



Research Article

E-Agriculture and Haryana: The Role of 'Digital Haryana' Intervention in the Rural Agricultural Economy

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DOI: <https://doi.org/10.5281/zenodo.23153596>

Abstract

This research paper analyses the impact on the rural agricultural economy of e-agricultural interventions, such as My Crop My Details, e-procurement and soil health card, implemented under the 'Digital Haryana' initiative in Haryana. Studies indicate that these initiatives increase transparency, profit-transfer speed, and resource-use efficiency. Also, barriers such as digital literacy, internet connectivity, data errors and limited access to small and tenant farmers limit their full benefits.

Manuscript Information

- ISSN No: 2583-7397
- Received: 11-08-2026
- Accepted: 30-09-2026
- Published: 05-10-2026
- IJCRM:5(5); 2026: 491-498
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- Plagiarism Checked: Yes
- Peer Review Process: Yes

How to Cite this Article

Pooja, Singh K. E-Agriculture and Haryana: The Role of 'Digital Haryana' Intervention in the Rural Agricultural Economy. Int J Contemp Res Multidiscip. 2026;5(5):491-498.

Access this Article Online



www.multiarticlesjournal.com

KEYWORDS: e-agriculture, digital Haryana, rural economy, my crop my details, e-procurement, soil health card, digital divide.

1. INTRODUCTION

Haryana has a distinctive place in the Indian economy, where agriculture and its associated activities are the basic cornerstone of rural life. Historically emerging as a harbinger of the 'green revolution', the state has made an unprecedented contribution to the country's food security. However, over time, many serious challenges arose to traditional agricultural systems, including falling groundwater levels, declining soil fertility, weather uncertainty, excessive interference by middlemen, and lack of accurate market price information. These barriers increased the cost of farmers and limited their benefits.

As a solution to these traditional and structural problems, the inclusion of information and communication technology (ICT) in the agricultural sector became an essential requirement. Under this objective, the 'Digital Haryana' initiative was envisaged by the Haryana Government, under which several important steps were taken to make the agriculture sector technologically advanced, transparent and responsive.

The e-agriculture system launched under 'Digital Haryana' has completely changed the methods of agricultural management at the rural level. For example, through the 'Meri Fasal Mera Bhara' portal, farmers have been facilitated to register their crops online, so that the benefits of government schemes and disaster compensation reach the eligible farmers in a direct and transparent manner. Similarly, the 'e-procurement' system has established a transparent process of digital gate-pass and payment, controlling the arbitrariness of middlemen in grain markets. Additionally, digital initiatives such as the Soil Health Card guide farmers to make proper use of fertilizers based on scientific data, thereby safeguarding the long-term productivity of the land.

This research paper attempts to understand against this background how these e-agricultural interventions implemented under 'Digital Haryana' are affecting the rural agricultural economy and enabling farmers to keep up with the digital era.

2. OBJECTIVES OF RESEARCH

1. To describe the structure and functioning of major e-agricultural initiatives implemented under 'Digital Haryana'.
2. Analyze the impact of these initiatives on farmers' income, cost of production, marketing and transparency.
3. Identify the challenges faced by farmers in adopting e-agriculture.
4. To submit policy suggestions to make e-agriculture more inclusive and effective.

3. REVIEW OF LITERATURE

Kumar, R. (2018). A study was conducted on the impact of ICT on farmers' access to agricultural information in Haryana, examining the farmers' perceptions. The findings indicated that accurate and timely information can create an environment for more profitable farming.

Kumar, P., Kumar, D., and Kumar, (2014) This research highlights that the journey of local self-governance dates back to ancient times, and ICT has now become a successful medium for the dissemination of e-governance services. Applications

developed under the NeGP strengthen Panchayati Raj Institutions for rural development.

Chetri, Sharma, and Ilavarasan (2021) They conducted a primary survey of 463 farmers across six districts of Haryana and employed path analysis.

Findings:

- Access to information directly and significantly enhances farmers' capacity to cope with climate-related risks.
- Despite the rapid spread of ICT, small farmers' access to information remains limited.
- The survey revealed that while 87% of farmers could read SMS messages, only 19% owned smartphones, and merely 6% used mobile banking; this indicates a lack of skills for complex digital tasks.
- Physical access to ICT alone is insufficient; social networks and the capacity to utilize the technology are also essential.

Ali and Kumar (2011) According to them, information obtained through ICT improved the quality of decisions made by farmers who used ICT. However, no difference was found in the decisions of ICT-using farmers belonging to the lower social strata compared to non-users from the same stratum. In other words, digital benefits are not distributed equally among all.

Nesheim, Barkved, and Bharti (2017) This study, conducted in three villages in Maharashtra, found that farmers showed little interest in actively seeking weather information themselves, as they already obtained it through their social networks. This highlights the role played by local groups and neighbors.

Mittal (2012) Their work focuses on the role of modern ICT in the agricultural development and risk management of small farmers in India. Chetri et al. (2021) cite this as evidence of reduced production and transaction costs.

Goyal (2010) This study examines the impact of information and direct access for farmers on rural market performance in Central India. Chetri et al. (2021) cite this as evidence of obtaining better market prices.

RESEARCH GAP

The aforementioned studies focus on the general role of ICT, information access, and the digital divide. There has been very limited comprehensive assessment of specific initiatives in Haryana—such as Meri Fasal Mera Byora, e-Procurement, and Soil Health Cards—regarding their impact on the rural economy. This research paper addresses this gap.

4. Hypotheses

- H1: Due to e-agriculture initiatives, transparency and speed have increased in farmers getting benefits of government schemes.
- H2: The digital procurement system has reduced dependence on middlemen and delay in payment in the market.
- H3: Farmers' education, age and land-holder size affect the utilization level of e-agricultural services.

5. Key e-Agriculture Initiatives under 'Digital Haryana'

Under 'Digital Haryana', work in the agriculture sector has focused on four pillars: identification and registration (Parivar Pehchan Patra, Meri Fasal Mera Byora), marketing (e-Procurement), input management (Soil Health Card), and resource conservation (Mera Pani Meri Virasat). Details, operational mechanisms, and available statistics for each are provided below.

1. Meri Fasal Mera Byora (MFMB)

Nature and Mechanism: This is an online portal (fasal.haryana.gov.in) of the Department of Agriculture and Farmers' Welfare, Haryana, where farmers register details of their crops. Registration involves entering Aadhaar and Parivar Pehchan Patra (Family ID) details, followed by OTP verification; subsequently, information regarding the crop, sown area, and bank account details is entered. Tenant farmers can also register by providing details of the landowner and a declaration regarding the lease. The portal enables the government to track which crops are sown and the extent of the area covered in each district.

Scope of Utility: The portal functions as a single-window system. It facilitates access to benefits such as government procurement, incentives under 'Mera Pani Meri Virasat', Direct Seeded Rice (DSR), crop residue management, natural farming, and the Bhavantar Bharpai Yojana (Price Deficit Compensation Scheme). Procurement at MSP is restricted to crops registered on this portal.

Key Statistics:

- In a single Rabi registration cycle, out of the state's approximately 89.85 lakh acres of cultivable land, 8,73,349 farmers registered 52,78,479 acres. The state average for registration stood at 58.74%, with Charkhi Dadri recording 76.82% and Karnal recording 74.58%. This district-wide variation reflects the disparity in digital adoption. * During the Rabi 2021 season, 54.3 lakh acres were registered out of a total of approximately 84 lakh acres. In the previous Rabi season, 59.5 lakh acres and 12 lakh farmers were registered, whereas this time only 8.25 lakh farmers managed to register—representing about 69% of the previous year's figure.
- For the Kharif 2026 season, farmers registered approximately 57 lakh acres, of which 23 lakh acres were dedicated to Parmal paddy.
- **Subsidy Savings:** According to the department, linking the Integrated Fertilizer Management System (IFMS) with the MFMB resulted in subsidy savings of ₹820 crore between October 8, 2025, and September 14, 2026; this occurred because fertilizers are dispensed via POS machines only to verified and registered farmers. As this figure is sourced from a secondary website citing the department, it should be cross-verified with the department's official report.

Limitations: During Kharif 2026, an area of 22.35 lakh acres was found to have "mismatched" data on the portal; of this, only about 9.14 lakh acres were verified, while approximately 13.20 lakh acres (about 59%) remained pending. This raised concerns regarding potential delays in paddy procurement. In

essence, while registration facilities exist, the pace of verification remains a significant challenge.

2. e-Kharid

Nature: This is an e-governance initiative designed to digitize the entire crop procurement process, linking everything—from farmer registration and crop sales to payment, transportation, and storage—via software. Its objective is to ensure farmers receive the Minimum Support Price (MSP). The Haryana government launched both the MFMB (Meri Fasal Mera Byora) and the e-Kharid portal in 2020 to bring transparency to the procurement process.

Mechanism: The estimated crop yield verified on the MFMB platform is linked to the e-Kharid system; the farmer receives a digital gate-pass, a weighment slip is generated at the mandi (market yard), and payment is finally made upon the issuance of the "J-Form." The goal is to ensure payment is made within approximately 72 hours. For the Rabi 2024-25 season, the Chief Secretary instructed officials to ensure payment within 72 hours of the J-Form's issuance.

- **Scale of the system:** e-Kharid operates across 22 districts, connecting over 600 buyers, 400+ mandis, 500+ sub-market committees, approximately 29,000 Arhatiyas (commission agents), around 11 lakh farmers, and 500 gatekeepers.
- **Kharif 2024-25 (up to October 2024):** 35.63 lakh metric tonnes of paddy arrived at the mandis; of this, 31.22 lakh tonnes were procured at MSP, and ₹4,314 crore was paid directly into farmers' bank accounts. According to the department, the online gate-pass facilitated the sales process.
- **Kharif 2025-26 (initial phase):** Paddy was procured from 63,356 farmers registered on the portal, and ₹543.66 crore was transferred directly to their accounts.

Issue of Middlemen: Arhatiyas have opposed the system of direct online payments. In the past, whenever the emphasis was placed on making direct payments to farmers' accounts, arhatiyas (commission agents) in Punjab and Haryana halted procurement. Payments had primarily been routed through them. Therefore, this system makes the role of middlemen transparent and trackable, rather than eliminating them entirely.

Limitations: On one occasion, farmers growing pearl millet did not receive payment for two weeks, even though the government claimed payments would be made within 72 hours. This demonstrates that adherence to the stipulated timeframe has not been consistent across seasons.

3. Soil Health Card (Har Khet-Swasth Khet)

Nature: This is a soil test report for each landholding. Testing is conducted based on 12 parameters (pH, EC, Carbon, Nitrogen, Phosphate, Potash, Sulphur, Zinc, Iron, Copper, Manganese, and Boron), and recommendations regarding chemical fertilisers, organic manure, and bio-fertilisers are provided accordingly.

Key Statistics:

- According to the agriculture minister, approximately 70 lakh soil samples were collected under the "Har Khet-Swasth Khet" (Healthy Soil for Every Farm) campaign, and cards were distributed following the analysis of 55 lakh samples. Over 86 lakh cards have been distributed to date, with a target to collect samples from every acre over the next 3–4 years.
- Infrastructure: 17 new permanent soil and water testing laboratories, 54 mini-laboratories in mandis (agricultural markets), and 240 mini-laboratories in government schools and colleges were established in the state. Science students collect and test the samples. The "Har Khet-Swasth Khet" portal was launched in 2022; it also integrates students into this digital ecosystem.
- National Context: By July 2025, over 25 crore Soil Health Cards had been distributed across the country.
- Economic Rationale: Balanced fertilizer application based on these cards reduces unnecessary expenditure on chemicals and preserves soil fertility in the long run. To demonstrate this impact, a primary survey comparing the fertilizer costs of farmers who received the cards versus those who did not would be useful.

4. Supporting Initiatives

(a) Parivar Pehchan Patra (PPP). This is a 14-digit unique

identification number that provides residents of Haryana with easy access to central and state welfare schemes; it aimed to cover approximately 54 lakh families (a population of 2.5 crore). In the context of agriculture, it serves as the basis for MFMB registration; therefore, any error in the PPP can directly hinder a farmer's access to benefits.

(b) Mera Pani Meri Virasat (MPMV). Launched on May 6, 2020, this scheme offers an incentive of ₹7,000 per acre to farmers in "dark zones" who switch from paddy cultivation to other crops. The first installment of ₹2,000 per acre is disbursed after verification, with the remainder paid during the crop-ripening stage. Eligibility requires diversifying more than 50% of the area previously used for paddy during the Kharif season. In the first year, 1,18,128 hectares were registered on the MFMB portal for sowing alternative crops. Recently, a target of 1 lakh acres was set for Kharif 2025, and the incentive was increased to ₹8,000 per acre. The target area comprises 39,835 acres for cotton—the largest share—followed by fodder/fallow land, vegetables/horticulture, etc. Benefits under this scheme are also contingent upon registration on the MFMB portal.

(c) CSC and Mobile Services. Common Service Centres (CSCs), Seva Kendras, and SMS-based notifications constitute the final link in the chain of registration, application, and information dissemination, providing crucial support to farmers with limited technical proficiency.

Table 1.1: Summary Table

Initiative	Core Function	Key Data Point	Expected Economic Impact	Main Limitation
Meri Fasal Mera Byora (MFMB)	Online crop registration and verification; gateway to MSP and schemes	About 57 lakh acres registered in Kharif 2026	Direct benefit transfer, MSP eligibility, subsidy leakage control	About 59% of mismatched area pending verification
e-Kharid	Digital gate pass, weighment record, online payment	₹4,314 crore paid directly in Kharif 2024-25 (till Oct 2024)	Payment within ~72 hours, less mandi uncertainty	Payment delays reported for bajra
Soil Health Card	12-parameter soil testing and fertiliser advice	86+ lakh cards distributed	Lower fertiliser cost, sustained soil fertility	Advice adoption not automatically measured
Parivar Pehchan Patra (PPP)	14-digit family ID for eligibility verification	Target of ~54 lakh households	Fewer duplicate or ineligible beneficiaries	Errors in PPP data can block benefits
Mera Pani Meri Virasat	Incentive for shifting from paddy to other crops	Target of 1 lakh acres in Kharif 2025 at ₹8,000/acre	Groundwater conservation, alternative crop income	Depends on MSP and market for alternative crops

Source: Official agricultural and e-governance portals of the Government of Haryana (such as MFMB, e-Kharid, and PPP data).

Table 1.2: Scheme-wise Data Table

Scheme	Indicator	Value	Period	Type
Meri Fasal Mera Byora (MFMB)	Cultivable land in state	89,85,420 acres	Rabi registration cycle (till 15 Feb)	Area
	Farmers registered / area registered	8,73,349 farmers; 52,78,479 acres	Same cycle	Coverage
	State average crop registration	58.74% (Charkhi Dadri 76.82%, Karnal 74.58%)	Same cycle	Coverage
	Farmers registered vs. landowners	8.25 lakh of ~16 lakh landowners (12 lakh registered in previous rabi)	Rabi 2021	Coverage
	Area registered vs. total cropped area	54.3 lakh of 84 lakh acres (previous rabi: 59.5 lakh acres)	Rabi 2021	Coverage
	Kharif crop area registered	~57 lakh acres, of which 23 lakh acres are parnal paddy	Kharif 2026	Coverage
	Mismatched area verified/pending	22.35 lakh acres mismatched; 9.14 lakh verified; 13.20 lakh pending (~59%)	Kharif 2026	Limitation
	Fertiliser subsidy saved via IFMS link	₹820 crore	8 Oct 2025 – 14 Sep 2026	Fiscal impact

e-Kharid	Network scale	22 districts; 400+ mandis; 500+ sub-market committees; ~29,000 agents; ~11 lakh farmers	As per Haryana IT Dept. page (2026)	Scale
	Target payment time	~72 hours	Current norm	Efficiency
	Paddy purchased at MSP	31.22 lakh MT (of 35.63 lakh MT arrivals)	Kharif 2024-25 (till Oct 2024)	Procurement
	Direct payment to farmers' accounts (paddy)	₹4,314 crore	Kharif 2024-25 (till Oct 2024)	Fiscal flow
	Early-season payment; farmers served	₹543.66 crore; paddy procured from 63,356 farmers	Kharif 2025-26 (early Oct 2025)	Procurement
	Payment delay reported (bajra)	11,000+ farmers unpaid for over two weeks in four districts	Bajra procurement season	Limitation
Soil Health Card (Har Khet-Swasth Khet)	Soil samples collected / analysed	~70 lakh collected; 55 lakh analysed	Minister's statement	Coverage
	Cards distributed (Haryana)	86+ lakh	Minister's statement	Coverage
	Testing infrastructure	17 new permanent labs; 54 mini-labs in mandis; 240 labs in schools/colleges	Minister's statement	Infrastructure
	Cards distributed (India)	25+ crore	As of July 2025,	National benchmark
Parivar Pehchan Patra (PPP)	Target coverage	54 lakh households (~2.5 crore population); 14-digit ID	Launch phase (2020)	Target
	Records vs. verified data	56.2 lakh families on record; "golden data" ready for 18.19 lakh families	Aug 2020	Progress
Mera Pani Meri Virasat (MPMV)	Launch and incentive	Launched 6 May 2020; ₹7,000 per acre	2020	Design
	Area registered on MFMB (first year)	1,18,128 hectares	Kharif 2020	Coverage
	Target and revised incentive	1 lakh acres target; ₹8,000 per acre (cotton 39,835 acres)	Kharif 2025	Target

Source: Official scheme metrics, government data portals, and ministerial statements of the Government of Haryana (MFMB, e-Kharid, Soil Health Card/Har Khet-Swasth Khet, PPP, and MPMV data).

6. Analysis and Discussion

6.1 Framework of Analysis

In this section, the three hypotheses of the study are evaluated based on secondary evidence. There are three sources of evidence:

1. Administrative data available from Haryana government departments and news reports;

2. Published path analysis based on 463 farmers across six districts of Haryana (Chetri, Sharma, and Ilavarasan, 2021);
3. Simple calculations of ratios and percentages derived from available data.

1.3 Evaluation of Hypotheses: Summary Table

Hypothesis	Key Evidence	Result
H1: e-Krishi initiatives have improved transparency and speed of benefit delivery to farmers	MFMB registration is mandatory for MSP sale; ₹820 crore fertiliser subsidy reportedly saved via IFMS–MFMB link; however, ~59% of mismatched area (13.20 of 22.35 lakh acres) awaited verification in Kharif 2026	Partially supported
H2: Digital procurement has reduced dependence on middlemen and payment delays	₹4,314 crore paid directly to farmers' accounts (Kharif 2024-25); 72-hour payment norm; but arhtiyas remain part of the system (~29,000 agents) and payment delays reported in bajra procurement	Partially supported
H3: Education, age and landholding size influence the use of e-Krishi services	Average area per registered farmer rose ~33% (4.96 → 6.58 acres) as registered farmers fell 31% while area fell 9%; path analysis (Chetri et al., 2021) shows land and ICT capability significant, education-linked human capital not significant	Supported for landholding and ICT capability; insufficient evidence for education and age

6.3 Analysis of Hypothesis H1: Transparency and Benefit Transfer

H1: E-agriculture initiatives have enhanced transparency and speed in the delivery of government scheme benefits to farmers.

'Meri Fasal Mera Byora' (MFMB) has created an official record of crops, and procurement at MSP is restricted to crops registered on the portal. Consequently, the basis for benefits shifts from individual recommendations to recorded data. This also has fiscal implications. According to the Department of Agriculture and Farmers Welfare, integrating the Integrated

Fertilizer Management System (IFMS) with MFMB resulted in a subsidy saving of ₹820 crore between October 8, 2025, and September 14, 2026, as fertilizers are distributed via POS machines only to verified and registered farmers.

Widespread participation is evident at the registration stage as well. During the Kharif 2026 season, crops were registered across approximately 57 lakh acres, with 'Parma' paddy accounting for 23 lakh acres.

The challenge of verification: During the same season, a discrepancy of 22.35 lakh acres was found on the portal; of this, only 9.14 lakh acres (approximately 41%) were verified, while about 13.20 lakh acres (approximately 59%) remained pending. This raised concerns regarding delays in paddy procurement. This implies that while the system is transparent, the speed of benefit delivery is constrained by verification capacity.

Conclusion (H1): There is sufficient evidence supporting transparency, but pending verification acts as a bottleneck regarding speed. Therefore, H1 is partially supported.

6.3 Analysis of Hypothesis H2: Marketing, Intermediaries, and Payments

H2: The digital procurement system has reduced dependence on intermediaries in the mandi (market) and minimized payment delays.

The entire process—covering registration, sale, payment, transportation, and storage—is managed through software on the e-procurement portal. This system operates across 22 districts, connecting over 400 mandis (wholesale markets), approximately 29,000 arhatiyas (commission agents), and around 1.1 million farmers. During the 2024-25 Kharif season,

3.122 million metric tonnes of paddy were procured at the Minimum Support Price (MSP), with ₹4,314 crore paid directly into farmers' bank accounts; additionally, the online gate-pass system streamlined the sales process. The target is to process payments within approximately 72 hours of the issuance of the 'J-form'.

Limitations: First, adherence to the payment timeline has not been consistent across crop seasons. On one occasion, over 11,000 pearl millet (bajra) farmers did not receive payment even after two weeks, despite the claim of a 72-hour turnaround. Second, arhatiyas have not been excluded from the system. There has been resistance from arhatiyas regarding direct online payments, as payments in Punjab and Haryana have traditionally been routed primarily through them. Thus, the role of intermediaries has not been eliminated; rather, it has become more transparent and documented.

Conclusion (H2): There is evidence of improvements in the directness and transparency of payments, but no evidence of the complete elimination of intermediaries or the total resolution of payment delays. Therefore, H2 is partially supported.

6.4 Analysis of Hypothesis H3: Unequal Adoption

H3: Farmers' education, age, and landholding size influence the level of e-agriculture service usage.

(a) Analysis of landholding size based on registration data. During the Rabi 2021 season, 5.43 million acres and 0.825 million farmers were registered out of a total of approximately 8.4 million acres, whereas in the previous Rabi season, 5.95 million acres and 1.2 million farmers were registered. These figures yield the following ratios: Area/Farmer: 4. /Farmer change

Table 1.4: Area per Registered Farmer on MFMB

Season	Registered Farmers (lakh)	Registered Area (lakh acres)	Area per Registered Farmer (acres)
Rabi 2020	12.00	59.50	4.96
Rabi 2021	8.25	54.30	6.58
Change (%)	-31.3%	-8.7%	+32.7%

Source: Derived from Meri Fasal Mera Byora (MFMB) portal records, Department of Agriculture and Farmers Welfare, Government of Haryana.

The number of registered farmers declined by 31.3%, whereas the registered area decreased by only 8.7%. This implies that the farmers who remained unregistered held relatively smaller landholdings, a finding that supports the observation regarding landholding size in H3. As this conclusion is based on aggregated data from only two seasons, it should be viewed as indicative.

(b) Path analysis concerning farmers in Haryana. Chetri, Sharma, and Ilavarasan (2021) conducted a path analysis using primary data from 463 farmers across six districts of Haryana. Their standardized coefficients are as follows:

Table 1.5: Selected Standardised Path Coefficients (Chetri et al., 2021; n = 463)

Path	Coefficient	Significance
ICT access → ICT capability and willingness	0.346	1% level
ICT capability and willingness → ICT ecosystem	0.486	1% level
Natural resources (land) → Agricultural technology	0.280	1% level
Natural resources (land) → Information	0.078	10% level
Human capital (literacy etc.) → Information	0.039	Not significant
Human capital → ICT ecosystem	—	—

Source: Chetri et al. (2021), based on a sample of n = 463 respondents.

These results indicate that access to ICT enhances a farmer's utilization capacity, and there is a positive correlation between land resources and information/technology. However, the impact of literacy-based human capital on information access was not found to be statistically significant. The same study revealed that while 87% of farmers could read SMS messages, only 19% owned smartphones and 6% engaged in mobile banking; this clearly shows that while simple services have reached farmers, complex digital activities remain limited.

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Conclusion (H3): Evidence supports the link between landholding size and ICT capacity. No clear evidence was found regarding the impact of education, and insufficient data exists concerning age. Thus, H3 is supported regarding landholding size and ICT capacity, while evidence is insufficient regarding education and age.

6.5 Discussion on production costs and resource conservation initiatives

Soil Health Cards: According to the State Agriculture Minister, approximately 7 million (70 lakh) soil samples were collected under the "Har Khet-Swasth Khet" (Healthy Farm for Every Farm) campaign; cards were distributed following the analysis of 5.5 million (55 lakh) samples, with a total of over 8.6 million (86 lakh) cards handed out. Infrastructure-wise, 17 new permanent laboratories, 54 mini-laboratories in mandis (agricultural markets), and 240 mini-laboratories in government schools and colleges were established. This serves as clear evidence of the distribution and testing mechanism. However, whether the recommendations provided in the cards actually led to a reduction in fertilizer costs can only be assessed through a primary study at the farmer level.

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Mera Pani Meri Virasat (My Water, My Heritage): A target of 100,000 (1 lakh) acres was set for the Kharif 2025 season, with an incentive of ₹8,000 per acre; of this, 39,835 acres were earmarked for cotton cultivation. This accounts for approximately 40% of the total target. In other words, the diversification strategy is largely focused on cotton, whereas the share of pulses (5,245 acres), maize (3,500 acres), and oilseeds (615 acres) is relatively small. This raises concerns regarding market risk and dependence on a single crop.

7. OVERALL DISCUSSION

Robust design, uneven implementation. A digital chain comprising registration, procurement, and payment has been established; however, lags persist in the speed of verification and payment.

District-wise disparity. During a single Rabi registration cycle, crop registration reached 76.82% in Charkhi Dadri and 74.58% in Karnal, whereas the state average stood at 58.74%. This highlights regional disparities in digital adoption.

Lagging small farmers. Landholding size and digital skills appear to be key determinants of adoption, making inclusion a central concern of the policy.

Consistency with literature. Aligning with the findings of Ali and Kumar (2011), the benefits of ICT do not accrue equally

across all socio-economic groups; this corroborates the study's findings regarding uneven adoption.

8. Limitations of the Study

The analysis is based on secondary data rather than a primary survey; consequently, statistical significance testing of hypotheses was not feasible.

- The data pertains to different seasons and years (Rabi 2021 to Kharif 2026), limiting direct comparability.
- Much of the data relies on government statements and news reports, and the economic impact (changes in income or costs) of every initiative could not be measured.
- Calculations for H3 are rough estimates based on aggregated data.

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