



Digitalization and Commercialization of Organic Farming: Assessing the Role of Digital Platforms in Improving Farmers' Market Access

Prakruthi S N*,^{ID} Manjula,^{ID} Apoorva Koli,^{ID} Prajwal B P,^{ID} and Darshan Kumar G R^{ID}

Department of Agricultural Extension Education, University of Agricultural Sciences Dharwad

Abstract

Although production-side and certification-side assistance has been a blessing for organic farming in India, market access remains a hurdle for the majority of certified farmers. Although digital platforms are often mooted as the solution, there is little evidence that they improve organic market outcomes. To assess how digital platforms could enhance organic farmers' market access, this review synthesizes peer-reviewed research, ICAR publications, and Government of India papers, mapping the role of the Indian Council of Agricultural Research, whose contribution is largely in production technology (All India Network Programme on Organic Farming, ICAR-IIFSR), extension (Krishi Vigyan Kendras) and digital advisory (Kisan Sarathi) and distinguishing it from the certification, labelling and marketing mandates of APEDA, the Department of Agriculture and Farmers Welfare (DA&FW), FSSAI and SFAC. Five mechanisms by which platforms may widen access are explored: price discovery, buyer reach, transaction cost and payment, trust and verification, and knowledge. Evidence is strongest for price and transaction-cost effects on general commodities (e-NAM) and weakest on organic-specific outcomes. Three structural gaps are identified: a registration-transaction gap, an assurance-interoperability gap and a production-market gap. To address these, the paper proposes (i) the ICAR-anchored Digital Organic Value Chain (IDOV), (ii) an Organic Digital Dossier that links farmer identity, production records, certification and lot traceability, (iii) a Digital Market-Access Readiness Index (DMARI), and (iv) six testable propositions. Policy actions are mapped to each institution, and a research agenda is outlined.

Keywords: organic farming; digital platforms; market access; Jaivik Kheti; e-NAM; ICAR; PGS-India; NPOP; AgriStack; Kisan Sarathi; farmer producer organisations.

1. Introduction

In India, organic farming is marketed as a way to improve soil health, reduce input costs, and provide safer food. Public support has been significant: by February 2025, the Paramparagat Krishi Vikas Yojana (PKVY) covered approximately 15 lakh hectares, 52,289 clusters, and 25.3 lakh farmers [25]; by 2023–2024, the total area under NPOP and PGS-India certification reached 59.74 lakh hectares [26]. However, certification and production do not ensure a profitable sale. Small and irregular lots, little local demand for high-quality produce, limited buyer discovery, and challenges demonstrating authenticity to far-off consumers are common challenges faced by small organic farmers.

India has developed public digital infrastructure for agriculture at the same time. The Digital Agriculture Mission, approved on 2 September 2024 with an outlay of ₹2,817 crore, is built around AgriStack, a Krishi Decision Support System and soil profile mapping [24]. The e-NAM trading platform connects regulated mandis. The Jaivik Kheti webpage was designed with organic produce in mind. Scientists from Krishi Vigyan Kendra (KVK) are connected to farmers through ICAR's Kisan Sarathi platform.

The cumulative impact of these systems on organic farmers has not been examined because they were created and are regulated independently.

REVIEW OF LITERATURE

1. Digitalisation and Agricultural Market Access

Due to its capacity to enhance price discovery, reduce information asymmetry, and connect farmers to geographically diverse buyers, digitalisation has become a crucial component of agricultural marketing. The potential of digital trading platforms to impact agricultural commodity prices and improve the efficiency of agricultural supply chains [1]. By providing information on prices, buyers, and market opportunities, digital platforms reduce search expenses. However, the benefits of digitalisation depend on the participation of buyers and sellers, as well as farmers' ability with the platforms they are using. The author explored the extent to which digitisation impacted agricultural wholesale pricing and uncovered indications of better price realization upon the introduction of electronic agricultural markets. According to their findings, digital trading can reduce certain transaction-related inefficiencies and improve price transparency.

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Prakruthi S N | prakruthisn222k@gmail.com

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However, the focus on traditional commodities implies the need for further research to determine whether organic markets provide similar advantages.[3]

The author responded to the creation of the National Agriculture Market (e-NAM), an electronic platform intended to improve price discovery and integrate agricultural markets. The platform includes features such as online transactions, price information, and electronic bidding. Organic farmers, especially those producing storable commodities, may find these mechanisms beneficial, but further research is required to determine the market outcomes unique to organic products.[2]

2. E-Commerce and Digital Platforms in Agricultural Marketing

A systematic review of e-commerce in the agri-food sector revealed the ability of online platforms to bridge geographical gaps between producers and consumers. E-commerce can enable direct marketing, enhance market data accessibility, and facilitate alternative marketing channels. Nonetheless, the utilization and success of e-commerce depend on infrastructure, digital capabilities, trust, logistics, and the nature of agricultural products.[32]

The significance of e-commerce is especially vital for organic products since organic items have credence characteristics that consumers cannot adequately verify through physical inspection. Therefore, marketing organic products digitally requires not merely listing products, but systems for ensuring authenticity, certification, and traceability.

The literature reviewed indicates that although digital agricultural platforms have proliferated rapidly, there is limited empirical evidence regarding their direct impact on the commercialization of organic farm products. Consequently, the available evidence supports conventional agricultural commodities more robustly than organic products.

3. Digital Platforms and Price Discovery

Price discovery is one of the important mechanisms through which the digital platforms may contribute to commercialisation. The author [3] using the difference-in-differences approach and agricultural markets in Uttar Pradesh as a setting report improved inflation-adjusted wholesale prices after the digital market integration. Their study also referred to the earlier evidence regarding electronic trading and e-tendering.

The innovations in agricultural marketing through the case of e-tendering in Karnataka. Their study provided the evidence concerning the role of electronic marketing mechanisms in improving market efficiency and price realization [20]. Similarly, the author have examined the impact of e-Mandi on commodity prices using the double-difference approach.[7]

However, the literature reviewed in the document cautions that these findings cannot be automatically generalized to organic produce because the studies mostly concerned conventional commodities. Organic products require the additional verification regarding the production practices and certification. Therefore, the relationship between digital price discovery and organic price premiums remains an important research gap.

4. Organic Certification, Trust and Commercialization

Organic produce is different from regular agricultural produce in that the organic production attribute is generally a credence attribute.

This means that the consumer cannot fully assess production practices by simply looking at the product. Thus, certification, labelling and traceability become fundamental aspects of the organic market. The document highlights the NPOP and PGS-India, both certification systems in India, being endorsed through the FSSAI organic food regulations, as well as the Jaivik Bharat logo, a common identity for organic food, and the Indian Organic Integrity Database, an institutional mechanism providing searches of organic products and businesses.

The author demonstrated the importance of institutional trust in online marketplaces. They demonstrate that the consumer's willingness to participate in online transactions is partially explained by mechanisms that reduce perceived risk. In the realm of organic farming, this becomes more important in that the consumer needs reassurance that the product marketed as organic has been genuinely produced and certified according to the relevant standards. [21]

Therefore, digital commercialization of organic produce needs to integrate digital market platforms with certification systems. Simply uploading an organic product listing does not build consumer trust or enable a price premium.

5. Digital Advisory and Agricultural Extension

Digitalization is not limited to marketing and trading but also plays an essential role in agricultural extension and knowledge dissemination. The document mentions Kisan Sarathi as a digital advisory platform connecting farmers with experts through Krishi Vigyan Kendras.

A difference-in-differences approach to evaluate Kisan Sarathi based on farmers' participation in three districts of Uttar Pradesh. The study found that knowledge scores improved among users of the digital platform. However, the study evaluated the outcome variable related to knowledge, not marketing or commercialization. Therefore, the causal chain from digital advisory → improved knowledge → improved production quality → better market realization remains not fully established. [17]

For organic farming, digital advisory can potentially help farmers adhere to organic production practices, maintain records, understand certification requirements, and access market information. However, the evidence related to organic-specific digital extension's impact on commercialization is limited.

6. Role of ICAR in Organic Farming and Commercialization

The reviewed document states that ICAR's contribution focuses on research, production technologies, and extension to organic farming, not on certification and marketing. The All India Network Project on Organic Farming run by ICAR-IIFSR develops region-specific production packages and technologies. These production technologies indirectly affect commercialization since uniform production, quality, and quantity are essential to meet the requirements of organized buyers. Thus, it becomes necessary to conceptualize the linkages between ICAR production technologies and digital marketplaces via a production-assurance-trade mechanism.

The literature reveals that the institutional division of responsibility is not clearly defined and that multiple agencies are involved. While ICAR focuses on research, production technologies, and extension services, APEDA manages NPOP and exports, FSSAI oversees organic food regulations, standards, and labeling, DA&FW handles organic farming promotion and digitalization, and SFAC implements e-NAM.

This division of labor must necessarily lead to a better integration of production, certification, extension, and marketing processes.

7. Jaivik Kheti and Organic Market Access

Jaivik Kheti is a particularly interesting innovation because it is focused exclusively on organic produce. As per the reviewed document, the digital platform offers registration mechanisms for farmers, buyers and local groups and features several price discovery mechanisms.

As of December 2024, the platform boasts a figure of approximately 6.23 lakh farmers and 8,676 buyers. Nonetheless, the literature review underlines that registration figures should not be conflated with market participation or successful transactions. There is a lack of publicly available evidence as to how many of the registered farmers had successfully sold their produce via the digital platform.

This poses an important caveat to the relationship between digital registration and commercialization. A farmer may register on a digital platform but not secure a buyer, finalize a sale or receive a price premium. As such, future studies should focus on transaction-level indicators such as number of listings, successful sales, quantity sold, buyer diversity, price realization and repeat transactions.

8. Digitalization and Transaction Costs

Digital platforms can potentially reduce various transaction costs associated with agricultural marketing, such as information search, price discovery, communication, and payment.

The author reported evidence showing more rapid payment cycles associated with electronic agricultural markets. [3]

However, digitization might incur additional costs, and farmers might need smartphones, Internet access, digital literacy, packaging, grading, certification, and logistics facilities. In the case of organic products, verification costs can be particularly important, as buyers need some assurance regarding organic claims. Thus, reducing search costs, without reducing verification costs, might not improve commercialization.

9. Digitalization, FPOs and Aggregation

Small organic farmers often tend to get relatively small and irregular quantities. Digital markets may thus be more effective if they are aggregated through Farmer Producer Organisations (FPOs), cooperatives or producer groups.

The reviewed framework suggests that FPO-mediated listings could potentially improve the probability of moving from registration to an actual sale because aggregation can improve lot size, grading, packaging and logistics; however, this relationship is presented as a testable proposition.

Therefore, literature on collective marketing and FPOs provides an important foundation for studying how organizational participation can mediate the relationship between digitalization and commercialization.

10. Digital Traceability and Organic Value Chains

Traceability has become an increasingly important factor in organic commercialization as it can provide information regarding production practices, certification, harvest, quality and movement of produce through the supply chain.

The reviewed document proposes an Organic Digital Dossier (ODD) that could connect farmer identity, plot information, production records, certification status, lot identification, quality information and transaction history.

The proposed system is conceptual and has not yet been empirically validated.

Such an integrated system could potentially reduce repeated documentation, improve verification and strengthen consumer confidence. Nevertheless, empirical studies are needed to determine whether digital traceability actually increases farmer-level price realization and market access.

3. Conceptual foundations

3.1 Organic produce as a credence good

While the buyer can determine the freshness of a tomato, they cannot assess the growing practices used to produce it. Organic status is a credence attribute; thus, only through a credible verification mechanism can a producer secure a premium. It is for this reason that certification, labelling, and public registries constitute the market mechanism itself, rather than being external to it. In India, these are provided through NPOP (third-party certification), PGS-India (peer-to-peer, for the domestic market), and the FSSAI organic regulations (see Section 4.6).

3.2 Transaction costs and information asymmetry

Farmers sell through a small number of local agents, who have weak bargaining power and provide limited information on prices. Digital trading platforms are expected to reduce information asymmetry by enabling a wider range of buyers to discover the produce and facilitate quicker payments [1][3]. In the case of credence goods, an additional transaction cost is incurred by the buyer in determining the quality of the product. Thus, a platform that reduces search cost but not verification cost will not deliver on its promise to enhance organic premiums.

3.3 Platform economics

Marketplaces are two-sided in that the value of the platform depends on the number of suppliers and buyers on the platform. A marketplace with many listed suppliers and few actual buyers does not benefit the sellers. This is directly relevant to the observed skew in the seller-buyer ratio on Jaivik Kheti (Section 5).

3.4 Digitalization versus commercialization

In this paper, digitalization refers to the adoption of digital identity, record-keeping, advisory, and transaction systems in farm and market management. Commercialization refers to securing sale of organic produce at scale into markets willing to pay a premium for the organic attribute, where yield, price, and continuity of supply matter. Digitalization is a means; enhanced commercial terms for the farmer are the test.

4. The institutional landscape: what ICAR does, and what it does not

4.1 A note on scope

Readers are likely to be looking for a single "ICAR guideline" for organic marketing. In the sources examined, none of these deal specifically with organic certification, labelling and e-marketing. ICAR's role in organic farming is confined to production technologies, research and extension. Certification and labelling fall to other agencies. With this caveat, this section reviews "ICAR guidelines" as ICAR packages, research findings and extension activities that bear on the question of a farmer's capacity to produce marketable produce and then goes on to examine their relevance to marketing institutions.

4.2 ICAR's production-side contribution

Network Project / All India Network Programme on Organic Farming (NPOF/AI-NPOF). ICAR's Network Project, also known as the All India Network Programme on Organic Farming, was launched in 2004-05 by the erstwhile Project Directorate for Farming Systems Research, Modipuram, to evolve location-specific technologies and packages of practices for organic farming. The project started with the participation of 13 centres in 12 states (Lok Sabha reply; NPOF, 2015). The mandate now lies with ICAR-IIFSR, which manages the AI-NPOF with the participation of 20 centres in 16 states and 10 agro-climatic regions (ICAR-IIFSR, n.d.). A government response to a question in the Lok Sabha states that scientific packages of practices have been evolved for 51 cropping systems in 12 states appropriate to the agro-climatic regions by utilizing green and green leaf manures, bio-fertilizers, enriched composts, oil cakes, vermicomposts, microbial consortiums, bio-control agents and bio-pesticides for nutrient management, insect pest and disease management (reported 2021; figures may have been updated since).

Institute-level technologies. Organic farming technologies developed at the institutional level include the development of biofertilizers and bioformulations by ICAR-IISS Bhopal that claim to reduce the use of NPK fertilizers by 10-25%. ICAR-NBAIM Mau has developed microbial technologies for soil health management and biopesticide formulations. The same source reports that ICAR has been implementing institute-level projects on organic vegetable farming, organic fruits, organic cashew, organic palms and spices, apart from an organic medicinal and aromatic crops mission and a network project on organic horticulture.

Outreach. ICAR's extension activities include the Scheduled Caste Sub Plan and Farmers FIRST schemes reported by ICAR-IIFSR (n.d.). The Tribal Sub Plan was also implemented by the network project through its collaborating centres [30].

Why it matters to marketing: The production packages have a bearing on yield stability, input compliance and documentation, all of which are factors in any certification or marketing scheme. Farmers following any of these packages would be able to provide uniform produce lots, a necessary condition for any form of platform marketing.

4.5 Who governs what

Table 1: Institutional responsibilities relevant to digital organic marketing

Function	Institution	Instrument
Organic production packages, research	ICAR (ICAR-IIFSR, IISS, NBAIM, SAUs)	AI-NPOF packages of practices
Farmer training, demonstrations, advisory	ICAR / KVKs	KVK programmes, Kisan Sarathi
Promotion, cluster support, PGS-India	DA&FW; NCOF as nodal body	PKVY, PGS-India, MOVCDNER
Third-party certification, exports	APEDA (Ministry of Commerce)	NPOP
Organic labelling and food-law compliance	FSSAI	FSS (Organic Foods) Regulations, 2017; Jaivik Bharat logo
Organic e-commerce and knowledge portal	DA&FW with MSTC	Jaivik Kheti
Mandi e-trading	DA&FW; SFAC as implementing agency	e-NAM
Digital identity, crop and land registries	DA&FW with states	Digital Agriculture Mission, AgriStack

Sources: India.gov.in (Jaivik Kheti page); Lok Sabha replies; FSSAI; PIB, 2024; SFAC, 2025.

4.6 Certification and labelling regime

The FSS (Organic Foods) Regulations, 2017, notified on 29 th December 2017 provides for the following two systems for organic food certification. They are NPOP notified by the Ministry of Commerce and Industry and PGS-India adopted by the Ministry of Agriculture and Farmers Welfare. The organic food produced needs to mention the unified logo of Jaivik Bharat, indicating conformity to either one of the systems. The organic food produced through direct sale by the small original producers/producers' organization to the consumer is exempt from certification (Lok Sabha reply, undated). Further, a portal Indian Organic Integrity Database has been developed by FSSAI in collaboration with APEDA and PGS-India for the purpose of registering and searching products and business [6].

4.3 ICAR's extension and digital advisory contribution

Krishi Vigyan Kendras (KVKs). KVKs perform frontline demonstration, training and capacity building and provide advisories through ICT. They serve as knowledge centres at the district level [25]

Kisan Sarathi. This MeitY-DA&FW joint initiative, implemented by ICAR-IASRI and Digital India Corporation, provides a two-way communication platform for farmers and KVKs. According to the PIB release on 29 June 2026, it has registered 2.95 crore farmers (56.16 lakh women), addressed 19.21 lakh queries and issued 21,900 advisories on 351 commodities as of the date mentioned above. An article in [10] summarizes a difference-in-differences study of the impact of Kisan Sarathi on rabi crop production in three districts of UP with a sample size of 300 farmers, 150 of whom were using the portal. It found a significant improvement in knowledge scores among users, though the study looked only at knowledge gains and did not find any impact on marketing. The findings are applicable only to the districts studied, as the sample was not representative.

Implication: ICAR has a large digital outreach through Kisan Sarathi, which has not been explored for organic certification or marketing. This is an opportunity (see Section 8).

4.4 ICAR's evidence on natural farming

The government's big push for natural farming (National Mission on Natural Farming, with an outlay of ₹2,481 crore) has created some confusion with organic farming. Secondary sources cite a NABARD-ICRIER study and an ICAR-IIFSR study that report contradictory results on yields. The ICAR-IIFSR study reports a 59% lower wheat yield and a 32% lower basmati rice yield under natural farming than under integrated crop management, while the Centre for Economic and Social Studies reports higher yields and incomes in Andhra Pradesh. These figures should be verified against the original studies before being cited. The relevance to marketing lies in the risk profile: lower yields, unless offset by higher prices or government support, will reduce the surplus available for marketing platforms.

PGS-India certifies produce for the domestic market, and the produce under transition for a period of 3 years is certified as PGS Green (secondary source). PKVY provides financial assistance at the rate of ₹4500/ha for 3 years for value addition, marketing and publicity. MOVCDNER focuses on the value-chain development in the North East for collection, aggregation, processing and marketing [26].

The table shows that third-party certified area is concentrated in a few states, while PGS is more prominent elsewhere (for example Andhra Pradesh and Uttar Pradesh). A platform strategy that assumes one certification type will therefore fit some regions and not others.

4.7 Mapping ICAR outputs to market-access relevance

Table 3: From ICAR output to digital market touchpoint

ICAR domain	What it gives the farmer	Market-access relevance	Digital touchpoint
AI-NPOF packages	Workable organic practices by system and region	Consistent yield, quality, lot size	Package advisories through Kisan Sarathi/KVK
Bio-input technologies (IISS, NBAIM)	Locally available inputs	Lower cost, lower residue risk	Input supplier listing on Jaivik Kheti
KVK training and demonstrations	Skills, records discipline	Certification readiness	KVK expert app, farmer registration
ICAR research on organic horticulture, spices, medicinal crops	Crop-specific protocols	High-value, storable products suited to online sale	Product pages, quality parameters
ICAR evidence on natural farming	Reality check on yield and profitability	Realistic premium expectations	Decision-support content

5. Digital platforms relevant to organic marketing

Table 4: Platform typology and scale indicators

Platform	Owner / lead	Primary function	Organic-specific?	Scale indicator (date)
Jaivik Kheti	DA&FW with MSTC	E-commerce and knowledge portal; price discovery	Yes	6.23 lakh farmers, 19,016 local groups, 89 input suppliers, 8,676 buyers (Dec 2024)
e-NAM	DA&FW; SFAC	Electronic mandi trading, inter-state trade	No	1.79 crore farmers, 4,392 FPOs, 1,473 APMCs, ₹4.12 lakh crore trade (28 Feb 2025)
Kisan Sarathi	MeitY, DA&FW, ICAR-IASRI	Multilingual advisory via KVKs	No	2.95 crore farmers registered (June 2026)
AgriStack / Digital Agriculture Mission	DA&FW with states	Farmer registry, geo-referenced maps, crop-sown registry	No	₹2,817 crore mission outlay (approved Sept 2024)
Jaivik Bharat portal / Indian Organic Integrity Database	FSSAI, APEDA, PGS-India	Regulatory verification of organic products and businesses	Yes	Regulatory database (n.d.)
Private agritech, FPO-run e-commerce, open digital networks	Various	Direct-to-consumer and B2B sales	Varies	No consolidated public data; requires separate study

Sources: PIB (2025, 2024, 2026); SFAC (2025); FSSAI (n.d.). Figures are administrative and dated.

Jaivik Kheti. The portal is a marketplace and knowledge platform connecting regional councils, local groups, individual farmers, buyers, government agencies and input suppliers. It provides seller, buyer and local-group registration, along with a range of price discovery mechanisms (forward auction, price-quantity bidding, book building and reverse auction). Farmers can register individually or as groups, which is important for aggregation.

Seller-buyer balance. Based on the PIB figures above and the implied assumption that farmers may register multiple times, the number of registered farmers outweighs the number of buyers by a factor of about 72 to 1 (6,23,000 ÷ 8,676; author's calculation). Against the 25.3 lakh farmers covered by PKVY, Jaivik Kheti's registration is equivalent to roughly one in four (note different reference dates, therefore only indicative). The number of registrations does not indicate the number of listings, which do not appear to be reflected in the public documents reviewed.

e-NAM's role. e-NAM is a general commodity marketplace, with a physical mandi as a back end, offering real-time price information, quality grading, online bidding and electronic payment [22].

Table 2: Certified organic area, selected states (hectares, cumulative to 2023–24)

State	NPOP (incl. MOVCDNER)	PGS under PKVY
Madhya Pradesh	11,48,236	74,960
Maharashtra	10,01,080	66,756
Gujarat	6,80,820	10,000
Rajasthan	5,80,092	1,48,500
Andhra Pradesh	63,679	3,60,805
Uttar Pradesh	66,391	1,71,185

Source: Rajya Sabha reply dated 7 February 2025, Annexure 1 (selected rows; figures rounded).

It has no organic category in the sources reviewed (should check current portal features). However, it could benefit organic producers of storable commodities who are able to meet its grading and lot requirements and who may be FPOs.

6. Evidence synthesis: how platforms may improve market access

6.1 Price discovery and transparency

The most robust empirical work concerns e-NAM. A difference-in-differences comparison of Meerut (e-NAM enabled) and Bijnor (not yet enabled) markets and a survey of 371 farmers and traders, [3] report higher inflation-adjusted wholesale prices for wheat and basmati paddy on e-NAM; the Meerut-Bijnor wheat price gap rose from USD 0.46 to USD 0.62 per 100 kg between 2015 and 2017. They cite prior Indian findings of about 6% higher prices for coffee on a private e-trading platform, relative to the farm gate and up to 9% better prices under e-tendering in Karnataka [20][7]. Limitations: the crops are conventional cereals, the markets few, and the pre/post windows short. The authors themselves note that the literature on rural income effects is mixed. These results cannot be assumed to transfer to organic produce.

6.2 Reach and buyer discovery

Digital listings allow farmers to reach buyers outside their district. Particularly important for organic produce with its dispersed premium buyers, compared to commodities. The evidence here is largely descriptive (numbers of registrations). No rigorous study of Jaivik Kheti's effect on buyer diversity or sales volume was located.

6.3 Transaction cost and payment

Electronic payment shortens the payment cycle; [3] report a one-day cycle on e-NAM, against one to two weeks previously. Commission agents also provide credit and cash payment, which platforms must match to attract farmers.

6.4 Trust and verification

The perceived risk in online trade rises with low ICT skills, weak vernacular content, quality-verification difficulty and non-delivery or payment concerns [21][28]. For organic produce, trust also depends on certification. The Jaivik Bharat logo and the Indian Organic Integrity Database give the institutional basis, but whether platform listings are linked to that database is not documented in the sources reviewed.

6.5 Knowledge and quality

Digital advisory improves knowledge[17], which is a precondition for quality. The step from knowledge to price premium has not been tested.

Table 5: Evidence strength by mechanism

Mechanism	Best available evidence	Strength	Organic-specific evidence
Price discovery	e-NAM DiD and surveys	Moderate (general commodities)	None located
Reach	Registration counts	Weak (descriptive)	None located
Transaction cost and payment	e-NAM case studies	Moderate-to-weak	None located
Trust and verification	Conceptual, regulatory design	Weak	Design exists (FSSAI); effect untested
Knowledge	Kisan Sarathi DiD	Moderate (one region)	Not organic-specific

7. Constraints: the three gaps

7.1 The registration-transaction gap

Registration is not participation. As of 31 December 2024, in Maharashtra, 12.3 lakh farmers were registered with e-NAM, of which approx 3 lakh traded (24%), while in Jalgaon district, 1,170 out of 37,903 registered farmers traded (3%) (Lok Sabha reply, 2025; the figures are the author's calculation). It is reasonable to assume similar transaction rates for Jaivik Kheti, as the public data do not indicate the contrary. Consequently, the mere fact of registration must not be mistaken for market access.

7.2 The assurance-interoperability gap

A certified organic farmer may possess multiple digital identities, including an identity card, a certification record, a mandi registration, a Jaivik Kheti profile, and a Kisan Sarathi account, among others, each created independently with no interoperability, as the sources do not show any. As a result, the farmer is obliged to re-enter the same data several times, and a potential buyer has no simple way of being sure that the seller's certificate corresponds to a particular farm and that the farm's produce is indeed organic. The exemption clause for small original producers with FSSAI allows for a further policy concern: how do the provisions apply if the sale is not direct but conducted online?

7.3 The production-market gap

Organic farming requires time to build up, and current yields are often lower before the conversion to organic practices begins. Certification, verification, and residue testing add to the cost and complexity, which are significant considerations for small-scale organic farmers. Additionally, price premiums for organic produce are often inconsistent, and buyer networks are underdeveloped, which challenges the commercial viability for farmers (secondary policy summaries of the organic farming schemes). Finally, the requirement for minimum lot sizes, grading, and packing at the platforms favor aggregators over smallholder farmers. The organic vegetable clusters do not have cold chain infrastructure, constraining their ability to sell their produce online, where organic farming is in greater demand.

7.4 Cross-cutting barriers

Access to smartphones, digital literacy, smartphone penetration, trust in unknown buyers, language, and gender norms are additional challenges to wider adoption [3]. Notably, farmers' smartphone ownership and digital literacy are said to vary depending on the local language, according to the [26].

8. A proposed framework

8.1 The ICAR-anchored Digital Organic Value Chain (IDOVC)

The framework is based on organic market development being a five-step value chain, in which step 5 utilizes the artefacts created by step 4, which in turn relies on the produce of step 3, and so on.

Table 6: IDOVC stages, responsible institutions and artefacts

Stage	Lead institution(s)	Digital instrument	Artefact produced
Know	ICAR, KVKs	Kisan Sarathi, KVK apps	Farmer profile with package recommendation
Grow	ICAR (AI-NPOF), SAUs	Digital farm diary linked to Farmer ID	Input and operations log
Assure	DA&FW/NCOF, APEDA, FSSAI	PGS-India / NPOP records, Integrity Database	Certificate status and validity
Trade	DA&FW, SFAC, FPOs, private	Jaivik Kheti, e-NAM, other channels	Lot listing with grade and price
Learn	ICAR, DA&FW	Price and demand analytics	Advisory on crop choice and timing

8.2 The Organic Digital Dossier (ODD)

The proposed solution is for the farmer, plot, and lot-linked record to accompany the produce, which would combine

- farmer and plot ID/geo-reference (using AgriStack registries),
- package adherence and input log (using the ICAR-aligned farm diary format),
- certification type, scope, and validity (using the PGS-India/NPOP records and the Integrity Database),
- lot identifier, harvest date, grade, and residue test result (using FPO or aggregator inputs), and
- transaction history (using platforms).

This would allow platforms to verify and not simply display organic claims, reduce redundant onboarding, and provide ICAR and DA&FW with a feedback dataset about what packages produce marketable produce. The design has to factor in data-protection law and farmer consent. Whether AgriStack currently tracks organic conversion is not evident in the sources reviewed and has to be confirmed.

8.3 Digital Market-Access Readiness Index (DMARI)

DMARI, a proposed farmer- or FPO-level diagnostic, is still conceptual and hence the indicators and weights proposed should be validated (e.g. via Delphi or AHP) as well as reliability testing and pilot surveys.

Table 7: DMARI dimensions and candidate indicators

Dimension	Candidate indicators (scored 0–4 each)
D1. Knowledge and production readiness	Adoption of ICAR/SAU organic package; record-keeping quality; KVK contact frequency
D2. Assurance status	Certification type and validity; label compliance (Jaivik Bharat); residue test availability
D3. Digital identity and access	Farmer ID; smartphone and connectivity; bank/UPI account; digital literacy
D4. Aggregation and logistics	FPO membership; minimum-lot capacity; grading and packing; storage or cold-chain access
D5. Market intelligence and trust	Platform registration; listing quality; buyer relationships; dispute experience

Composite scores could classify units as *Pre-ready*, *Emerging*, *Platform-ready* or *Premium-ready*, so support can be targeted (for example, training for pre-ready units, logistics support for emerging units).

8.4 Testable propositions

- **P1** (Assurance legibility). Price premium and buyer conversion are higher for listings that are certified in a manner that is machine-verifiable via the integrity database versus those with self-declared or uploaded claims.
- **P2** (Aggregation). The probability of transition from registration to first sale is higher for FPO-mediated listings than for individual farmer listings.

- **P3** (Knowledge to quality). Farmers receiving ICAR/KVK advisory calibrated to organic packages show lower lot-rejection and better grade outcomes.
- **P4** (Product heterogeneity). Access to digital marketplaces leads to improvement in outcomes for storable, high-value products (spices, millets, pulses, oils, honey) more than for perishables that require cold chain.
- **P5** (Interoperability). Reuse of AgriStack and certification data decreases the onboarding time and cost vis-a-vis separate registration.
- **P6** (Two-sided liquidity). The sale probability decreases with the increase in ratio of sellers to active buyers beyond a threshold specific to a platform.

9. Policy and practice implications

Table 8: Recommended actions by institution

Institution	Recommended action
ICAR (IIFSR, KVKs, IASRI)	Add organic-specific modules to Kisan Sarathi (package advisories, record-keeping, certification readiness); publish crop-wise organic package summaries in accessible, vernacular formats; test a digital farm diary
DA&FW / NCOF	Link Jaivik Kheti listings to PGS-India and NPOP certificate status; publish transaction-level indicators (listings, orders, repeat buyers), not just registrations; correct the buyer-side shortfall through institutional buyers
APEDA and FSSAI	Enable machine-readable certificate verification for platforms; clarify how the direct-sale exemption applies to online sales
SFAC / e-NAM	Pilot an organic-flagged trading category and assaying parameters where technically feasible; strengthen FPO onboarding
States, FPOs, KVKs	Build aggregation, grading and cold-chain capacity in clusters; provide assisted listing for first-time sellers
Researchers	Evaluate organic-specific outcomes using the designs in Section 10

10. Research agenda

1. Quasi-experimental impact analysis of Jaivik Kheti (difference-in-differences or staggered adoption) using transaction data from DA&FW or MSTC
2. Field experiments on assisted-listing (by KVK or FPO staff) to measure conversion from listing to sale
3. Organic-premium estimation across channels, controlling for grade, lot size and location
4. Verification experiments testing P1, comparing response to verified and unverified organic claims
5. Mixed-methods study on women, tribal and NE farmers – to which MOVCDNER's value-chain methods are applied
6. Validation of DMARI (content, reliability, predictive validity vis-a-vis sales)
7. Tracking down the original ICAR-IIFSR and CESS studies underlining the natural-farming evidence to assess implications for marketable surplus.

11. Conclusion

India has separately developed the elements necessary for digital organic commerce: production knowledge through ICAR, cluster and certification support through DA&FW, statutory labelling through FSSAI, public trading rails through e-NAM and Jaivik Kheti, and digital identity through AgriStack. What it does not have is the articulation of these to enable digital organic commerce. The evidence suggests that digital platforms can improve price transparency and transaction speeds for general commodities, that ICAR's digital advisory can increase farmers' knowledge, and that a regulatory basis for organic trust exists; however, it does not show that these advantages flow through to organic farmers in the form of higher prices or more reliable sales, the registration–transaction, assurance–interoperability and production–market gaps being a partial explanation.

The proposed IDOVC, Organic Digital Dossier and DMARI provide a way for researchers and policymakers to close these gaps in order to measure progress by transactions and price outcomes rather than registrations.

Appendix A. ICAR-aligned checklist for digitally marketed organic produce

This checklist translates the review into a practical sequence. It is not an official ICAR document.

Step	Action	Where to get support
1. Production	Follow the organic package for your cropping system and agro-climatic zone; use only inputs permitted under the certification standard you have chosen	KVK, State Agricultural University, AI-NPOF centre
2. Records	Keep a dated farm diary (inputs, operations, purchases, sales); store scans or photos	KVK; PGS-India local group
3. Certification	Choose PGS-India (domestic) or NPOP (export and formal channels); note certificate validity and scope	DA&FW/NCOF regional councils; APEDA-accredited agencies
4. Labelling	Use the Jaivik Bharat logo with the FSSAI licence number where required; add the NPOP or PGS-India mark as applicable	FSSAI
5. Digital identity	Obtain Farmer ID under AgriStack where available; link bank account and UPI	State agriculture department, CSC
6. Listing	Register individually or through a local group or FPO; state quantity, grade and price basis; upload certificate	Jaivik Kheti; e-NAM (where the commodity is tradable)
7. Advisory	Register on Kisan Sarathi and ask organic-specific queries	KVK, Kisan Call Centre
8. Post-harvest	Grade, clean and pack to platform specifications; keep lot identifiers	FPO, aggregator

Appendix B. Search strategy template

Suggested string (adapt to each database):

("organic farming" OR "organic agriculture" OR "chemical-free" OR "natural farming" OR "PGS-India" OR NPOP) AND (("digital platform" OR "e-commerce" OR "e-NAM" OR "online marketing" OR "ICT" OR "mobile advisory" OR "market access" OR "price discovery") AND (India OR "developing countries"))

Databases: Scopus; Web of Science; CAB Abstracts; ICAR e-Pubs; Google Scholar. Period: [state]. Language: English. Screening: title/abstract followed by full text, by [one or two] reviewers; report counts in a PRISMA-style flow diagram.

Appendix C. Pre-submission verification checklist (delete before submission)

1. Primary sources for † references. Obtain and cite Banker et al. (2011), Pavithra et al. (2018), Zeng et al. (2017), Chand (2016), Roy et al. (2018) and Pavlou & Gefen (2004) directly.
2. Natural-farming figures. Locate the ICAR-IIFSR study behind the 59% wheat and 32% basmati yield declines, and the CESS study, plus the NABARD_ICRIER paper that discusses both, and cite them directly.
3. Undated Lok Sabha replies. Add dates and question numbers from the Digital Sansad pages.
4. AI-NPOF packages. Confirm the current number of cropping systems and states covered (the figure of 51 systems in 12 states is from a 2021 statement).
5. ICAR mobile apps. If you cite the count of 113 ICAR apps, obtain the full reference for the Journal of Agricultural Extension Management article.
6. Portal features. Check current Jaivik Kheti and e-NAM functionality (transaction data, organic flags) directly on the portals.
7. AgriStack. Confirm whether organic-conversion status is recorded.
8. Update statistics. Refresh e-NAM, Jaivik Kheti and Kisan Sarathi figures on the date of submission.
9. Ethics and originality. Run a similarity check and ensure the framework is described as conceptual.
10. Secondary sources for policy details. The "PGS Green" three-year conversion description, the PKVY challenges in Section 7.3 and the KVK mandate were drawn from secondary summaries. Replace them with the PGS-India guidelines, the PKVY operational guidelines and ICAR's KVK guidelines.
11. Section 4.6 exemption. Check the current text of the FSS (Organic Foods) Regulations, 2017 (and amendments) for the direct-sale exemption before relying on it.

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