting in a total sample size of 160 farmers. Data were collected through personal interviews using a specially designed interview schedule, initially prepared in English and then translated into Gujarati. The schedule was pre-tested with 20 non-sampled respondents and refined based on their feedback to ensure clarity and reliability. The tool development and validation were guided by scientists from Anand Agricultural University. Descriptive statistics summarized the data, providing a comprehensive overview of the farmer profile and constraints faced in adopting soil reclamation practices. Step-wise regression analysis was employed to identify and quantify the factors influencing the adoption of these practices. The study aimed to pinpoint key constraints and offer strategic suggestions for overcoming these barriers, facilitating more effective soil reclamation efforts in the *Bhal* region.

Regression Analysis

The multiple linear regression analysis was done to find out the relative contribution of the independent variables to the dependent variable.

In the stepwise method, the regression analysis was started with regression of y and $x_i \ldots x_k$ taken singly. The variate giving the highest accountability in sum of squares of y is first selected. The bivariate regression in which x_i appeared were worked out. The variable which gives the highest additional accountability in sum of squares in y after fitting x_i variable was selected. All the trivariate regression that includes both x_1 and x_2 were computed. The analysis was continued till the last variate of which additional contribution was the least of all variables.

The prediction equation used as:

$$y = a + b_1x_1 + b_2x_2 + b_3x_3 + \ldots \ldots + b_kx_k$$

Where,

y = Dependent variable

a = Intercept

$b_1 \ldots b_k$ = Partial regression co-efficient of respective independent variables.

$x_1 \ldots . \ldots . x_k$ = Independent variable

After the regression equation, the 'F' values for partial regression co-efficient were tested for their significance.

Standard Partial Regression Co-efficient

The various independent variables had their own unit of measurement which did not permit a comparison of the partial regression co-efficient (byi.j) value. To facilitate comparison, the partial regression co-efficient (byi.j) values which were converted in to standard partial regression co-efficient (b'yi.j) values which were free from the units of measurements.

In order to assign the rank to various selected independent variables, the standard partial regression co-efficient were used. It was calculated by using the following formula.

$$SPRC = byi.j \text{ X } \frac{\text{S.D. of independent variable}}{\text{S.D. of dependent variable}}$$

Where,

byi.j = Partial regression Co-efficient (byi.j)

A comparison of any two standard partial regressions Co-efficient indicates the relative importance of the independent variables involved in predicting the rational behaviour. The significance of the partial regression co-efficient was tested by "t" statistic.

RESULTS AND DISCUSSION

Relative importance of independent variables in explaining adoption of problematic soil reclamation practices

The relationship between dependent and independent variables was expressed using derived correlation coefficients ('r'). However, in the behavioural sciences, no dependent variable is influenced by a single independent variable alone. The adoption of problematic soil reclamation practices is influenced by multiple independent variables interacting and reciprocating with each other. To evaluate the influence (contribution) of each independent variable on the dependent variable, the effects of other variables were held constant. Stepwise regression, a widely used method in multiple regression analysis, offers the advantage of examining each variable's predictive value at every stage of the analysis. The results of the stepwise regression analysis are presented in Table 1.

From the Table 1, it can be observed that out of sixteen independent variables, three variables had a significant influence on the adoption of problematic soil reclamation practices. All the independent variables together explained 40.50 per cent of the variation, as indicated by the R^2 value. It can be inferred that 22.90 per cent of the variation in the adoption of problematic soil reclamation practices is contributed by the knowledge variable alone. However, when knowledge is combined with risk orientation, the explained variation increases to 35.40 per cent.

Table 1: Step-wise multiple regression analysis of adoption of problematic soil reclamation practices (n = 160)

Model	Independent Variables	Multiple correlation coefficient (R)	Coefficient of Determination (R^2)	Partial regression coefficient (b)	Std. Error	"t" value	Standard Partial Regression Coefficient (SPRC)	Adjusted R^2	Rank
1	Knowledge	0.479	0.229	0.364	0.053	6.855**	0.479	0.338	1st
2	Knowledge + Risk orientation	0.595	0.354	0.348 0.238	0.049 0.043	7.142** 5.499**	0.459 0.353		2nd
3	Knowledge + Risk orientation + Irrigation facility	0.609	0.371	0.347 0.227 0.321	0.048 0.043 0.156	7.193** 5.269** 2.066*	0.458 0.338 0.132		3rd

Furthermore, the combination of knowledge, risk orientation and irrigation facility accounts for 37.10 per cent of the variation in adoption of problematic soil reclamation practices. The R^2 values at each stage of the stepwise regression were found to be significant.

Constraints faced by the farmers in the adoption of problematic soil reclamation practices

(A) Economic constraints

Table 2: Economic constraints faced by the farmers in the adoption of problematic soil reclamation practices

(n = 160)

Sr. No.	Economic constraints	Mean score	Rank
1	Cost intensive reclamation technology	01.90	7th
2	High cost and non-availability of organic matter	02.62	2nd
3	High cost of inputs	02.72	1st
4	Poor financial position	02.37	3rd
5	High cost for farm pond construction	01.96	6th
6	Non-availability of assured market for the agriculture produces	02.11	5th
7	High cost of land levelling implements	02.14	4th

The Table 2 shows that the main economic problems faced by farmers in adopting problematic soil reclamation practices were; high cost of inputs (2.72 mean), followed by high cost and non-availability of organic matter (2.62 mean), poor financial position (2.37 mean), high cost of land levelling implements (2.14 mean), non-availability of assured market for the agriculture produces (2.11 mean), high cost for farm pond construction (1.96 mean) and cost intensive reclamation technology (1.90 mean), respectively. These findings are in line with Ansari *et al.* (2023) and Desai *et al.* (2023).

(B) Technological constraints

The Table 3 highlights the primary technological problems encountered by farmers in adopting problematic soil reclamation practices, which were; lack of knowledge about irrigation and drainage management practices (2.64 mean), lack of knowledge about agronomic practices for problematic soil reclamation (2.53 mean), lack of knowledge about integrated water management system (2.23 mean), lack of training about reclamation of problematic soils (2.13 mean), transfer of half-baked technology (2.09 mean), lack of knowledge about alternate land use system, scraping, leaching etc. (2.08 mean) and lack of knowledge about salt tolerant/resistant crops/varieties (1.81 mean), respectively.

The finding was in accordance with the findings of research conducted by Natwadia *et al.* (2023).

Table 3: Technological constraints faced by the farmers in the adoption of problematic soil reclamation practices

(n = 160)

Sr. No.	Technological constraints	Mean score	Rank
1	Transfer of half-baked technology	02.09	5th
2	Lack of knowledge about irrigation and drainage management practices	02.64	1st
3	Lack of knowledge about agronomic practices for problematic soil reclamation	02.53	2nd
4	Lack of training about reclamation of problematic soils	02.13	4th
5	Lack of knowledge about salt tolerant/resistant crops/varieties	01.81	7th
6	Lack of knowledge about alternate land use system, scraping, leaching *etc*.	02.08	6th
7	Lack of knowledge about integrated water management system	02.23	3rd

(C) Administrative constraints

Table 4: Administrative constraints faced by the farmers in the adoption of problematic soil reclamation practices

(n = 160)

Sr. No.	Administrative constraints	Mean score	Rank
1	Limited availability of problematic soil reclaiming amendments	02.18	5th
2	Lack of credit facility for soil reclamation	02.54	1st
3	Lack of soil testing facility	02.49	2nd
4	Insufficient irrigation water supply	02.39	3rd
5	Non availability of extension literature on soil management practices	02.19	4th
6	Lack of training for adoption of salinity management practices	02.05	6th

The Table 4 outlines the key administrative constraints faced by farmers in adopting problematic soil reclamation practices, which included; lack of credit facility for soil reclamation (2.54 mean), lack of soil testing facility (2.49 mean), insufficient irrigation water supply (2.39 mean), non-availability of extension literature on soil management practices (2.19 mean), limited availability of problematic soil reclaiming amendments (2.18 mean) and lack of training for adoption of salinity management practices (2.05 mean), respectively.

(D) Personal and socio-psychological constraints

Table 5: Personal and socio-psychological constraints faced by the farmers in the adoption of problematic soil reclamation practices

(n = 160)

Sr. No.	Personal and socio-psychological constraints	Mean score	Rank
1	Low level of literacy	02.16	5th
2	Lack of people participation	02.59	2nd
3	Lack of awareness regarding green manuring crops	02.61	1st
4	Lack of risk bearing capacity	02.46	3rd
5	Fragmentation of land into unconventional shape and size	02.19	4th

The Table 5 outlines the key personal and socio-psychological constraints faced by farmers in adopting problematic soil reclamation practices, which were; lack of awareness regarding green manuring crops (2.61 mean), lack of people participation (2.59 mean), lack of risk bearing capacity (2.46 mean), fragmentation of land into unconventional shape and size (2.19 mean) and low level of literacy (2.16 mean), respectively.

The present findings are supported with Chavai *et al.* (2012), Singh *et al.* (2013) and Yarazari (2022).

Suggestions from the farmers to overcome various constraints faced in adoption of problematic soil reclamation practices

Table 6: Suggestions from the farmers to overcome various constraints faced by the farmers in the adoption of problematic soil reclamation practices (n = 160)

Sr. No.	Suggestions	Mean score	Rank
1	People's participation should be increased	02.25	5th
2	Provide timely and proper information about irrigation and drainage management practices	02.38	3rd
3	Provide timely information about improved agronomic practices for problematic soil reclamation practices	02.47	2nd
4	Adequate supply of inputs for maintenance of problematic soil	02.49	1st
5	Financial assistance with low rate of interest should be provided for the management of problematic soil	02.31	4th

The results displayed in Table 6 indicate that the major suggestions provided by the farmers, ranked in descending order of importance, were: adequate supply of inputs for maintenance of problematic soil (mean score 2.49), followed by the need to provide timely information about improved agronomic practices for problematic soil reclamation practices (mean score 2.47), provide timely and proper information about irrigation and drainage management practices (mean score 2.38), financial assistance with low rate of interest should be provided for the management of problematic soil (mean score 2.31) and people participation should be increased (mean score 2.25), respectively. The present findings are supported with Yarazari *et al.* (2019) and Huang *et al.* (2020).

CONCLUSION

The combined influence of knowledge, risk orientation and irrigation facility explain 37.10 per cent of the variation in the adoption of problematic soil reclamation practices and all the independent variables together had contributed 40.50 per cent variation. The R^2 values at each stage of the stepwise regression were found to be significant.

Major constraints faced by farmers in adopting problematic soil reclamation practices include high input costs for technologies and high cost and non-availability of organic matter as economic constraint, lack of knowledge about irrigation and drainage management practices and lack of knowledge about agronomic practices for problematic soil reclamation as technological constraint, lack of credit facility for soil reclamation and lack of soil testing facility as administrative constraint and lack of awareness regarding green manuring crop and lack of people's participation as personal and socio-psychological constraint.

Key suggestions to overcome constraints in soil reclamation practices given by the farmers were adequate supply of input for maintenance of problematic soil, provide timely information about improved agronomic practices for problematic soil reclamation and provide timely and proper information about irrigation and drainage management practices.

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CONFLICT OF INTEREST

All authors declare that they have no conflict of interest

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