Determinants of Awareness of Rythu Bharosa Kendra's (RBK's) Programmes in Andhra Pradesh, India

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

Original Research Article

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ABSTRACT

Aim: The present study was taken up to understand the determinants of awareness about government intervention programme (RBK) in Andhra Pradesh

Study design: To represent the whole study area**,** multi-stage random sampling was used. In total, 400 respondents were selected from 4 regions consisting of 100 respondents from each region.

Place and duration of study: The present study was based on primary data collected from the year 2021-22 in Andhra Pradesh

Methodology: Binary logistic regression was applied using R software to study the awareness of determinants. Were level of awareness (0 or 1) was regressed against Gender, Age, Literacy Status, Operational Holding, Occupation and Extention Contact.

Results: The analysis revealed that the majority of respondents are male (87.75%), of middle age (65.5%), had primary (23%) and secondary education (23%), have marginal (39.5%), small (40.5%) operational holdings, having occupations in agriculture (29.5%) and combined with animal husbandry (35.75%). They had full awareness about agricultural extension, Rythu Bharosa, e-crop booking, and crop insurance. Nearly complete awareness for quality inputs and interest subsidy. Lower awareness is noted for custom hiring centers (78.5 %), agriculture advisory board (64.25%), veterinary services (56%), digital library (48.75%), WhatsApp advisory (49.75%), milk collection (18%), soil testing (15.5%), and seed germination testing (13%). The logistic regression analysis revealed that the explanatory variables like gender, literacy status, operational land holding, occupation and extension contact were the major determinants of awareness among the farmers. A unit increase in these variables favors positively the odds ratio of a farmers regarding RBK services at Andhra Pradesh.

Conclusion: The analysis reveals significant insights into the socio-economic profile and awareness of Rythu Bharosa Kendras (RBKs) schemes among farmers. A gender disparity highlights the need for targeted support for female farmers. Varied education levels and notable illiteracy indicate the necessity for tailored educational outreach. Enhanced extension services and focused support for small and marginal farmers can improve scheme uptake. Awareness of certain valuable services is low, necessitating targeted campaigns. Effective communication strategies and regular monitoring are crucial for better information dissemination and program refinement, ensuring inclusive and impactful support for the farming community.

1. INTRODUCTION

In India, Andhra Pradesh was a major agrarian state, with around 62.17 per cent of the working population dependent on agriculture and allied sectors. Andhra Pradesh has 55.36 lakh hectares under cultivation (34.01%); Agriculture and allied sectors contributed 34.14% to the state's Gross Value Added (GVA) in 2023-24, with agriculture alone contributing 13.67% [1].

Agricultural extension services have been shown to build farmers' agricultural knowledge and skills, disseminate new technology, and change farmers' attitudes [2,3,4,5,6]. It also promotes community development through human and social capital development, facilitate access to markets, and work with farmers towards sustainable natural resource management [7]. In numerous countries, extension services are an example of a formal institution that plays a vital role in supporting small-scale agriculture and ensuring both national and household food security [8].

To address the agriculture and rural development area, the Andhra Pradesh state government introduced the concept of Rythu Bharosa Kendra a new age extention system, known as Farmer Assurance Centres in English translate [9], which aims to provide comprehensive assistance to farmers at the village level, where in old system, farmers need to visit mandal-level office for availing any agricultural scheme. Each RBK has one village-level assistant known as Village agriculture or horticulture sericulture assistance (VAA/ VHA/VSA) [10]. In addition, RBK has Veterinary/fishery assistants (VVA/ VFA) delivering the service last mile to the farming community at the village level. RBKs serve as a one-stop destination for farmers [11], offering a wide range of services from seed to crop procurement it includes, including agricultural

extension, Rythu Bharosa, e-crop booking, crop insurance, crop procurement, supply of quality inputs, Custom Hiring Centres (CHC), Agriculture Advisory Board (AAB), farmers' fields schools (FFS), Crop Cultivator Rights Cards (CCRC), Veterinary Services, digital library, farm magazine, WhatsApp advisory, milk collection, soil testing, crop price and weather forecast, moisture testing, seed germination testing and Interest Subsidy [12]. Awareness was an important factor for participation; through participation, public policy achieved the desired result of increasing farming community welfare. Hence, the research paper aimed to understand the awareness level and determine factors for awareness of the RBK programme.

2. METHODOLOGY

2.1 Sample Selection

A multistage random sampling design was adopted to select the sample. The concept of RBK is present only in Andhra Pradesh. Hence, Andhra Pradesh was purposively selected for the present study. Then, to represent all the socio-economic conditions, agro-climatic conditions and cropping patterns, the state was divided into four regions, namely the North Coastal Region, Central Coastal Region, Southern Coastal Region and Rayalaseema Region; in each region, one district was selected randomly; Visakhapatnam district is from the North Coastal region, West Godavari district is from the Central Coastal Region, Guntur district is from the South Coastal Region, and Anantapur is from the Rayalaseema region. In total, four districts were selected. One mandal was selected randomly from each district. Anakapalle mandal is from the Visakhapatnam district, Bhimavaram mandal district is from the West Godavari, Bollapalli mandal is from the Guntur district and Dharmavaram mandal is from the Anantapur district. Four mandals were selected. Ten RBKs from each Mandal were selected randomly. A total of forty RBKs were selected. Ten farmers from each RBK were selected randomly, making 400 farmers respondents.

2.2 Analytical Tools

2.2.1 Binary Logistic Regression Analysis

The Binary Logistic Model was used to evaluate the factors affecting the awareness level of the sampled farmers [13]. The average awareness of agriculture schemes is calculated, and farmers with less than 50 per cent of the average awareness about agriculture schemes are considered just aware, while others are well aware. This Logit Model regressed the "just aware" and "well-aware" of RBK schemes were regressed against the explanatory variables. The dependent variables' value is 1 for the well-aware and 0 for the just aware. The logistic regression constrains the probability value between 0 and 1 [14]. The results of binary logit regression were analysed using R software.
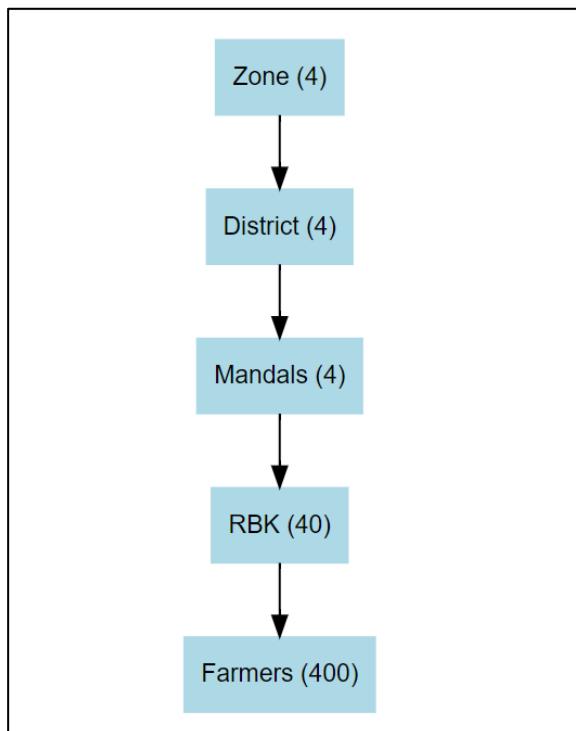

Fig. 1. Sampling plan

The Binary logit model specification is as follows:

$$Logit(P_i) = \ln\left(\frac{P_i}{1 - P_i}\right) = \beta_0 + \sum_{i=1}^{n} \beta_1 X_{ij}$$

$$In\ Logistic\ Distribution\ Function, P_i = \frac{1}{1 + e^{-(\beta_0 + \sum P_i X_i)}}$$

The probability $P_i = \dfrac{1}{1 + e^{(-zi)}} = \dfrac{e^{zi}}{1 + e^{zi}}$ if $Z_i + \beta_0 + \sum \beta_i X_i$

and $(1 - P_i) = 1 - \dfrac{1}{1 + e^{(-zi)}} = \dfrac{1}{1 + e^{zi}}$

Where:

P_i = Probability of the ith farmers well aware of RBK schemes
1; (P_i =1) Log-odds ratio in favor to Well Aware (P_i=1): >1/2 of total scheme awareness
0; ($1-P_i$ = 0) Aware: <=1/2 of total scheme awareness
Ln = [$P_i/1-P_i$] = natural log of odd ratio
B_0 = intercept or constant term
β_1 = vector of response coefficient
X_i = set of explanatory Variables or independent Variables

Depending upon the explanatory variables included, the logit model was postulated as

$$Ln = P_i/1 - P_i = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \cdots + \beta_6 X_6 + e_i$$
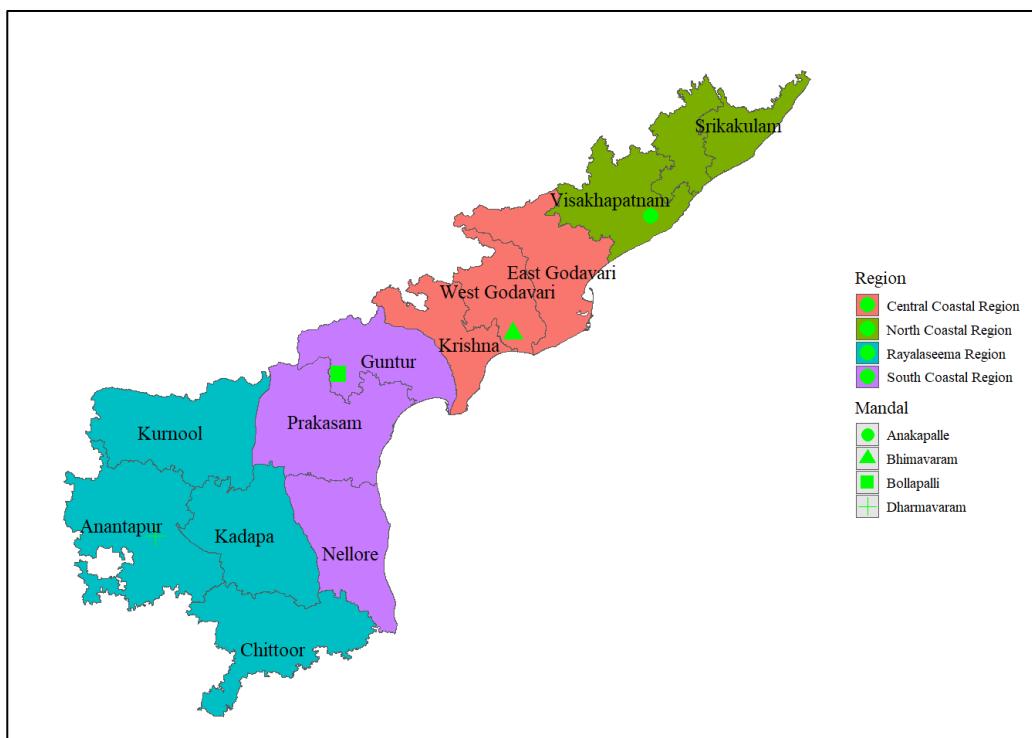
Fig. 2. Map of Andhra Pradesh with Selected Study Area

Table 1. Description of variables used in the binary logit regression model

Coding	Variable Category	Variable
Y	**Levels of Awareness**	1. Just Aware (< 50% awareness of All RBK Schemes = 0)
		2. Well Aware (≥ 50% awareness of All RBK Schemes = 1)
X_1	**Gender**	1. Female*, 2. Male
X_2	**Age**	1. Young age (up to 34) *, 2. Middle age (35 to 55) and
		3. Old age (more than 55) [15]
X_3	**Literacy Status**	1. Illiterate*, 2. Primary Education, 3. Secondary Education,

Coding	Variable Category	Variable
		4. Higher Secondary Education, and 5. Collegiate.
X_4	**Operational Holding**	1. Marginal Farmer (up to 1 ha) *, 2. Small Farmer (1 to 2 ha), 3. Medium Farmer (2 to 4 ha) and 4. Large Farmer (More than 4 ha)
X_5	**Occupation**	1. Agriculture*, 2. Agril + Animal Husbandry, 3. Agril + Business, 4. Agril + Job and 5. Agril + labour [16]
X_6	**Extention Contact**	1. Low*, 2. Medium and 3. High. [17]

* Reference Category

2.2.1.1 Goodness of fit of the model

Among different tests, the Hosmer and Lemeshow test [18] and the Omnibus test of model coefficients have been used to evaluate the binary logistic regression model's goodness of fit. These tests are frequently used to evaluate the model's fit quality and accept any number of independent variables. The Omnibus test of model coefficients shows a good fit if the model is significant; however, the Hosmer - Lemeshow statistic indicates a poor fit if the significance value is less than 0.05.

2.2.1.2 R^2 – statistics

In a binary logistic regression model, the variation of the dependent variable owing to variation in the independent variables has been presented by the coefficient of determination based on likelihood, an approach pioneered by Nagelkerke. The Nagelkerke R^2 has also been calculated and published in this study. Nagelkerke R^2 value ranges from 0 to 1. Values closer to 1 tend to explain the model's goodness of fit [19].

3. RESULTS AND DISCUSSION

3.1 Socio-economic Profile of Sample Respondents

Table 2 presents the socio-economic profile of the sample respondents, detailing various characteristics such as gender, age, literacy status, operational land holding, and occupation. The gender distribution shows a significant majority of male respondents (88.75 %), with females comprising only 11.25 per cent. Age-wise, the middle-aged group (35 to 55 years) years) at 28.5 per cent, and the young age group

Table 2. Socio-economic Profile characteristics of the sample respondents (n = 400)

Socio-Economic Variables	Particulars	Frequency	Percentage
Gender	Male	355	88.75
	Female	45	11.25
Age Group	Young age (up to 34)	24	6
	Middle Age (35 to 55)	262	65.5
	Old age (more than 55)	114	28.5
Literacy Status	Illiterate	52	13
	Primary Education	92	23
	Secondary Education	92	23
	Higher Secondary Education	108	27
	Collegiate	56	14
Operational Land Holding	Marginal Farmer (up to 1ha)	158	39.5
	Small Farmer (1 to 2 ha)	162	40.5
	Medium Farmer (2 to 4 ha)	56	14
	Large Farmer (More than 4 ha)	24	6
Occupation	Agriculture	118	29.5
	Agri + Animal Husbandry	143	35.75
	Agri+ labour	83	20.75
	Agri + Job	35	8.75
	Agri + Business	21	5.25

Source: Primary data

(up to 34 years) at 6 per cent. In terms of educational attainment, a varied range is observed: 27 per cent have higher secondary education, followed by 23 per cent each have primary and secondary education, 14 per cent have collegiate-level education and 13 per cent of respondents are illiterate.

Regarding land holdings, the majority are either marginal (up to 1 ha) or small farmers (1 to 2 ha), accounting for 39.5 per cent and 40.5 per cent of respondents, respectively. Medium farmers (2 to 4 ha) make up 14 per cent, while large farmers (more than 4 ha) constitute 6 per cent. The occupational profile indicates that 29.5 per cent of respondents are solely engaged in agriculture. A significant number diversify their activities: 35.75 per cent combine agriculture with animal husbandry, 20.75 per cent with labour, 8.75 per cent with jobs, and 5.25 per cent with business ventures. This comprehensive socio-economic profile sourced from primary data offers an overview of the demographic and occupational characteristics of the respondents, highlighting the diversity in education levels, land ownership, and income-generating activities within the farming community.

Fig. 3 presents information on farmers' awareness of Rythu Bharosa Kendras (RBKs) schemes, revealing a broad spectrum of understanding and familiarity among the surveyed farmers, highlighting both strengths and gaps in knowledge dissemination. With a total sample size of 400 farmers, the data shows full awareness (100 per cent) of fundamental schemes such as Agricultural extension, Rythu Bharosa [20,9], e-Crop booking, and Crop insurance [21,9]. This high level of awareness can be attributed to the essential nature of these services, which directly impact the farmers' daily operations and financial security. Were the Rythu Bharosa scheme to give financial assistance of rupees 13500/ year for a farm family, e-crop booking is an essential scheme linked to other schemes like crop insurance, crop procurement [9], and input subsidy. In the crop insurance scheme, the premium was fully subsidised and paid by the government on behalf of farmers. The widespread knowledge of these schemes suggests effective communication and outreach efforts by RBKs, ensuring that farmers are well-informed about critical agricultural support mechanisms. Additionally, schemes like the Supply of quality inputs and interest subsidy also show nearly complete awareness (99% and 98%, respectively), indicating that RBKs have successfully conveyed the benefits and availability of these programs, which are crucial for maintaining the quality of agricultural production and reducing financial burdens.

However, the table also highlights significant areas where farmer awareness is notably lower, pointing to potential areas for improvement in RBKs' outreach strategies. For instance, while 89.5 per cent of farmers are aware of Crop procurement, a substantial drop is observed in the awareness of Custom hiring centres (78.5 %) [22, 9] and Agriculture Advisory Board services (64.25 %). These figs. suggest that while most farmers are informed about essential procurement processes, many may need more information about services that could enhance their agricultural productivity and decision-making capabilities. More strikingly, awareness plummets for schemes such as Veterinary Services (56 %), Digital Library (48.75 %) [22], and WhatsApp Advisory (49.75 %), indicating that these resources, despite their potential benefits, are not reaching nearly half of the farming population surveyed. This trend continues with even lower awareness levels for schemes like Milk Collection (18 %), Soil Testing (15.5 %), and Seed Germination Testing (13 %), which could be crucial for improving agricultural efficiency and productivity.

3.2 Determinants of Awareness of Rythu Bharosa Kendra's (RBK's) Programs

Based on the 50 per cent awareness level about the RBK scheme, respondents are classified into two groups, namely "Just Aware" (< 50 %) and "Well Aware" (≥ 50%). Table 3 indicates that a significant majority of the farmers (78.75%) are classified as "Well Aware," while a smaller portion (21.25%) are classified as "Just Aware."

The Omnibus Tests of Model Coefficients Table 4 indicates a highly significant improvement of the full model over the null model (p < 2.2e-16), suggesting that the predictors in the full model contribute meaningfully to explaining the variance in the outcome. The substantial decrease in residual deviance from 413.8 (null) to 218.78 (full) with 16 degrees of freedom supports this improvement. Overall, the full model fits the data significantly better than the null model. Hosmer and Lemeshow Test were used to test the model's goodness of fit [18], as presented in Table 5. The p-value of .006 (<0.05) indicates that the theoretical model fits the data [23].

Table 6 provides the results of the logistic analysis. The value of Nagelkerke R Squwere [19] was 0.598, depicting that the model was a good fit, explaining about 59.8 per cent of the variability in the dependent variable, i.e., the awareness status of the farmers. The pseudo-R Squwere values suggest that the independent variable could impact the dependent variable from 47.1 per cent to 38.5 per cent. Gender, higher secondary and collegiate education under literacy status, small farmer under land holding, occupation and extension contact increased the odds ratio of good awareness among the farmers.
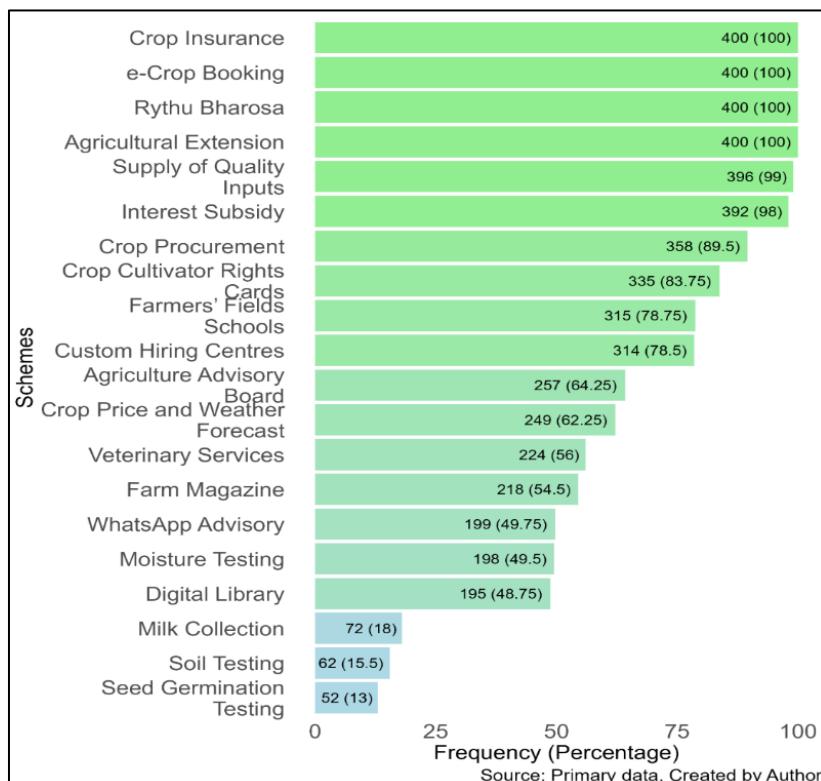

Fig. 3. Farmers' Awareness of Rythu Bharosa Kendras (RBKs) Schemes (n=400)

Table 3. Classification sample Farmers based on level of Awareness

Levels	Frequency	Percentage
Just Aware	85	21.25
Well Aware	315	78.75
Total	400	100

The cut value is 50 per cent of average awareness, **Source: Primary data.**

Table 4. Omnibus Tests of Model Coefficients

Model	Residual Degrees of Freedom	Residual Deviance	Degrees of Freedom	Deviance	Pr(>Chi)
Null Model	399	413.8	16	195.02	< 2.2e-16 ***
Full Model	383	218.78			

*** *1 % LOS   R output*

Table 5. Hosmer and Lemeshow test

Step	X-squared	df	Sig. (p-value)
1	14.88	8	0.006

Source: Primary data - R Output

Table 6. Determinants of awareness of Rythu Bharosa Kendra (RBK)

Variable Category	Variable	log (Odds Ratio)	95% Confidence Interval	p-value
Gender	Female	—	—	
	Male	3	1.9, 4.2	<0.001***
Age Group	Young age (up to 34)	—	—	
	Middle age (35 to 55)	1.1	-0.34, 2.4	0.12(NS)
	Old age (more than 55)	0.01	-1.6, 1.5	>0.9(NS)
Literacy Status	Illiterate	—	—	
	Primary Education	-0.21	-1.3, 0.87	0.7(NS)
	Secondary Education	0.74	-0.38, 1.9	0.2(NS)
	Higher Secondary Education	2.7	1.4, 4.2	<0.001***
	Collegiate	1.8	0.34, 3.4	0.021**
Operational Land Holding	Marginal Farmer (up to 1ha)	—	—	
	Small Farmer (1 to 2 ha)	1.9	1.0, 2.8	<0.001***
	Medium Farmer (2 to 4 ha)	0.36	-0.64, 1.4	0.5(NS)
	Large Farmer (More than 4 ha)	0.69	-0.86, 2.5	0.4 (NS)
Occupation	Agriculture	—	—	
	Agri + Animal Husbandry	1.5	0.49, 2.6	0.005**
	Agri + labour	-1.2	-2.2, -0.21	0.018**
	Agri + Job	-1.1	-2.2, -0.02	0.048**
	Agri + Business	-2.4	-4.1, -0.86	0.003**
Extension Contact	Low	—	—	
	Medium	0.85	-0.07, 1.8	0.072*
	High	3.6	2.3, 5.2	<0.001***
-2 Likelihood ratio		283.24		
Cox and Snell R square value		0.385		
Nagelkerke R square value		0.598		

*NS - Not Significant, *** 1 % LOS, ** 5 % LOS, *10% LOS, Source: Primary data - R Output*

Gender had a positive impact on farmers' awareness [24]. The possibilities or odds of a well-aware category increased by a factor of 3 of male farmers compared to female farmers as a reference, which was statistically significant at a 1 per cent level and reflected the dominant position of male farmers in agriculture. In the age group category, young age was taken as a reference. Old-age farmers had a positive impact on the awareness status of the farmers. The odds for the well-aware category were increased by a factor of 0.01 for old-age farmers and increased by 1.1 for middle-aged farmers compared to young age as a reference, but they were statically insignificant. In terms of literacy status, illiteracy was taken as a reference category. Literacy status had a significant impact on farmers' awareness. The possibilities or odds of a well-aware category decreased by 0.21 for farmers with primary educational qualifications. They increased by a factor of 2.7 and 1.8 for farmers who completed higher secondary education and collegiate education, respectively, compared to the reference category, which was also statistically significant at 1 per cent and 5 per cent. The land-holding category had significance on the well-awareness status of the farmers [25]. The odds of a well-aware category increased by a factor of 1.9, 0.36 and .69 for small, medium and large farmers compared to reference as marginal farmers are also statically significant at a one per cent level for small farmers [24]. It shows the dependency of marginal and small farmers towards the RBK system.

In the category of occupation, Agriculture was taken as the reference category. The possibilities or odds to the well-aware category decreased by a factor of 1.2, 1.1, and 2.4 for farmers doing Agriculture + labour, Agriculture + Job and Agriculture + Business, but possibilities or odds to the well-aware category increased by a factor of 1.5 for farmers doing Agriculture + Animal Husbandry and compared to the reference category. All occupations were statistically significant at 5 per cent. In the category of extension contact, the low-level extension contact category was taken as the reference category. A medium and High extension contact positively impacted the farmers' awareness status and was statistically significant at 10 per cent and 1 per cent. The possibilities or odds to well the category increased by a factor of 0.85, and 3.6 of the farmers had medium and high levels of extension contact compared to low levels of social participation as a reference;

extension contacts significantly influence awareness [23, 26, 27] emphasis the importance of extension contact.

4. SUMMARY AND CONCLUSIONS

The analysis of the socio-economic profile of the respondents highlighted that 88.75 per cent of respondents are male. The age distribution shows 65.5 per cent are 35-55 years old, 28.5 per cent are over 55, and 6 per cent are under 34. Education levels vary: 27 per cent have higher secondary education, 23 per cent each have primary and secondary education, 14 per cent have collegiate education, and 13 per cent are illiterate. Regarding land holdings, 39.5 per cent are marginal farmers, 40.5 per cent are small farmers, 14 per cent are medium farmers, and 6 per cent are large farmers. Occupationally, 29.5 per cent are solely in agriculture, while others combine it with animal husbandry, labour, jobs, or business. Percentage analysis reveals varied awareness among 400 farmers about Rythu Bharosa Kendras (RBKs) schemes. Full awareness (100%) is seen for Agricultural extension, Rythu Bharosa, e-crop booking, and Crop insurance reflecting effective communication by RBKs. Nearly complete awareness exists for Quality inputs (99%) and Interest subsidy (98%). However, lower awareness is noted for Custom hiring centres (78.5%), Agriculture Advisory Board services (64.25%), Veterinary Services (56%), Digital Library (48.75%), WhatsApp Advisory (49.75%), Milk Collection (18%), Soil Testing (15.5%), and Seed Germination Testing (13%). The logistic regression analysis revealed that explanatory variables like gender, literacy status, operational land holding, occupation and extension contact were the major determinants of awareness among the farmers. A unit increase in these variables positively favors the odds ratio of Farmers regarding RBK services.

5. POLICY IMPLICATIONS

- The data indicates a significant gender disparity, with only 11.25 per cent of respondents being female. Targeted initiatives are needed to increase female farmer participation, ensuring equal awareness and benefits from RBKs.
- Tailored educational programs and awareness campaigns using visual aids and local languages, more hospitality, and participating kits can significantly improve understanding and utilization of RBK services among illiterate farmers.

- Expanding extension services with regular, high-quality interactions and better training for extension officers can boost awareness. Policies should focus on marginal and small farmers, providing tailored support, subsidies, and prioritized awareness campaigns. Recognizing and supporting farmers with mixed occupations through integrated services and training can enhance their economic stability.
- Low awareness of certain schemes like Veterinary Services and Digital Library suggests the need for targeted campaigns using various media and community collaborations. Modern communication tools such as mobile apps and SMS alerts can improve information dissemination.
- Regular monitoring and evaluation mechanisms will help assess campaign effectiveness and refine strategies, ensuring a more inclusive and effective RBK program that meets the diverse needs of the farming community.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc) and text-to-image generators have been used during writing or editing of manuscripts.

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