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A study on profile characteristics and constraints faced by the DAMU beneficiary farmers

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Abstract

The District Agro-Meteorological Unit (DAMU), established under the Gramin Krishi Mausam Seva (GKMS) scheme, provides critical weather-based agro-advisories to help farmers mitigate climate risks. This study investigates the socio-economic profile, utilization patterns, perceived constraints, and suggestions of DAMU beneficiary farmers in the NTR district of Andhra Pradesh. Conducted during the 2023-24 agricultural year, the research employed a purposive sampling technique to select 120 active beneficiary farmers across 12 mandals. Primary data was collected through face-to-face interviews using a pre-tested, structured interview schedule and analyzed using descriptive statistics. The findings reveal that the majority of beneficiaries were middle-aged (70.00%), educated up to high school (53.33%), possessed marginal to small landholdings (64.99%), and actively participated in social organizations (81.67%). A vast majority (95.00%) perceived the weather advisories as highly useful, relying on them primarily to protect mature crops during harvesting (100.00%) and to optimize irrigation (94.16%). Mobile-based push technologies, specifically SMS (94.16%) and WhatsApp (78.33%), emerged as the overwhelmingly preferred communication channels. However, full adoption is significantly hindered by content-related constraints, most notably the lack of updated input market prices (87.50%) and the absence of specific insecticide and fungicide recommendations (74.16%). To improve the service, farmers overwhelmingly suggested providing timely, location-specific updates (96.67%) paired with precise agronomic guidance. The study concludes that grassroots extension agencies must pivot from broadcasting generic weather forecasts to delivering holistic, economically actionable crop management solutions tailored for mobile delivery to drive deeper adoption and maximize farmer benefit.

Keywords: Agromet Advisory Services (AAS), District Agro-Meteorological Unit (DAMU), climate risk mitigation, ICT in agriculture, farmer constraints, mobile-based extension

Introduction

India is primarily an agriculture-dependent country, and its agricultural sector relies heavily on various climatic conditions. Every year, agriculture faces severe weather aberrations such as typhoons, erratic rainfall, droughts, cold winds, and frost, all of which significantly dictate crop production and productivity. Because agriculture and its allied sectors are highly vulnerable to micro-level weather parameters including temperature, rainfall, wind velocity,

and frost the continuous monitoring and efficient utilization of meteorological data are crucial for sustainable farming. To address climate-related agricultural risks, the Gramin Krishi Mausam Seva (GKMS) scheme was launched as a flagship program by the Ministry of Earth Sciences (MoES), Government of India. This initiative aims to provide critical weather-related services that aid farmers in their day-to-day agricultural decision-making. Collaboratively undertaken by the India Meteorological Department (IMD) and the Indian

Council of Agricultural Research (ICAR), the scheme has successfully facilitated the establishment of 200 District Agromet Units (DAMUs) across India to date. With recent advancements in observational networks and forecasting technology, the Agromet Advisory Service (AAS) network was systematically extended to the sub-district and block levels during the 2018-2019 period. These DAMUs were strategically set up within the premises of Krishi Vigyan Kendras (KVKs) and State Agricultural Universities through Agricultural Technology Application Research Institutes (ATARIs), operating under a formal Memorandum of Understanding (MOU) between the ICAR and the IMD. Accordingly, a District Agro-Met Unit was established and operationalized at the Dr. K. L. Rao Krishi Vigyan Kendra in Garikapadu in October 2019, followed by the installation and functioning of an Automatic Weather Station (AWS) on February 27, 2020. Since its inception, the unit has actively served the farming communities of the Krishna and NTR districts by issuing district- and block-level Agromet Advisory Services (AAS). These advisories are disseminated bi-weekly (on Tuesdays and Fridays) in both English and the regional language, supplemented by special emergency bulletins during extreme weather events. The AAS bulletins provide value-added weather forecasts for the upcoming five days, accompanied by crop-specific advisory messages formulated in consultation with KVK scientists. By disseminating this targeted information directly to the farming community, the DAMU empowers farmers to plan their agricultural and horticultural operations scientifically. Ultimately, the efficient adoption of these services aims to mitigate severe crop losses, optimize input usage, double farmers' incomes, and contribute to the overall growth of the Indian agricultural economy.

Methodology

The present study was conducted in the NTR district of Andhra Pradesh during the agricultural year 2023-24 to analyze the socio-economic characteristics, constraints, and suggestions of District Agro-Meteorological Unit (DAMU) beneficiary farmers. During the operational period of the 27th February 2020 DAMU scheme, bi-weekly agromet advisory bulletins were issued every Tuesday and Friday to key extension functionaries, including Assistant Directors of Agriculture (ADAs), Mandal Agricultural Officers (MAOs), and Village Agriculture Assistants (VAAs). These time-sensitive weather and crop advisories were subsequently disseminated directly to the beneficiary farmers through digital channels, primarily WhatsApp groups, emails, and the Meghdoot mobile application. A purposive sampling technique was employed for the selection of both the study area and the respondents. The research was carried out across 12 selected mandals within the NTR district, from which 10 active DAMU beneficiary farmers were purposively chosen per mandal, resulting in a total sample size of 120 respondents. Primary data was collected directly from the farmers through face-to-face interviews using a pre-tested, well-structured interview schedule. Finally, to draw meaningful inferences from the raw data, the responses were tabulated and evaluated using descriptive statistical tools, specifically utilizing mean, median, frequencies, and percentages.

Results and Discussions

Socio Economic characteristics of KVK-DAMU beneficiary farmers

1. Age

Table 1 reveals that a significant majority (70.00%) of the DAMU beneficiary farmers were middle-aged. Young and old farmers constituted 22.50% and 7.50% of the respondents, respectively. This finding is strongly supported by Jayanthi and Asokhan (2016) ^[7], who also reported a predominance of middle-aged farmers (54.17%) utilizing SMS-based agromet advisories. Similarly, Venkatasubramanian *et al.* (2014) ^[2] and Hasan *et al.* (2018) ^[6] observed that middle-aged farmers form the majority of weather-advisory adopters, attributing this trend to their higher family responsibilities and readiness to integrate climate-risk mitigation tools into farm management.

Table 1: Distribution of DAMU beneficiary farmers according to their age (n=120)

S. No	Category	Frequency	Percentage
1.	Young age (Upto 35 years)	27	22.50
2.	Middle age (35 -50 years)	84	70.00
3.	Old age (Above 50 years)	9	7.50
Total		120	100.00

2. Education

From Table 2, it can be concluded that the majority of the DAMU beneficiary farmers possessed a high school education (53.33%), followed by middle school (20.83%) and primary school (10.00%). A smaller proportion had a college education and above (5.00%) or an intermediate education (4.16%), while the remaining minority were either illiterate (4.17%) or could only read and write (2.50%). This distribution indicates a highly literate beneficiary base, which serves as a fundamental catalyst for the successful adoption of digital extension services. Because over 84% of the respondents possess at least a primary to high school education, they have the foundational literacy required to independently read, comprehend, and act upon the KVK's bi-weekly Telugu SMS advisories and WhatsApp bulletins. This level of education allows extension teams to confidently include specific chemical names, dosages, and meteorological terms in their messages. This finding is in strict conformity with Gopi *et al.* (2023) ^[3] and Mandal and Jirli (2018) ^[15], who similarly established that secondary and high school education is the dominant literacy level among active adopters of ICT-based agro-meteorological information, significantly enhancing a farming community's capacity to decode digital advisories and transition towards climate-resilient agriculture.

Table 2: Distribution of DAMU beneficiary farmers according to their education (n=120)

S. No	Education	Frequency	Percentage
1.	Illiterate	5	4.17
2.	Can Read and Write only	3	2.50
3.	Primary School	12	10.00
4.	Middle School	25	20.83
5.	High School	64	53.34
6.	Intermediate	5	4.16
7.	College Education & above	6	5.00
Total:-		120	100.00

3. Family size

From Table 3, it can be concluded that the majority of the DAMU beneficiary farmers belonged to the medium family size category (72.50%), followed by large (12.50%) and small (11.67%) families. This finding is in line with Singh *et al.* (2019) ^[16] and the CCAFS, which similarly reported a predominance of medium-sized families among adopters of resilient agricultural practices. It can be inferred from these results that medium-sized farming households possess the optimal internal family labor force required to quickly execute time-sensitive farm operations such as irrigation scheduling or protective spraying based on real-time agromet advisories.

Table 3: Distribution of DAMU beneficiary farmers according to their family size (n=120)

S. No	Family Size	Frequency	Percentage
1.	Small	14	11.67
2.	Medium	87	72.50
3.	Large	15	12.50
4.	Very large	4	3.33
		120	100.00

4. Land Holding

From the table 4, it can be concluded that the majority of the DAMU beneficiary farmers possessed marginal landholdings (35.83%), followed by small (29.16%), semi-medium (15.83%), landless (8.34%), medium (5.84%), and large (5.00%) landholding. This distribution indicates that DAMU advisories are predominantly reaching resource-poor farmers, with small and marginal landholders constituting a combined 64.99% of the beneficiaries. This finding is in conformity with Gopi *et al.* (2023) ^[3] and Dupdal *et al.* (2020) ^[2], who similarly observed that small and marginal farmers form the majority of agromet advisory users, as they heavily rely on micro-level weather data to manage their limited resources and minimize input costs. Furthermore, access to these real-time advisories is vital for these vulnerable groups to mitigate climate risk and protect their crop yields (Nannevar *et al.*, 2023) ^[11].

Table 4: Distribution of DAMU beneficiary farmers according to land holding (n=120)

S. No	Land Holding	Frequency	Percentage
1	Land less (no land)	10	8.34
2	Marginal (Up to 2.5 acres)	43	35.83
3	Small (2.5 to 5 acres)	35	29.16
4	Semi-medium (5 to 7.5 acres)	19	15.83
5	Medium (7.5 to 10 acres)	7	5.84
6	Large (>10 acres)	6	5.00
		120	100.00

5. Social participation

From Table 5, it can be concluded that the majority of the DAMU beneficiary farmers (81.67%) participated in various social activities, followed by 18.33% who did not participate. This high rate of social participation indicates that most DAMU beneficiaries are actively connected with local agricultural networks, cooperative societies, or community organizations. Such social connectivity is a major catalyst for the adoption of weather-based agro-advisories, as farmers with wider networks can easily share,

discuss, and implement time-sensitive climate information through peer-to-peer communication (Rohit *et al.*, 2024) ^[12]. This is consistent with the findings of Harshavardhan *et al.* (2023) ^[5] and Hanif *et al.* (2023) ^[4], who established that higher social participation significantly increases a farmer's likelihood of adopting DAMU extension services and climate-resilient practices.

Table 5: Distribution of DAMU beneficiary farmers according to social participation (n=120)

S. No	Social Participation	Frequency	Percentage
1	Yes	98	81.67
2	No	22	18.33
	Total:-	120	100.00

6. Farming experience

From Table 6, it can be concluded that nearly half of the DAMU beneficiary farmers had low farming experience (48.33%), followed by those with middle (40.00%) and high (11.67%) farming experience. These results indicate that farmers with low to medium farming experience are significantly more inclined to adopt ICT-based weather advisories compared to highly experienced farmers. This trend is commonly observed in agricultural extension, as younger or less experienced farmers are generally more technologically literate and open to integrating scientific, real-time digital advisories into their farm management. Conversely, farmers with over 25 years of experience often possess deeply ingrained traditional knowledge and indigenous practices, making them comparatively more hesitant to shift toward modern Agromet Advisory Services (Rohit *et al.*, 2024) ^[12]. This conclusion is strongly supported by Hanif *et al.* (2023) ^[4] and Hasan *et al.* (2018) ^[6], who found that lower to medium farming experience positively correlates with the adoption of digital extension tools and climate-smart agricultural information.

Table 6: Distribution of DAMU beneficiary farmers according to Farming Experience (n=120)

S. No	Farming experience	Frequency	Percentage
A.	Low (less than 15 years)	58	48.33
B.	Middle (16-25 years)	48	40.00
C.	High (more than 25 years)	14	11.67
		120	100

7. Type of farming

From Table 7, it can be concluded that an overwhelming majority of the DAMU beneficiary farmers practiced irrigated farming (85.00%), while only a small proportion (15.00%) relied on rain-fed farming. This distribution strongly indicates that farmers with assured irrigation facilities are highly proactive in seeking and utilizing real-time meteorological data. In irrigated ecosystems, weather advisories are critical for resource optimization specifically, farmers use rainfall forecasts to decide when to pause their pumps, thereby saving groundwater, electricity, and preventing the leaching of expensive fertilizers. For extension functionaries at KVK Garikapadu, this underscores the importance of embedding precise irrigation scheduling advice (e.g., 'postpone irrigation for the next 48 hours') within the space-constrained Kisan Sarathi SMS bulletins. This finding is in line with Dupdal *et al.* (2020) ^[2]

and Hanif *et al.* (2023) ^[4], who similarly reported a higher adoption rate of agromet advisories among irrigated farmers, as they actively leverage predictive weather data to minimize input wastage and maximize crop efficiency.

Table 7: Distribution of DAMU beneficiary farmers according to type of farming

S. No	Type Farming	Frequency	Percentage
1.	Irrigated	102	85.00
2.	Rain fed	18	15.00
		120.00	100.00

8. Source of weather forecast and agro advisory services

From Table 7, it can be concluded that the overwhelming majority of the DAMU beneficiary farmers accessed weather forecasts and agro-advisory services through SMS or text messages (89.16%), followed by WhatsApp (72.50%), newspapers (43.33%), the Meghdoot mobile app (40.00%), other sources (34.16%), and the IMD website (30.00%). This distribution clearly indicates that mobile-based push technologies specifically SMS and WhatsApp are the most highly preferred and effective channels for disseminating real-time agricultural information. For extension functionaries operating at the Krishi Vigyan Kendra (KVK) level, this highlights the critical importance of drafting concise, localized advisories (such as tailored Telugu messages for the Kisan Sarathi platform) that respect strict SMS character limits, while utilizing WhatsApp groups for sharing more detailed, multimedia pest management warnings. Additionally, the moderate adoption of the specialized Meghdoot app (40.00%) demonstrates a growing digital literacy among beneficiaries. These findings are strongly supported by Rohit *et al.* (2024) ^[12] and Sayyad and Jadhav (2023) ^[13], who similarly concluded that SMS and WhatsApp are the dominant communication channels for Agromet Advisory Services due to their instant reach and accessibility. Furthermore, Dhulipala *et al.* (2021) ^[1] observed that mobile applications like Meghdoot are increasingly playing a vital role in providing location-specific, climate-smart advisories directly to rural farmers.

Table 8: Distribution of DAMU beneficiary farmers according to Source of weather forecast and agro advisory services

S. No	Source of weather forecast and agro advisory services	Frequency	Percentage
1.	News papers	52	43.33
2.	SMS (Text message)	107	89.16
3.	What's app	87	72.50
4.	Meghdoot mobile app	48	40.00
5.	IMD website	36	30.00
6.	others	41	34.16

9. Most suited and preferred medium of weather forecast and advisory services

From Table 7, it can be concluded that the most suited and preferred medium for receiving weather forecasts and advisory services among the DAMU beneficiary farmers was SMS/text messages (94.16%), followed closely by WhatsApp groups (78.33%). The remaining respondents preferred newspapers (55.83%), other sources (38.33%), the IMD website (36.66%), and the Meghdoot App (12.50%).

The data from Table 7 clearly establishes that mobile-based push technologies specifically SMS and WhatsApp are the overwhelmingly preferred channels for extension delivery. Considering that a significant majority (70.00%) of these farmers are middle-aged (as established in Table 1), this preference is highly logical; SMS is universally accessible even on basic feature phones, requiring minimal digital literacy compared to navigating specialized mobile applications like Meghdoot or the IMD website. For Krishi Vigyan Kendras (KVKs) and extension functionaries, this emphasizes the critical need to prioritize platforms like Kisan Sarathi. To maximize impact, advisories must be highly concise, accurately translated into the local language (Telugu), and carefully drafted to fit within standard SMS character limits. Concurrently, WhatsApp groups can be leveraged as a secondary medium to provide the multimedia support (such as photos of pest attacks) that basic SMS lacks. These findings are strongly supported by Gopi *et al.* (2023) ^[3] and Mittal and Mehar (2016) ^[10], who similarly concluded that text messaging remains the most inclusive and preferred ICT tool for middle-aged farmers in India due to its instantaneous, low-cost, and direct-to-farmer approach.

Table 9: Distribution of respondents according to their preferred medium of weather forecast and advisory services (n=120)

S. No	Preferred Medium	Frequency	Percentage
	News Paper	67	55.83
1.	SMS (Text messages)	113	94.16
2.	Whats app group	94	78.33
3.	Meghdoot App	15	12.50
4.	IMD website	44	36.66
5.	Others	46	38.33

10. Farm operation for which weather forecast/ agro met advisories useful

From the table, it can be concluded that all DAMU beneficiaries (100.00%) found agromet advisories most useful for harvesting and threshing, followed by irrigation (94.16%), chemical application (92.50%), fertilizer application (76.67%), and sowing (60.00%). This demonstrates that farmers primarily rely on real-time weather data to prevent severe economic losses specifically by protecting mature crops from unseasonal rain and pausing irrigation or spraying to avoid input runoff. Consequently, local extension teams, such as KVK Garikapadu, should prioritize urgent SMS alerts via Kisan Sarathi for harvesting warnings and chemical/irrigation scheduling. These findings align with Dupdal *et al.* (2020) ^[2] and Gopi *et al.* (2023) ^[3], who established that weather advisories crucially reduce input wastage and safeguard crop yields.

Table 10: Distribution of Respondents according to their farm operation for which weather forecast/agro met advisories useful (n=120)

S. No	Farm operation	Frequency	Percentage
1.	Sowing/transplanting	72	60.00
2.	Irrigation application	113	94.16
3.	Fertilizer application	92	76.67
4.	Chemical application	111	92.50
5.	Harvesting/threshing	120	100.00

11. Relevant/useful of are the weather based agro advisory services

From Table 11, it can be concluded that a vast majority of DAMU beneficiaries (95.00%) perceived the weather-based agro-advisories as highly useful, while the remaining minority (5.00%) found them partially useful. Notably, zero farmers (0.00%) found the services to be not useful. This overwhelmingly positive feedback demonstrates the undeniable practical value and relevance of real-time meteorological data at the grassroots level. Because not a single farmer deemed the service useless, it strongly validates the continuous efforts of local extension units, such as KVK Garikapadu, in translating and broadcasting precise, actionable Telugu advisories via Kisan Sarathi. To sustain this high utility, extension teams must ensure future messages remain highly location-specific and timely. These findings perfectly align with previous studies Gopi *et al.* (2023)^[3], Dupdal *et al.* (2020)^[2] which similarly reported a near-unanimous positive perception among farmers regarding the economic and agricultural utility of DAMU interventions.

Table 11: Distribution of respondents according to their relevant/useful of are the weather based agro advisory services

S. No	relevant/useful message	Frequency	Percentage
1.	Highly useful	114	95.00
2.	Partially useful	6	5.00
3.	Not useful	0	0.00
		120	100.00

12. Weather event most useful farm operation

From the table, it can be concluded that all DAMU beneficiaries (100.00%) found forecasts regarding rain to be the most useful for their farm operations. This was followed by cloud coverage (85.00%), soil temperature (66.67%), wind (58.33%), relative humidity (50.83%), and heavy rain (37.50%). Advisories for low temperature (27.50%), high temperature (15.00%), and thunderstorms (12.50%) were utilized to a lesser extent. This demonstrates that farmers primarily depend on precipitation and cloud-cover data to make critical, day-to-day decisions regarding irrigation scheduling and pest management, as cloudiness and humidity directly trigger pest outbreaks. Consequently, for extension teams drafting targeted Telugu advisories for the Kisan Sarathi platform, prioritizing precise, localized rain and cloud-cover predictions will deliver the highest value within strict SMS character limits. These findings align with Gopi *et al.* (2023)^[3] and Dupdal *et al.* (2020)^[2], who noted that rainfall and cloud-cover forecasts are the most highly sought-after parameters by farmers to prevent crop damage and optimize chemical spraying.

Table 12: Distribution of respondents according to their weather event most useful farm operation

S. No	Weather event most useful farm operation	Frequency	Percentage
1.	Rain	120	100.00
2.	Heavy Rain	45	37.50
3.	Low temperature	33	27.50
4.	High temperature	18	15.00
5.	Cloud coverage	102	85.00
6.	Relative humidity	61	50.83

7.	Wind	70	58.33
8.	Thunder storm	15	12.50
9.	Soil temperature	80	66.67

13. Constraints in the adoption of KVK-DAMU advisory services

From the table, it can be concluded that the most major constraint faced by farmers in adopting agro-advisory services was the lack of updated information on input prices, which leads to a higher cost of cultivation (87.50%). This was followed by a general lack of interest in adopting the advisories (80.00%), a lack of updated information regarding specific insecticides and fungicides in the weather bulletins (74.16%), poor communication among peer farmers (67.50%), unawareness regarding the benefits of SMS weather advisory services (59.16%), network and connectivity issues (53.33%), and a lack of credit to purchase modern IT gadgets (43.33%). Reluctance to adopt agro-advisories stems from content deficiencies, not just infrastructural barriers. Farmers need actionable economic information like input prices and exact chemical recommendations rather than generic weather forecasts. Omitting these details fosters disinterest and unawareness. Compounded by poor rural connectivity and weak peer networks, extension agencies must pivot. As supported by Jayashree *et al.* (2024)^[8] and Rohit *et al.* (2024)^[12], integrating specific market and pesticide data into SMS bulletins is critical to driving adoption and providing true grassroots value.

Table 13: Distribution of respondents according to their constraints in the adoption of KVK-DAMU advisory services

S. No.	CONSTRAINTS	F	%	Rank
1.	Network and connectivity problems	64	53.33	7
2.	Un aware about benefits of SMS weather advisory services	73	60.83	5
3.	Lack of updated information about insecticides and fungicides in weather bulletins	89	74.16	3
4.	Not interested to adopt the agro-advisory services	96	80.00	2
5.	Lack of updated information on inputs prices leads to high Cost of cultivation	105	87.50	1
6.	Lack of communication between the farmers	81	67.50	4
7.	Weather forecast information is not location specific	71	59.16	6
8.	Lack of credit to use modern IT gadgets	52	43.33	8

F=Frequency, %= Percentage

14. Suggestions given by beneficiary farmers to enhance the adoption of KVK-DAMU advisory services

From the Table No 13, it can be concluded that the primary suggestions for improving DAMU advisories center on hyper-local precision, hands-on extension support, and technological accessibility. The overwhelming demand for timely, location-specific weather updates (96.67%) and proper agronomic guidance (85.33%) clearly indicates that farmers require actionable, block-level data tailored to their immediate crop stages rather than generic regional forecasts. Furthermore, the requests for the right technology (72.50%),

affordable services (63.33%), improved network connectivity (50.83%), and specific guidance on using modern IT gadgets (47.50%) highlight a persistent digital divide in rural areas. While farmers are highly receptive to digital agriculture, they require active capacity-building to navigate these tools effectively. Finally, the need for reliable references (44.16%) underscores the importance of maintaining institutional trust. For extension functionaries at the KVK level, this mandates a dual approach: delivering highly accurate, localized Telugu SMS alerts via platforms like Kisan Sarathi, while simultaneously conducting village-level digital literacy interventions to train farmers on utilizing modern agromet tools. This finding is strongly supported by Rohit *et al.* (2024) ^[12] and Gopi *et al.* (2023) ^[3], who similarly reported that ensuring location-specific timeliness, mitigating rural network issues, and providing direct IT training are the most critical, farmer-driven suggestions for scaling the adoption of agromet services.

Table 14: Suggestions given by beneficiary farmers to enhance the adoption of KVK-DAMU advisory services

S. No.	Suggestions	F	%	Rank
1.	Provide the right technology	87	72.50	III
2.	The reference must be reliable	53	44.16	VII
3.	Provide proper guidance	103	85.83	II
4.	Provide updated information about weather at right time and right place	116	96.67	I
5.	Providing services at low cost	76	63.33	IV
6.	Provide guidance to use modern IT gadgets	57	47.50	VI
7.	Network connectivity	61	50.83	V

F=Frequency, %= Percentage

Conclusion

The study concludes that beneficiary farmers in the NTR district highly value and actively utilize DAMU weather-based agro-advisories as a vital risk mitigation and resource optimization strategy. However, to maximize the utility of these services, the findings highlight the critical need for targeted institutional interventions, grassroots digital skill development, and policy support. Specifically, extension agencies must pivot toward providing hyper-local forecast precision and integrating actionable economic data such as current input prices and exact agro-chemical recommendations into mobile bulletins to strengthen the sustainability, widespread adoption, and overall economic impact of digital agricultural extension services.

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