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Digital Governance and Pradhan Mantri Fasal Bima Yojana: A Critical Review of its Implementation and Uptake

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Abstract:
Background: *The Pradhan Mantri Fasal Bima Yojana (PMFBY), launched in 2016, is a major government initiative aimed at protecting farmers against agricultural risks and stabilising farm incomes. The scheme incorporates digital governance mechanisms to improve enrolment, crop-loss assessment, claim processing, transparency and service delivery. However, concerns regarding farmers' participation, delayed claim settlement, limited awareness and the actual effectiveness of digital interventions highlight the need for a critical assessment of its implementation and uptake.*
Materials and Methods: *The study adopts a qualitative, thematic review approach based on the critical appraisal and synthesis of 32 documents published between 2015 and 2026. The reviewed literature includes national household surveys, state-level evaluations, aggregate scheme analyses, district-level farmer perception surveys, research reviews and international comparative studies. The documents were examined on six parameters: clarity of objectives, appropriateness of research design, sampling and denominators, scheme-specific relevance, data reliability and internal consistency of findings.*
Results: *The findings reveal that despite considerable growth in enrolment, actual voluntary participation remains limited and is partly influenced by administrative and institutional factors. Claim settlement continues to face delays and transparency-related challenges, primarily associated with late submission of crop-yield data and delayed release of government subsidies. Farmers' awareness and trust in the scheme remain relatively low, while inadequate information regarding claim rejection further weakens confidence. The review also identifies a significant gap between the technological promises of PMFBY and their actual implementation. Although digital platforms, remote sensing, satellite imagery, drones, mobile applications and AI-based assessment are frequently recommended, the reviewed literature provides virtually no empirical evaluation of their effectiveness in improving enrolment, claim settlement, transparency or farmers' satisfaction. Based on the evidence, the study proposes a four-function analytical framework covering enrolment and verification, crop-loss assessment, claims processing and transparency, and information dissemination and grievance redressal.*
Conclusion: *The study concludes that the major challenges of PMFBY relate not merely to scheme design but also to administrative capacity, institutional coordination, fiscal governance and effective implementation. Although digital governance offers considerable potential for improving agricultural insurance delivery, its effectiveness remains insufficiently established through empirical research. The study emphasises the need for timely crop-yield data, predictable subsidy disbursement, transparent communication of claim decisions, effective grievance redressal and rigorous evaluation of digital interventions. Future research should prioritise PMFBY-specific, post-2020 empirical investigations using standardised indicators to assess the actual contribution of digital governance to farmers' accessibility, participation and insurance outcomes.*
Keywords: *Pradhan Mantri Fasal Bima Yojana (PMFBY), Digital Governance, Crop Insurance, Implementation, Farmers' Participation, Claim Settlement, Thematic Review.*

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I. Introduction

Agricultural production in India is exposed to weather shocks, pests and price volatility, and crop insurance is one of the p[1]rincipal instruments through which the state attempts to stabilise farm incomes.[1,2] India's experience spans several generations of schemes: the Comprehensive Crop Insurance Scheme, the National

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Agricultural Insurance Scheme (NAIS), the Modified NAIS, and weather-index pilots, culminating in the Pradhan Mantri Fasal Bima Yojana launched in 2016 and, alongside it, the Restructured Weather Based Crop Insurance Scheme (RWBCIS).[3,2] PMFBY set farmers' premiums at 2% of the sum insured for kharif food crops and oilseeds, 1.5% for rabi crops and 5% for commercial and horticultural crops, with the remainder shared between the central and state governments.[3,4] Enrolment, initially compulsory for loanee farmers, became voluntary from kharif 2020.[5] PMFBY is area-yield based: indemnities depend on yields measured for a defined insurance unit through crop-cutting experiments (CCEs). One consequence is that the quality and timeliness of yield data, and of state subsidy release, shape claims. Another is that digital tools, including remote sensing, smartphone-based data capture and online platforms, were promised as means of speeding assessment.[1] A growing literature evaluates PMFBY, but it is heterogeneous in design, quality and focus. Some studies compute national or state aggregates[6,7], some use nationally representative household surveys[8,9], many are small district surveys, and an influential institutional report evaluates governance directly.[1] A critical synthesis is needed to separate what is established from what is asserted. This review addresses the following four questions:

- What does the evidence show about PMFBY enrolment, coverage and performance?
- What explains delays and opacity in claim settlement?
- Why do farmers enrol or not, and how reliable is the evidence on awareness, trust and satisfaction?
- What does the evidence say about digital governance of PMFBY, and what is missing?

The review is based on 32 distinct documents. They fall into five groups like PMFBY-specific and India-focused empirical studies (8); PMFBY farmer-perception surveys (5); Indian reviews and descriptive syntheses (8); international and design-oriented evidence from China, Africa, the United States and cross-country mapping (6); and digital, financial-inclusion and peripheral papers (5). Each document was appraised on six criteria: clarity of objective; fit of design to claims; sampling and denominators; PMFBY specificity and data vintage; internal consistency of reported figures; and the extent to which conclusions follow from the evidence.

II. Policy and Theoretical Background

The earlier area-yield scheme, NAIS, was criticised for high basis risk and long delays in claim settlement.[2] PMFBY retained the area-yield approach, introduced uniform low farmer premiums, a high government subsidy, insurer selection by e-bidding in district clusters, and technology-assisted assessment.[1] Beula note that government pays roughly 80% to 85% of the premium, so the scheme is largely publicly financed while private insurers handle enrolment, claims and assessment[3].

Theoretical Lenses in the Evidence Base

The PMFBY-specific papers are overwhelmingly atheoretical; most state no framework. Theory enters mainly through international and behavioural studies and a few Indian household analyses:

- Expected utility and risk preferences underpin design simulations[10,11] and the experimental study of uptake.[12]
- Behavioural economics is used to explain non-purchase in India, including ambiguity aversion, the certainty effect, overconfidence, hyperbolic discounting, loss aversion and trust.[13]
- Risk balancing and credit-insurance bundling frame.[8,9]
- Moral hazard frames[14] for the United States.
- Information asymmetry and social capital frame digital credit effects in China.[15]
- Financial literacy frames.[16]

The theoretical thinness of the PMFBY implementation literature limits cumulative knowledge: studies measure different things in different ways, and few test mechanisms.

III. Thematic Review

A Thematic Review is a systematic and organised examination of a particular subject, issue, policy, programme, institution, or area of research by identifying, analysing, and interpreting its major themes, patterns, trends, challenges, and emerging issues. It involves reviewing relevant literature, documents, reports, policies, research studies, and other sources of information to develop a comprehensive understanding of a specific subject. Unlike a general review, which may provide a broad overview of a topic, a thematic review focuses on specific themes or dimensions of a subject. It brings together different perspectives and findings to identify common issues, differences, gaps, strengths, weaknesses, and areas requiring further attention.

Enrolment growth, supply-driven uptake and the voluntary shift

The most consistent descriptive finding is rapid enrolment growth, but several papers suggest that growth overstates farmer demand. In West Bengal, more than 3.06 million farmers enrolled in the first season, a growth of 216.1% against 5.6% nationally, yet the evaluation attributes this largely to supply-side factors: the scheme was offered free of cost to farmers, was mandatory for loanees, and was promoted by gram panchayats, so that

voluntary enrolment was only about 30% among loanee and 40% among non-loanee farmers.[1] The same report notes that non-loanees, who make up more than 70% of the state's farmers, adopted poorly, and that coverage was weaker in irrigated paddy, jute and potato areas than in rain-fed and hilly regions. National aggregates are mixed. Rudramuni and Venkatesh[7] report compound annual growth in enrolment of 18.5% in kharif and 14.9% in rabi between 2018 and 2023, but insured area grew only 1.6% in kharif and fell 2.8% in rabi. Kaur et al.[6] report that farmers insured fell by 14.87% (from 572.50 to 481.58 lakh) between 2016-17 and 2017-18, and that farmers benefited fell by 64.66%.

The 2020 move to voluntary enrolment is the most important policy change in the set, yet it has been tested only once, and weakly. Keerthikumara et al.[5] compare loanee and non-loanee enrolment before and after kharif 2020 using a paired t-test on four observations and find no significant difference ($p = 0.099$). The authors acknowledge limited power, and the design cannot separate the policy from underlying trends. The result is therefore uninformative about causal effects, rather than evidence of no effect. The interpretation of national totals also requires caution. Ravichandiran[26] reports 4,846.43 lakh farmers insured under PMFBY and RWBCIS between 2016-17 and 2022-23, with Rajasthan highest, but provides no denominator and does not say whether counts are unique farmers or cumulative seasonal enrolments. Keerthikumara et al.[5] report a different national total (4,512.57 lakh) from a different source for the same period. Neither can be read as a coverage rate. Enrolment counts are plentiful but weak indicators of demand or protection. The evidence base lacks denominators (eligible farmers or area), unique-farmer counts, and credible comparisons around the 2020 reform.

Claims settlement, yield data and fiscal governance

Delayed and opaque claim settlement is the most consistent implementation finding, and the papers converge on its causes. Roy et al.[1] find that claim settlement in West Bengal was delayed by six to twelve months because the government failed to submit yield data on time (owing to the burden of conducting large numbers of CCEs) and failed to release premium subsidy on time (owing to limited budget provisions), which in turn gave insurers a reason to delay or deny compensation. In the first year, insurers collected Rs. 730 crore in premium but had settled less than Rs. 1 crore of claims by July 2017, rising to Rs. 421 crore by January 2018; the overall claim-to-premium ratio was 57.73%. Kaur et al.[6] similarly report claim delays beyond a year linked to pending state subsidy shares. Beula et al.[3] report that only Rs. 5,875 crore, about 45% of expected claims, had been paid as of July 2019. At the household level, Munshi and Laha[9], using the 2019 Situation Assessment Survey, find that only 35.56% of claimants received indemnity within six months and that 94.04% were unaware of the reasons for rejection. They further report that roughly three-quarters of claims were rejected and about two-thirds of accepted claims were delayed. These findings point to a governance chain: state capacity to conduct CCEs, state fiscal release, insurer incentives, and farmer-facing transparency. The chain is asserted across papers but has not been estimated. Comparability is also a problem. Claim indicators in the set are computed against gross premium, sum insured or farmer premium. Rudramuni and Venkatesh[7] describe their premium as farmer-paid; if so, ratios above 1 are mechanical because farmers pay only 1.5% to 5% of the sum insured, and the ratio is not a loss ratio. Keerthikumara et al.[5] define a loss measure as claims over sum insured. From the state table in Keerthikumara et al.[5], national claims over gross premium work out at about 69% (author's calculation), with large state variation, which illustrates how conclusions depend on the ratio chosen. Evidence on delay is consistent and credible in direction (several independent sources) but largely descriptive and concentrated in the first years of PMFBY. The mechanisms (late yield data, late subsidy) are well documented in a single state study and a national secondary analysis, not tested.

Awareness, trust and behavioural barriers

Low awareness is a near-universal finding. Cariappa et al.[8], using NSSO data from 2012-13, report that about 5% of households were insured and 77% were unaware of crop insurance; Roy et al.[1] find that about 70% of non-insured farmers in West Bengal had not heard of PMFBY and 95% did not know its features. Explanations draw on structural and behavioural factors. Biswal and Bahinipati[13] identify documentation and tenancy constraints and a set of behavioural biases, and note a shortage of Indian behavioural evidence. International studies strengthen the trust and complexity explanation. In Anhui, China, non-purchasers cited price (20.59%), distrust that the insurer would pay (17.65%), and complexity (14.71%)[12]. Jin et al.[16] and Pan[17] reports that farmers who had not been compensated often declined to repurchase. Nshakira-Rukundo et al. [18] show across 23 African countries that trust and information are recurrent determinants. The Indian perception surveys add little that is reliable on who is aware. Philip et al. (2025) conclude that non-loanee farmers are typically more aware, whereas Roy et al. [1] find non-loanee uptake weak. Ajay et al. [20] report a significant association between awareness and enrolment (chi-square = 32.43), but their abstract names premium affordability as a major deterrent while their own test finds no association ($p = 0.9973$). The direction of the evidence (low awareness, low trust) is robust; its magnitude and drivers are not, because the strongest awareness estimates pre-date PMFBY[8] or come from one state.[1]

Credit linkage and risk balancing

The interaction between insurance and credit is contested. Cariappa et al.[8] find that insured households had lower outstanding loans, which contradicts the risk-balancing hypothesis that insurance enables more borrowing. Munshi and Laha[9] report results consistent with risk balancing for bundled insurance and credit but sensitive to hidden bias. The studies differ in survey year (2012-13 versus 2019), in insurance scheme and in specification, so the disagreement is better treated as an open empirical question than as a contradiction. A macro-level analysis[5] finds that marginal and small farmers hold a large share of indebted households but a smaller share of institutional credit, which suggests that credit-linked enrolment may under-serve those with least access.

Design, subsidy and basis risk: comparator evidence

International and design papers inform PMFBY indirectly. Negi and Ramaswami[10], using 311 Indian districts, show that yield-rainfall tail dependence is weak and varies by crop (from 0.0001 for maize to 0.188 for rice), supporting subsidy concentrated on a catastrophic layer. Wang et al.[11] show that farmers in four of five Chinese provinces prefer direct subsidy to the existing insurance and that insurance dominates no insurance only above province-specific subsidy thresholds (20% to 60%). Pan[17] argues that Chinese pooled premium covers only 36.25% (2022) and 48.56% (2023) of direct losses and that fiscal limits constrain subsidy expansion. Vishnoi et al.[2] argue that basis risk and weather-data constraints are central challenges for index products in India, while Vyas et al.[21] show that research on agricultural insurance concentrates in high-income countries and is weakly aligned with projected climate risk. These are design arguments about index or lower-subsidy contexts. PMFBY's area-yield design and high subsidy differ, so these studies are best used as comparators and as sources of hypotheses (for example, about subsidy layering and basis risk), not as direct evidence on PMFBY.

What perception surveys can and cannot show

A large share of PMFBY studies in the set are district-level surveys like Mayiladuthurai- 240 insured farmers; Radhika & Rengarajan[22], Ramanagara and Tumkuru-115; Girisha & Venkatesh[23], Kolar-200; Jiragal et al.[24], Mysuru-120; Ajay et al. [20] and Darbhanga-120; Kumar & Stephen.[4] Their conclusions are broadly consistent (modest perceived benefits, awareness gaps, delays), but their evidential value is limited by sampling only beneficiaries in several cases, by Likert or ranking measures without inference, and by reporting problems. Girisha and Venkatesh[23] report regression statistics inconsistent with their sample size and regress "effectiveness" on its own components; Radhika and Rengarajan[22] conflate occupation and landholding shares; Kumar and Stephen[4] report constraint counts that sum to fewer than the stated sample. Jiragal et al. [24] are more transparent about the modesty of effects (beneficiaries "slightly" better), but self-reported scores with unequal groups cannot support causal claims. Roy et al.[1] show why satisfaction is a weak metric: 80% rated PMFBY better than earlier schemes despite having received no claims. These surveys document local experience and may suggest hypotheses, but they should not be pooled or used as evidence of scheme-level effectiveness.

IV. Digital Governance of PMFBY: Promises, Recommendations and the Evidence Gap

The digital governance of the Pradhan Mantri Fasal Bima Yojana (PMFBY) represents an important transformation in the administration and delivery of crop insurance services in India. Through digital platforms, online registration, Aadhaar-enabled verification, remote sensing, satellite-based crop assessment, mobile applications, and technology-driven claim processing, the scheme seeks to enhance transparency, efficiency, accountability, accessibility, and timely compensation to farmers. While these technological interventions promise to minimise administrative delays, improve accuracy in crop-loss assessment, reduce procedural complexities, and strengthen institutional coordination, their actual effectiveness depends on the quality of implementation, digital infrastructure, administrative capacity, and farmers' awareness and accessibility. Consequently, recommendations for strengthening digital governance must address technological limitations, digital exclusion, grievance redressal, transparency in claim settlement, and institutional accountability. An important evidence gap, however, remains between the expected benefits of digital transformation and its actual outcomes at the grassroots level, particularly regarding farmers' experiences, accessibility, adoption, satisfaction, and the timeliness and effectiveness of insurance claims. Therefore, a systematic thematic review of PMFBY's digital governance is essential to examine its promises, assess existing recommendations, and identify the gaps between policy objectives and empirical evidence.

What the Set Shows

Digital governance appears throughout the set, but almost always as aspiration or inventory. Roy et al. (2018) provide the closest implementation test: PMFBY envisaged smartphones, remote sensing and drones to reduce the number of crop-cutting experiments and speed yield estimation, yet in West Bengal these were not used to that end, and the burden of CCEs contributed to late yield data. Kumar and Uppal[25] catalogue PMFBY's digital touchpoints (applications and portals) but describe them rather than evaluate them. Munshi and Laha[9]

recommend technology-enabled yield estimation and independent audit; Rudramuni and Venkatesh[7] recommend satellite, drone and AI-based assessment; Philip et al.[19] recommend technology-based outreach; Beula et al.[3] propose drones, blockchain and satellites and assert they would eliminate moral hazard, a claim for which the paper offers no analysis. Ravichandiran[26] links fluctuations in PM-KISAN beneficiary numbers to Aadhaar verification, which is relevant to digital identity in agricultural programmes but concerns income support, not crop insurance.

Comparator and conceptual studies describe mechanisms. Nshakira-Rukundo et al.[18] note that picture-based monitoring was first tested in India and that mobile payments and ICT help delivery, but trust remains decisive; they also report that of 31 million mobile-based insurance policies worldwide by mid-2015, only 7% were agricultural. Chen et al.[15] show that digital technology use raises farmers' credit in China, although the social-capital channel explains little of the effect (2.41% and 5.04%). Wu et al.[27] identify data governance and interoperability as barriers to digital agriculture and suggest that better monitoring could improve insurance access by reducing information asymmetry, but treat the link prospectively. Yekimov et al.[28] argue conceptually that digital tools can lower insurer risk and premiums, without data.

A Function-based Framework

To organise this dispersed material, researcher propose analysing digital governance by the function it serves in the PMFBY cycle. The framework is an analytical synthesis of the evidence set, not a model tested by any of the studies.

Function	What the Set Says	Strength of Evidence
Enrolment and verification (identity, land records, tenant documentation)	Documentation and tenancy barriers[13]; digitised land records and online enrolment through common service centres recommended[1]; Aadhaar verification cited for PM-KISAN changes[26]	Recommendations and description; no PMFBY evaluation
Loss assessment (crop-cutting data, remote sensing, weather data)	Promised technology not used to reduce CCEs and late yield data[1]; weather-data resolution and gaps as a design constraint for index products[2]; satellite, drone and AI recommended[7]	One documented implementation gap (single state, 2016-17); otherwise, recommendations
Claims processing and transparency	Slow settlement and unexplained rejection[9]; audit and technology-enabled yield estimation recommended; portals listed, not evaluated[25]	Strong on the problem; none on the digital remedy
Information, trust and grievance redress	Trust and information as determinants[12,18]; regional-language portal[1]; WhatsApp and call-centre grievance channels recommended[23]	Comparator evidence; PMFBY-specific evidence absent
Cross-cutting: data governance and interoperability	Barriers to digital agriculture[27]; digital use and credit[5]	Conceptual or non-insurance

Source: The Authors

As conclusion, the problems that digital instruments are meant to solve (late yield data, opaque claims, low information) are well documented. Secondly, there is no evidence in this set on whether PMFBY's digital instruments actually solve them: no study measures effects on enrolment, claim time, rejection rates or trust. The recommendation literature is therefore running well ahead of the evaluation literature. The one implementation study that examines technology, Roy et al. (2018), reports a failure of use rather than of design, which suggests that digital governance depends on state capacity and incentives as much as on the technology.

V. Critical Appraisal of the Evidence Base

The critical appraisal of the evidence base involves a systematic examination of the quality, reliability, relevance, and adequacy of existing research, reports, policy documents, and empirical findings relating to a particular subject. In the context of the digital governance of PMFBY, it assesses whether the available evidence adequately demonstrates the effectiveness of digital interventions in improving transparency, administrative efficiency, crop-loss assessment, claim settlement, and farmers' accessibility to insurance services. It also examines methodological limitations, geographical coverage, inconsistencies in findings, and the extent to which farmers' experiences are represented. Such an appraisal helps distinguish between policy claims, technological promises, and empirically established outcomes while identifying areas where further field-based research and reliable evidence are required.

Evidence type	Studies	Strengths	Weaknesses
Institutional evaluation	Roy et al. (2018) [1]	Joint governance and uptake analysis; stakeholder evidence; documents unmet digital promises	One state, first year, free-premium design; small purposive sample

Evidence type	Studies	Strengths	Weaknesses
Nationally representative household surveys with matching	Cariappa et al. (2021)[8]; Munshi & Laha (2026)[9]	Large samples; formal modelling; implementation outcomes[9]	Cariappa uses pre-PMFBY data; insurance measured generically; matching on observables only; inconsistent income claims (Cariappa)
Aggregate secondary analyses	Kaur et al. (2021)[6]; Rudramuni & Venkatesh (2025)[7]; Keerthikumara et al. (2025)[5]; Ravichandiran (2026)[26]; Devi & Bimla (2026)[29]	Cover scheme-level trends	No denominators or counterfactuals; non-comparable ratios; near-circular regression[6]; n = 4 test[5]; sample inconsistency[29]
District perception surveys	Radhika & Rengarajan (2024)[22]; Girisha & Venkatesh (2024)[23]; Jiragal et al. (2025)[24]; Ajay et al. (2025)[20]; Kumar & Stephen (2025)[4]	Local detail on experience	Small, local, often beneficiary-only; Likert or ranking data; statistical reporting inconsistencies
Indian reviews and descriptive syntheses	Biswal & Bahinipati (2022)[13]; Vishnoi et al. (2020)[2]; Beula et al. (2022)[3]; Kumar & Uppal (2026)[25]; Tripathi et al. (2023)[30]; Philip et al. (2025)[19]; Tiwari et al. (2020)[31]	Conceptual orientation (Biswal & Bahinipati; Vishnoi et al.)	Mostly no protocol or evidence synthesis; some factual errors (for example PMFBY described as weather-based in Kumar & Uppal); unsupported technology claims[3]
International and design evidence	Negi & Ramaswami (2024)[10]; Wang et al. (2015)[11]; Jin et al. (2016)[12]; Nshakira-Rukundo et al. (2021)[18]; Pan (2026)[17]; Vyas et al. (2021)[21]; Wu et al. (2020)[14]	Methodological rigour (copulas, experiments, systematic searches)	Different schemes and contexts; limited transferability to area-yield PMFBY
Digital and peripheral	Chen et al. (2026)[15]; Wu et al. (2026)[27]; Das & Maji (2026)[16]; Yekimov et al. (2023)[28]; Wang et al. (2026)[32]	Mechanisms for digital finance and technology	No PMFBY outcomes[32] is off-topic

Source: The Authors

VI. Discussion and Implications

Taken together, the evidence suggests that PMFBY's principal difficulties lie less in product design than in delivery. Three implications follow, offered as tentative because they rest on a limited evidence set. First, the timeliness of yield data and state subsidy release appear to be binding constraints on claim settlement.[1,6] Interventions that reduce CCE burden or make subsidy release predictable are therefore more likely to shorten delays than outreach alone, although this has not been tested. Second, transparency of claim outcomes matters. The finding that 94.04% of claimants did not know why claims were rejected[9] points to a farmer-facing information deficit that digital notification and audit could address, and which trust-based explanations of non-purchase[12,17] suggest may affect repeat demand. Third, the 2020 voluntary-enrolment reform and the digital agenda both require proper evaluation before further expansion is justified. The current evidence cannot say whether the reform changed enrolment composition or whether digital tools improved outcomes. For researchers, a practical implication is methodological: studies should report denominators, unique-farmer counts, claim indicators on gross premium and time-to-settlement, and should separate PMFBY from other schemes.

VII. Conclusion

The review rests on a reviewed set of documents, not a systematic database search, so statements about gaps apply to this set and may not hold for the wider literature. Finally, the appraisal reflects judgements about design and consistency that other reviewers might weigh differently. The evidence reviewed supports a clear but sobering picture. PMFBY has achieved large enrolment, but enrolment is partly administratively driven, claim settlement is slow and opaque, and farmer awareness and trust remain low. The causes most credibly identified are late yield data and delayed state subsidy, but these have been documented descriptively and not tested. Evidence on the 2020 voluntary reform is too weak to inform policy, and evidence on digital governance is effectively absent: many papers recommend technology, none evaluates PMFBY's digital instruments. International studies supply useful design arguments, but their transfer to an area-yield, heavily subsidised scheme is untested. The priority for future research is therefore not more enrolment counts or small perception surveys,

but causal, PMFBY-specific, post-2020 evaluations of claims outcomes and of the digital tools intended to improve them, using harmonised indicators.

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