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Determinants of Marketing Channel Choices among Paddy Farmers in Andhra Pradesh, India: Insights into Electronic Negotiable Warehouse Receipts (e-NWRs)

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

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ABSTRACT

Warehouses are specialized storage facilities designed for scientific preservation, while receipt systems integrate credit with marketing to enhance marketing efficiency. Warehousing in India gained importance with the 1928 Royal Commission on Agriculture. Despite various interventions from the government, farmers struggle to access remunerative prices due to their reliance on traditional marketing channels. Understanding the key factors influencing farmers' choice between traditional and warehouse-based marketing is crucial for designing effective policies that enhance market participation. Electronic Negotiable Warehouse Receipts (e-NWRs) play a crucial role in improving market access and financial security for farmers. This study examined the factors affecting marketing channel choices among paddy farmers in Andhra Pradesh. A multistage sampling technique was used to select 240 farmers from Guntur and Krishna districts, including both e-NWR adopters and non-adopters. Logistic regression analysis was employed to determine key factors affecting the adoption of e-NWR. The results revealed that the education level of farmers, farm size, access to market information, and access to training significantly influenced warehouse market channel choice. Conversely, the age of the farmer and the distance to warehouses had a negative influence on the adoption of e-NWR. The findings emphasized the need for improved infrastructure, financial literacy, improved access to market information & training and awareness programs to promote e-NWR adoption and enhance farmers' market engagement. The study concluded that education, farm size, income, market information, and training encouraged adoption, while age and distance to warehouses posed challenges. Farmers with higher levels of education, larger farm sizes, and better access to market information and training were more likely to participate in warehouse-based markets. It was recommended that warehouse management should strengthen the market information systems and develop government-backed digital platforms to provide real-time price updates and establish training programs to enhance farmers' market awareness. Improving farm-to-market infrastructure and accessibility and promoting decentralized mini-warehouses closer to farming communities to enhance the adoption of e-NWR.

Keywords: Andhra Pradesh; e-NWR; marketing channel; paddy farmers; logistic regression.

1. INTRODUCTION

Developments in agricultural production technologies, improvements in the means of transport and storage facilities and marketing infrastructure have also transformed agriculture into a commercial activity (Khan et al., 2021). However, these developments have also led to the entry of a large number of intermediaries resulting in non-remunerative prices to the farmers even though the price of commodities has been going up over the years. Farmers have fully realised that more than increasing production, it is important to ensure better markets for their produce (Ma et al., 2024; Mapunda et al., 2019). Recognizing that securing better markets is as crucial as increasing production, the Indian Government has implemented policies to enhance the agricultural marketing system, addressing components such as aggregation, grading, storage, transportation, distribution, processing, and value addition (Baskar & Shalendra, 2022).

Providing credit to farmers remains a challenge, further aggravated by the lack of suitable assets for collateral (Shalendra et al., 2016). The

financial commitments made by the farmers during the production period and low prices at the time of harvesting made them resort to distress sales (Rao et al., 2020). To mitigate this, the government has linked credit with marketing by establishing warehouse receipts (Ramaulu et al., 2014). This initiative allows farmers to clear their loans and sell their produce at more remunerative prices (Kumar et al., 2021).

Warehousing in India gained importance with the 1928 Royal Commission on Agriculture. The 1956 Act established a three-tier system. The WDRA, set up in 2010 under the 2007 Act, introduced Negotiable Warehouse Receipts (NWRs) to enhance agricultural credit. The main objective of the WDRA is to implement the NWR system in India so as to encourage farmers not to sell their produce immediately after harvest when prices tend to be the lowest in the year and can seek pledge loans from banks (Sharon & Kumar, 2023). However, adoption was slow due to paperwork, security risks, and inaccuracy, limiting farmers' access to finance, and losses due to theft and pilfering. To address this, electronic NWRs (e-NWRs) were introduced on

September 26, 2017, and made mandatory for WDRA-registered warehouses from August 1, 2019. There has been a decline in the growth of e-NWR issued from 2019 (134939) to 2021 (88480) and facing problems like poor awareness and complicated procedures. So, there is a need to strengthen the e-NWR mechanism (Sharon & Kumar, 2023).

Despite these interventions, farmers still struggle to access remunerative prices due to their reliance on traditional marketing channels. Many are unable to participate in warehouse-based marketing and adopt e-NWRs due to factors such as limited awareness and understanding, inadequate infrastructure, technological challenges and limited financial literacy (Nabirasool & Gopal, 2020). Understanding the key factors influencing farmers' choice between traditional and warehouse-based marketing is crucial for designing effective policies that enhance market participation. In view of this, it is proposed to conduct the study with an objective to determine the factors influencing marketing channel choices across e-NWR and e-NWR non-adopter paddy farmers in Andhra Pradesh.

2. MATERIALS AND METHODS

A multistage sampling technique was used for the selection of states, districts, warehouses and respondents. Andhra Pradesh state was purposively selected as it stands in 6th position in India with a total of 151 WDRA registered warehouses including private warehouses (WDRA, 2023). In Andhra Pradesh, Guntur and Krishna districts which issued the highest number of e-NWRs for paddy *i.e.* 628 and 531, respectively including APSWC, CWC and private warehouses were selected. Paddy is one of the major crops in Guntur and Krishna districts with an area of 2.54 lakh ha and 2.68 lakh ha, respectively (des.gov.in. 2022-23).

From each district of Andhra Pradesh, 40 farmers who availed loans from banks by pledging e-NWR as security were selected, constituting a total of 80 farmers. Apart from that, 160 farmers who did not store their produce in the warehouse to get e-NWR were randomly selected from the study area, thus constituting the total sample of 240 farmers. These farmers were surveyed to collect the necessary information related to the objective of the present study.

2.1 Data Collection

The data pertaining to the study were obtained through survey method and enquiries were made with the help of pre-tested structured questionnaires, commercial and cooperative banks and warehouse reports. The present study pertains to the agricultural year 2022-23.

A binary logistic regression model based on the cumulative logistic probability function which is computationally easier to use than the probit models was used in this study (Pindyck & Rubinfeld, 1981). It was used to determine the factors that influence marketing channel choices for paddy between adopters & non-adopters of e-NWR farmers. It gives the maximum likelihood estimates, overcomes most of the problems associated with linear probability models and provides estimators that are asymptotically consistent, efficient and Gaussian. The cumulative logistic probability model is specified as:

$$\text{Ln} (P_i/(1 - P_i)) = \beta_0 + \beta_1 X_1 + \dots + \beta_n X_n + e_i.$$

Where,

P_i = Marketing channel choice of e-NWR farmer
 $1 - P_i$ = Marketing channel choice of non e-NWR farmer

β_0 = intercept

β_i = Regression coefficients,

X_i = Independent variables and

e_i = error term.

For this study, the above equation is expressed implicitly as:

$$Y = a + b_1 X_1 + b_2 X_2 + b_3 X_3 + b_4 X_4 + b_5 X_5 + b_6 X_6 + b_7 X_7 + u_i$$

Where,

Y = The dependent variable is a binary variable representing the marketing channel choice of e-NWR adopters (1) and otherwise (0)

X_1 = Educational level of farmer (years)
 (0=Illiterate, 1-Primary, 2-Secondary,

3-Intermediate and 4-Graduate

X_2 = Age of the farmer (years)

X_3 = Farm size (hectares)

X_4 = Off farm income (Rs)

X_5 = Access to market information for paddy (1-yes, 0-otherwise)

X_6 = Distance to warehouse (Km)

X_7 = Access to training (1-yes, 0-otherwise)

b_1, b_2, \dots, b_7 are parameters corresponding to estimated variables' coefficients.

u_i is the error term and consists of unobservable random variables.

Marginal effect of a continuous independent variable on the probability. The marginal effect is:

$$\frac{dp}{db} = f(bX)b$$

where,

p = the probability of participation in warehouse marketing channel

b = slope coefficients

X = value of explanatory variables

3. RESULTS AND DISCUSSION

Logistic regression was used to determine the factors that influence marketing channel choices for paddy between e-NWR and non-e-NWR farmers and the results are presented in Table 1.

Educational level of the farmer: The educational level of the paddy farmers showed a positive relationship with participation in the warehouse-based market and was found statistically significant at a 5 per cent level. The marginal value for this variable 0.425 denotes that the probability of adoption of e-NWR has increased by 42.5 per cent with one level increase in the farmers' education. Educated farmers were more adaptive to new technologies, efficient in farm management, and better at decision-making. A higher level of education equips farmers with the skills and knowledge needed to maximize the benefits of e-NWR with higher remunerative prices, improve productivity, and enhance market participation. A similar study also found that the household head's characteristics significantly influenced the marketing channels such as the household

head's age, farming experience, household head's education. Older smallholder farmers, smallholder farmers who had low farming experiences, and low education levels sold their products through indirect marketing channels (Chiv et al., 2020).

Age of the farmer: The age of the farmer showed a negative relationship with the probability of participation of paddy farmers in the warehouse-based market and was found statistically significant at a 5 per cent level. The marginal value for this variable -0.220 denotes that the probability of adoption increased by 22 per cent with a year decrease in the farmers' age. It indicated that age and the farmer's decision to participate had a negative relationship. When compared to older farmers, younger farmers were early adopters of new technologies and more inclined to participate in the warehouse-based market. It is known that younger farmers were more inventive and resourceful, which enabled them to have better access to market knowledge. Whereas old farmers were habituated to traditional practices and not aware and no interest towards adoption of new technologies.

Farm Size: The farm size of the farmer showed a positive relationship with the probability of participation of paddy farmers in the warehouse-based marketing channel in the study area. It was found statistically significant at a 1 per cent level with a marginal value of 0.402 which indicated that the probability of participation in the warehouse-based market increased by 40.2 per cent with a one hectare increase in the farm size. Larger farms typically have higher production volumes, enabling farmers to store their produce in warehouses and take advantage of e-NWRs. Large farmers usually have greater

Table 1. Factors influencing marketing channel choice of paddy farmers

Variables	dy/dx	Standard Error	P-Value
Educational level of the farmer	0.425**	0.197	0.045
Age of the farmer	-0.220**	0.038	0.032
Farm Size	0.402***	0.121	0.000
Off-farm income	0.188	0.113	0.121
Access to market information for paddy	0.206**	0.027	0.021
Distance to warehouse	-0.667***	0.244	0.001
Access to training	0.713**	0.648	0.045
Pseudo R ²	0.84		
Log-likelihood	-75.282		
Number of observations	240		

Note: *** significant at a 1 per cent level of significance and ** significant at a 5 per cent level of significance

financial resources, higher marketable surplus, access to information & infrastructure and risk management and price optimization. It suggests improving accessibility for small and marginal farmers, ensuring they can benefit from e-NWRs through financial support and awareness programs.

Access to market information for paddy:

Access to information was found to have a statistically significant, 5 per cent level of positive relationship with participation in the warehouse-based marketing channel. This suggested a beneficial association between farmers' adoption decisions and access to information. A marginal value of 0.206 showed a 20.6 per cent increase in the likelihood of participation in the warehouse-based market. Access to accurate market information, continuous education, and awareness about e NWR significantly boosts farmer confidence in participating in the warehouse-based marketing system. Timely and transparent information on paddy prices, storage benefits, and loan accessibility can empower farmers to make informed decisions, reduce dependence on middlemen, and improve their income. Similarly, empirical results of a study suggested that several farming and marketing characteristics play the most important role in the farmers' choice of a marketing channel. Specifically, access to appropriate marketing information sources has a highly significant influence on farmers' market participation choices (Mgale & Yunxian, 2020). Access to technical advice and market information (awareness of the MSP) increases the chance that farmers will choose a more profitable value chain (like mandis) than local traders. Only 25% of the farmers are aware of the floor price (MSP) (Cariappa & Sinha, 2020).

Distance to warehouse: The participation in warehouse-based marketing channels was negatively correlated with the distance to warehouse and significant at one per cent level. The marginal value for this variable 0.667 denotes that the probability of adoption increased by 66.7 per cent with a 1 km decrease in the distance. Because of the lack of proper transportation facilities, non-availability of labour for loading and unloading and the risk of transporting the produce to distant warehouses, many farmers sell their produce at the farm level. Government intervention in facilitating warehouse operations close to farmers is crucial for reducing transportation costs, improving

market access, and increasing farmer participation in e-NWR. Proximity to scientific storage facilities like warehouses allows farmers to store their produce safely, reduce post-harvest losses, and sell at better prices with low transportation costs. Similarly, a study was conducted to identify the challenges in marketing channel selection by smallholder pineapple growers in Sarawak, Malaysia. The findings of the study revealed that five main challenges have caused pineapple growers to carefully select the marketing channel in marketing their produce namely; lack of market information; inefficient transportation; price volatility; market distance; and product perishability (Jengka, 2020).

Access to training: Paddy farmers who had access to training showed a positive and statistically significant relationship with the participation in warehouse-based market at five per cent. A marginal effect value of 0.713 for this variable indicated that the probability of participation in the warehouse market increased by 71.3 per cent with an increase in access to training. A similar study noted that there could be some farmers who do not have adequate knowledge or expertise to engage in some kind of post-harvesting value addition activity and due to the same fact, who do not have access to marketplaces like supermarkets and online stores. Hence these regulators can enhance the knowledge of these farmers regarding post-harvest value addition by means of training and development programs and so on (Wanasinghe & Sachitra, 2022). Regular participation in training programs and awareness campaigns by warehouse management significantly improves farmers' knowledge and ability to manage farms efficiently while increasing their adoption of e-NWR.

4. SUMMARY AND CONCLUSION

Results revealed the factors affecting marketing channel choices among paddy farmers. Education, farm size, income, market information, and training encouraged adoption, while age and distance to warehouses posed challenges. Farmers with higher levels of education, larger farm sizes, and better access to market information and training were more likely to participate in warehouse-based markets. Improved access to market information and training reduced knowledge imbalance and enhanced participation, while greater distances

to warehouses limited the adoption of e-NWR. Warehouse management should strengthen the market information systems and develop government-backed digital platforms to provide real-time price updates and establish training programs to enhance farmers' market awareness. Improving farm-to-market infrastructure and accessibility and promoting decentralized mini-warehouses closer to farming communities to enhance the adoption of e-NWR.

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 this manuscript.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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