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E-crop as a digital extension intervention: Evidence from crop insurance linkages in Bapatla District of Andhra Pradesh

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Abstract

The Government of Andhra Pradesh introduced the e-Crop (Electronic Crop Booking) system as a digital extension intervention aimed at improving the accuracy of crop enumeration, enhancing transparency in scheme implementation, and strengthening the delivery of crop insurance. The present study evaluates the performance of the e-Crop system in Bapatla district with specific emphasis on (i) trends in crop coverage under e-Crop and (ii) the role of extension facilitation in strengthening crop insurance delivery. Both primary data and secondary data were utilised. Primary data were collected during 2023-24 from 60 extension professionals using a structured and pre-tested questionnaire. Secondary data on crop-wise area registered under e-Crop for paddy, maize, and pulses were collected for the period 2019-20 to 2022-23 from official records. Analytical tools such as compound annual growth rate, Pearson's correlation, Garrett ranking, and construction of an Extension Effectiveness Index (EEI) were employed. The findings revealed a consistent increase in e-Crop registration across major crops, accompanied by a corresponding improvement in crop insurance coverage. Correlation analysis indicated a positive and significant relationship between extension facilitation and insurance effectiveness, underscoring the pivotal role of extension personnel in operationalising digital platforms. The EEI showed that 86.67 per cent of extension professionals perceived medium to high effectiveness of e-Crop implementation. Poor internet connectivity and increased workload were identified as the major constraints affecting system performance. The study concludes that e-Crop has emerged as an effective digital extension mechanism for strengthening crop insurance delivery; however, investments in digital infrastructure and continuous capacity building of extension personnel are essential to sustain and scale its impact.

Keywords: e-Crop, digital extension, crop insurance, extension effectiveness index, Andhra Pradesh

Introduction

Digitalization of agricultural extension has become a key policy priority in India to improve efficiency, transparency, and inclusiveness of service delivery by enabling data-driven decision-making and evidence-based scheme implementation. In Andhra Pradesh, the e-Crop (Electronic Crop Booking) system was introduced as a state-wide digital extension initiative to generate real-time, geo-referenced crop data at the farmer and plot level through active facilitation by frontline extension personnel. Accurate crop enumeration is crucial for effective implementation of crop insurance schemes, particularly for enrolment validation, loss assessment, and timely settlement of claims. Bapatla district, being a major producer of paddy and other

crops, with intensive insurance coverage under government schemes, provides an ideal setting to examine the performance of the e-Crop system. Despite its operational significance, systematic empirical evidence examining e-Crop as an integrated extension-insurance intervention at the district level remains limited. Hence, the present study was undertaken to critically assess the role of e-Crop in strengthening crop insurance delivery through extension facilitation.

Previous studies on digital extension tools have highlighted their role in improving information flow, transparency, and farmer participation within agricultural innovation and service delivery systems. ICT-based interventions were found to enhance efficiency of extension delivery and

scheme targeting by reducing manual errors and improving accountability.

Studies on crop insurance implementation in India reported that inaccurate crop data and weak extension support often result in exclusion errors and delayed claim settlement thereby undermining farmer confidence in insurance schemes. Recent extension research has emphasised the role of frontline extension personnel as digital intermediaries and change agents in facilitating digital platforms and bridging the digital divide among farmers. However, location-specific and empirically grounded studies on the e-Crop system remain sparse, particularly those explicitly linking extension facilitation with insurance effectiveness using both primary data and secondary data. The present study attempts to fill this gap by integrating crop-wise secondary statistics with primary perceptions of extension professionals, thereby providing an extension-centric evaluation of e-Crop as a digital governance tool.

Objectives of the Study

1. To analyse the trend in crop coverage under the e-Crop scheme for major crops in Bapatla district.
2. To examine the role of e-Crop in strengthening crop insurance delivery through extension facilitation.

Methodology

The study followed a descriptive and analytical research design to assess the performance of the e-Crop system as a digital extension intervention and its linkage with crop insurance delivery in Bapatla district of Andhra Pradesh. Both primary and secondary data were utilised. Primary data were collected during 2023-24 from 60 extension professionals directly involved in e-Crop implementation. Secondary data on crop-wise area registered under e-Crop and corresponding insurance coverage for major crops, namely paddy, maize, and pulses, were collected for the

period 2019-20 to 2022-23 from official records of the Department of Agriculture, Government of Andhra Pradesh. A purposive sampling technique was employed to ensure representation of key extension functionaries associated with the operationalisation of the e-Crop system. The sample comprised Assistant Directors of Agriculture, Mandal Agriculture Officers, Agricultural Extension Officers, and Village Agriculture Assistants. Data were collected using a structured and pre-tested interview schedule. The internal consistency of Likert-scale items was assessed using Cronbach's alpha, which yielded a value of 0.78, indicating acceptable reliability of the instrument. The collected data were analysed using appropriate statistical tools. Garrett ranking technique was applied to prioritise constraints faced by extension professionals. An Extension Effectiveness Index (EEI) was constructed using normalised scores of awareness, facilitation, transparency, and insurance linkage dimensions, and respondents were categorised into low, medium, and high effectiveness groups based on index values.

$$EEI = (\Sigma \text{ Normalised dimension scores}) / \text{Number of dimensions}$$

Based on index values, respondents were classified into low (<0.50), medium (0.50-0.75), and high (>0.75) effectiveness categories.

Results and Discussion

Figure 1 depicts the conceptual framework of e-Crop as a digital extension intervention, emphasizing the pivotal role of extension personnel in facilitating digital crop booking, ensuring accuracy of crop data, and strengthening crop insurance delivery. The framework highlights extension personnel as critical intermediaries between farmers and digital governance systems.

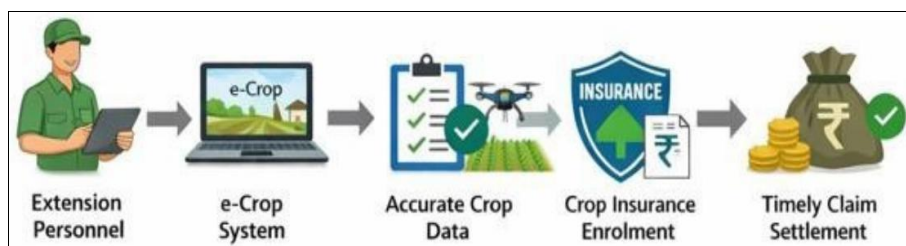
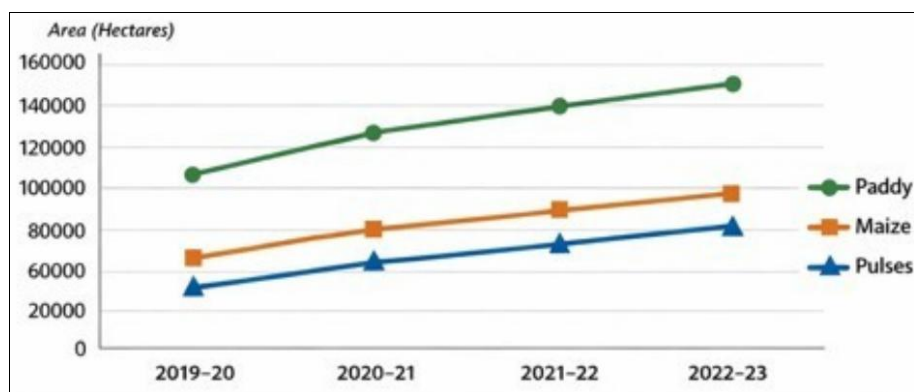


Fig 1: Conceptual Framework of e-Crop as a Digital Extension Intervention

Trend in Crop Coverage under e-Crop

The trend in area registered under the e-Crop system for major crops in Bapatla district during 2019-20 to 2022-23 is presented in Figure 2 and Table 1. A consistent increase in registered area was observed for paddy, maize, and pulses over the study period. Paddy accounted for the highest registered area throughout, followed by maize and pulses,

reflecting the district's predominant cropping pattern. The steady growth in e-Crop registration indicates increased adoption of digital crop booking and improved facilitation by extension personnel over time. This trend suggests enhanced farmer participation and improved institutionalisation of the digital system at the field level.



Source: Department of Agriculture, Government of Andhra Pradesh

Fig 2: Trend in Area Registered under e-Crop for Major Crops in Bapatla District (2019- 20 to 2022-23)

Table 1: Crop-wise Area Registered under e-Crop Scheme in Bapatla District (2019-20 to 2022- 23)

Year	Paddy (ha)	Maize (ha)	Pulses (ha)	Total Area (ha)
2019-20	68,420	9,860	7,240	85,520
2020-21	72,150	10,430	7,880	90,460
2021-22	75,680	11,120	8,450	95,250
2022-23	79,340	12,040	9,210	100,590

Source: Department of Agriculture, Government of Andhra Pradesh (e-Crop records)

Linkage between e-Crop Registration and Crop Insurance Coverage

Crop-wise insurance coverage linked with e-Crop registration is presented in Table 2. Insurance coverage showed a progressive increase across all major crops during the study period. Paddy recorded the highest insurance coverage, followed by maize and pulses. The parallel increase in e- Crop registration and insurance coverage underscores the effectiveness of accurate digital crop data in strengthening insurance enrolment and reducing exclusion errors. These findings highlight the importance of digital extension tools in improving scheme targeting and operational efficiency of crop insurance programmes.

Table 2: Crop-wise Insurance Coverage Linked with e-Crop in Bapatla District

Year	Paddy (%)	Maize (%)	Pulses (%)
2019-20	64.5	58.2	52.6
2020-21	69.8	63.4	57.9
2021-22	74.2	68.6	62.3
2022-23	78.9	72.5	66.8

Source: Department of Agriculture and Crop Insurance Records, Government of Andhra Pradesh

Perceived Effectiveness of e-Crop by Extension Professionals

The perceptions of extension professionals regarding the effectiveness of the e-Crop system are summarised in Table 3. High mean scores were recorded for accuracy of crop data, transparency in scheme delivery, and facilitation of insurance enrolment, indicating favourable perceptions of the system. The relatively lower mean score for timeliness of claim settlement suggests that while e-Crop enhances data accuracy and enrolment processes, claim settlement may be influenced by administrative factors beyond the direct control of extension personnel. Overall, the results

indicate that extension professionals perceive e-Crop as an effective digital tool for improving extension service delivery.

Table 3: Perception of Extension Professionals on e-Crop Effectiveness (2023-24)

Indicator	Mean Score
Accuracy of crop data	4.36
Reduction in manual errors	4.18
Transparency in scheme delivery	4.24
Insurance enrolment facilitation	4.42
Timeliness of claim settlement	3.98

Extension Effectiveness Index (EEI)

The distribution of extension professionals based on the Extension Effectiveness Index is presented in Table 4. Many of the respondents (86.67%) fell under medium to high effectiveness categories, indicating substantial perceived effectiveness of e-Crop implementation. The index-based assessment provides a comprehensive measure of extension effectiveness by integrating multiple dimensions, thereby offering a holistic understanding of the system's performance from an extension perspective.

Table 4: Distribution of Extension Professionals by Extension Effectiveness Index (EEI)

EEI Category	Index Range	Percentage of Respondents
Low	< 0.50	13.33
Medium	0.50 - 0.75	46.67
High	> 0.75	40.00

Dimension-wise Extension Effectiveness of e-Crop

To gain deeper insight into the performance of the e-Crop system, a dimension-wise analysis of the Extension Effectiveness Index was carried out by disaggregating the index into its four constituent dimensions, namely awareness, facilitation, transparency, and insurance linkage. The results revealed that extension professionals perceived facilitation and transparency dimensions to be relatively more effective compared to awareness and insurance linkage dimensions.

Higher scores for facilitation indicate the effectiveness of extension personnel in supporting digital crop booking, resolving operational issues, and guiding farmers during registration and insurance enrolment processes. Similarly,

higher transparency scores reflect improved accountability and reduction in manual errors under the e-Crop system. In contrast, comparatively lower scores for awareness and insurance linkage dimensions suggest the need for enhanced farmer sensitisation and strengthened coordination between extension agencies and insurance institutions.

The dimension-wise findings highlight that while e-Crop has strengthened operational efficiency and transparency in extension service delivery, greater emphasis on awareness creation and insurance-related advisory support is required to maximise the benefits of the digital intervention. This disaggregated analysis reinforces the critical role of extension personnel not only as facilitators of digital tools but also as communicators and advisors in crop insurance implementation.

Table 5: Dimension-wise Mean Scores of Extension Effectiveness of e-Crop

Dimension	Mean Score
Awareness	3.96
Facilitation	4.38
Transparency	4.29
Insurance linkage	4.02

Relationship between Extension Facilitation and Insurance Effectiveness

Correlation analysis revealed a positive and significant relationship ($r = 0.60$) between extension facilitation and insurance effectiveness (Table 6). This finding empirically establishes the critical role of extension personnel in translating digital platforms into effective insurance outcomes. Effective facilitation by extension professionals enhances farmer awareness, ensures accurate crop registration, and supports timely insurance enrolment, thereby improving overall insurance effectiveness.

Table 6: Relationship between Extension Facilitation and Insurance Effectiveness

Variable	Correlation Coefficient (r)
Extension facilitation score vs. Insurance effectiveness	0.60**

**Significant at 5 per cent level

Constraints in e-Crop Implementation

Constraints faced by extension professionals in e-Crop implementation are presented in Table 7. Poor internet connectivity emerged as the most severe constraint, followed by increased workload and technical issues in the application. Inadequate training was ranked as a relatively less severe constraint. These findings indicate that infrastructural and operational challenges continue to affect the smooth functioning of digital extension interventions and may limit their scalability and sustainability if not adequately addressed.

Table 7: Constraints Faced by Extension Professionals in e-Crop Implementation

Constraint	Mean Garrett Score	Rank
Poor internet connectivity	72.4	I
Increased workload	66.1	II
Technical issues in application	59.3	III
Inadequate training	52.7	IV

Policy Implications

The findings of the study suggest the need to strengthen rural digital infrastructure to enhance the functionality of the e-Crop system. Regular capacity-building programmes for extension personnel are essential to improve technical proficiency and operational efficiency. Provision of dedicated technical support and additional manpower at the field level would help reduce workload-related bottlenecks and further improve the effectiveness of e-Crop as a digital extension intervention.

Conclusion

The study evaluated the e-Crop system as a digital extension intervention and its linkage with crop insurance delivery in Bapatla district of Andhra Pradesh. The findings revealed a steady increase in crop area registered under e-Crop and a corresponding improvement in crop insurance coverage for major crops, indicating enhanced adoption of digital crop booking. Favourable perceptions of extension professionals and predominance of medium to high Extension Effectiveness Index scores further confirmed the effectiveness of the system in improving data accuracy, transparency, and insurance facilitation. The significant positive relationship between extension facilitation and insurance effectiveness highlights the critical role of extension personnel. However, poor internet connectivity and increased workload remain key challenges, necessitating infrastructural strengthening and capacity building for sustained impact.

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